University of the State of New York Bulletin

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Published fortnightly

No. 578 ALBANY, N. Y. NOVEMBER 1, 1914

New York State Museum

JOHN M. CLARKE, Director

Museum Bulletin 173

TENTH REPORT OF THE DIRECTOR OF THE STATE MUSEUM AND SCIENCE DEPARTMENT

INCLUDING THE 67th REPORT OF THE STATE MUSEUM, THE 33d REPORT OF THE STATE GEOLOGIST, AND THE REPORT OF THE STATE PALEONTOLOGIST FOR 1913

The University of the State of New York
Department of Science, March 16, 1914

Dr John H. Finley
President of the University

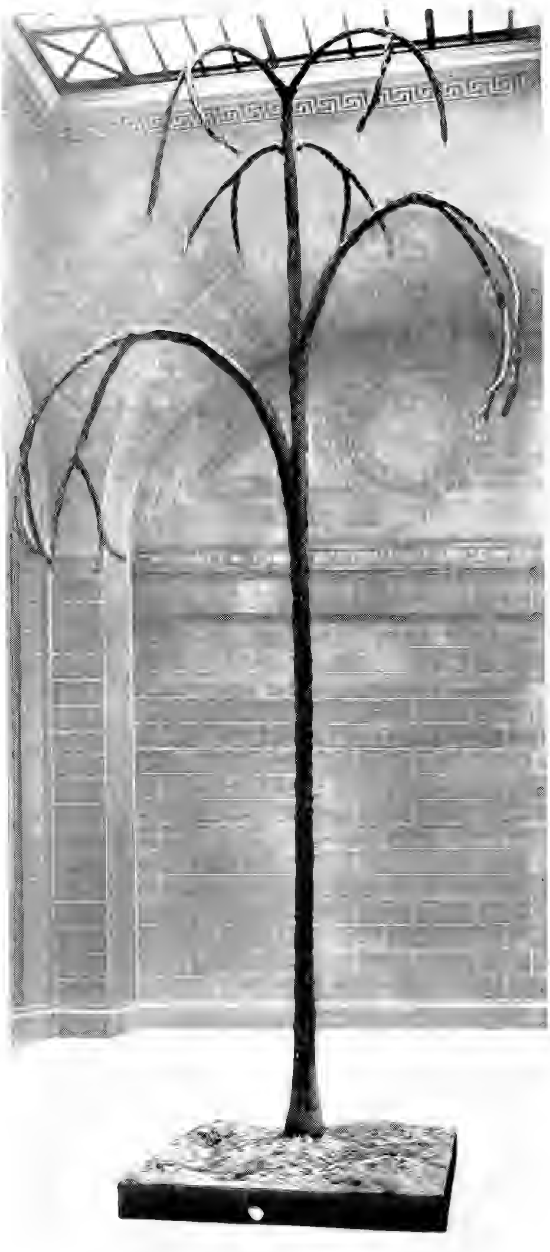
Sir: I have the honor to transmit herewith my annual report as Director of the State Museum for the fiscal year ending September 30, 1913, and to recommend it for publication as a Museum bulletin.

Very respectfully
John M. Clarke
Director

Approved for publication this 18th day of March 1914

John H. Finley

President of the University



A restoration of one of the oldest trees of the earth
(*Archeosigillaria primeva*)

Recently erected in the State Museum and reconstructed from a specimen found in the Devonic rocks of Naples, N. Y.

University of the State of New York Bulletin

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TENTH REPORT OF THE DIRECTOR OF THE STATE MUSEUM AND SCIENCE DEPARTMENT

INCLUDING THE 67TH REPORT OF THE STATE MUSEUM, THE 33D REPORT OF THE STATE GEOLOGIST AND THE REPORT OF THE STATE PALEONTOLOGIST FOR 1913

INTRODUCTION

This report covers all divisions of the scientific and other Museum work under the charge of the Regents of the University and concerns the progress made therein during the fiscal year 1912–13. It constitutes the 67th consecutive annual report of the State Museum, the 33d annual report of the State Geologist (consecutive since 1881) and the report of the State Paleontologist for 1913. It is introductory to all memoirs, bulletins and other publications issued from this Department during the year named.

The committee of the Board of Regents having supervision of the affairs of this Department are the Honorables: Charles B. Alexander M.A. LL.B. LL.D. Litt.D., Tuxedo; Francis M. Carpenter, Mount Kisco; Lucius N. Littauer B.A., Gloversville.

The subjects presented in this report are considered under the following chapters:

I Condition of the New Museum and Progress in Installation
II Report on the Geological Survey
III Report of the State Botanist
IV Report of the State Entomologist
V Report on the Division of Zoology

VI Report on the Division of Archeology and Ethnology
VII Report on the Publications of the Department for the Year
VIII Report on the Collection of Coins and Medals
IX Staff of the Department
X Accessions to the Collections
XI Appendixes (to be continued in subsequent volumes)

I

CONDITION OF THE NEW MUSEUM

The entire energy of this staff has been given, during the past year, almost without reserve, to the equipment of the Museum halls and offices. The transfer of the collections from the State Hall, Geological Hall, Universalist church, Taylor brewery (storehouse) and other buildings which had been utilized for storage, began in October last and the process of moving continued throughout the winter. It was unavoidable that in spite of every precaution in such removal, a state of confusion should ensue, and even the temporary arrangement of this great accumulation of scientific material in such form as to make it accessible for installation and orderly storage made the utmost demands on the industry and patience of the staff. Every man has given his best service to the relief of conditions which constantly exacted laborious manual work and unremitting good nature.

At the time of this removal there were no cases in which the collections could be installed or stored except the few brought over from other buildings, which it was the intention to use temporarily. Boxes, crates, barrels and drawers were piled up on the bare floors, with such attempts at arrangement as could be made under the urgent pressure of a moving contract. In March the parts of the new Musuem cases which have been under construction by George W. Cobb, jr, were delivered and final assembling of them has continued throughout the year. These conditions falling together made the problems of installation peculiarly trying, requiring the unpacking of the materials while there was no case room available for them. But the selection and preparation of the collections proceeded with such temporary expedients as could be devised while the construction of the cases went on with the deliberation essential to good workmanship.

NEW MUSEUM CASES

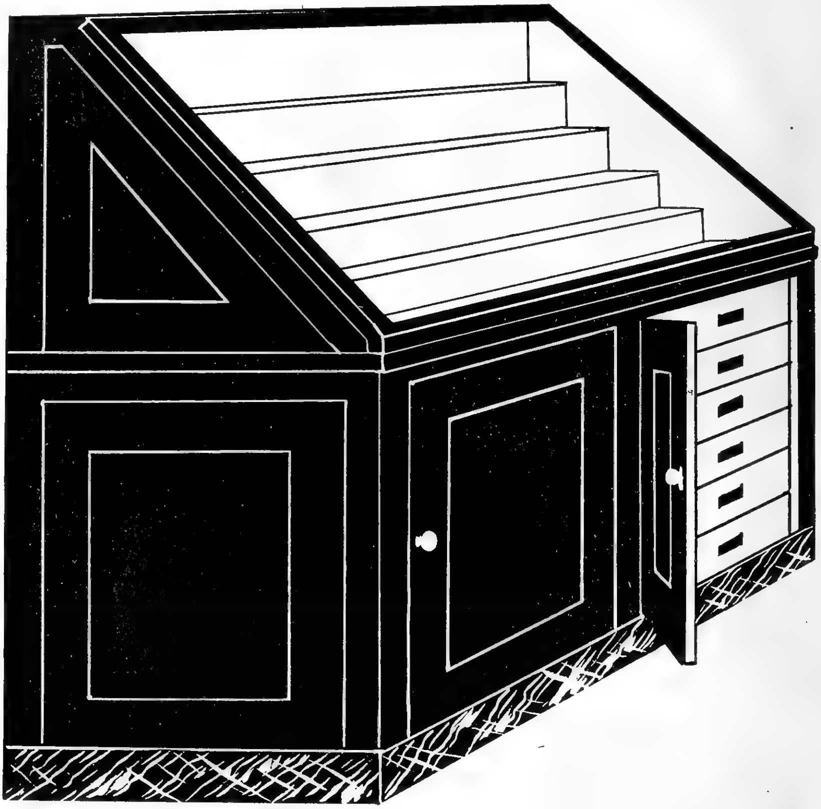
The contract for the new case equipment called for 384 cases of 28 different types. The general design and plans were worked out by the scientific staff with special reference to their adaptation to distinctive exhibits. These cases are now all completed and it may be well to give herewith, as a matter of record, a brief notice of the several types and styles of construction. In selecting the materials for these cases, it was determined to avoid, so far as possible, the use of metal. The action of the metal and the oak cases under the conflagration conditions of the Capitol fire left barely a choice in this matter, and after full consideration by the Regents committee specially charged with the letting of the contract, it was deemed wise to avoid metal except in the construction of the cases for the herbarium. Wood and plate glass, being determined upon as the essential construction materials, in order to avoid monotony of color, mahogany was selected for the wood in the cases for the Zoology, Paleontology and Archeology Halls, ebonized cherry for the Geology and Mineralogy Halls. The following brief exposition of their composition and projection has been prepared by Mr Whitlock.

EXHIBITION AND STORAGE TYPES

Type B. Cases of type B were designed primarily for the exhibition of the general collection of minerals. They have, however, been adopted throughout other sections of the Museum to such an extent that over 50 per cent of the exhibition cases are included under this type. Type B must therefore be regarded as a case adapted to the combined display and storage of small or medium sized objects which it is desirable to show in rows close enough to the eye to admit of the objects being seen in detail. This applies to small fossils, minerals, hand specimens of rock, shells, birds' eggs and small archeological objects, such as pipes, bone implements, etc. The design of this case was modified from one in use in the mineralogical museum of Columbia University, which in turn was derived from a style of case in the University Museum at Prague.

The exhibition space of this type case consists of a triangular prism 5 feet long by 2 feet 3 inches wide by 2 feet 3 inches high, the deck being raised to a level of 3 feet 1½ inches from the floor level. This exhibition space is accessible by one single-panel lid inclined, hinged at the top. Removable steps, in two sections to the case, are provided for the display of small specimens, giving five levels with about 25 feet of shelf length in each case.

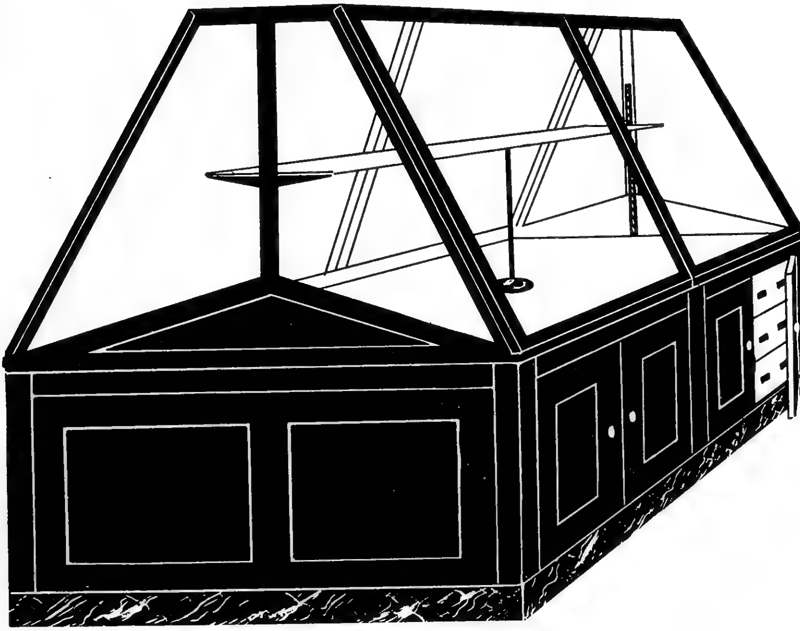
The space below the exhibition portion of the case is furnished with 12 drawers in 2 rows, inclosed by wooden doors which lock with the same key as the lid of the exhibition portion.



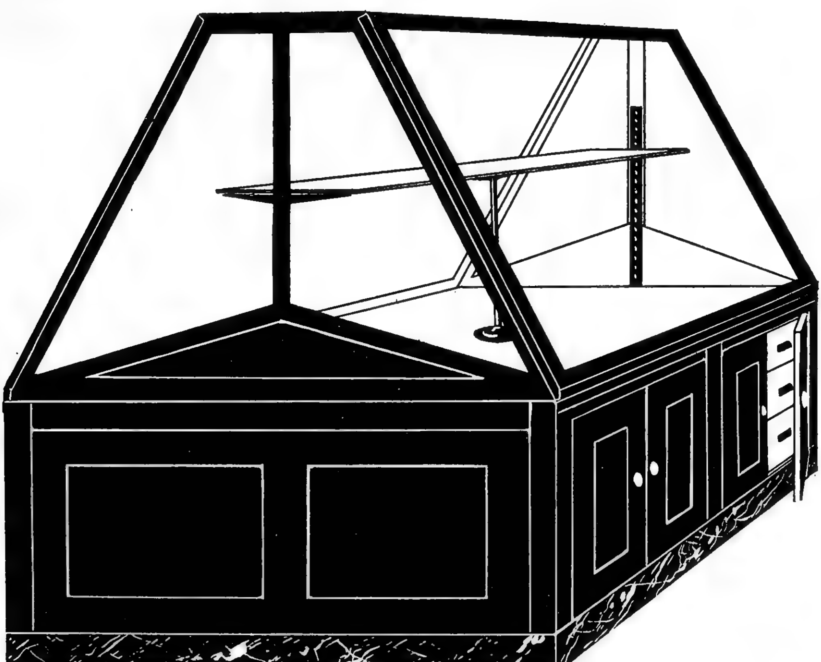
TYPE B

The type B cases are in most instances assembled back to back in blocks of four.

Types C and D. Types C and D are essentially the same, the only difference being that C is 2 feet longer than D. Both types are designed for the display of archeological specimens in definite groupings, such as articles from a grave, series of objects showing method of manufacture, comparison of the same sort of articles, etc.

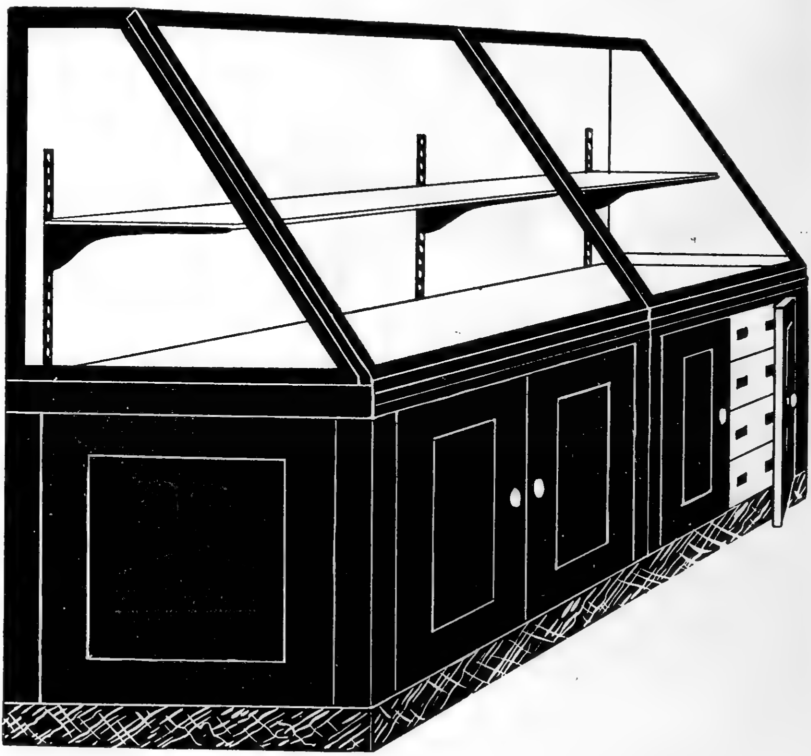


Type C



Type D

The exhibition space is in the form of a truncated wedge 8 feet (6 feet for D) long by 4 feet 6 inches wide by 2 feet 10 inches high with sloping sides on the long dimension and inclosed on the sides, the exposed ends and the top with glass. The deck of this exhibition space is raised 3 feet from the floor level, the space below being furnished with 24 drawers in 8 rows (12 drawers in 4 rows for D) inclosed by wooden doors. A removable glass shelf running the length of the exhibition space 1 foot 4 inches above the deck furnishes a second level upon which specimens may be displayed. Access to the exhibition space may be obtained on the two long



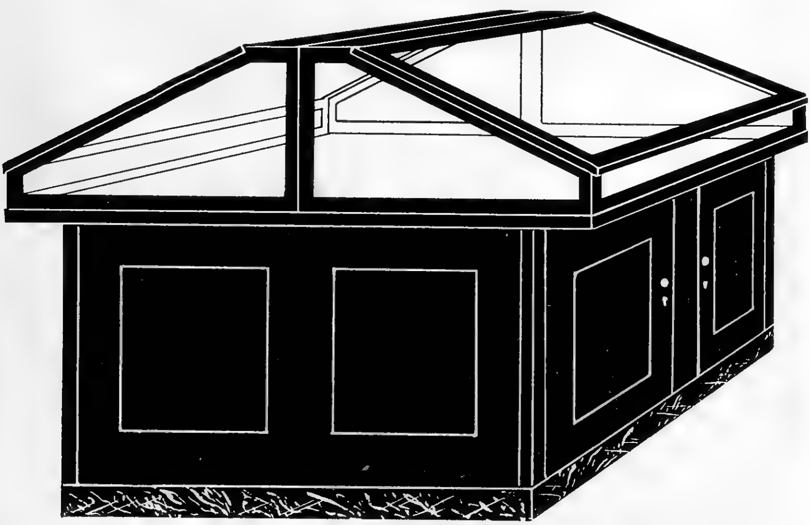
Type E

sides by means of doors hinged at the top. The cases are grouped in rows of three, giving aisles 24 feet and 16 feet for C and D respectively.

Type E. Type E is an adaptation of the type C intended to occupy space next to the wall. It is consequently constructed as the longitudinal half of C, somewhat widened (2 feet 9 inches wide) to give it proportion, and closed at the back where it comes in contact with the wall. It is designed to display the same series of objects as types C and D.

The storage space consists of 16 drawers arranged in 4 rows of 4. The cases as at present installed stand singly against the south wall of the west mezzanine.

Type F. Type F is specially adapted to the display of such groupings as lend themselves to a flat display treatment, such as feather ornaments, war clubs, wampum belts, etc. Consequently, the level of the exhibition space is somewhat lower with respect to the floor level and the space proportionately low to its length and width; in other words, type C has been flattened out to meet the needs for the display of flatter objects.



Type F

The exhibition space is in the form of a low wedge 5 feet long by 5 feet wide and 1 foot 3 inches high, the top, sides and ends of which are glazed. The inclined tops form the lids and the exhibition space somewhat overhangs the supporting storage portion to give better symmetry to the general case outline.

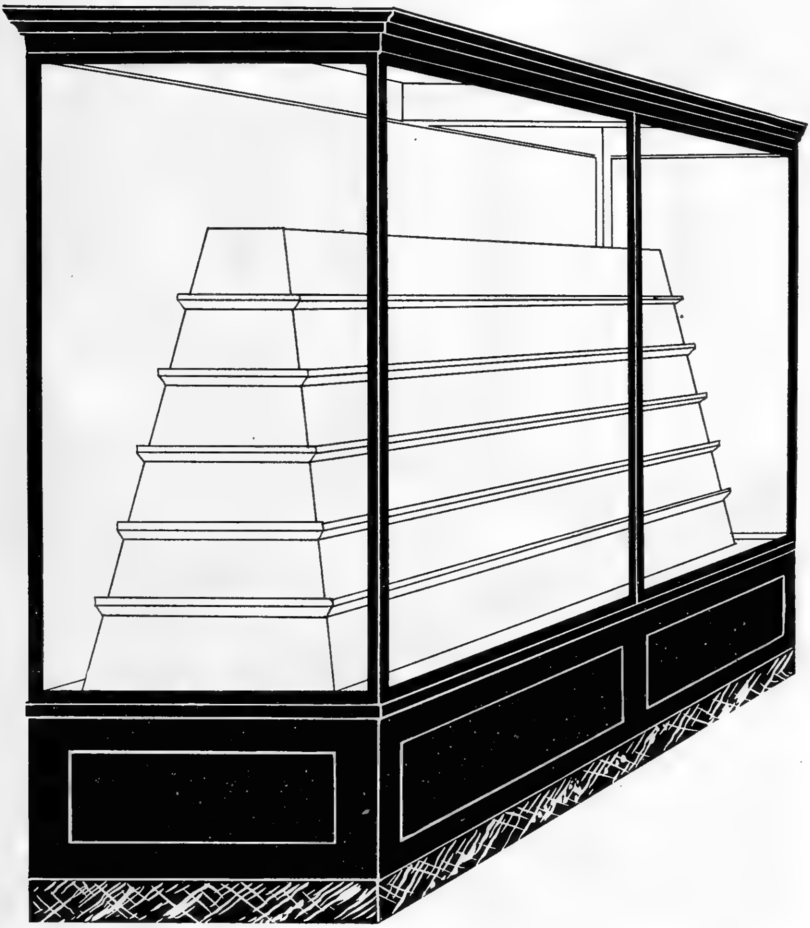
The storage portion is furnished with a bottom and one shelf on both sides of the case closed with wooden doors.

As installed at present, the type F cases are free standing, that is, accessible on all four sides.

Type G. Type G combines the longitudinal half of type F lengthened and adapted to the space next the wall, with a superposed wall case section. The object of this type of case is to show

TYPE G

in proximate relation objects which are more or less flat and those, such as garments, head dresses, etc., which require to be displayed on a vertical surface. This practically results in two exhibition spaces, the lower of which, corresponding to a longitudinal half of type F, is 8 feet long by 3 feet wide by 1 foot 4 inches high, opening in two single-panel glazed lids. The upper or vertical exhibition space is 8 feet long by 10 inches wide by 3 feet 9 inches



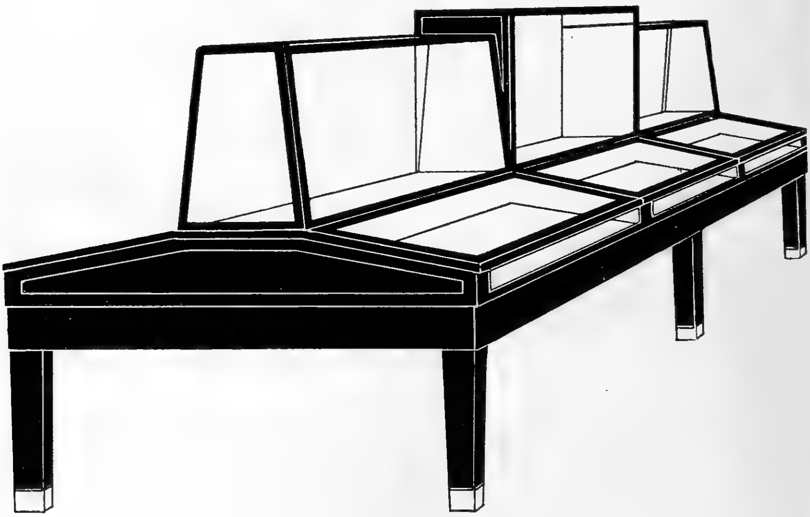
TYPE A

high, occupying a vertical space from the floor level of roughly from 4 to 8 feet, and opening by means of four single panel doors.

The storage space is shelved similar to type F.

Type A. Type A was designed to exhibit specimens of fossils and was adapted from a similar type of case in use in the National

Museum at Washington. The case is "free standing," that is, open to view on all four sides. It measures 8 feet long by 3 feet wide by 8 feet high and the deck or case flooring is 1 foot 11 inches above the general floor level. Access to the cases is obtained through double doors on both long sides which admit of the easy arrangement of specimens in every portion of the exhibition space. A wooden diaphragm for the support of slabs is fitted inside each case, attached in such a way as to be readily removable should the free case space be required for the display of large objects. The diaphragms are in the form of rectangular, truncated pyramids of steep inclination and are provided with narrow cleatlike projections, running continuously around the diaphragm at convenient



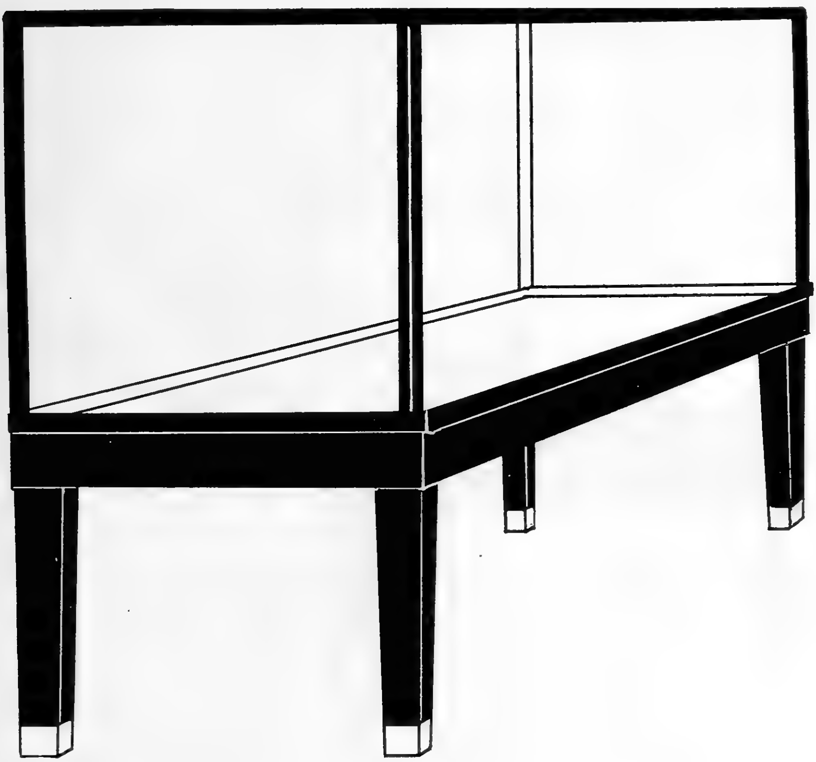
Type H

levels, to provide for the mounting of specimens on all four sides of the case.

SPECIAL ENTOMOLOGY TYPE

Type H. Type H was designed to exhibit insects mounted on flat surfaces in proximate relation to descriptive groups showing the life history of typical members of the series illustrated in the flat exhibits. The general design of this case somewhat resembles the entomological cases of the American Museum of Natural History known as the "A" and table cases combined, but with the added feature of a middle upright section in the shape of a rectangular exhibition space for the display of the life history groups.

The exhibition space is divided into three sections in which each of the two end sections consists of two shallow flat elements on either side of the longitudinal axis opening by hinged lids and surmounted by narrow vertical elements with slightly inclined sides, one of which is removable for the insertion of a double diaphragm



TYPE I

to hold the specimens which are consequently visible from both sides of the case. In the middle section, the vertical element is rectangular and is not provided with a diaphragm. The horizontal elements are 4 feet long by 1 foot 10 inches wide by 6 inches deep, the decks and lids are parallel and slightly inclined from the horizontal, the former being 2 feet 2 inches at the outside and 2 feet 6 inches at the inside line.

The upright end element is 4 feet long, 1 foot 3 inches wide at the bottom and 2 feet high. The same dimensions hold for the middle element except that this latter is 2 feet 3 inches high. The deck for all the upright elements is 3 feet 2 inches from the floor level. The case is supported on legs and covers a floor space of 12 feet by 5 feet.

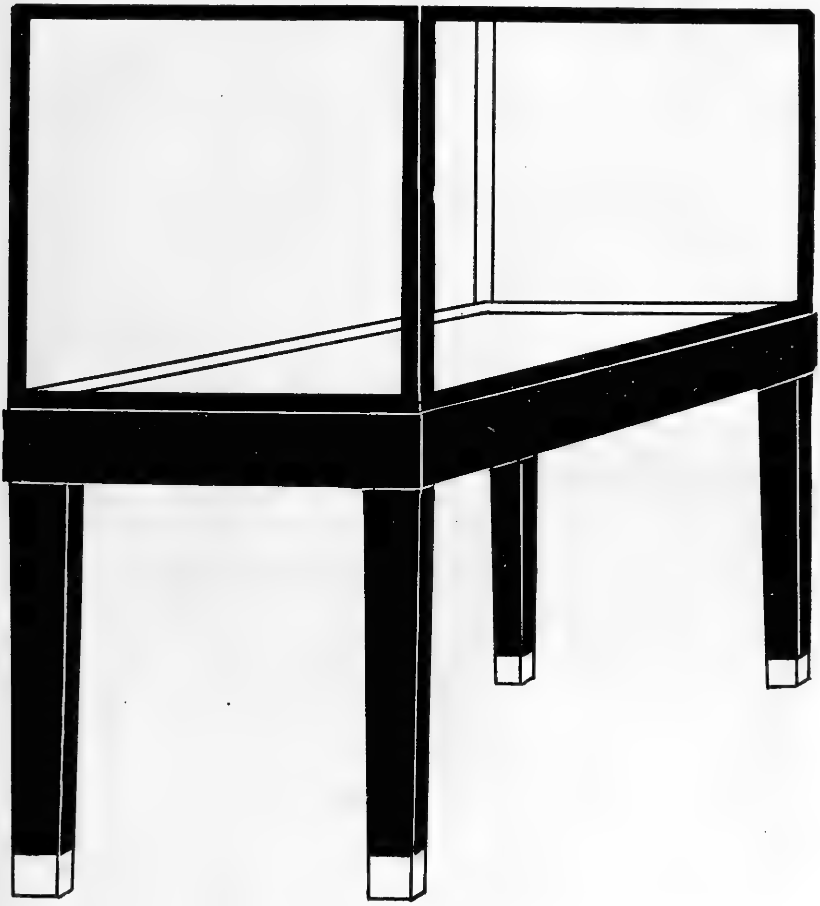
FREE STANDING TYPES FOR LARGE SPECIMENS

In the free standing types of cases are represented the extremes of simplicity in case design, in that they involve primarily a deck

Type J

or exhibition floor supported on legs and inclosed in glass to a height which gives sufficient head room for the required exhibit.

Type I. Type I represents a "general utility" case for the display of large objects such as mineral or geological specimens, series of specimens in industrial geology and paleontology. This type can also be used to advantage for the display of models of mine workings, industrial plants, etc. The exhibition space is rectangular and measures 6 feet long by 3 feet wide by 3 feet high and is mounted on legs to raise the deck 2 feet 6 inches from the floor level. Access is obtained by removing one of the long sides by means of removable screws which work in brass sockets. In practice, the interior may be furnished with block-steps or diaphragms depending on the nature of the material to be exhibited,

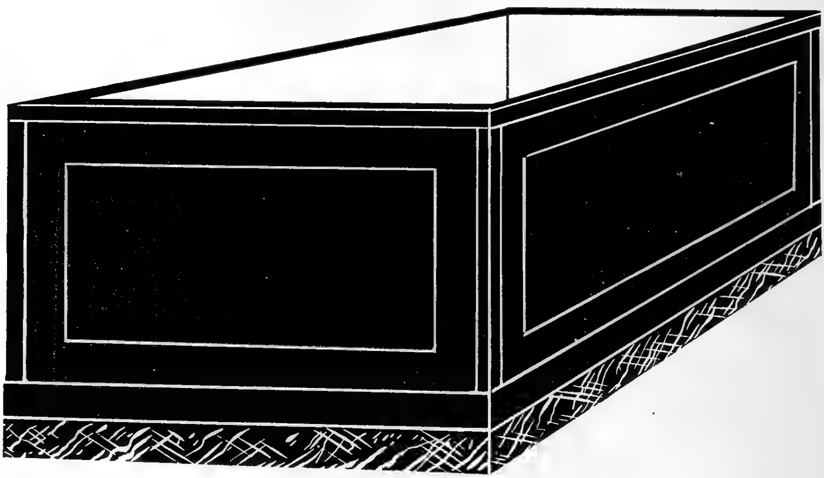


TYPE K

the proportions of the exhibition space yielding much latitude of treatment in this respect.

Type J. Cases of type J are also designed for the display of definite specimens, that is, large minerals of a special occurrence. They are intended to be used without diaphragms or step-blocks and to be installed in a group of which the single type L case forms a center. The exhibition space is in the form of a truncated wedge of which the base is 8 feet long by 3 feet wide and is raised 3 feet above the floor level.

Type K. Type K cases differ from type I only in size and proportions. They are intended for the display of the larger slabs of fossil remains which, on account of their development of fine detail, need to be closer to the eye of the observer than would be possible in a deck as close to the floor level as that of type I. The rectangular exhibition space which measures 4 feet long by 2 feet 6 inches wide by 2 feet 6 inches high, is consequently raised to a level of 3 feet from the floor level. For the interior furnishing of these cases narrow, high diaphragms or step-blocks are best adapted



TYPE M M

both from the point of view of the proportion of the material to be exhibited and from that of the proportions of the exhibition space.

Type L. Unlike the preceding types, this case design, of which only one was installed, was made to accommodate one particular specimen, a large crystal of calcite installed in the Mineralogy Hall. The exhibition space is rectangular, measures 4 feet 6 inches square by 2 feet high, and is raised 2 feet 6 inches above the floor level.

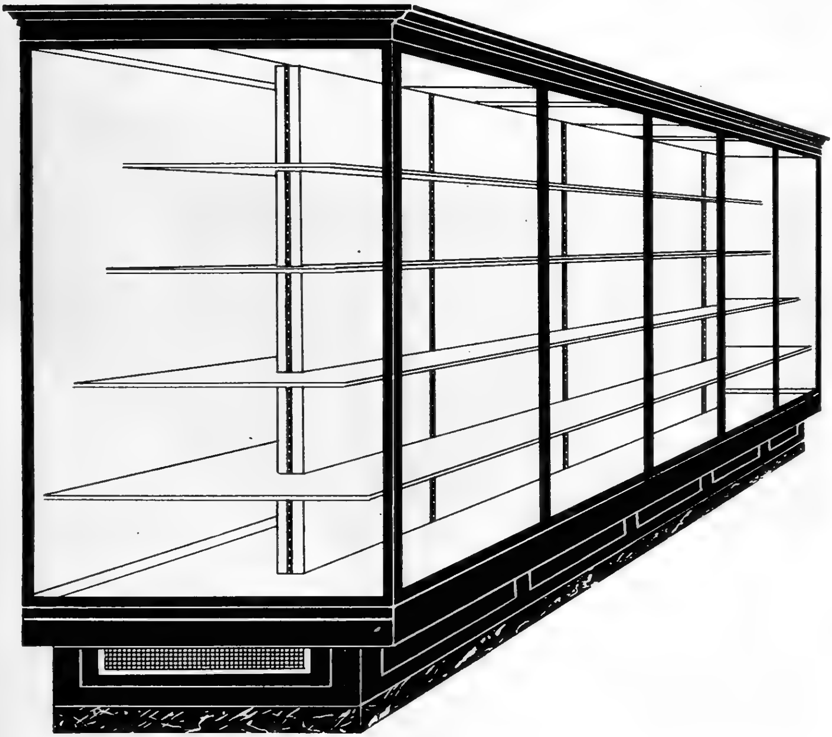
ARCHEOLOGY EXCAVATION TYPES

The archeology excavation types of cases consist essentially of rectangular boxes 3 feet in height, setting directly on the floor.

They are designed for the exhibit of reproductions of Indian grave excavations to be viewed through the glass lid which may be removed to gain access to the case. The two types, M and MM, differ only in one dimension, being 5 feet (6 feet for MM) long by 4 feet wide by 3 feet high. They are designed to be free standing, but may be installed with one side against the wall.

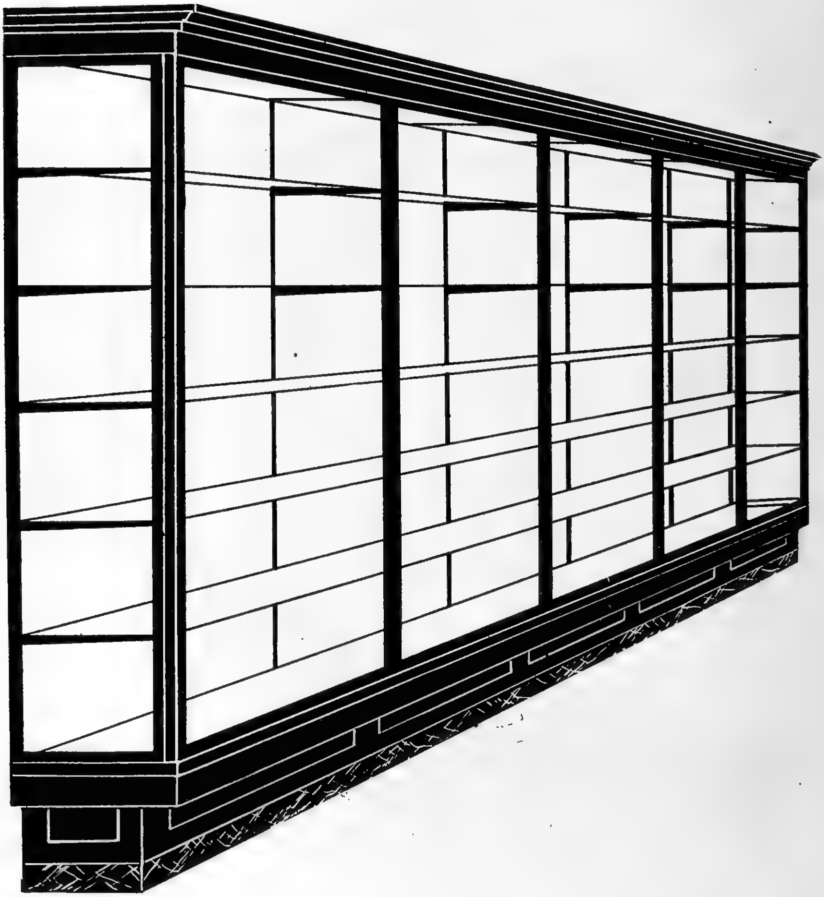
TYPES WITH ADJUSTABLE SHELVES AND WALL-CASE TYPES

Under the group of types with adjustable shelves and wall-case types are included the various forms of wall cases and the detached



TYPE N

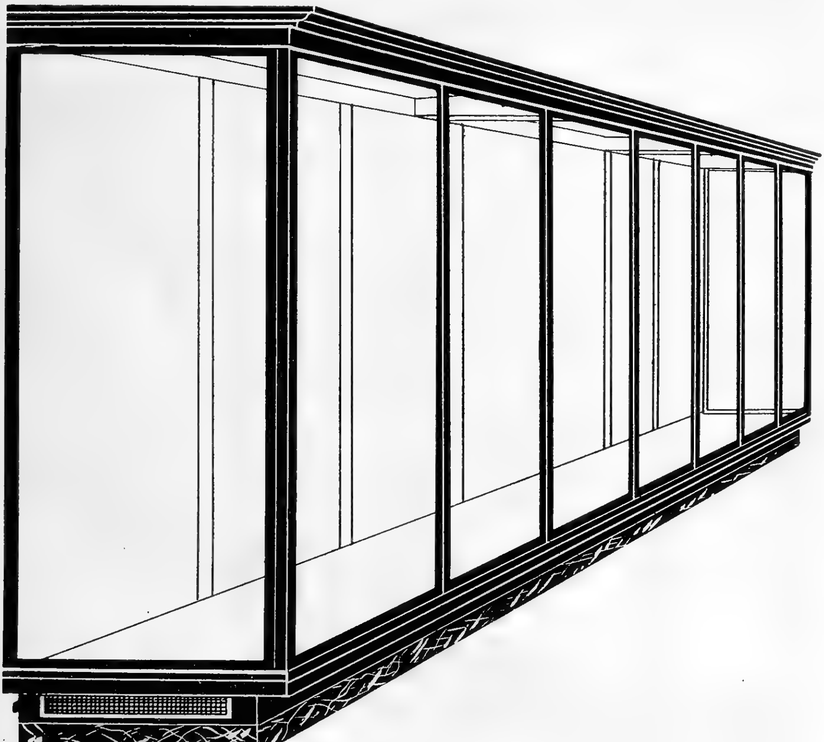
type with shelves which may for purposes of classification be considered a detached pier wall case. The group of types is characterized by a low deck and a uniform height of about 8 feet, the limit between which zoological and archeological specimens may be seen to advantage, the exception to the 8 foot height in cases of this group being type Q, which was designed for a children's exhibit in archeology. The longitudinal dimension in wall type cases is, of course, limited by the length of wall space to be filled and the lateral dimension by the character of the material to be exhibited; for instance, for large mammals or Indian canoes, a fairly wide wall case is required, while for Indian garments, ceremonial masks



Type O

or rows of bottled alcoholic specimens of invertebrates, a comparatively narrow wall case is best adapted. In the large zoology types of this group two features appear for the first time in this description: (1) The base is recessed in order to permit the observer to stand close to the glass. By this means an economy of aisle room is effected. (2) A ventilating device is introduced in the base by means of which the air passing into the case when pressure is equalized, after a sudden change of temperature, is filtered free of dust through a series of sheets of cotton.

Type N. Cases of type N were designed for the display of the general collection of New York small mammals, birds, fishes etc. The exhibition space is 16 feet long by 4 feet wide and 6 feet



Type P

6 inches high, raised on the recessed base 1 foot 6 inches from the floor level. The case is divided longitudinally by a substantial diaphragm furnished with slotted strips upon which adjustable brackets are fastened which in turn support the wooden shelves. Access is gained through the second and fourth panels on both sides and the two end panels which are hinged doors. The top panels are glazed. The cases as at present installed are free standing arranged

with an aisle of about 10 feet between cases and an aisle of about 4 feet between the ends of the cases and the wall, giving an alcove effect in arrangement.

Type O. The two cases of type O are distinctly wall cases. They were designed for the display of small zoological specimens,

Type PP

models and preparations to illustrate the invertebrate fauna of New York. The type is consequently narrow compared with its length and has its glass shelves spaced closer together than those of type N. The exhibition space is 14 feet long by 1 foot 6 inches wide by 6 feet 6 inches high and is raised on a recessed base 1 foot 6 inches from the floor level. Access is gained through the second and fourth panels which are swinging doors. The glass shelves are adjustable on bronze brackets supported from the back on slotted strips. The top panels are glazed.

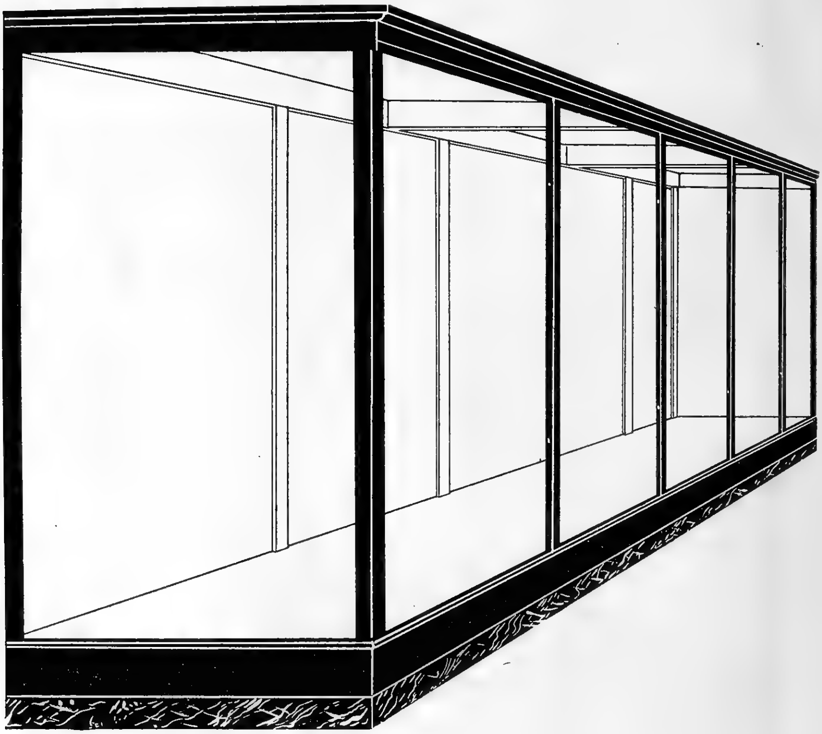
Type P. Type P is a single wall case occupying the space between the entrances of the Zoology Hall. It is designed for the display of groups of the larger birds, such as eagles and hawks.

Type Q

The exhibition space is consequently unbroken by shelves, is 19 feet long by 3 feet wide by 7 feet high and is raised 1 foot above the floor level on a recessed base. On account of the size of the exhibition space the case is ventilated with the dust-filtering device. The first, third, fifth and seventh panels are hinged, giving access to the case. The top panels are glazed.

Type PP. The wall cases of type PP are planned for the display of the larger archeological specimens such as baskets, canoe paddles, pestles and mortars for pulverizing maize, etc. The exhibition space measures 10 feet long by 3 feet wide by 7 feet high and is raised 1 foot above the floor level. The glass shelves are supported on adjustable bronze brackets. The top panels are glazed. Access is gained through the first and third panels which are hinged on the end side.

Type Q. The two wall cases of type Q are intended for a children's exhibit of objects relating to Indian life and customs. The



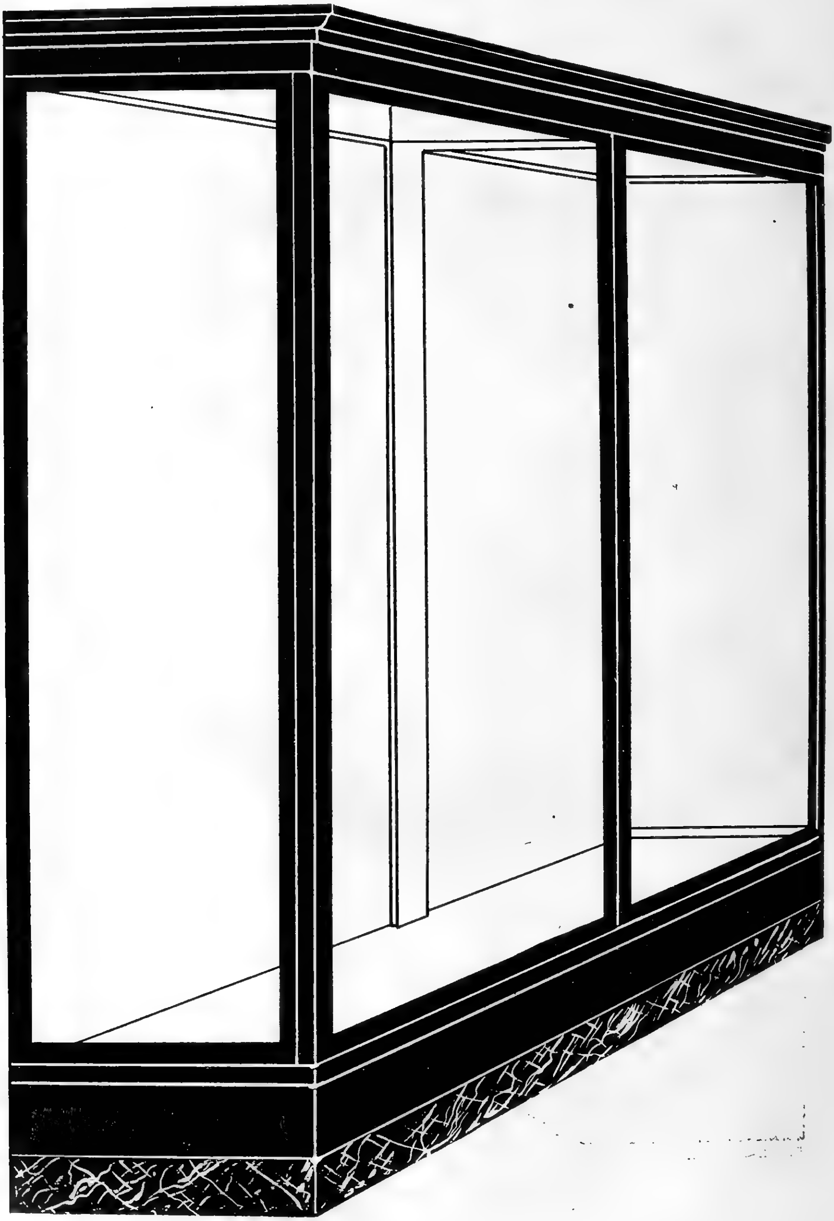
Type R

cases are consequently two feet lower than the customary height for wall cases. The exhibition space is 8 feet long by 3 feet wide by 5 feet high and is raised 1 foot above the floor level. The first and third front panels are hinged on the end sides giving access to the case. The top panels are glazed. The glass shelves are supported on adjustable bronze brackets and are divided between brackets into three units for each level so that a panel of shelving or any level of a panel can be eliminated to give head room for larger specimens.

Type R. The single case of type R was designed for the display of Indian canoes in the Archeology Hall. The case is con-

Type S

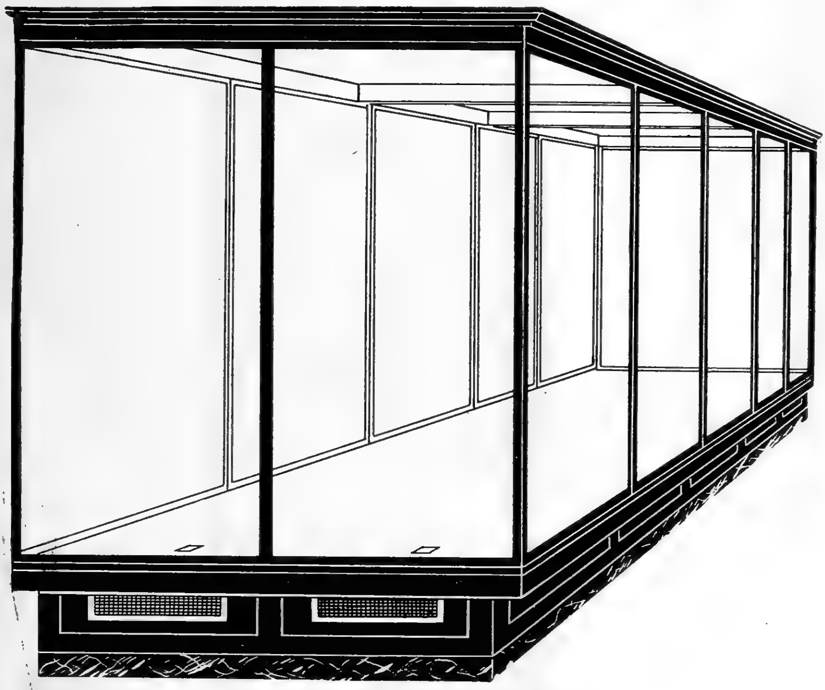
sequently longer and wider than is usual with wall cases and is not provided with shelves, the canoes being hung from the top of the case or supported on brackets from the back. The exhibition



Type T

space is 20 feet long by 4 feet wide by 7 feet high and is raised 1 foot above the floor level. The case is accessible through the first, third and fifth front panels which are hinged. The top panels are glazed.

Type S. Wall cases of type S were designed for the display of skulls in the collection of New York anthropology. The exhibition space is 8 feet long by 1 foot 6 inches wide by 7 feet high and is raised 1 foot above the floor level. Access is gained through



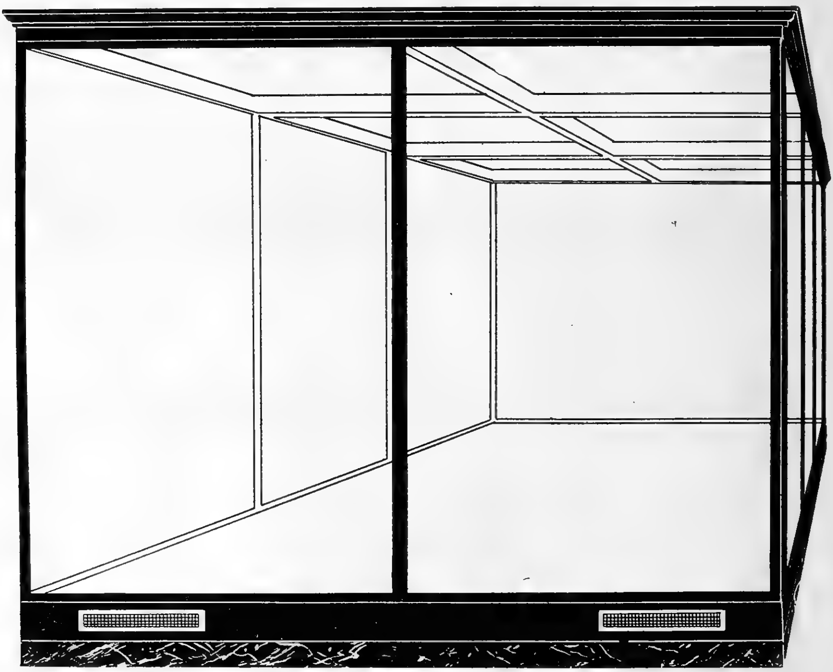
TYPE NN

the first and third front panels which are hinged on the end sides. The top panels are glazed. The glass shelves are supported by adjustable bronze brackets.

Type T. Wall cases of type T were designed to display such specimens in the ethnology and anthropology collections as complete Indian skeletons, clothing and miscellaneous ethnology objects. The exhibition space is 6 feet long by 2 feet wide by 7 feet high and is raised 1 foot above the floor level. The top panels are glazed. Access is gained through double doors in front.

LARGE FREE STANDING CASES FOR MAMMALS AND MAMMAL GROUPS

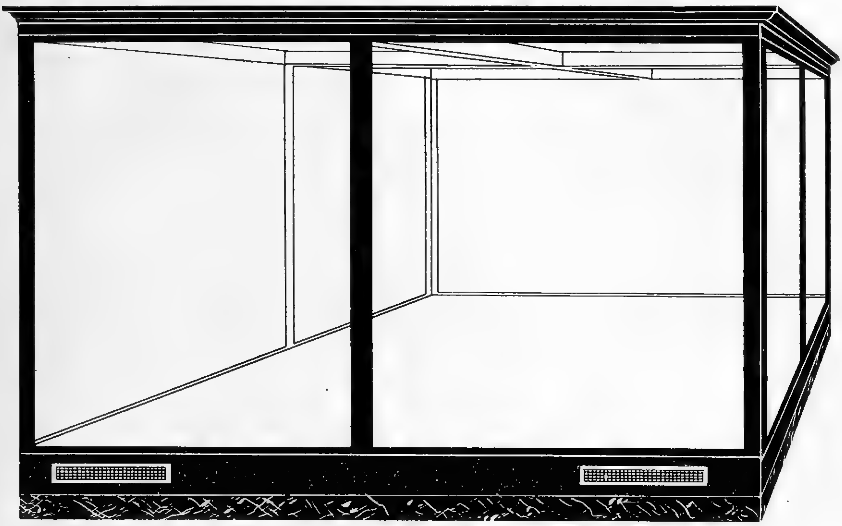
With the exception of type NN, the large cases for mammals are each designed to contain a certain definite group, as the moose group or the puma group, mounted to show the natural surroundings and habits of the animals. Type NN cases are here included because their museum function connects them more closely with the large mammal cases, but structurally they belong with the type N cases to which they conform in general design and with which they form a continuous series running around three sides of the Hall of Zoology. The ventilating dust-filter device is used on all cases of this group of types.



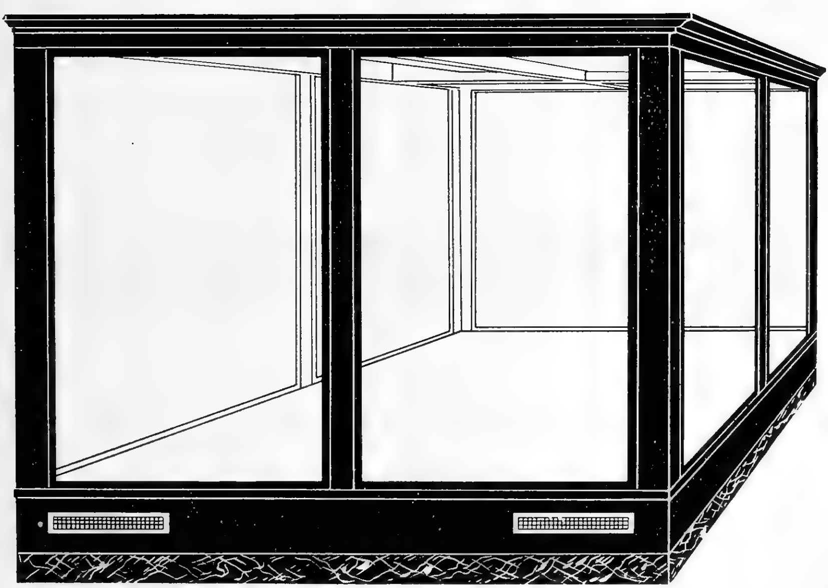
Type U

Type NN. The two cases of type NN were designed for the display of large mammals and groups of the smaller mammals in the collection of New York fauna. In design they are very closely related to type N cases, differing from the latter only in width. The exhibition space is 16 feet long by 6 feet wide by 6 feet 6 inches high and is raised 1 foot 6 inches from the floor level on a recessed base.

Types U, V, W, X and Y. Case types U, V, W, X and Y were designed to contain the large mammal groups of New York fauna. They differ from one another only in the dimensions of the exhi-



Type X



Type Y

bition space which is governed by the proportions of the group. They are all mounted on a straight (nonrecessed) base which is 1 foot high in the larger types U, V and W and 1 foot 3 inches high in types X and Y. Access to cases of these types is gained through one of the glazed top panels which is removable. Ground glass, instead of plain plate glass, is used for the top panels in order to cut off the view of the ceiling of the hall and thus render the group more detached. The sizes of the exhibition spaces are:

	Long	Wide	High
Type U	16 feet	12 feet	8 feet
V	14 "	12 "	9 "
W	10 "	10 "	7 "
X	10 "	8 "	5 " 9 inches
Y	8 "	$5\frac{1}{2}$ "	5 " 9 "

Number and distribution of types of museum cases

(Initial equipment)

Type	Archeology Hall	Entomology Hall	Geology Hall	Mineralogy Hall	Paleontology Hall	Zoology Hall	Total
A	....	....	....	....	20	....	20
B	30	....	75	48	33	24	210
C	12	....	....	....	....	....	12
D	6	....	....	....	....	....	6
E	12	....	....	....	....	....	12
F	6	....	....	....	....	....	6
G	11	....	....	....	....	....	11
H	....	12	....	....	....	....	12
I	....	....	19	15	....	....	34
J	....	....	....	4	....	....	4
K	....	....	....	....	11	....	11
L	....	....	....	1	....	....	1
M	3	....	....	....	....	....	3
MM	1	....	....	....	....	....	1
N	....	....	....	....	....	14	14
NN	....	....	....	....	....	2	2
O	....	....	....	....	....	2	2
P	....	....	....	....	....	1	1
PP	6	....	....	....	....	....	6
Q	2	....	....	....	....	....	2
R	1	....	....	....	....	....	1
S	3	....	....	....	....	....	3
T	2	....	....	....	....	....	2
U	....	....	....	....	....	1	1
V	....	....	....	....	....	1	1
W	....	....	....	....	....	2	2
X	....	....	....	....	....	2	2
Y	....	....	....	....	....	2	2
Total	95	12	94	68	64	51	384

PROGRESS OF INSTALLATION

As already intimated, the equipment of the collections has been in a measure restrained by the progressive completion of the cases. Those finished first were filled first; those which have just been completed are still vacant. The progress of this work has also depended in some measure on the condition of the collections. Some which had been on exhibition years before had been packed away in an orderly manner and judiciously selected. Others had to be taken over just as they had lain in storage for many years. The sum of the material assembled in all departments of work was very large; taken as a whole and, as was necessary, all at once, it was well-nigh overwhelming. Preliminary to any attempt at installation was the necessity of assorting these materials according to kind and quality and the selection of representative series of the best from the great preponderance of the second best. Confronted by these conditions the work of installation has proceeded well.

Mineralogy. The collections in mineralogy were removed from Geological Hall many years ago and put in storage. In dismantling the old collections everything was packed in carefully arranged consecutive order, so that on reopening these collections were in approximate readiness for installation. Having an advantage in this foresight, as well as in the fact that the mineral cases were the first to be completed, the curator, Mr Whitlock, has brought an effective installation nearly to completion. The general mineral collections and the collection of New York State minerals now occupy 78 cases at the west end of the long south hall, and it is quite probable that this section of the Museum may be opened to the public within a reasonably short time.

Geology. In illustrations of economic and structural geology the collections have proved quite deficient and every earnest effort has been made to acquire such and replenish the losses to the Museum arising from too lavish gifts to other institutions of displays made by the State Museum at various world fairs.

These efforts are bringing together the necessary materials for instructive exhibits, relating in large measure to the most active lines of mineral production in the State, but many serious problems in this section are still unsolved, and in some respects the case room is inadequate, the general treatment of Geology Hall is still ineffective and somber and much remains to be accomplished before the room can be exposed to the public. The work, in charge of Mr

Newland and Mr Jones, will eventually be brought to a successful conclusion.

Paleontology. The collections in the paleontology section which are very large, came to the new quarters in unavoidable disorder, due to the fact that the best part of them had been twice moved since the dismantling of the exhibit in Geological Hall, and the rest had in large measure been packed in boxes from five to thirty years and during this time shifted from pillar to post — from Professor Hall's laboratory to the State Hall and Geological Hall, from there to the McCredie malthouse, to the Taylor brewery — at length to this building where, for the first time since their collection, all were assembled in one place with the purpose of selection for one permanent exhibit. The boxes and crates and drawers containing this material were more than a thousand and the first and immediate problem here was to ascertain the nature and quality of their contents.

The progress made in this work is satisfactory, in view of the small number of men on the staff available for such service. The paleontology cases, 66 in number and consisting at present of four different types of construction, were made finally available in August and, except for a few of the smaller ones intended for special exhibits, all have been filled with a temporary arrangement of materials, and a final and permanent display has been worked out for certain groups of fossils: the Trilobites, Eurypterida, Crustacea and Cephalopods. This work has been carried out by Doctor Ruedemann, Mr Hartnagel and Mr Wardell.

In addition to this, much has been accomplished in the preparation of large exhibits of invertebrate fossils mounted on uncovered pedestals. Of these are a unique slab of Devonic starfish 4 feet 9 inches by 4 feet 9 inches, from Saugerties, N. Y., collected and mounted by Mr Wardell; a very striking display of cephalopods from the Agoniatite limestone, collected by Mr Hartnagel, developed by Mr Norton and mounted by Mr Wardell; a great slab of Devonic sponges from the Jenks quarry at Bath, N. Y., collected by the late C. Van Deloo, developed by Mr Norton and mounted by N. T. Clarke. Some very effective natural size reproductions of the Eurypterida, *Pterygotus, Eusarcus, Stylonurus,* have been made, framed and set up in the hall. These have been modeled by Mr Marchand and colored by Mr Barkentin. A series of natural size and enlarged relief designs to show the structure of the fossil cephalopods have been modeled by Doctor Ruedemann, cast by Mr Clarke and effectively colored by Mr Barkentin.

The fossil plants from the New York rocks will be assembled in the hall at the elevator landing. As a central piece for the room will be a restoration in life proportions of the unique Devonic tree, *Archaeosigillaria,* the largest and most complete of the terrestrial lycopod plants known from these rocks. The original of the restoration, taken from the Portage rocks at Naples and constituting a flattened trunk 11 feet long, has been remounted and cased, as has also the giant sea-weed *Nematophytum* from the Devonic rocks of Monroe, N. Y.

For the very extensive series of invertebrate fossils sufficient case room is not yet available and the necessary money has been provided for the construction of 37 additional cases which are designed to go entirely about the walls of the Paleontology Hall.

Attention has also been given to the vertebrate fossils. The Cohoes mastodon, a very celebrated skeleton and among the most complete known of the animal, has been set up by Mr Mirguet and in a manner much more effective than its original mounting. The Irish elk and the Asiatic elephant have also been remounted, the skull and tusk of the Ellenville mastodon set together and encased, the Harriman tusks and Monroe tusks put together. What is believed to be a fairly successful attempt to restore in natural proportions the extinct giant beaver of this State, Castoroides ohioensis, has been carried out and the model set up. It was modeled from measurements taken from the skull found at Clyde, N. Y., aided by more complete remains in the museum of Earlham College, Indiana. The workmanship is by Mr Marchand.

Restorations of the ancient Devonic fishes have been assembled in one case, recolored and effectively mounted.

A word should be said here in regard to the difficulty of preparing these exhibits in paleontology. The rocks of New York produce fossils which are almost exclusively of the invertebrate type and as a consequence the specimens are naturally small and rather inconspicuous except for certain noteworthy exceptions. The problem here is to present the small organisms to the public eye with the same effectiveness as if they were vertebrate objects of notable dimensions. It is needless to state that as natural objects each one is as momentous in its character and in the chain of life as though it attained the dimensions of the mammoth or the mastodon. Still, in the display of these small objects, all of a high degree of scientific interest, great thought and extreme care are necessary to make the presentation of them perfectly effective.

The remarks thus far made have especial reference only to the large south hall of the Museum. The efforts that have thus far been made herein toward installation have been supplemented by the accumulation and setting of the geological relief maps of which the Museum has now a considerable number and which it is hoped to supplement. The final determination of the arrangement of these relief maps has not yet been reached, but the walls of the halls afford reasonably favorable exposure for them and for such photographic illumination and similar decorative effect as may seem suitable.

Zoology. The cases for the Zoology Hall were not completed until the very end of the fiscal year, and as a consequence but little work has been possible in the matter of installing the extensive zoological collections. These cases number in all 43 and are divided into two series, one for the exhibition in zoology proper and the other for the exhibition in entomology, the two series of cases being of quite distinct types. In large measure the cases for the Zoology Hall are of conspicuous size and the installation in them of such groups as the large mammals will require much labor, artistic rendering and corresponding expense. From the old Museum was brought a limited number of small mounted groups, many of which have had to be repaired on account of the jolting received in moving. Among these also was one large group which has been entirely reset, and these few constitute all the mounted groups now in Zoology Hall. There remains, therefore, a very large amount of work to be done here, and if it is to be effectively done, it must be by the hands of expert workmen, who have not only ideas of scientific accuracy, but artistic conception and manual skill. Such men are not easy to find but the effort is being made to acquire the services of the highest grade in order that there may be no sacrifice of effectiveness in this hall. Meanwhile the installation of individual specimens of the higher mammalian and avian fauna has gone forward and at this time the case room available seems to be adequate for the immediate purposes of this division. It is, however, perfectly evident that this hall is now so full of cases that additions will be difficult and, if necessary, can not fail to close up the narrow aisles and aggravate the present obviously crowded condition. The members of the staff charged with this work are few in number and it will probably be necessary for a long time to come to go outside and employ the requisite expert assistants in ordering the zoological groups.

Archeology. The archeology section is to occupy the two mezzanine floors. Originally it was planned to restrict the archeological exhibit to the large mezzanine at the west of the building and to reserve the smaller mezzanine for the botanical collections. It seems, however, impracticable now to put together an effective exhibit in botany sufficient to fill the smaller mezzanine. The demands of the growing section of archeology for more room are imperious and the present plan contemplates assigning both mezzanines to this section and restricting botany, for the time being, to the space available in the separate compartment on the mezzanine floor at the east end of the building. The cases for the archeology section were released by the contractor only near the close of the fiscal year and these included only such as were embraced within the contract of George W. Cobb, jr. No provision had been made in that contract for the construction of the large group cases which are to contain the series of ethnological displays of the Six Nations. Since then plans have been undertaken which will lead to the construction of these cases to receive the groups for which the cost was contributed by the generosity of Mrs F. F. Thompson, and while these plans are now progressing, it will obviously be some time before these great cases are constructed and the exhibits completed.

Additional cases will be required, and reasonable provision has been made therefor, in order to put the smaller mezzanine in proper equipment for the reception of the archeological collections. In view of the uncertainty which prevailed as to the proper adaptation of the lesser mezzanine, the Cobb contract did not call for a sufficient number of cases to equip it suitably, and it is now hoped that the provision which has been made by the Board for additional cases may be adequate to put this room into proper order.

As a necessary consequence of these conditions the installation of the archeological collections, so far as it has gone (and some of the cases have been filled) is only temporary, for the construction of the new cases will require the removal and replacing of some cases already installed. Mention might properly be made, however, of certain work which has been done in the construction of the Indian graves in the cases prepared for them, the work on these having been effectively rendered and completed. This work has been carried out under the direction of Mr Parker by his assistants, Mr Clarke and Mr Lansing.

General. The Museum is still imperfectly equipped in office facilities and more especially in regard to suitable drawers for the keeping of the excess and duplicate storage collections of its material. We brought over from Geological Hall and State Hall many thousands of wooden drawers with their standards, for the purpose of affording necessary, even though dangerous, storage, and these are now standing in the corridors. In the basement of the building the machinery plant has been installed and the balance of the room there appropriated for the work of the Museum is given over to the storage of the large amount of material which it has been as yet impossible to open.

There have been some notable accessions to the collections purchased during the past year. These have been principally in the division of archeology which was the most severely injured by the Capitol fire. Of these recent additions those of leading importance are the collections of Indian materials brought together by R. D. Loveland, Watertown; Charles P. Oatman, Liverpool; Raymond C. Dann, Fairport; Alva S. Reed, Livonia; Frederick H. Crofoot, Sonyea; D. F. Thompson, Troy, and Otis M. Bigelow, Baldwinsville. This series of collections of Indian cultural relics constitutes the best of the Iroquois and pre-Iroquois materials now available in the State, and although further additions are always desirable, it is quite likely that they must be of very much less size and significance. To this list should be added the extensive collection of such materials made by Mr D. D. Luther, a member of the staff, from the Indian village in the town of Naples.

The Museum has also acquired by purchase the William D. Gebhard collection of fossils from the classical region of the Schoharie valley. This is the last of the great collections of fossils brought together by the Gebhards, through three generations, and the State Museum is fortunate in getting possession of it. An extensive collection of minerals from Orange county, made by the late Silas A. Young of Edenville, has also come into the possession of the Museum and makes an essential addition to the representation of New York minerals.

Full inventory of these collections will be given in the accession lists and made a part of this report, together with memoranda regarding smaller collections of various kinds and varying interest.

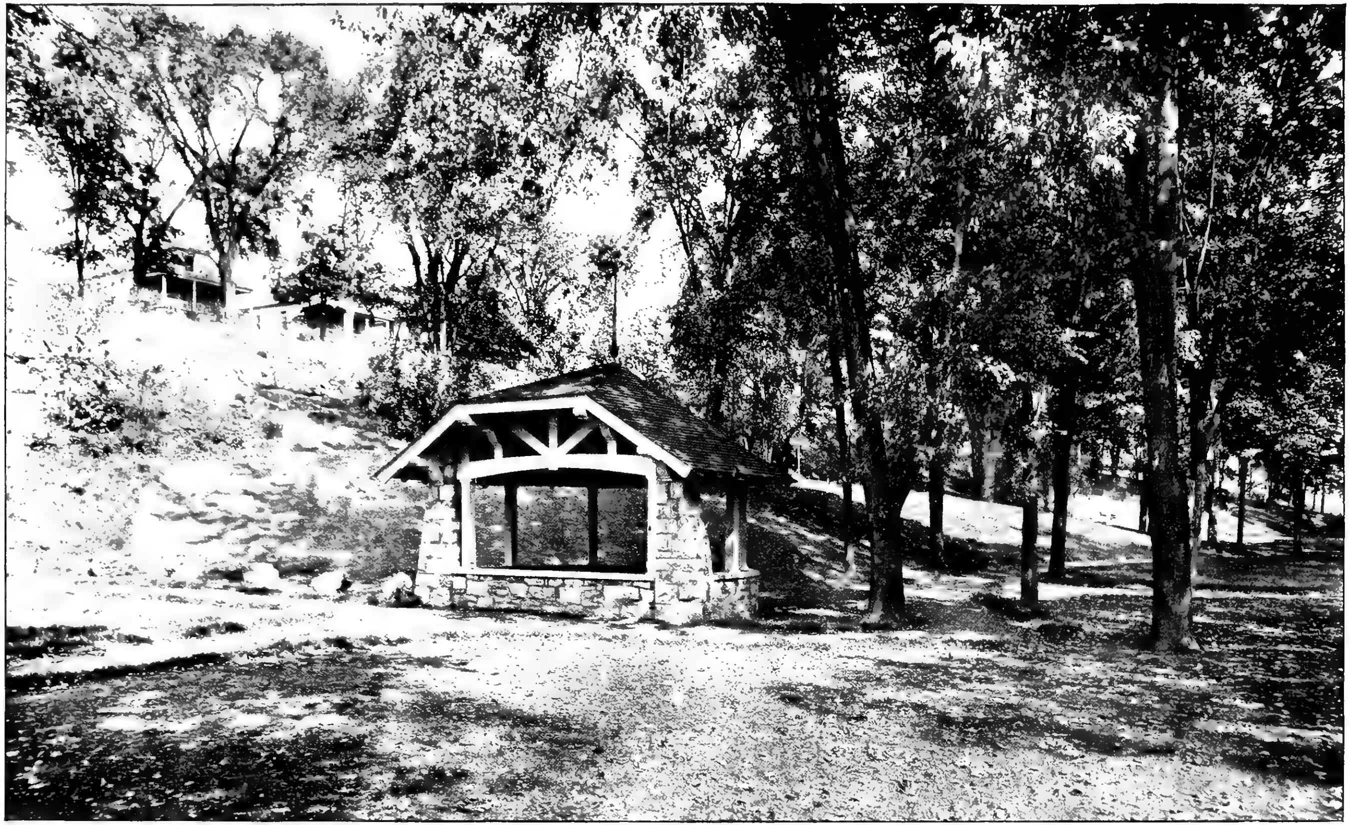
Orders have been given for the construction of a large relief map of the Finger Lakes region on the topographic scale of one mile to one inch. This is constructed for the purpose of showing the detailed stratigraphy of that region as it has been worked out by the members of the Geological Survey. The map will cover the quadrangles of Canandaigua, Naples, Bath, Phelps, Penn Yan and Hammondsport. There is also under construction a model of Mormon hill, near Palmyra, celebrated for its historical associations as the place where the alleged " gold plates " of the Mormon bible were dug up and quite as interesting geologically as an illustration of a glacial drumlin, a topographic form which occurs abundantly in the region of the Lake Ontario plain.

II

REPORT OF THE GEOLOGICAL SURVEY

CIVIC GEOLOGY

The mineral springs and the fault at Saratoga. On a later page reference will be made to the completion of the areal survey of the Saratoga quadrangle which covers the Mineral Springs basin. In the very successful operations made at Saratoga by the State Reservation Commission toward the rejuvenation of the exhausted springs, this office has taken a keen interest and has exercised such cooperation as has been in its control. In the execution of this work the commission has been successful to an unexpected degree in restoring the springs to their original virility, and in connection with the elaborate experimentation thereupon opportunity has been found to clear away the accumulations of rubbish and the tumble-down buildings which have long covered most of the escarpment of the celebrated *Saratoga fault*. The Saratoga fault has achieved a distinction which is perhaps quite out of proportion to its importance, and yet this fracture is a controlling influence upon the relief of the mineral water storage. The fault scarp stands as a rock cliff running through the village from the High Rock spring southward, gradually becoming a less conspicuous feature in the topography until it disappears in the vicinity of Congress Park or the United States hotel. The Saratoga fault has its heaviest throw far to the north of the village and in its course southward its escarpment lowers on its way through the length of the village until it is lost. It was formerly supposed that there was a direct continuation of this fault southward to Ballston where it influenced the Ballston mineral waters as it does those at Saratoga. The soil mantle covers all this area so deeply as to make it difficult to substantiate such an assumption. It has become clear, however, that the surface evidence of displacement terminates near Congress Park. In recent excavations made by the commission in preparation of the Spencer Trask memorial, to occupy this park, an opportunity was afforded of uncovering the rock surface at the south end of the fault where the displacement line is known to make a sharp turn to the west. The commission has, with fine appreciation of the geological interest attaching to this phenomenon, given instructions to have the probable course of the fault from this point uncovered where it crosses the street in the direction of the Ainsworth spring — the only water-bearing hole which has been put down west of the fault line.



Saratoga Fault
As exposed near the High Rock spring

Saratoga Fault
The escarpment at the High Rock spring

Saratoga Fault
The northern limb which has been cleared and parked

Saratoga Fault

The fault face, used as a dump for rubbish — a condition that will not long be tolerated

Of the several explanations offered for the existence of the heavily carbonated waters of Saratoga, one has assumed that it is along the fissure of the fault that the carbon dioxid has found its way from great depths within the crust of the earth.

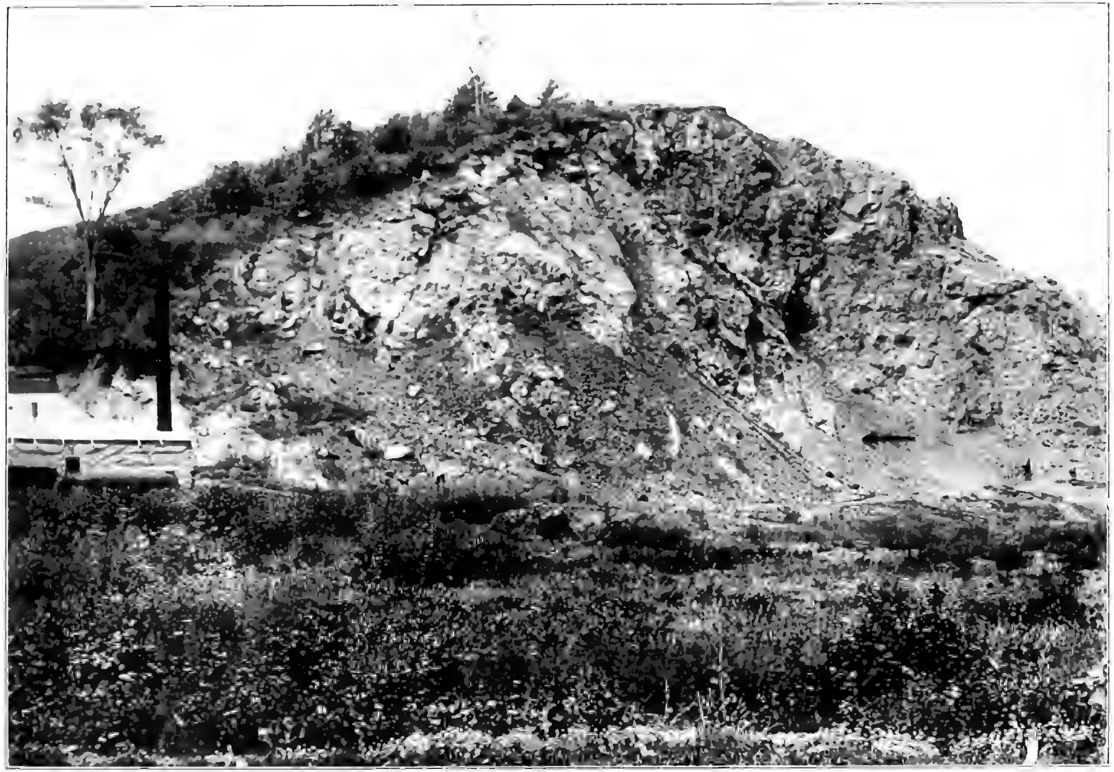
Our present understanding of the geological origin of the mineral springs waters, briefly stated, is this: The region eastward of the fault is covered by a thick layer of impervious shale, which is very much broken up in the vicinity of the Hudson river. Where these shales are most disturbed and broken, the percolating meteoric waters have penetrated and have traveled along the dip of the underlying rock through the limestone beneath where as a result of secondary changes there taking place in the limestone, they have acquired carbon dioxid and when saturated with this gas have gained an increased solvent power which has enabled them to take up various soluble salts from the rocks through which they have passed. Traveling easterly they reach the fault fissure which they have been unable to traverse, and thus it happens that the springs derived through natural crevices or artificial holes in this basin, all lie on the east side of the fault line.[1] Whatever the future of the Saratoga mineral springs may be, and with the present and coming development of the science of hydrotherapy the outlook is most brilliant, Saratoga will always remain a place of high geological interest from the very fact of the relations of these waters to the rocks and to the fault line. It is therefore a matter of considerable public interest that the State commission should have brought out to its full effectiveness this fault cliff, even though the displacement is of a lesser order of magnitude. To increase public appreciation it might be well worth while to attach to the accessible face of the cliff, some placard or tablet which would explain the cause of the fissure and its influence upon the mineral waters. An eminent student of earthquake movements has suggested that it would be well worth while to attach a tablet not only to the face of the cliff but to the ground surface of the fault as well and have a precise leveling between fixed points on these two tablets so that it might be possible to determine any movement of the cliff up or down, that is to say, any reappearance of seismic or earthquake movements along this ancient line of weakness.

Stark's knob, Saratoga county. Stark's knob is a knoll of volcanic rock near the village of Schuylerville which, as its name

[1] The Ainsworth spring lying on the west of the fault, traversed it and derived its water from the east side.

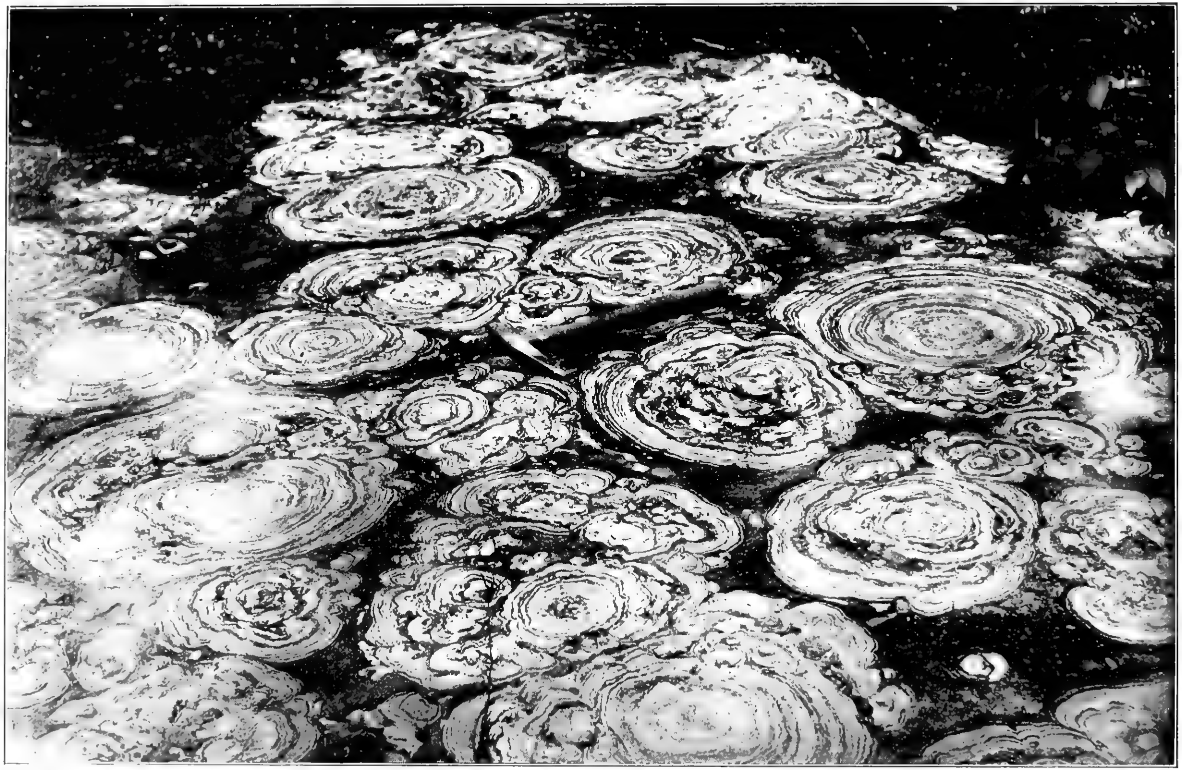
indicates, has a definite historic association. It is the place where Captain John Stark established a little redoubt and effectually obstructed the movements of General Burgoyne during the battle of Saratoga. Its scientific interest, however, is quite as great, perhaps greater, than its historic. It has been described at length in the reports of the Geological Survey as a volcano or volcanic plug and as such is the only geological phenomenon of this kind known to occur in the State of New York. The question as to the origin of this plug, the stage at which the lavas penetrated the rock and the relation of the mass to all the surrounding geological terrane, has been much investigated and much discussed. There appears now to be very excellent reason, quite acceptable to those who have studied the phenomenon most closely, for assuming that this volcanic plug is not autochthonic, that is to say, is not now in the place where it originally appeared, but that in the great earth movements occurring in eastern New York during the time of the Taconic revolution, this volcanic mass was carried over on the crest of an earth wave from its original situs, possibly as far to the east as from the Connecticut valley in Vermont. This fact is not at the present time fully demonstrable but, as intimated, it seems a reasonable explanation to those who have studied the occurrence most closely. There are thus two elements of interest in this small and somewhat obscure topographic feature, of interest so extraordinary and unusual as to demand that some degree of public consideration be given to the preservation of this spot. Unfortunately some years ago the volcanic rock, which is a diabase, was thought to be available for highway construction, and the knoll or knob was leased for the purposes of producing road metal. The rock has decomposed so badly, however, that it has never well served any such purpose.

The writer has made an earnest effort to bring this spot under protection and control and there is a hope, perhaps not too remote, that the place may eventually become the property of the State under the custodianship of the State Museum. If this can be effected it will be a partial realization of a general public appeal made some years ago by the Director of the Museum for the preservation of objects of unique or noteworthy natural interest. This appeal met with many warm responses, but could be supported only by the activities of local societies or interested individuals, as no State money was available.



H. P.Cushing, photo

"Stark's Redoubt" as it appeared in 1910; from the southeast. Removal of rock has chiefly been from the south end; on the north it has been stripped though but little has been removed. The arrow points toward the slickensided surfaces



H. P. Cushing, photo, 1910

Glaciated surface of the "Cryptozoon Ledge" in the town of Greenfield, Saratoga county


H. P. Cushing, photo, 1910

Another view of the "Cryptozoon Ledge"

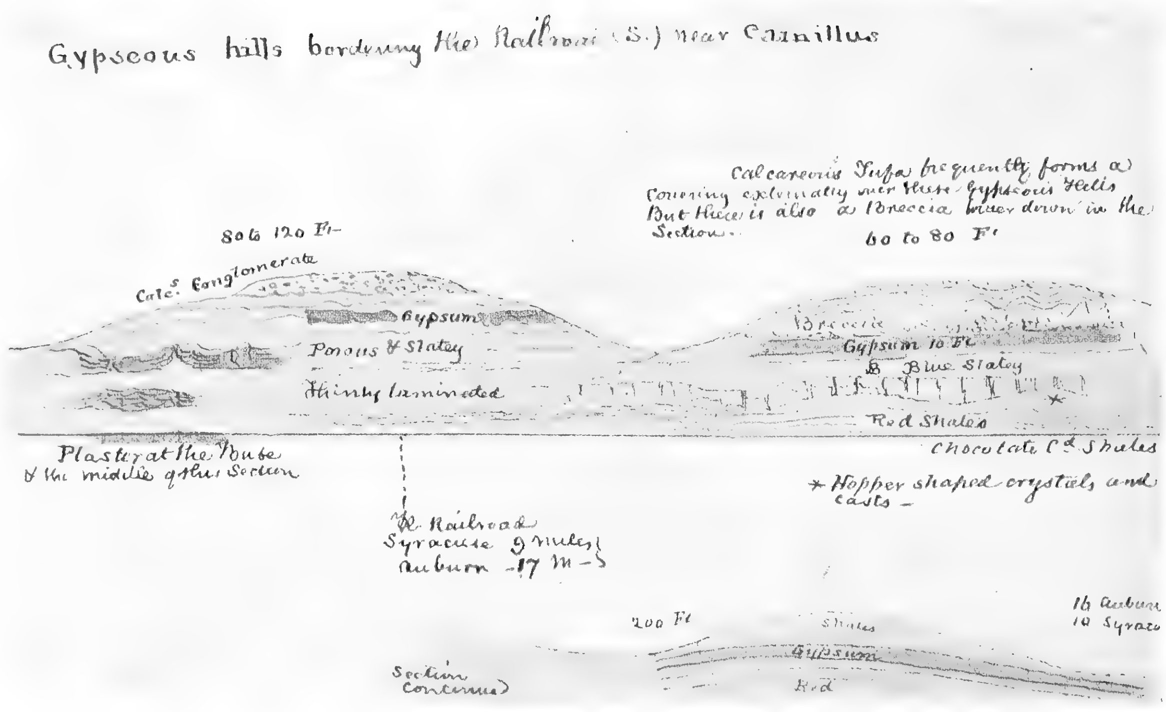
The "Cryptozoon ledge" in the town of Greenfield, Saratoga county. The geologists of the Survey have long been aware of the occurrence on the property now owned by Mrs Mabel A. Wesley, but generally known as the "Hoyt quarry," of a remarkable ledge of Cambric rocks exposing in most extraordinary fashion a reef of the fossil known as *Cryptozoon,* which is believed to be an algoid plant secreting a calcareous skeleton. This exposure is to be seen along the roadside from Saratoga Springs to Greenfield and the fact that the ledge has been smoothed down by glacial action renders it all the more conspicuous and interesting. These great circular Cryptozoon masses are often many feet in circumference, made up of concentric layers of algoid growths, and it is quite probable (indeed, it is so stated freely by geologists who have studied these ancient organisms in various parts of the world) that this exhibit is altogether unique. Especial interest attaches to these organisms from the fact that it is now thought that such reefs of algae or water plants, either marine or of fresh water, were present in the rocks of the Precambric and were among the first of known forms of life. This peculiar ledge of Cryptozoon is so out of the ordinary, so impressive to the student and even to the casual visitor, that an effort is now being made to bring it also under the control of the State as a public reservation. This is fully justified by the fact that the ledge is extraordinary, unique and teaches an interesting lesson which could well be explicated on the spot in case it can thus be brought under the control of the State Museum.

Mormon hill. Reference has been made to the production of a relief map of Mormon hill, in Wayne county near the village of Palmyra. This glacial drumlin or melon-shaped hill deposited by the melting ice sheet on its retreat to the north, is the spot where Joseph Smith, on a dark night in 1827, is alleged to have dug up the golden plates of the Book of Mormon. It is thus the Mecca of the Mormons and is visited by their distinguished members with frequency. In the history, therefore, of this State, it stands as a monument to a religious and civic enterprise which has now taken on an influential form, both of quality and circumstance; and it is well, therefore, that the place should be preserved. Doubtless the time will come when the disciples of this growing religious cult will themselves desire to possess and to protect the place; and should this ever happen, it is still to be remembered that its preeminent place as a factor in the history of the State is as one of the series of great glacial drumlins from a region in western New York where they are better developed than probably in any other part of the world.

Indian Ladder Park. Geologists in many parts of the world will be interested in the announcement recently made of the gift to the State of New York as a public park of the "Indian Ladder" and its adjoining portions of the Helderberg mountains escarpment in Albany county, New York. Next, perhaps, to the Schoharie valley, the Helderbergs and the Indian Ladder have the most intimate and ancient association with the history of geology in this State and are really a classic ground in American geological science. Interesting not alone for its geology, as the original section of the "Helderberg formation" and its various subdivisions, with their profusion of organic remains, the Indian Ladder is equally commanding as a scenic feature. There is perhaps nothing just like it in origin and effectiveness. From the summit of the long sheer limestone cliff the eye commands the panorama of the conjoined Hudson and Mohawk valleys picturesquely spread out over a vast area bounded at the north by the foothills of the Adirondacks and at the northeast by the Taconic mountains and the Berkshires. And over this splendid picture generations of geologists have gazed, for the Helderbergs have been the Mecca of geologists for well-nigh a century.

The generous gift to the people of New York State comes from Mrs Emma Treadwell Thacher, widow of the late Hon. John Boyd Thacher, a distinguished statesman, historian and litterateur. Its more than 350 acres extends along the escarpment so far as to include all its most striking portions and the new reservation is essentially a geologic and scenic park.

Geological sketches from an old notebook. During the past year the Director received from Thomas T. Wierman, Esq., of Harrisburg, Pa., an old field notebook of the New York State Geological Survey, dated 1841. The book bears no evidence on its face of original ownership, but inquiry from Mr Wierman brought out the fact that the book had originally belonged to Richard C. Taylor, an English geologist of that period, whose notes and papers became the property of Captain John McCandles of Philadelphia and were later passed on to Mr John Fulton, a mining engineer, with whom Mr Wierman was employed in Bedford county, Pennsylvania, back in the '70s of the last century. Mr Wierman further states that Mr Fulton became a resident of Johnstown, Pa., a village which was wiped out by the great floods of 1889



Gypseous hills near Camillus
Sketch from the notebook of R. C. Taylor, 1841

and that all the Taylor books and papers were lost with the exception of this, which finally came into his possession.

The book is a noteworthy record. Mr Taylor was an accomplished geologist and a fine field observer, as well as a sketch artist of no mean ability. The pages of the book are filled with carefully detailed geological sketches in water color, many of them of outcrops and of localities in this State which are no longer accessible. Mr Taylor had come to New York evidently for the purpose of putting himself in touch with the recently acquired results by the New York State geologists, and seems to have been particularly intimate with Mr Vanuxem, of the Third District. Evidently he was received with courtesy by his colleagues here and given this notebook, which bears the official stamp of the organization; but his field trips were made independently of the official geologists themselves and he traversed the State from the southwest corner to its eastern boundary and beyond. Some of Mr Taylor's sketches are of so great interest as to be worth bringing back to the public eye and to the public record of the New York Geological Survey, into which they have entered only in one or two instances; for it is to be noticed that Mr Vanuxem made references to Mr Taylor's Pennsylvania work in his annual report for 1837 and used several of his drawings in the Final Report on the Third District, of which may be mentioned the sketches of the cliffs on Cayuga lake and of the inclined strata in Howland's quarry near Union Springs. But Mr. Taylor's connection with the organization has never before been a matter of record and it may be well to give here the following brief sketch of his career.

He was born in England in 1789 and came to America in 1831. In his own country he had been a mining engineer and practical geologist, a member of the Geological Society of London and other learned institutions of Great Britain. His practice of geology was entirely economic, and in the development of the coal and iron industry, particularly of Wales, he gained for himself noteworthy distinction.

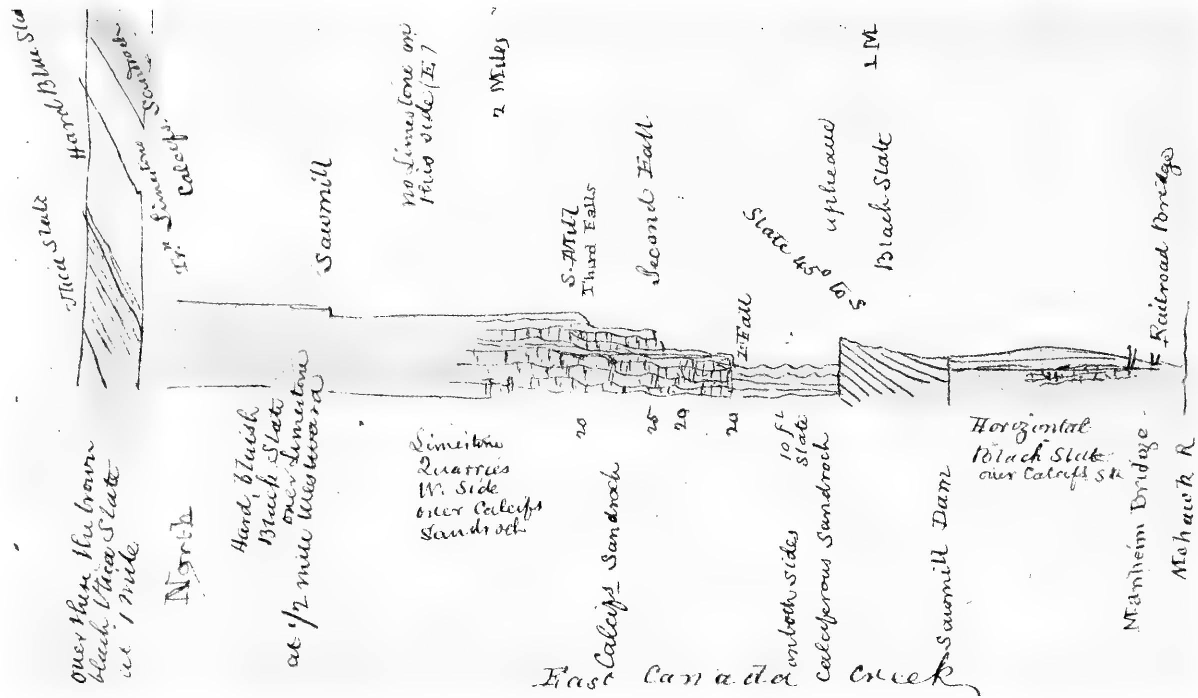
Upon his arrival in America he took up his residence in Philadelphia and shortly after was engaged in a survey of the coal fields of Tioga county, Pennsylvania, and subsequently in the southern coal fields in Dauphin county. Of so high order were these undertakings that he was frequently under professional engagement in other mineral districts of the United States. His great work, however, and that upon which his repute as a geologist rests, is probably his well-known book "Statistics of Coal," published in Philadelphia in 1848. The book contained summaries of labors of a long life in connection with coal formation and coal production, and it was received both in England and here with the highest approval and with unstinted commendation.

It was not exclusively to economic geology, however, that he devoted his interests, for his geological contributions show the versatility of his observations. He writes on the fossil marine plants of Mifflin county, on the existence of an ancient lake in Mifflin county, on the copper region of Cuba, on fossil plants in Dauphin county, on Indian mounds and earthworks, etc., etc.

Mr Taylor was a member of the American Philosophical Society and it is from the obituary notice of him read by Isaac Lea that the above memorandum has been largely taken. No mention, however, is made in any of the notices of his life that the writer has found, of his association with the New York State geologists or of his experience in the field of New York geology. As Mr Taylor was 52 years old when he came into the New York field, he was older than any of the four geologists engaged upon the survey and unquestionably had an experience in the field, especially, at least, in the field of economic geology, to which none of them could lay claim. Yet in spite of this fact, there is nothing in this notebook to indicate that his mind was especially fixed or his eye particularly keen to such development in New York. He seemed to be looking only for a knowledge of geological structure, to test the conclusions of the four geologists for his own personal and professional information and, so far as the writer is aware, he never expressed any public opinion or published any reference to his experiences and observations in the New York field.

Mr Taylor died in Philadelphia in 1851.

The time may come when it will seem well to reproduce, for the purpose of perfecting the record of the history of this survey, more of these sketches than are here given; but to indicate their character, their worth and their exactitude, the following pages carry a few of these, given, so far as seems practicable, in their original tints and with the original memoranda attached thereto.



SECTION ON EAST CANADA CREEK
Sketch from the notebook of R. C. Taylor, 1841

BOARD OF GEOGRAPHIC NAMES

The Legislature of 1913 provided for the institution of a State Board of Geographic Names, in the following law, which is chapter 187:

Section 1 Article 10 of chapter 23 of the Laws of 1909, entitled "An act in relation to executive officers, constituting chapter 18 of the Consolidated Laws," is hereby amended by adding, at the end thereof, a new section, to be known as section 110, and to read as follows:

§ 110 **Board of geographic names; powers and duties.** A State Board of Geographic Names is hereby created, to consist of five members, of which the Commissioner of Education and the State Geologist shall be ex officio members, and three of whom shall be appointed by the Governor to hold for terms of two, four and six years, to be designated by him when the appointments are made. Their successors shall be appointed by the Governor for terms of six years. Vacancies shall be filled by the Governor for the unexpired terms of the offices vacated. The State Geologist shall be the secretary and executive officer of such board. All of such members shall serve without compensation. The said board shall have power, and it shall be its duty:

1 To determine and establish the correct historical and etymological form of the place names in this State and to recommend the adoption of such correct forms for public use.

2 To determine the form and propriety of new place names proposed for general use, and no corporation, individual or community shall introduce such new place names without the consent and approval of this board.

3 To cooperate with the United States Board of Geographic Names and with the United States post office department in establishing a proper, correct and historically accurate form for all place names proposed as designations of new post offices.

§ 2 This act shall take effect immediately.

Acting under the authority given him by this law, Governor Sulzer appointed as members for the terms of two, four and six years, Arnold J. F. van Laer, Albany, Hugh P. Baker, Syracuse, Herman Leroy Fairchild, Rochester. This law carried no appropriation for the execution of its provisions, for clerical help or even for stationery; but as the work of the board has an obviously University function, it has seemed entirely proper, for the present, to carry on this work in connection with the other activities of this Department, awaiting the day when the Board of Geographic Names shall very properly become an organic part of the University.

There have been many and very excellent reasons for the creation of such a board and these were fully appreciated, both by the late Commissioner of Education and the committees of the Legislature before whom the proposition was brought, and expressed in the enactment. Local place names in the State have often gone astray from their original significance; very frequently names which have no propriety within the State of New York have been, of late years, added to its already somewhat incongruous assemblage; meaningless names, names which are combinations of euphonious, perhaps, but jejune syllables have been imposed upon the State, often at the instigation or by the connivance of public service corporations. New York has had its own troubles in its place names and there probably is not another equal area in America which is so bespangled with classical names without the remotest relationship to this country, as the Old Military Tract of central New York.

This board has been called upon to exercise its functions on several occasions in regard to the institution of new or proposed names, and this has been without solicitation or warning on its own part. It seems, however, quite likely that in the further rearrangement of place names in the State, it may be part of the duty of the board to direct attention to the existence of the law and to invite conformity therewith.

As a present evidence of the activity of the board and its purpose to do something more than pass upon applications made to it from whatever quarter, there is submitted herewith a glossary of the place names of three of the counties of the State, Albany, Schenectady and Rensselaer. The prosecution of such work as this, if carried out thoroughly, would form a useful series of documents bearing upon the historic development of settlements in the State and such work should be pursued even more completely than is here indicated. It will be understood that the present brief definition of the place names herewith attached is only a suggestion or a hint of the appropriate direction which some of the labors of the board may take.

THE PLACE NAMES OF ALBANY COUNTY

ADAMS STATION. Hamlet. Named for Nathaniel Adams, early settler. Also known as Adamsville. (Now *Delmar,* absurd misappropriation of well-known town name on border of Delaware and Maryland.)

ALBANY. County and city. Named in honor of James, Duke of York and Albany (1664), afterwards James II.

ALCOVE. Hamlet. Formerly Stephensville.

ALTAMONT. Hamlet (formerly Knowersville). Fancy name of no historical significance. *High mountain;* lies at base of Helderbergs.

AQUEDUCT. Hamlet. The Erie canal here crosses the Mohawk river.

AQUETUCK. Hamlet. *Ach-que-tuck,* Iroquois. Ach-que-tuck or Aquetuck was an early name for Coeymans Hollow. It is usually applied to the flats there but appears to be the *Hagguato* of the map of the New Hampshire Grants and the stream mentioned by Schoolcraft as *Hakitak,* below Coeymans. It may be derived from Ahque, *he leaves off,* and tuk, *a river;* i. e., *a river at a boundary* (Beauchamp).

AURANIA or URANIA. An early alternative name of Fort Orange.

BABCOCK CORNERS. Cognominal. Now Bethlehem Center.

BASIC creek. Thought to be Mahican; "may be a corruption of quassik, *a stone*" (Beauchamp).

BEACON island. Descriptive.

BEAR island. Descriptive.

BECKERS CORNERS. Hamlet. The Becker family were early settlers.

BEEREN island. The island of bears (Dutch). The Mahican name has a similar meaning (Beauchamp).

BERNE; BERNEVILLE; SOUTH BERNE. From Berne, Switzerland, native place of Jacob Weidman, one of the early settlers.

BETHLEHEM; BETHLEHEM CENTER. Suggesting the religious proclivities of the settlers.

BEVERWYCK. Original Dutch name of Albany.

BLACK creek. Flows over exposures of black shale.

BLOCKHOUSE creek. Early settlers built a blockhouse here.

BOGHT. Hamlet. Dutch = bend of the Mohawk river.

CABBAGE island. Descriptive.

CALLANAN CORNERS. Named for Henry Callanan, an early settler.

CASTLE island. Same as Van Rensselaer island. Fort Nassau was built on this island.

CEDAR HILL. Hamlet. Red cedar formerly covered the hills.

CHESTERVILLE. Hamlet. Named for Rev. John Chester of Albany. Now known as Westerlo.

CLARKSVILLE. Village. Named for Adam A. Clark, 1822.

COEYMANS. Town, village. Named for Barent Pieterse Coeymans, patentee.

COEYMANS HOLLOW. Hamlet on Hannacrois creek.

COHOES. Town, city. Mohawk = Ga-ha-oos, *canoe shooting over the falls.* "Cah-hoos or Ca-hoos, *a canoe falling,* as explained by the late Indian sachem, Brant." (Spafford)

COLONIE. Town. The Colony (Rensselaerwyck).

CONNERSVILLE. Cognominal.

COOKSBURG. Hamlet. Thomas B. Cook of Catskill, 1840, leading man in the Catskill and Canajoharie Railroad enterprise.

CRESCENT STATION. Hamlet. In the great bend of the Mohawk.

DELMAR. See ADAMS STATION.

DISBROWS. Hamlet in town of Westerlo. Name no longer in use.

DORMANSVILLE. Hamlet. Named for Daniel Dorman, first postmaster, 1832.

DUNNSVILLE. Hamlet. Named for Christopher Dunn, original owner.

DUNSBACK FERRY. Hamlet. Dunsback, early settler. Ferry over Mohawk.

EAST TOWNSHIP. Hamlet.

EIGHT-MILE creek. Descriptive.

ELDER creek. Descriptive.

ELSMERE. Modern name without appropriateness.

FECHTBERG. Hill in town of Berne. The name is said to have come from a dispute as to leadership among settlers, 1750.

FEURABUSH. Hamlet. Dutch: *vurenbosch* (pronounced *vürebosch*), fir-bush, or woods. (A. J. F. van Laer) Now known as Jerusalem, the name Feurabush being attached to the railroad station.

FLY creek. Dutch: *Vlaie,* meaning *a meadow.* Same as *Vly.*

"This word *vly,* in the records also written *vley* and *vleye,* is a puzzling word in the Dutch language. It is obsolete at present and its real meaning is unknown to me. The word seems to apply in nearly all cases to low, marshy land, or to salt meadows, and I suspect that it is nothing but a contraction of *valey,* valley, or low land. At all events I should say that the meaning was low land, rather than meadow. *Vlaie,* is probably a later corruption, which, as far as I remember, does not occur in the Dutch records." (A. J. F. van Laer)

FONT GROVE. Modern name.

FOXENKILL = Foxes stream.

FRENCH'S MILLS. Hamlet. Named for Abel French, miller.

FULLER. Hamlet. Named for Major John Fuller.

GIBBONSVILLE. Old village incorporated into West Troy, 1836. Now a part of Watervliet.

GLENMONT. Hamlet. Fancy name.

GREEN ISLAND. Village. Descriptive.

GROESBECK. Formerly a suburb of Albany, in the town of Bethlehem. Named for the Groesbeck family. Now obsolete and included in the southern part of the city.

GUILDERLAND. Township and village. Named from Gelderland, in the Netherlands.

GUILDERLAND CENTER and GUILDERLAND STATION.

HAMILTON or HAMILTONVILLE. "A town or settlement lately laid out in Albany county, New York, in the extensive township of Water Vliet, formerly called the *Glass Factory;* and has its present name in honor of that great patron of American manufactures, the late secretary of the Treasury of the United States of America. It lies 10 miles west of Albany, 2 miles from the Schenectady road; and is one of the most decisive efforts of private enterprise in the manufacturing line, as yet exhibited in the United States. The glass manufactory is now so well established and so happily situated for the supply of the northern and western people of the State of New York as well as Vermont and Canada, that it is to be expected that the proprietors will be amply rewarded for their great and expensive exertions. The glass is in good reputation. Here are two glass houses and various other buildings, curious hydraulic works to save manual labor by the help of machinery. A copious stream runs through the heart of the settlement which lies high; and being surrounded by pine plains, the air is highly salubrious. The great Schoharie road traverses the settlement. A spacious schoolhouse and a church of octagon form are soon to be erected."

"The enterprising proprietors of the *Glass* and other works in this thriving settlement, were incorporated by the Legislature of New York in the spring of 1797; by the name of 'The Hamilton Manufacturing Society,' which act has given spring to the works here; and authorizes a hope that American manufactures may not only subserve the interests of our county but that also of the proprietors." (Jedediah Morse's *Gazetteer,* 1798).

The settlement and enterprise became effaced by 1840 and the only local trace of it now remaining is to be found in the name "Hamilton Church" in Guilderland township.

HANNACROIS creek. Supposed to be from Dutch signifying a crowing cock. It is said that during a freshet a barn was carried down stream and perched upon an open door stood a cock crowing.

HAVERS island. In the Mohawk. From the Dutch: *haver,* oats. Same as VanSchaick's island.

HELDERBERG mountains. Variant derivations have been suggested for this Dutch word; *helder* = bright, *bergen,* mountains. *Helder,* a fort in Holland.

HILLHOUSE island. Cognominal.

HUNGER KILL. The local story says that wagon trains from Albany to Buffalo stopped here for refreshment.

HURSTVILLE. Hamlet. Named for William Hurst, 1861.

INDIAN FIELDS. Hamlet. Indians had planted fields and orchards.

IRELAND CORNERS. Hamlet. Named for Elias H. Ireland, 1832.

IRISH HILL (Berne). The first settlers were Scotch-Irish.

JANES CORNERS. Same as SOUTH BETHLEHEM. Elisha Janes kept tavern here.

JERUSALEM. Formerly Feurabush. This later application of an old name which has appeared only on recent maps is objectionable, in view of the well-established application of the word to a township in Yates county and to a village in Queens county.

KAIKOUT kill. Stream. Dutch: *kijkuit = look-out.* See Kykout (Rensselaer co.)

KARNER. Hamlet. Cognominal.

KEEFER CORNERS. Hamlet. Named for Balthus Keefer, 1791.

KENWOOD. Suburb of Albany. Named by Mayor Jared Rathbone, Albany, after a Scotch place of his acquaintance.

KIMMEY'S CORNERS. Cognominal.

KNOWERSVILLE. Now ALTAMONT.

KNOX. Township and village. Named for John Knox by the Scotch settlers.

KRUM kill. Stream. Would seem to be from the Dutch *krom* or *kromme,* crooked.

LAMBS CORNERS. Hamlet. Named for Jehial Lamb, early settler.

LISHA KILL. Hamlet and stream. Name of Indian buried here.

LOUDONVILLE. Hamlet; on Loudon road, 3 miles from Albany. Named in memory of Lord Loudon, general of the English forces in barracks at Albany, 1756.

MCKOWNSVILLE. Hamlet. Named for the McKown family, early settlers.

MARSH island. Descriptive.

MEADOWDALE. Hamlet. Fancy name, modern.

MEDUSA. Hamlet. Modern intrusion. Originally Hall's Mills, named for Uriah Hall, 1783.

MENANDS (properly MENAND). Hamlet. Named for Louis Menand, a Frenchman and first settler.

MORE'S CORNERS.

NEW SALEM. Hamlet. Named in 1830. An expression of the piety of the early settlers.

NEW SCOTLAND. Township, village. There were many Scotch families among the early settlers.

NEWTONVILLE. Hamlet. Named for John M. Newton.

NORMANS kill. Stream. A Hollander, Albert Andriessen Bradt, from Frederikstad, Norway, surnamed the Norman, settled at mouth of creek about 1630.

NORMANSVILLE. See NORMANS KILL. Early name UPPER HOLLOW.

ONISKETHAU. Hamlet. See ONISKETHAU creek.

ONISKETHAU creek. The old Indian name of the region *O-nits-quat-haa,* deeded in 1685 to Teunis Slingerland and Johannes Appel. " It is said to have been an early name for Coeymans, meaning *cornfields.*" (Beauchamp)

PATROON creek. Named after the Patroon of Rensselaerswyck.

PATROON island. The same.

PEORIA. Hamlet. Borrowed name.

PORT SCHUYLER. Old hamlet incorporated into West Troy 1836. Now part of the city of Watervliet.

POTTER HOLLOW. Hamlet. The Potter family were early settlers.

PRESTON HOLLOW. Named for Dr Samuel Preston, 1798.

RAVENA. Modern name. It has no local significance.

REIDVILLE. Village. Named for George Reid, Scotch immigrant.

RENSSELAERVILLE. Township, village. Named for General Stephen Van Rensselaer, patroon of Rensselaerswyck.

RENSSELAER lake. The same.

SELKIRK. Hamlet. The first settlers were the Selkirk families of Scotch descent.

SHAKERS. Hamlet. The Shakers settled here in 1776.

SLINGERLANDS. Village. Named for descendants of John A. Slingerland.

SOUTH BETHLEHEM. See BETHLEHEM and JANES CORNERS.

SPENCERVILLE. Cognominal. Same as West Albany.

STEPHENSVILLE. Hamlet. Named for Archibald Stephens, miller.

STONY HILL. Hamlet. Descriptive.

SWITZKILL. Stream. There were many Swiss settlers in the town of Berne.

TEN-MILE creek. Descriptive.

THOMPSON lake. Named for John and William Thompson.

TIVOLI HOLLOW. Early hamlet now included in the northern part of the city of Albany.

TOWNHOUSE CORNERS. Hamlet. Descriptive.

UNIONVILLE. Hamlet. A "Union" church is located here. Originally UNION CHURCH.

UPPER HOLLOW. Early name for Normansville.

VAN LEUVEN'S CORNERS. Hamlet. Named for Isaac Van Leuven, early settler.

VAN SCHAICKS island. In the Mohawk. Cognominal.

VAN WIE'S POINT. On Hudson river. Named for Jan Van Wie.

VLAUMANS kill. Stream. Cognominal.

VOORHEESVILLE. Hamlet. Named for Alonzo B. Voorhees, 1862.

WARNER lake. Named for Johannes and Christopher Warner.

WATERVLIET. City. Dutch; *water*=water, *vliet,* stream, course. Former name West Troy, which, in 1836, was incorporated of the villages or hamlets of Gibbonsville, Watervliet and Port Schuyler.

WEMPLE. Hamlet. From a pioneer family.

WESTERLO. Township and village. Named for Rev. Eilardus Westerlo, a Dutch clergyman in Albany, 1760. Formerly known as Chesterville.

WESTERLO island.

WEST TOWNSHIP. Hamlet.

WEST TROY. Now a part of Watervliet.

WILLEMSTADT. The name given to Albany in 1673 in honor of Willem (William) III, of Orange, later king of England.

WILLIAMSBURGH. Hamlet. Now Connersville.

WOLF creek. Descriptive.

WOLF HILL. Hamlet.

THE PLACE NAMES OF RENSSELAER COUNTY

ALBIA. Suburb of Troy.

ALPS. Hamlet. In the hilly eastern part of the county.

AVERILL PARK. Hamlet. Named from old and prominent family in the town of Sand Lake.

BABCOCK pond. Named for John Babcock.

BALD mountain. Descriptive.

BARBERVILLE. Hamlet. Cognominal.

BATH. Named from supposed medicinal qualities of a spring near it. Now included in city of Rensselaer and name abandoned.

BERLIN. Township, hamlet.

BERLIN CENTER. See BERLIN.

BLACK brook. Takes its name from the black shales over which it flows.

BLACK river. Same as above.

BOYNTONVILLE. Village. Cognominal.

BRAINARD STATION. Hamlet. Named for David Brainard, missionary to the Indians here.

BROOKVIEW. Hamlet. Modern name; formerly Schodack Center.

BRUNSWICK. Township; hamlet. Said to have been settled by a colony of Germans. Among early settlers was a family by the name of Braunschweiger.

BURDEN lake. Cognominal.

BUSKIRK'S BRIDGE. Village, on Hoosick river. Named for Van Buskirk family, early settlers.

CAMPBELL island. Cognominal.

CASTLETON. Village. Named from Castle hill on which stood an Indian fortification.

CENTER BRUNSWICK. See BRUNSWICK.

CHURCH HOLLOW. Named from the Church family, early settlers.

CLUM'S CORNERS. Hamlet. Named for O. Clum, blacksmith.

COW island.

COOPER pond. Cognominal.

CRANBERRY pond. Descriptive.

CROPSEYVILLE. Hamlet. Named for Valentine Cropsey, early settler.

DEEP kill. Descriptive.

DEFREESTVILLE. Hamlet. Named for the early settlers DeForeest; also spelled DeForest, DeFreest and DeFriest.

DUNHAM HOLLOW. Named for Isaac Dunham, settler, 1800.

DILL creek. This may have been a family name, or perhaps derived from the presence of dill along its banks.

DWAAS kill. Stream connecting the Hoosick and Hudson rivers, its current varying with freshet. "This is probably a corruption of *Dwars kill,* or cross creek, a stream connecting two others, just as a *dwars straat* means a cross street. *Dwaas=foolish;* hence, I suppose, the attempt to explain the name as "of two minds," a stream "flowing both ways." (A. J. F. van Laer)

EAGLE BRIDGE. Village at the bridge over Hoosick river. Patriotic.

EAGLE MILLS (MILLVILLE). Village. Valuable water power on Poestenkill.

EAST GRAFTON. See Grafton.

EAST POESTENKILL. Hamlet. See POESTENKILL.

FONDA hill. Named for John Fonda, 1750.

FOX HOLLOW. Name may be derived from Levit Fox, early settler, or may be descriptive.

GARFIELD. Hamlet. Modern and patriotic; originally South Stephentown.

GLASSHOUSE. Extensive glass works.

GLASS lake.

GRAFTON. Township and hamlet. Named from Grafton, Vt.

GRANT HOLLOW. Hamlet. Grant-Ferris Co. operated an agricultural implements factory here.

GRAVEL pond. Descriptive.

GREENBUSH. Township and village. *Greene bosch,* from the pine woods adjoining. Now part of the city of Rensselaer.

HANFORD pond. Cognominal.

HAYNERVILLE. Hamlet. Named for the Hayner families, early settlers.

HAYNERS pond. Cognominal.

HICKS pond. Given as *Hacks pond* on old map.

HILLS HOLLOW.

HOAG CORNERS. Named for W. B. Hoag, early settler.

HOAG'S pond. Named for Jonathan Hoag who constructed dam and formed pond.

HOOSICK. Township, village, river. Mohawk, *stony place* (Ruttenber). Algonquin, *along the kettle* (Beauchamp).

HOOSICK FALLS, HOOSICK JUNCTION, WEST HOOSICK and NORTH HOOSICK, all take name from the river.

IVES CORNERS. Hamlet. Named for Ives family, early settlers.

JOHNSONVILLE. Hamlet. Named for William Johnson, early proprietor, 1800.

KENDALL pond. Named for David Kendall, early settler.

KINDERHOOK creek. A Dutch name signifying "Children's Point." Name belongs properly to Columbia county.

KYKOUT hill. From Dutch *Kykuyt* or *Kijkuit* (modern spelling) = *lookout.*

LANSINGBURGH. Town, village (part of Troy). Named for and laid out in 1771 by Abraham Jacob Lansingh as the City of

Lansinghburgh. In its early history commonly known as New City in contrast to Albany, the "Old City."

LITTLE SCHODACK island. See SCHODACK.

LONG pond. Descriptive.

LOWER SCHODACK island. See SCHODACK.

LYONS pond. Cognominal.

MASTENS CORNERS. Hamlet. Named for the Masten family, storekeepers.

MELROSE. Hamlet. Probably Scotch.

MESHODAC PEAK. Indian = *mishadchu, great mountain* (Beauchamp).

MILLER CORNERS. Hamlet. Named for George Miller, storekeeper, 1840.

MILLVILLE. Alternative name for Eagle Mills.

MOLLS island. Named for the Molls family.

MOLLS PLAAT. Named for the Molls family.

MOON hill. Named for the family of J. S. Moon.

MOORDENER kill. Stream. Refers to an early battle on its banks between settlers and robbers. "Moordener is a corruption of Moordenaer or Moordenaar = murderer." (A. J. F. van Laer)

MUITZES kill. Stream. The story is that a Dutch female with high hat lost it in the stream and cried out, "Di muitz is in de Kil." "*Muitzes* may be a corruption of *Mutzen* (pl. of *Muts* = woman's lace cap or man's woolen or fur cap), but the story sounds foolish. More likely, *Muitzes* is a corruption of *Muizen* –mice." (A. J. F. van Laer)

NASSAU. Township, village. Named from old Nassau; originally Philipstown.

NORTH NASSAU, EAST NASSAU, NASSAU pond.

NEPIMORE creek.

NEWCOMB POND. Named for Daniel Newcomb, 1790.

NORTH GREENBUSH. See GREENBUSH.

ODELL hill. Named for Simeon Odell, 1790.

PAPSCANIE island. Abbreviated from the name of the original owner, Papsickenekas or Paep-Sikenekomtas.

PATTERSONS CORNERS. Hamlet. Named from early settlers.

PECKHAM pond. Named for early pioneer who lived near it.

PETERSBURG. Township, village. Named for Peter Simmons, 1791.

NORTH PETERSBURG.

PETERSBURG JUNCTION.

PIKE hill. A companion name to Pike pond.

PIKE pond. Descriptive.

PITTSTOWN. Township, hamlet.

PIXTAWAY island.

PLATTSTOWN. Hamlet. Originally Platstown from Peter Plate, innkeeper. Better known as *Tamarac.*

POESTENKILL. Township and hamlet. Named for Jan Barentsen Wemp, nicknamed Poest. "*Poest* means a cowherd." (A. J. F. van Laer)

POPLAR hill and POPLAR island.

POTTER hill. Hamlet. A man named Potter was killed here by accident.

PROSSER HOLLOW. Stream. Named for Ichabod Prosser, early settler.

QUACKEN kill. "Probably from Quack, or Kwak (pl. Quacken, Kwakken), a heron (Ardea nycticorax). Kwakken also means 'to croak,' but if the kill was full of frogs, it would more likely be called Kikoorschen kill than Quacken kill." (A. J. F. van Laer)

RAYMERTOWN. Hamlet. Named for Raymer family, early settlers.

RED pond. Descriptive; colored by soil.

REICHARD pond. From Reichard family, early settlers.

RENSSELAER. City, county. Taken from Albany county in 1791 and named for the Patroon of Rensselaerswyck.

REYNOLDS. Hamlet. Cognominal.

ROCK HOLLOW. Hamlet. One of the gorges of Quacken kill.

ROUND pond. Descriptive.

SAND LAKE. Township, hamlet, lake. Descriptive.

SCHAGHTICOKE. Township, village. Named for the Schaghticoke or Skaachkook tribe of Indians.

SCHAGHTICOKE hill.

SCHAGHTICOKE JUNCTION.

SCHERMERHORN island. Named for Cornelius Schermerhorn.

SCHODACK. Township. Indian *Skootag,* fire, *ack,* place; "fireplace of the nation." Council seat of the Mahicans in this town.

SCHODACK CENTER. Hamlet = BROOKVIEW; SCHODACK LANDING; SOUTH SCHODACK; Hamlets.

EAST SCHODACK. Hamlet.

SHAD island. Descriptive.

SHAVER pond.

SHINGLE HOLLOW. Stream. Recalls a shingle mill.

SLITERS. Village. Named for Calvin Sliter.

SNAKE hill. Descriptive.

SOUTH BERLIN. Hamlet. See BERLIN.

SPEIGLETOWN. Hamlet. Named for the Vanderspeigle families, early settlers. " Vanderspeigle is probably a corruption of the well-known Dutch family name of van de Spiegel. Cf. Lawrens Pieter van de Spiegel, a famous Dutch statesman, about the time of the French revolution, for whom a street in Amsterdam is named." (A. J. F. van Laer)

STAATS island. Named for Barent Staats.

STEPHENTOWN. Township, hamlet. Named for Stephen Van Rensselaer, Patroon, 1784.

STEPHENTOWN CENTER. Hamlet (formerly Mechanicsville).

WEST STEPHENTOWN, SOUTH STEPHENTOWN and NORTH STEPHENTOWN. Hamlets.

STILLMAN VILLAGE. Hamlet. Cognominal.

SUNKAUISSIA creek. Sank-an-is-sick, a branch of the Tomhannock. Root may be sonkin, *to grow up like a plant*. (Beauchamp).

SWEET MILK creek.

TACONIC mountains. Indian name. Beauchamp gives Tagh-ka-nick, *water enough*. Zeisberger has Tach-an-ni-ke, *full of timber*.

TACKAWASICK pond and creek. (=Tsat-sa-was-sa and Sas-sa-was-sa).

The name may refer to a stone mortar (Beauchamp).

TIASHOKE. Hamlet. (Ty-o-shoke). Iroquois, " meeting of waters " (Beauchamp).

TIERKEN kill. Dutch=noisy creek. " The derivation from the verb *tieren*, to make a noise, does not account for the *k* and seems impossible, as *tieren* is used only in connection with people. A more likely derivation is from Tierk, or Tjerk, the Frisian form for Dirck, the given name of some early settler." (A. J. F. van Laer)

TOMHANNOCK. Hamlet and creek. Mohawk=a flooded river (Beauchamp).

TROY. City. Originally Van Der Leyden and Van Der Leyden's Ferry. " Changed in 1789 into the more classic name of Troy." It contains two hills, Mt Olympus and Mt Ida.

UPPER SCHODACK island. See SCHODACK.

VALLEY FALLS. Village, on Hoosick river.

VOSBURGH pond. Cognominal.

WALLOOMSAC. River and hamlet. Variously written, of Indian derivation.

WEST SAND LAKE. See SAND LAKE.
WHITE LILY pond. Descriptive.
WHITE ROCK mountain.
WYNANTSKILL. Village and stream. Named for Wynant Gerritse Vanderpoel, 1674.

THE PLACE NAMES OF SCHENECTADY COUNTY

AALPLAATS. Village and stream. Dutch, *a place for eels.* Now corrupted to Alplaus. "Given as Aelplaats in Burr's atlas of 1829, Aelplatts and Alplatts on map of 1856. Though *plaats,* in Holland, by the illiterate, is often pronounced *plaus,* it would seem as if Alplaus might be a corruption of *Aalplas* = eel pond." (A. J. F. van Laer)
ADAMS KILLETYE. Stream. From Adam Mull, taken prisoner by the Indians when drinking from it. "*Killetye,* corruption of *Killetje* = little kill (old spelling *Killetie,* though doubtless pronounced Killetje and not Killet*ee*)." (A. J. F. van Laer)
ALPLAUS. Modern corruption of Aalplaats.
AQUEDUCT. Hamlet. Canal crosses Mohawk.
BINNE kill. Stream. "Inner river." A short diverted part of the Mohawk south of Van Slyck island.
BONNY BROOK. Named by the Scotch settlers.
BRAMANS CORNERS. Hamlet. Named for Dr Joseph Braman, 1840.
CHUCTENUNDA. Stream. Chaugh-ta-noon-da = *stony houses* or *stony places.*
COOKSBOROUGH. Hamlet. Named for the Vandercook (Van der Koek?) families.
CRABBE kill. Stream. Cognominal.
DELANSON. Village. Present name of Quaker Street. Combination of "Delaware and Hudson."
DUANESBURG. Town, village. Named for James Duane who settled here in 1765.
EAST GLENVILLE. Hamlet. See GLENVILLE.
EATON CORNERS. Hamlet.
FEATHERSTONHAUGH lake. Named for the Featherstonhaugh family. Now improperly written Featherstone lake.
GIFFORDS. Hamlet. Named for J. Gifford, hotel keeper.
GLENVILLE. Township and village. Named for Sanders Leendertse Glen, patentee, 1820.
GREENS CORNERS. Hamlet. Named for the early settlers.

HIGH MILLS. Hamlet. Old milling settlement deriving its name from falls in the Alplaus known as High falls.

HOFFMAN'S FERRY. Named for John Hoffman, 1835. Now HOFFMAN. Originally VEDDER'S FERRY, from Harmanus Vedder, 1790.

JAN WEMPS creek. Jan Barentsen Wemp was the ancestor of the Wemp family. Name appears on some maps as Van Wemps creek.

KELLEY'S STATION. Hamlet. Named for Andrew Kelley.

MARIAVILLE. Hamlet. Named for a daughter of James Duane.

MOHAWKVILLE. Hamlet.

NISKAYUNA. Township, village. Con-nes-ti-gu-ne or Nis-ti-goo-ne, *cornflats.*

NISKAYUNA pool. Name recently introduced, with approval of Board of Geographic Names, for a body of water impounded by barge canal construction. Replaces "Peck Lake," not approved.

PATTERSONVILLE. Village. Named for W. H. Patterson, hotel keeper.

PLOTTER kill. Stream. "Plotter kill is probably a corruption of Platte kill, which occurs also in Ulster county. Platte kill = *flat creek,* seems a strange name. *Het platte land* is the term applied in Holland to the country districts, in contradistinction to the cities, and in a country which is mostly flat, is self-explanatory. But why a kill should be called *plat* I do not know." (A. J. F. van Laer)

POENTICS kill. Stream. "This may be a corruption of Poenties kill. Poentie (or Poentje) was the nickname given to both Teunis Cornelissen Van Vechten and Teunis Dircksen Van Vechten (see Van Rensselaer Bowier MSS, p. 815, 819). The meaning of the word *poentje* is unknown to me. *Poent* is Middle Dutch spelling for modern *punt* = point. *Poentje* is the diminutive form. There is also a word *poenter* = assessor, so that poentje may be either a nickname for a person with a pointed face, nose or chin, or else be the real surname of the Van Vechtens, derived from some ancestor who held the office of assessor." (A. J. F. van Laer)

PRINCETOWN. Named for John Prince of Schenectady, member of Assembly.

QUAKER STREET. Village. Quakers settled here in 1790 and made purchases of land. Now Delanson.

REESEVILLE. Named for an early settler. Now a part of Scotia.

ROTTERDAM. Township and village. Named from Rotterdam, Holland, on account of lowlands.

RYNEX CORNERS. Hamlet. Several members of Rynex family settled in this vicinity.

SANDERS lake. Named for Sanders family.

SANDSEA kill (formerly, ZANTZEE kill). Stream. "*Zantzee* (better *Zandzee,* or else *Santsee*) is a familiar Dutch expression for *sand desert.*" (A. J. F. van Laer)

SCHENECTADY. County and city. Schagh-nac-taa-dagh, *beyond the pine plains.*

SCOTIA. Village. The ancient name of Scotland. The patentee, Sanders Leendertse Glen, was a Scotchman.

TOWN HOUSE CORNERS. Hamlet. The town's business was transacted here.

VAN SLYCKS island. Named for Jacques Van Slyck, 1662.

VERF kill. Stream. Dutch = *paint creek.* "Given in Burr's atlas of 1829 as Vert kill. This, however, has no significance as most of the Dutch names in that atlas are misspelled." (A. J. F. van Laer)

WEST GLENVILLE. See GLENVILLE.

AREAL GEOLOGY

In previous annual reports statements have been regularly given in regard to the progress made in the completion of the great geologic map of the State on the topographic base, scale of one mile to one inch. It may be broadly stated that the quadrangles which have been surveyed and fully reported upon, or upon which work is under way, now number approximately 40, although this is but a small percentage of the total number of quadrangles of the State already surveyed by the United States Geological Survey, in cooperation with the State Engineer and Surveyor. The execution of the geological work is of a kind which must of necessity progress very slowly and with every possible attention to detail. The progress of the work, however, has at no time been interrupted and at the time of writing this report there are now in press final reports on the following areas, accompanied by detailed geologic maps on the topographic base:

The Attica and Depew quadrangles

Published together as a single map with descriptive text, by Mr Luther.

The Saratoga and Schuylerville quadrangles

Also published together in one report with full descriptive details and discussion of the various important interests pertaining to the Saratoga Mineral Springs basin, by Professor Cushing and Doctor Ruedemann.

The North Creek quadrangle

Lying in the eastern Adirondack region, the report and map of which have been prepared by Professor Miller.

The Syracuse quadrangle

and its accompanying text, by Professor Hopkins.

In addition to these reports, there is also a bulletin on the Geological History of New York by Professor Miller, which relates especially to the physical development of this State. All these publications will presently be ready for distribution.

Central and western New York. In this region Mr Luther has continued the long series of field surveys upon which he has been engaged for nearly twenty years, and during the season of 1913 covered the quadrangles of Olcott and Lockport and that part of the Tonawanda-Wilson quadrangles which lies east of the east line of the map prepared and published some years ago in connection with Professor Grabau's bulletin on the Geology of Niagara Falls. Mr Luther's reports on the quadrangles mentioned are now essentially prepared and will soon be ready for publication.

Northern New York. Professor Miller began the survey of the *Blue Mountain* quadrangle during the summer of 1913. Most of the time was spent in making a detailed study of approximately one-third of the area in the vincinity of Long Lake and Blue Mountain Lake villages. As most of the quadrangle has not been examined and no laboratory work on the rocks yet been undertaken, only certain more evident results of the field work so far executed can be here presented.

Grenville series. The Grenville rocks are but slightly represented. Their only important development, where free from closely involved igneous rocks, is in Blue Mountain lake and immediate vicinity. With slight exceptions, all the islands of the lake consist of Grenville limestone and hornblende-garnet gneiss together with smaller amounts of quartzite and various well-banded gneisses. Outcrops are usually large and excellent. Similar outcrops occur on the lake shores except on the north, and no doubt the bottom of the lake consists almost wholly of such Grenville strata.

Syenite-granite gneiss series. Rocks of the syenite-granite gneiss series constitute most of the area studied. No very basic phases of the syenite were noted, the usual rock being the greenish grey, quartzose variety so well known throughout the Adirondacks. There are many fine exposures as, for example, on Blue mountain, Owl's Head mountain and in the vicinity of Long Lake village, particularly in the large stone quarry alongside the road 1½ miles southwest of the village. With increasing quartz content this rock passes into a granitic syenite which frequently shows a pinkish color. The granitic syenite in turn grades into true granite gneisses which are nearly always pink or red. Many small and large Grenville gneiss bands or inclusions occur parallel to the foliation in all facies of the syenite-granite series. Frequently these rocks show rather rapid changes in color and composition parallel to the foliation, though not the slightest evidence that one of these rock types cuts another has yet been found. Rather there is much evidence to show that the different facies really grade into each other and are only variations of the same intrusive body. Though at times the porphyritic texture is somewhat developed, no mappable areas of granite or syenite porphyry were found.

Mixed gneiss series. There are two considerable areas of syenite-granite and Grenville mixed gneisses. One of these occupies several square miles just south of Blue Mountain and Eagle lakes and the other some 8 or 10 square miles along the northern border of the quadrangle. As usual, in areas previously reported by the writer, these rocks consist of Grenville strata shot through by and closely involved with syenite or granite. Often wide bands of Grenville are plainly visible while more rarely the Grenville has been more or less assimilated by the intruding magma.

Gabbro. Several gabbro stocks or dikes of the usual sort with associated amphibolite have been found. The largest, occupying three-fourths of a square mile, is crossed by the main road 4 miles east of Long Lake village.

Diabase. Two fine diabase dikes occur on the eastern shore of Long lake, respectively one-half mile and 1 mile north of Long Lake village. One dike has a width of 40 feet and both show sharp contacts and clear-cut branches from the main masses. They strike north 30° east.

Faults. It is quite evident that the western portion of the Blue Mountain quadrangle lies west of the region of extreme faulting in the Adirondacks. Good evidence for but one fault was found and this line of fracture has determined the Raquette river channel across the corner of the quadrangle. Thus the remarkably straight northeast-southwest strike of this channel is accounted for. Nothing very positive can be said regarding the amount of displacement and date of this fracture but its presence is demonstrated by fine crushed and broken rock zones at Buttermilk falls and several places in the ledges along the shores of the lake.

Glaciation. A number of good glacial striae were observed especially near Long Lake village and toward the western base of Blue mountain. These bear from south 30° to 50° west, thus harmonizing with other observations in the interior Adirondack region. Much glacial drift has been deposited, particularly over the lowlands, but there is no good evidence for ice erosion other than the removal of superficial loose or decomposed materials.

Brier Hill and Ogdensburg quadrangles. Professor Cushing was engaged for part of the summer of 1913 in the Brier Hill and Ogdensburg quadrangles and reports that, so far as his observations have extended, the Precambric rocks are of considerable interest. There are long, narrow tongues of porphyritic syenite cutting the Grenville rocks and in parallelism with their structure. It is suggested that they are of the nature of huge dikes, but if this is the case the parent body of syenite from which they sprung nowhere appears and must lie to the south on the Gouverneur sheet. There is much amphibolite and interbedded Grenville sediments cut by the porphyritic syenite. Part of this amphibolite, however, into which the porphyritic syenite appears to grade, is evidently igneous, yet so far it has proved impossible to distinguish certainly the two in the field.

The Paleozoic section is well shown on these two quadrangles and is of much interest. The Potsdam sandstone is thin and of unequal thickness owing to the irregularity of the surface on which it was deposited. It is quite like the Potsdam of the Alexandria Bay and Theresa region described in Museum Bulletin 145. The overlying Theresa formation has greatly thickened and in its upper portion carries a massive 20 foot sandstone which is prominent all across this district and, according to Professor Chadwick, is continuous into the Canton quadrangle. The horizon is fossiliferous but until a definite examination of the fossils has been made it is not practicable to say whether this sandstone and the overlying beds are positively of Theresa or whether they may be of the age of the Tribes Hill formation. The overlying Beekmantown formation has a thickness of about 100 feet, with no summit shown. It is highly fossiliferous and these fossils indicate that the base of the formation here is comparable with the middle of subdivision D of the Champlain section, that is, that division D and C of that section and the lower part of D, are lacking here and that Beekmantown deposition at the west of the Adirondacks began correspondingly later than in the Champlain valley.

Canton quadrangle. Mr Martin, who has been occupied with the Precambric rocks of this quadrangle, reports as follows:

The *Grenville formations* and the later intrusives are about equally abundant in the area examined. Nothing older than Grenville was discovered, for these rocks everywhere rest upon later igneous masses. Their total thickness is not demonstrably greater than 2 miles. Of the Grenville sediments, the limestones, in varying degrees of purity, are perhaps the most abundant; sometimes they are made up of pure carbonate of lime, but as a rule there is a prominent admixture of silicates, actinolite, coccolite, phlogopite and other minerals. Transitions through quartz-mesh varieties to thin-bedded quartz-schists are often observed.

Garnet-gneiss, with garnet-free varieties, is strongly developed in the southeastern part of the quadrangle, but elsewhere it occurs only in thin layers. These rocks are associated with limestones and rusty gneisses, and the total thickness is not far from 3500 feet. The series has been injected by later intrusives of both gabbroic or gabbro-dioritic and granitic composition, and the whole doubly folded back upon itself into an immense isoclinal sigmoid, now beveled by the surface of erosion.

Silicious gneisses, occurring chiefly in the western part of the sheet, comprise garnetiferous biotite schists, quartz-feldspar-biotite paragneisses, thin quartzites and other transitional sedimentary varieties. With these are sometimes associated thin laminae and layers of calcareous quartzite, and some limestone strata, only the largest of which are mapped separately. Minor types, such as quartzite, quartz-mesh limestone, quartz schist and pyritous gneiss, are of restricted development, and of these the latter has the more general distribution. Certain amphibolites, in the lack of precise indications as to their origin, are questionably included in this series.

The amphibolites of the Pierrepont region, on the other hand, are believed to be, and those of the Little River-Pyrites belt are known to be, derived from an early gabbro intrusion, and the two masses are probably, though not certainly, continuous. South of Pierrepont Center the basic intrusive has formed an injection zone with the garnet-gneiss as country rock; in the case of the Pyrites mass, numerous xenoliths of Grenville limestone and gneisses have been included, among them the narrow belt of pyritous gneiss at Pyrites which is the ore-bearing stratum.

The pink granite-gneiss occupies broad belts and smaller isolated subcircular areas; while generally foliated, it is rarely massive and saccharoidal. Pegmatite dikes of simple mineralogical composition are abundantly developed in the western area where they cut through Grenville silicious gneisses. Some of these penetrate the amphibolitic border of the gabbro formation, and the granite is believed therefore, though other evidence is lacking, to be younger than the latter. The granite contains abundant amphibolitic inclusions; in the absence of satisfactory data as to the derivation of these by the metamorphism of limestone, which nowhere shows contact alteration as distinct from regional, the xenoliths are viewed as inclusions of the earlier basic rocks caught up during the intrusion of the granite. Inclusions other than amphibolite are absent, and because of the apparent impotence of the granite to produce contact alteration, it is believed that widespread assimilation has not taken place in those portions of the magma now accessible to observation.

The schistosity has a general northeast-southwest strike and a northwest dip of 20 to 40 degrees; it ordinarily follows the banding or strike of the formations, but in numerous instances the latter intersects it at an angle as high as 90 degrees. Pitch, as applied to the directrices of folds of all sizes and to the elongation of mineral groups and individuals, is usually parallel to the direction of average dip, but may depart from it as much as 15 or 20 degrees. In the more western gneisses, on the contrary, it is almost parallel to the strike. On the whole, the axes of folds in the limestone, garnet, gneiss and other formations, as well as the elongation of xenoliths in granite, conform with remarkable constancy to this northwest pitch.

An important structure is the tilted sigmoidal isocline south and west of Pierrepont, which involves the broad belt of garnet-gneiss already referred to, and its peripheral amphibolitic and granitic injection zone. Its axes correspond to the regional pitch, its axial planes to the regional foliation and its limbs are parallel to the regional trend of the formations. Its greatest measured dimension is over 6 miles in an east-northeast direction; from top to bottom it measures 3½ miles, and it is perhaps the largest Precambric structure of its type known. The wide departure of its axes from the formation trend is believed to point to at least two periods of orographic disturbance in this vicinity.

Igneous rocks are ordinarily in the form of sills. In the case of the gabbro these may represent stocks or bosses rolled out by dynamic readjustments, but many of the smaller masses were undoubtedly intruded as thin sheets to form an injection zone, such as that south of Pierrepont. In the case of the granite, the habit is much the same; but the sills are of huge dimensions and together with the smaller bosses probably represent the irregular surface of a regional bathylith.

In view of the limited area covered by the field work for this report, perhaps too much reliance should not be placed upon the broad generalizations here offered. Nevertheless they represent, in the writer's opinion, the weight of evidence for this quadrangle; but they are recognized as being subject to modification when viewed in the light of future more extended researches.

Professor Chadwick, who has been engaged with the Paleozoic rocks of this quadrangle, reports as follows:

The Paleozoic formations occupy the northern third of the quadrangle and occur also as several small outliers through the southern half. The northern outcrops are in general quite limited in number and in area, since the region is under a heavy cover of drumlin drift; they are confined chiefly to the beds of the Grasse river, Trout and Stony brooks, and the Raquette. While all the layers decline, broadly speaking, to the northward, following the present slope of the subsurface of Precambric crystallines, they present many minor undulations of gentle dip, crisscrossing like the waves of a choppy sea.

Along the contact of the main mass with the crystalline rocks that lie to the south, there exists a blank zone exceeding 1½ miles in breadth, in which bedrock is wholly concealed. The first outcrops seen on the north of this zone are small, often easily overlooked, exposures of the *Theresa beds* — upper semicalcareous Cambric strata. These are followed, usually immediately, by extensive ledges of a white vitreous "quartzite," 20 feet or more in thickness, containing numerous "Scolithus" and having much the appearance of the "white Potsdam" sandstone, with which it has evidently been confused in earlier explorations. Fine exposures of this are seen at Morley and northeastward to the Trout brook, thence southeastward along Stony brook to Sissonville on the

Raquette river. The discovery of large flat-coiled gastropods up to $3\frac{1}{2}$ inches in diameter in this sandstone early threw doubt upon its supposed Potsdam age and led to the study of the better sections on the neighboring Ogdensburg and Brier Hill quadrangles. At Heuvelton, on the Oswegatchie, the field relations of the much more conspicuous ledges there widely exposed indicated a position above the Theresa division, which formation shows well in the falls below the dam; and this was confirmed by the succession of these strata in the nearly continuous section exposed along the St Lawrence river between Morristown and Ogdensburg. The heavy "twenty-foot" sandstone, carrying the large gastropods and "Scolithus," was found to lie far up in the "transition" series of mixed calcareous and arenaceous beds and to belong apparently in the base of the Canadian group (Ordovicic), corresponding to a part of what have been termed the "Tribes Hill" beds farther west and south.

The overlying, alternating sandy and dolomitic beds of the Tribes Hill formation are best displayed at Buck's bridge on the Grasse river and there carry well-preserved Pleurotomaria hunterensis[1] in the sandy layers; though farther west, as at Theresa and Heuvelton, these occur in the calcareous parts only. In passing eastward this formation has become far more arenaceous than in Jefferson county, so much so that it too has been included with the "Potsdam" in the earlier mapping. Its lithic characters are here much more like those of the (restricted) Theresa beds than is the case in the Theresa region, where the Tribes Hill outcrops at once suggest the higher marine Beekmantown.

What appear to be the top beds of this division are overlaid conformerly opposite the lower mills at Hewittville on the Raquette[2] by 10 or 11 feet of more calcareous strata of different aspect. These consist of drab calcilutytes, weathering light buff or greenish yellow, more or less shot with irregular, brown-weathering streaks of sand. In the Morristown-Ogdensburg section, 4 or 5 feet of similar beds are seen at the summit of the Tribes Hill; but at an intervening exposure on Trout brook they seem to be lacking though present again in a railway cut a few rods to the west. The appearance of an unconformity with the overlying purer dolomites of the Beekmantown at each of these three lo-

[1] Identified by Doctor Ruedemann.

[2] This locality is just over the line on the Potsdam quadrangle.

calities is thus emphasized by this discontinuity of the subformation. It is expected that these beds will be found to thicken eastwardly and to take on a more open-water character, whereas here they have many marks of a shoreward, shoal-water deposit. A small Maclurea-like gastropod is the only fossil observed in them.

The beds that succeed, apparently unconformably, are of normal " upper Beekmantown " character, mostly drab or gray dolomites, sometimes with a pinkish cast, though there are one or more sharply defined beds of white sandstone of " Potsdam " type in the series, and a limited amount of sand in scattered worn grains is likely to be found at any level, but its presence is not conspicuous. The rock generally has a velvety surface on fresh fracture. These beds are well seen along the Rutland Railroad at the Madrid-Potsdam turnpike crossing and near Norwood, and constitute the highest layers exposed on the Canton quadrangle.

Paleozoic outliers. Returning to the southern boundary, it is observed that the rock sequence above discussed lacks a base, and that no exposures of its lowest beds, where the substantial Potsdam sandstone is to be expected, are known on this quadrangle, and only the topmost part of the succeeding Theresa formation. A glance at the State geologic map will show that the Precambric crystalline rocks protrude far to the north on the meridian of Canton. A reasonable assumption, to which the field evidence offers no dissent, is that the Potsdam sandstone is entirely, or nearly, cut out across this quadrangle by an elevated area or monadnock in the Precambric erosion surface (" sub-Potsdam peneplain ") north of Canton. There is abundant evidence about Canton of the ruggedness of this sub-Potsdam surface, and this would be merely repeating over a larger district what happens in a smaller way here and there about Theresa and on Wellesley island.[1] What comes the nearest to being an outcrop of the main body of white sandstone below the Theresa is an extensive exposure of cross-bedded saccharoidal sandstone with occasional large white quartz cobbles, in the bed of the Grasse river just above the county house. This small area is nearly surrounded by the crystallines, the actual contacts covered, however, and thus must fit a deep embayment in these, if it is not actually an isolated outlier. No great thickness is visible, though the ledges form two separate series of rapids.

[1] N. Y. State Mus. Bul. 145, p. 60.

Similar white saccharoidal sandstone, usually but little disturbed and with dips no greater than have been seen over the northern belts, occurs as outliers in separate localities along the east side of the Grasse river 2 and 3 miles respectively south of Canton. At the nearer of these the actual contact with the adjacent Grenville quartzite is excellently revealed, the latter beds standing vertically. Not far away are exposures of a more indurated and disturbed red or reddish sandstone of typical Potsdam character and revealing extensive brecciation and microfaulting. Often this rock is virtually a quartzite, though quite distinct in character from the thoroughly metamorphic Grenville. Small thrusts and monoclines are common. Some of the rock is highly autoclastic. These two types of rocks, with their color contrast even more pronounced perhaps, occur in very close proximity at the more southerly locality, where the *red* one is seen (as at several other points) in an equally unconformable but strikingly different type of contact with the Grenville quartzite and marble. The relations here are such that pertinence of the white and the red sandstones to the same formation seems open to question, though positive evidence of difference of age is not yet discovered. And these doubts intrude themselves at all the other localities examined, including the exposures north and south of Potsdam village. A distinction between these beds has been suggested by Cushing [1] for the Theresa quadrangle, with an erosion interval postulated on the basis of red pebbles incorporated in the white beds. It appears to us that no considerable age difference is indicated by the accumulating data and that Winchell's suggestion [2] of lower or middle Cambric age for the true red *Potsdam sandstone* of the Hannawa quarries (type locality) is hardly acceptable, though still possible.

SURFICIAL GEOLOGY

During the year past Professor Fairchild has continued his observations upon the changes in the postglacial waters. In the summer of 1913 his work was partly in the Champlain valley and partly, for purposes of comparison, in the valley of the Connecticut river. The manuscript copy of the forthcoming Churubusco or Ellenburg quadrangle sheet gave opportunity for determination of altitudes in the area near the Canadian boundary east and southeast of Covey hill. With the help of this map, it was found that the series

[1] N. Y. State Mus. Bul. 145, p. 62.
[2] *Vide* N. Y. State Mus. Bul. 95, p. 360.

of heavy cobble beaches at and north of Cannon Corners reached 735 feet in altitude, which is very near to the figure 750 feet which has been used for the theoretic height at the north line of the State. It seemed apparent that the up and down movement of the Hudson-Champlain valley must have involved the adjacent Connecticut valley, and therefore an exploration was made of the latter from Long Island sound to Wells River. This invasion of New England is also necessary for the study of the pleistocene of Long Island, since in position and in glacial history the latter area is a part of the former.

It was found that the phenomena of submergence in sea-level waters, so obtrusive in the Hudson-Champlain valley, were clear and abundant in the Connecticut valley. The high-level "terraces" and sand plains, of which much has been written, attributing them to deposits of the glacially-flooded river, are really delta deposits made in standing waters at sea level. The plains and terraces are partly contributed, as in the Hudson valley, by glacial outwash and partly by land drainage, and later somewhat distributed and shaped by river work at lower levels.

The origin of the plains in Massachusetts as static water deposits were recognized by Professor Emerson, and so described in his United States Geological Survey publications, Monograph XXIX, and Holyoke folio, no. 50. His water plane was taken as a datum plane, and it was found practically to mark the upper limit of the standing water from Middletown north to the mouth of Passumpsic river, about 280 miles. Northward from this point the valley was above the sea level.

In the Connecticut valley the uplifted marine plane has a northward rise of 2.30 feet a mile, nearly identical with the gradient in the Hudson valley which is 2.23 feet. But for equal latitudes the Connecticut plane lies about 50 feet higher than the Hudson plane, which makes the isobases or lines of equal uplift lie about 20 degrees north of west by 20 degrees south of east.

Following are some of the altitudes in the Connecticut valley: Riverhead, L. I., 120 feet; New Haven, Conn., 180; Middletown, 220; Hartford, 280; Springfield, Mass., 300; Brattleboro, Vt., 420; Hanover, N. H., 565; Wells River, Vt., 620. These are theoretic altitudes of the datum plane, but are very close to the actual levels of the summit terraces.

It appears that the west end of Long Island was mostly above this sea while the east end was mostly submerged. The heavy moraines stood above the sea. The broad sand plains, so characteristic of broad areas of Long Island, are attributed to the submergence in the ocean as the ice sheet melted.

The Winooski valley in Vermont, opening at Burlington and heading east of Montpelier, is a replica of the Connecticut valley. It was deeply flooded by the Champlain sea-level water and exhibits well-formed high deltas. The history of its terraces is the same as for the Connecticut.

It is planned to publish as a bulletin of the State Museum the proofs of the marine submergence of the Hudson-Champlain valley and description of the phenomena. In this connection it will be necessary to make comparison with the corresponding features in New England.

The study of the surficial geology of the Saratoga quadrangle was completed by Professor Stoller and the final report, with map, submitted. Beginning was also made by him in the study of the glacial geology of the Cohoes quadrangle.

INDUSTRIAL GEOLOGY

The collections relating to the economic mineral materials of the State have been so largely augmented during the past season as to constitute practically an entirely new addition to the Museum. The materials have been assembled by solicitation among the representative industries and in part by personal canvass in the field. Although fairly complete exhibits of the kind have been prepared at different times by the Museum for the expositions at Chicago, St Louis, Portland and Buffalo, there has never been any attempt hitherto to incorporate a series of the products of our mineral industry as a permanent feature of the Museum itself. As a consequence, the collections previously made were largely scattered after they had served their purpose of temporary display, and much of the remnant returned to Albany has suffered damage from repeated removals from one storage place to another. A list of the new collections is included with the Museum accessions for the year.

It is proper to state that the plan of assembling such an exhibit has met with hearty cooperation on the part of the mining and quarry enterprises concerned, and that many have gone to considerable inconvenience and expense in preparing the necessary materials. Acknowledgment may be made in this place for the general support that has thus been received, without which the labor would have been greatly increased and the results no doubt much diminished in value.

Mining and quarry review. The usual statistical canvass of the mineral industries was carried out, as a basis for the publication of a summary of the year's activities. The total production returned by the industries for 1912 had a value of $36,552,789. This indicated a period of general business expansion, since it was larger by nearly 17 per cent than the amount reported for the preceding year. In fact, the value of the output failed by only a small amount of reaching a new record, although the market conditions were by no means so favorable as they had been in some of the previous years.

In some branches of the mineral industry, New York State occupies a very prominent place and it participates in a large number of others which altogether contribute very considerably to the aggregate. There were thirty-five materials listed in the general table of products. The clay-making and quarry industries accounted for the largest items, the former with a total of $11,947,497 and the latter with an aggregate value of $5,718,984. These branches show great stability, but no marked tendency toward expansion from year to year. On the other hand, the cement industry, which in a sense competed with both the stone and clay-working industries, has made rapid strides of late years, after a period of vicissitude that nearly exterminated the once prosperous natural cement business of the State. With the decline of the latter, the portland cement branch was built up and has more than counterbalanced the loss of the former, with a gain in output over last year of nearly one-third. Similarly, the gypsum industry within a short time has developed from small proportions to a very important business that appears capable of further growth. The local mines supply a large share of the gypsum required by the Pennsylvania and New York portland cement plants which insure a steady market for the surplus rock. Most of the output, however, is used by the producers themselves for the manufacture of wall plasters and stucco. Another industry in which local enterprise is prominently concerned is the production of salt, both by underground mining and by evaporation of brines pumped from wells. Two of the largest salt mines in the country are located in Genesee county and there are more than twenty-five evaporating works distributed among six counties. The annual output is now above 10,000,000 barrels and is gaining steadily. The iron deposits of the State have attracted much attention recently and there is prospect of a material enlargement of the productive industry which has long been an important one. Recently the resources of the Highlands region have shown the greatest interest perhaps, although developments have continued in the Adirondacks where the principal mines are now situated. Additional details in regard to the economic situation of the mineral resources will be found in the report already mentioned.

Report on quarry materials. Owing to the press of other work, it has not been possible to extend the investigation of the quarry materials beyond the crystalline rocks, and consequently the preparation of a comprehensive report on the subject which was mentioned last year as in progress has had to be postponed for the present. The matter already in hand has been made ready for publication and will be submitted for that purpose unless the field work can be resumed during the coming season. The part completed covers the crystalline silicate rocks and the marbles, the materials that have received the least attention in previous work in the field.

Molding sand. Some of the molding sand localities in the vicinity of Albany were visited last summer for the purpose of procuring samples for the Museum collections, and the opportunity was used to study the features surrounding the occurrence of this material. The origin of the sands and of their peculiar qualities which give them industrial value have received little attention hitherto beyond brief statements included in some of the areal reports on the Hudson river region and one or two other publications.

Stoller in his report on the "Glacial Geology of the Schenectady Quadrangle" remarks that the deposits in that vicinity do not occur at any definite level, but rise and fall with the surface contours, a feature which is true for the sands throughout the region. Although they are restricted to the flat-terraced area of sands, gravels and clays accumulated in the glacial Lake Albany, there is a variation of 200 feet in the elevations at which they are found in the section around Albany and Schenectady. Moreover, the sand in any particular locality follows the minor surface irregularities with a variation sometimes of as much as 20 feet between the high and low places. Any sudden and pronounced change in the topography, however, such as caused by a stream cutting into the terrace, marks the disappearance of the valuable sand. The thickness of the sand ranges from a mere film to several feet. Eight or 9 feet was stated by the gatherers as the maximum known to have been excavated in the vicinity, but the average is probably not over 30 inches.

The molding sand occurs directly under the soil and is succeeded by a layer of loose or "open" sand of variable thickness. The latter is usually of coarser nature and does not pack like the molding sand. It has a grayish color from admixture of shale with the quartz grains. Below this layer is found the Hudson river clay, yellow on top, changing to blue in depth.

The features surrounding the field occurrence of the sand appear to be exceptional for a simple water-laid deposit like the sand, gravels and clays that underlie it. It is not a definite bed or layer interstratified with the others and exposed at certain horizons, nor does it appear to have any counterpart in the series. It contrasts with the underlying sands in its fine, even grain, in its evidences of a weathered condition and in the fact that except for the intermixed clayey material is a very fine quartz sand. In its distribution it has the character of a surficial mantle that varies in thickness rather rapidly and also changes in vertical altitude more than would be expected from an undisturbed water-laid stratum.

The characteristic fine-grained sands which form the principal material shipped to foundries are made up of angular to subrounded quartz grains. Under the microscope the individual grains are frequently observed to possess sharply concave sides which are natural fracture surfaces of the quartz, developed no doubt by granulation under pressure. This points to a glacial source which, of course, is generally accepted as the origin for the whole series of detrital deposits, but there appears to be some indication of additional abrasion by other agencies. The angles are more or less rounded and the grains may show frosted or pitted surfaces, features suggestive of wind action subsequent to that of the ice.

Sufficient details of the field occurrence of the sand have not been assembled as yet to justify any conclusions as to the process by which the sand has attained its present distribution and attitude toward the other deposits. In some places, however, there is strong resemblance to eolian deposits, with modifications arising from their fixation by plant growth and subsequent weathering. Live sand dunes exist in the vicinity of the molding sands. Their materials are similar to the latter with the difference that they are not so well sorted and lack the weathered appearance which is always found in the true molding sands. It seems quite probable that the finer particles of these shifting sands are being sorted out by the winds and distributed over the surrounding area and may thus contribute some share to the upbuilding of the molding sand layer. There is little question that weathering influences by the breaking down of the shale particles and the hydration and oxidation of their constituents, specially the iron compounds, exercise a beneficial change upon the material. The subject needs further study, however, in order to ascertain the specific effects wrought by the different agencies.

Miscellaneous. Field investigations other than those incident to brief trips for collecting purposes have been suspended during the year.

The office work has involved the usual extensive correspondence, of which a large part is concerned with the statistical canvass of the mineral industries. There has been a very active interest shown in the various undeveloped resources of the State, and numerous inquiries were received for advice as to possible locations for enterprise. These have related to almost all departments, but there seems to be particular interest at present in natural gas, iron ores, and high-grade limestones. It is aimed to give all possible assistance to legitimate requests of this character. The office has also been frequently called upon to identify and value samples of minerals, a function that is well within its province so long as there is not involved any elaborate chemical analysis or assay, in which case commercial laboratories must be consulted.

MINERALOGY

The time of the mineralogist has been given exclusively to the arrangement of the mineralogical collections, which is now well advanced. Reference has already been made to the acquisition of the Silas A. Young collection of minerals of Orange county which has been incorporated in the general arrangement. The mineral collections as now displayed constitute a double series, one being the general collection which has been made as complete as circumstances permit, and the other a series of New York State minerals which is undoubtedly the best of its kind.

PALEONTOLOGY

The attention of the paleontological staff has also been almost exclusively given to the arrangement of the paleontological collections. This work has been carried well forward, but the preliminary arrangement must of necessity be succeeded by a more permanent and carefully selected one. Into this collection of materials from the old Museum has had to be incorporated a large amount of material obtained by the purchase of the Gebhard collection. In addition to this work of arrangement of fossils, much has been done toward the effective restoration of fossils, and to these reference has been made. A series of life-size restorations of the Eurypterida of the genera Pterygotus, Eurypterus, Eusarcus and Stylonurus, have been prepared, effectively colored, framed and set up in the Museum. The reproduction of Pterygotus, a New York species, is upwards of 9 feet in length, a statement which may convey some conception of the enormous size attained by these great arthropods of the shallow waters of the Silurian sea. Doctor Ruedemann has also very successfully rendered a series of reconstructions of the cephalopods, showing the interior structure as well as the complete form of the exterior. This series includes the genera Manticoceras, Gyroceras, Endoceras, Orthoceras, Piloceras, Trochoceras and Gonioceras, all on sufficiently large scale to bring out the structural details, which are not always clearly preserved in the fossils themselves.

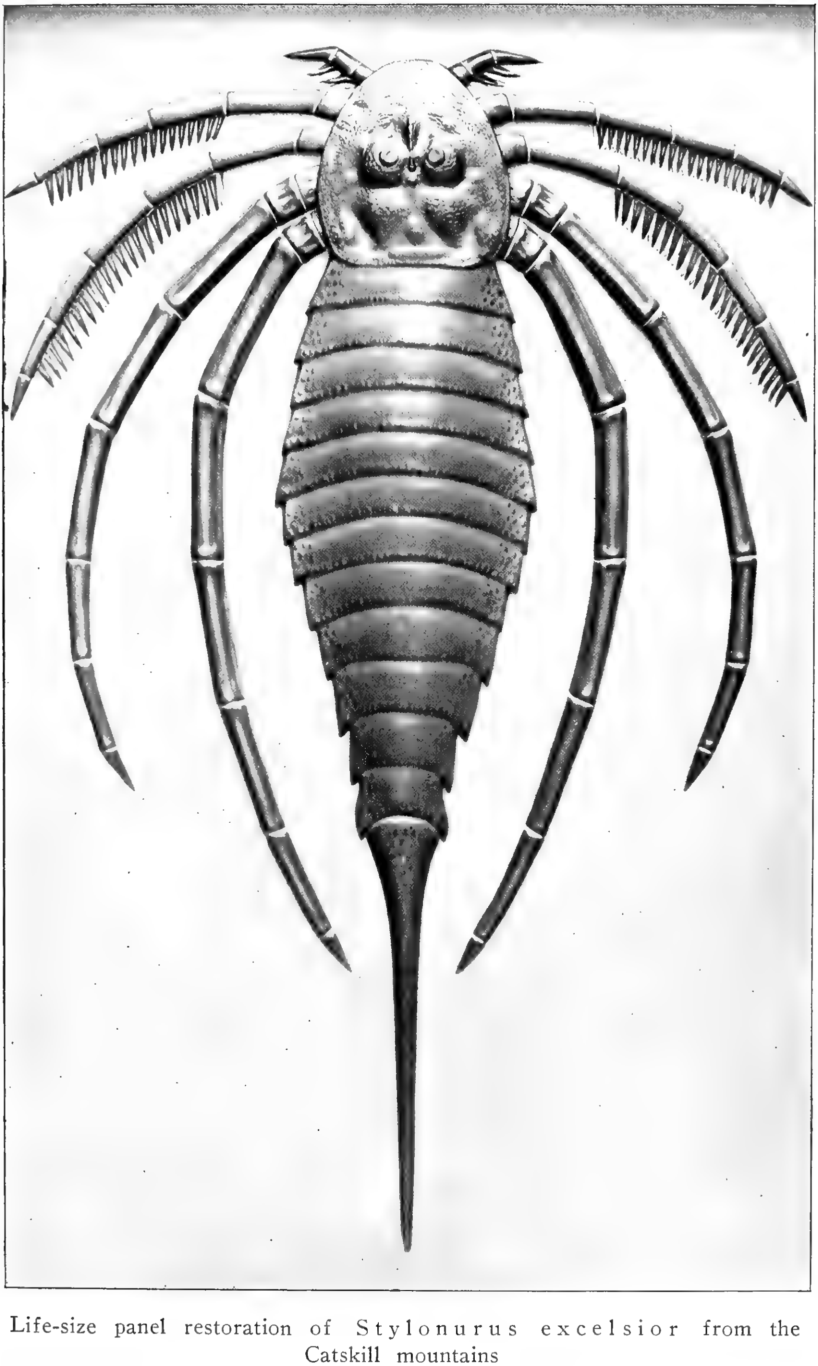
In the face of the pressure of Museum work it has not been possible during the past year to accomplish any field work in paleontology or to carry forward in the office any extensive researches in this subject.

For a number of years past the paleontologist has made reference in these reports to the development of the New York fossil faunas and their containing formations in lower Canada, specially in the region of the Gaspé peninsula. During the summer of 1913 the twelfth meeting of the International Geological Congress convened in Toronto, and among the geological excursions that were prepared in connection with that meeting was one into the Maritime Provinces including the Gaspé peninsula. At the request of the Canadian authorities, the paleontologist prepared a guide for the part of this excursion embracing the Gaspé peninsula and a portion of northern New Brunswick, and was privileged to act as guide over part of the course. This inviting excursion was participated in by about seventy geologists from various parts of the world, among them being the directors of the Geological Surveys of Great Britain and of France, as well as distinguished workers in this field from all the countries of Europe, from Indo-China, China, Japan, South Africa and the isles of the sea. Inasmuch as this field has been so fully exploited in the reports of the New York Geological Survey, it seems altogether appropriate now to present here a summary opinion of its geology by the director of the Geological Survey of France, M. Pierre Termier, recently published in the Proceedings of the *Academie des Sciences*. For these very ex-

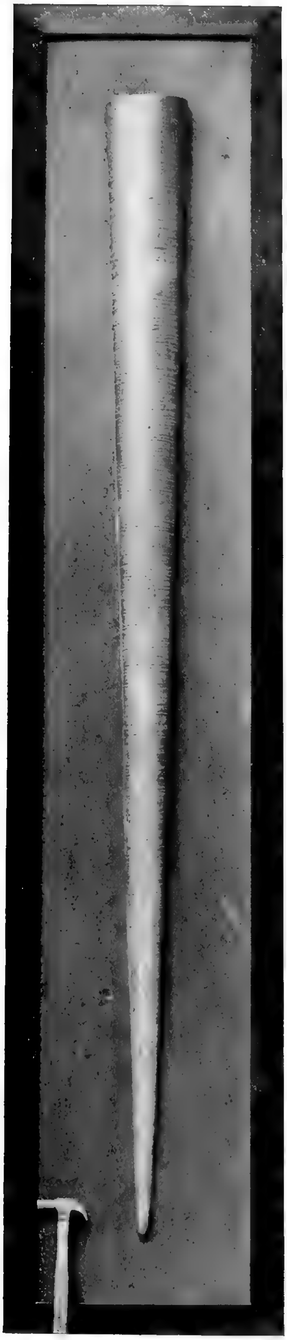
Panel restoration of the Siluric merostome *Pterygotus buffaloensis*. Actual length of animal, 9 feet

Life-size panel restoration of the Siluric merostome Eusarcus

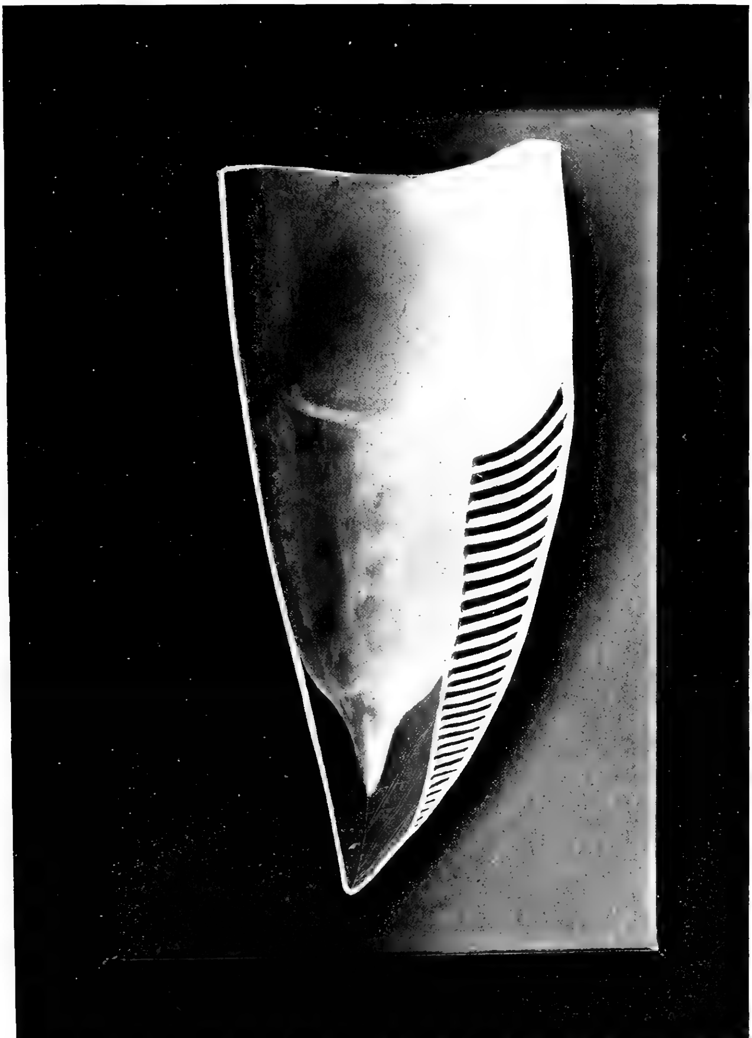
Life-size Eusarcus habitat group. Submarine view showing the ancient merostomes in their natural surroundings during the period of the Bertie waterlime (Siluric)



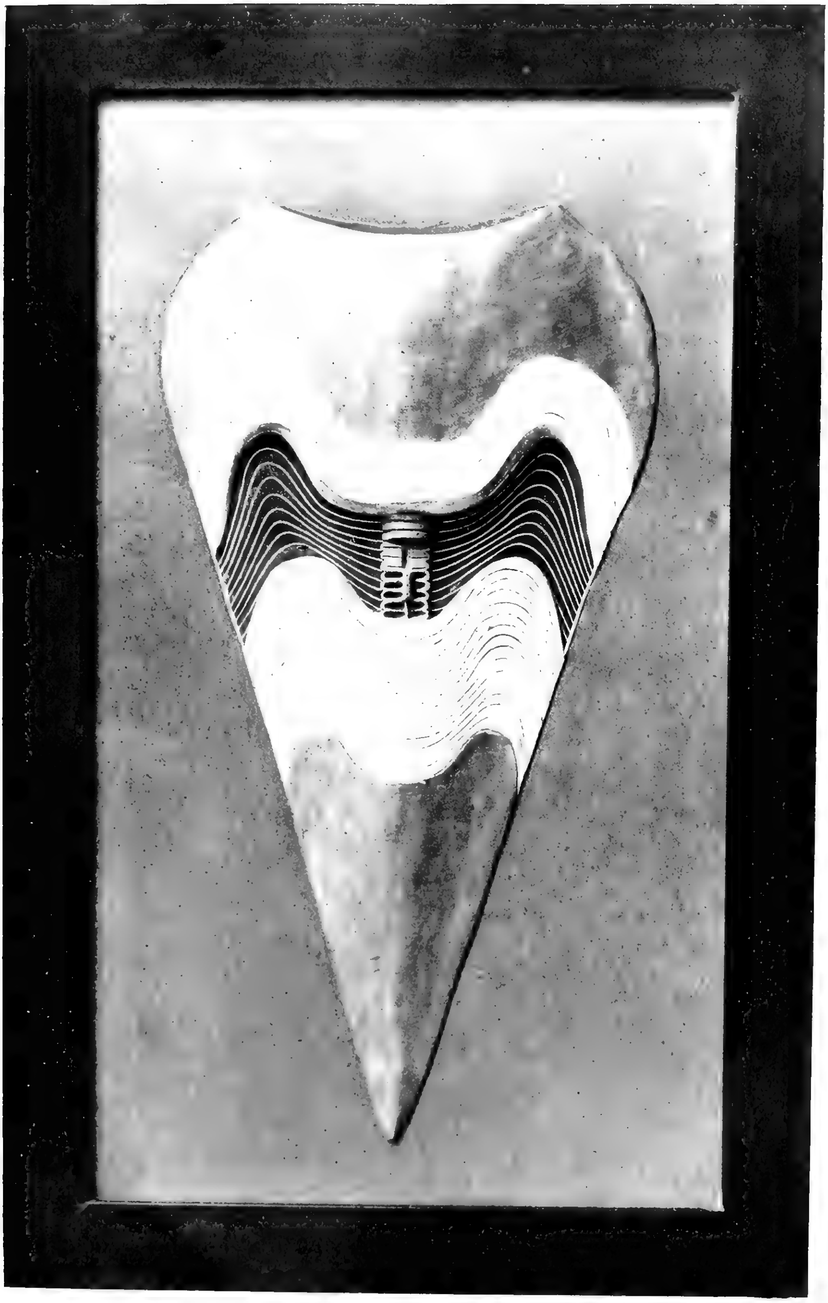
Life-size panel restoration of *Stylonurus excelsior* from the Catskill mountains



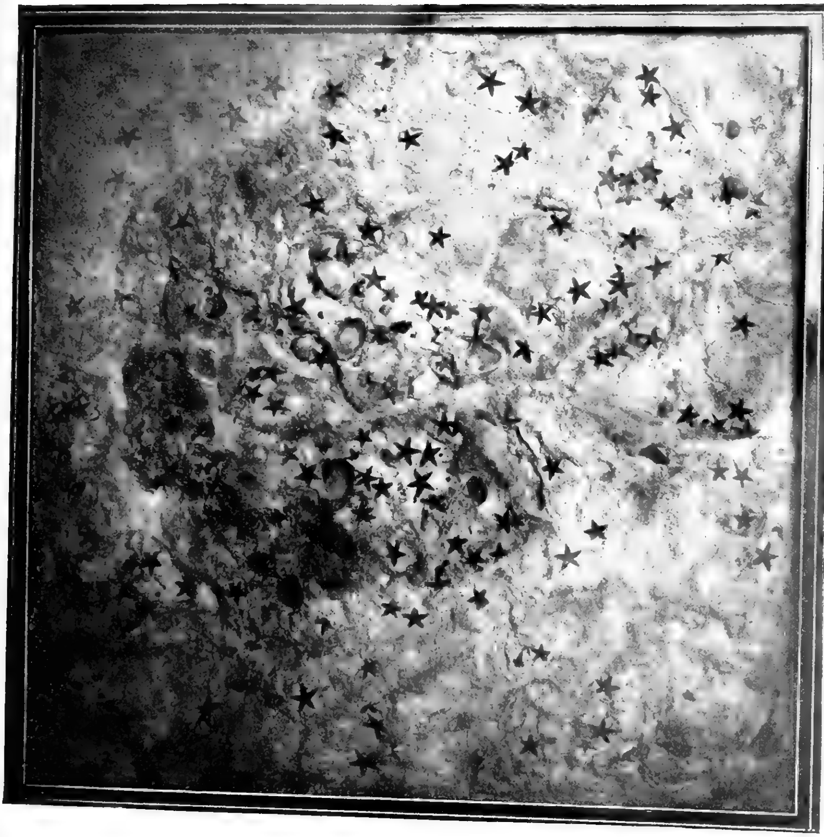
Model of a giant Endoceras from the Ordovicic rocks



Restoration of the internal structure of the cephalopod Piloceras



Restoration of the Ordovicic cephalopod, Gonioceras



Slab of Devonic starfish from Saugerties, N. Y., as mounted in the Museum. This slab measures 4 feet 9 inches x 4 feet 9 inches and carries 190 starfish. View taken from above

cellent reasons, a translation of M. Termier's summation of his observations in the field is herewith attached:

This excursion led us across the region of the primitive rocks, some of them much folded, some only undulated or even nearly horizontal, and which lie between the St Lawrence river and the Atlantic coast of Nova Scotia. I call this country the Appalachian region of Canada; for it is the prolongation, in Canadian territory, of the primary folded region known as the Appalachians which plays so important a rôle in the eastern United States. The same folded belt extends farther on to the north, to form Newfoundland; it then buries itself beneath the waters of the Atlantic, and Marcel Bertrand believed that he had seen it, in the ocean depths, joining the folded Armorican belt.

The interest of this excursion, to my mind, was twofold: stratigraphic and tectonic. Under guidance of the best authorities, the whole primary series, almost complete, and often rich in fossils, to discern the folds of this series; to follow them and fix their date, in a folded belt not less than 600 kilometers in width and the length of which we failed to cover in more than 500 kilometers; it is that which occupied and enamored us for eighteen days.

The Appalachian region of Canada parallels the southeastern border of Laurentia, pressing and molding itself against it. It is well known that Laurentia (of Edouard Suess), still called the Canadian Shield, is an immense domain of the earth's surface lying as though frozen down since Cambric times. All the beds belonging to it which are not earlier than the Cambric, are horizontal. They may be faulted and eroded; they are not rearranged nor folded. This anchored Laurentia comprises the greater part of Canada. At the south it reaches well into the United States; at the west to the Rocky mountains; on the northwest to the Mackenzie river; at the north as far as the mountains recently discovered in Ellesmere, Grinnell and Grant Lands; on the northeast it extends beneath the Atlantic, and the ancient north Atlantic continent, of which Greenland and Iceland are only the debris, seems to belong to it. Quebec is a point on the southeast margin of Laurentia. To the northeast of Quebec this margin coincides with the valley of the St Lawrence; it trends down-river toward the east, then toward the southeast along the coast of Gaspesia passing between this shore and the south coast of the island of Anticosti, and regaining its direction toward the northeast, passes along the Straits of Belle Isle, to lose itself at once in the Atlantic. To the southwest of Quebec the southeast border of Laurentia crosses the valley of the St Lawrence, then, little by little, taking a south-southeast direction and even an almost due south course, coincides with the long depression of Lake Champlain. Wherever it can be seen, the southeast border of Laurentia is a great fault. The two regions separated by the fault are in striking contrast: contrast in the aspect of the paleozoic lands, here perfectly horizontal, there folded, twisted, some times crushed; contrast in the relief of the ground, much more striking than in Laurentia which is a country overelevated and formed of hard rocks while the folded paleozoic country is a low land, profoundly worn, and with gentle curves.

There are few regions on the surface of the earth where the present geography is so intimately bound to a very ancient geography, where the present relief has so great an antiquity as in the Appalachian region of Canada. One may say that since the Cambric or at least since the lower Ordovicic, the St Lawrence has flowed as it does today from the place where Quebec now stands; sometimes in the condition of a marine channel, long and straight, turning to the south of Anticosti and passing through Belle Isle; sometimes as a vast fluvial valley collecting the waters of the immense American continent and carrying them to the sea by way of the Cabot strait, as it does today.

All about the Gulf of St Lawrence the plan of the coasts is an ancient plan, determined in its ground lines by phenomena earlier than the Carbonic. The peninsula of Nova Scotia, with its curious shape, is a Precarbonic link formerly connected with Newfoundland, partly covered by the whole of a transgressive series which has remained horizontal but manifests nevertheless the Precarbonic aspect in the alinement of its hillocks and its coasts, in the rias which characterizes the entire island of Cape Breton. The Bay of Fundy has not changed since Triassic times and in those times it resembled very much what it had been during the Carbonic. It requires but little imagination to see this country as it was in the different epochs of the Paleozoic, in the Gothlandic, in the Devonic, in the Westphalic, in the Permic. In very truth, if any member of the human family had lived in those times so prodigiously remote, for example at the end of the Devonic, if he had then traversed all this region already folded and prepared for the great Carbonic transgression, and if he could return today after millions of centuries of sleep and exile, to Gaspèsia, New Brunswick or Nova Scotia, it would not seem at all a strange land to him.

The great orogenic movements in the Appalachian region of Canada are of Devonic age. As always, they had been slowly prepared by preliminary movements, and for a long time after them the ground continued to undulate. Preliminary movements and posthumous undulations have had, broadly speaking, the same direction as the principal folding. The most ancient preliminary movements date back to the Cambric. It is in the Cambric that history ceased to be the same for Laurentia and for the Appalachian region.

The age of the principal folding is perhaps not everywhere exactly the same. In Gaspesia and about the Bay Chaleur where there are two highly fossiliferous Devonic series, one lower Devonic, the other upper Devonic, and where the great discordance lies between the two, the principal plication is dated with reasonable precision — the middle Devonic. No part of it seems to have been delayed into the Dinantic.

The principal folding, of Devonic age, was extremely energetic. The folds are often greatly squeezed with a general tendency to leaning to overthrust toward the northwest. It is the push toward Laurentia, as intimated long ago. This may have resulted in the formation of veritable sheets which have gradually disappeared. We have seen one indisputable overthrust, that of the Ordovicic of Cap-des-Rosiers by the Lower Devonic of Cap-Bon-Ami and Grande Grève, at the extreme point of Gaspesia. The surface of displacement, unfortunately not very clear, dips here to the southeast at an angle of about 30°.

Very often the folds are straight and the beds vertical. Phenomena of crushing and foliation have not seemed to me very frequent or very intense. I have seen them, however, very beautifully developed in the Bathurst iron mine south of the Bay Chaleur — a foliated microgranite, having the aspect of gneiss and even the appearance of glazed slates, gray or clear green, in a band of folded Ordovicic. There are analogous compressions, and much more abundant, in the azoic rocks of Nova Scotia, granites and diabases on the east coast of the Bras d'Or, auriferous slates and granites in the region of Halifax; but these terranes are probably Precambric and their folding belongs to an epoch much more remote than the Appalachian folding.

The folds of Devonic age are, in a general sense, directed southwest-northeast. They are the ones which, as I have above said, determine the prolongation of Nova Scotia and the island of Cape Breton; likewise those which determine the rias of this island and those of Newfoundland. But the easternmost of these folds, those that are close against the margin of Laurentia, bend downward, beginning at St Anne-des-Monts, parallel to the coast of Gaspesia. At Gaspé and Percé, they are oriented toward the southeast. It is clear that this sinuosity is quite local and that the same folds, concealed today at the bottom of the Gulf of St Lawrence, regain soon between Anticosti and the Magdalen Islands, the northeast direction. The Carbonic mantle of New Brunswick conceals from view the same sinuous effects in the Devonic plications of this province. It seems as though we had an analogous sinuosity, but highly attenuated, on the east coast of the Bay of Fundy, on the long fjord (Minas bay) and in the country which extends from Truro to Arisaig. It will then be manifested by posthumous undulations much more than by the almost invisible Devonic folds. At any rate the sunken region of the ancient Devonic chain, which has become the Gulf of St Lawrence, corresponds to an energetic destruction of plication and it seems to me that under the waters of the gulf all the folds of Gaspesia are squeezed and crushed along the west coast of Newfoundland. This great Devonic chain, at least 600 kilometers across, where widest, and even 400 kilometers on the north of Newfoundland, doubtless continues well beyond that to the northeast. But does it go, as Marcel Bertrand thought, toward the south of England and toward Bretagne? I do not think so, now that I have seen it. The Devonic chain of Canada is an *arrested Caledonian* chain; I mean to say by that, a branch of the great chain of northern Scotland, of a little later date than the Scottish stock. It is with the Highlands of Scotland that the old Newfoundland mountains seem to me to be in agreement.

Here, as there, upon the partly leveled Caledonian folds extend, transgressive and rich in coarse conglomerate, the red sandstones. Those of Canada are a little more yellow than those of Scotland and their highest members are of Dinantic age. These red sandstones of Canada, dated, here and there, by fishes or by plants, are often nearly horizontal. The Bonaventure, the Scaumenac, the Horton Bluffs formations belong to them. The so-called Windsor beds (with brachiopod limestones and frequent gypsum masses) seem to me to be the upper element of this complex and incontestably Dinantic.

After the deposition of this mantle of red sandstones, and doubtless toward the close of the Dinantic, began a new movement, of slight intensity, gently displacing the coasts and producing here and there lacunes and discordances in sedimentation. For over a restricted area of the ancient chain, an area covering the northeast portion of New Brunswick, Prince Edward Island, Cape Breton and northwestern Nova Scotia, the Westphalic is deposited almost everywhere to an enormous thickness. The base of the Westphalic is often designated by the name Riversdale and Union formation and correlated in a broad way with the Millstone grit. It incloses many beds of red sandstones or schists, and numerous black schists with Leaia and Anthracomya. This group alone may have a thickness of 3000 meters. The upper part is a productive coal, very actively exploited at different points (Stellarton, Pictou, Sydney etc.) with a thickness of 600 meters at Sydney, more than 2000 meters at the Joggins. It may be that the most elevated of these coal beds are Stephanic. There was a new movement again, a new discordance or a new formation of conglomerates in the Stephanic epoch. The New Glasgow conglomerate is at the base of a very heavy series of coarse conglomerates, the upper part of which is Permic and which form today all of Prince Edward Island and almost the whole isthmus which attaches Nova Scotia to the mainland. The Trias of the Bay of Fundy which extends as far as Truro, corresponds to an analogous episode, but much later and affecting a region which the Permic transgression did not reach.

Trias and Permic have remained nearly horizontal. In the vast Carbonic mantle, the thickness of which will reach about 4000 meters, there are, generally speaking, only undulations, but accompanied by truncations through faulting. The coal of Sydney and Glace Bay disappears gently beneath the sea with a feeble dip and a perfect regularity and the workings are boldly going forward beneath the waters of the Atlantic. Nowhere have we seen the Carboniferous actually folded. It is, nevertheless, at certain points in southern New Brunswick and at Pictou, but such local folds are not intense, it seems, except in the early Carbonic.

The stratigraphic analogies between the Carbonic of the Maritime Provinces and that of England and the north of France are everywhere remarkable. They were pointed out long ago. But, tectonically speaking, there has been no direct connection between the Appalachians and the European coal chain. In Canada the Appalachian chain is a chain of Middle Devonic age, thus a Caledonian chain; and the movements which have affected it, at different times, in the Carbonic, the Permic, perhaps also at the end of the Trias, are very slight movements, which are entitled to be designated only as posthumous movements. Farther southwest, in the United States, these posthumous movements became gradually more intense and have built up a real chain, a true range of *American Altaids* in the exact prolongation of the *Canadian Caledonids.*

III

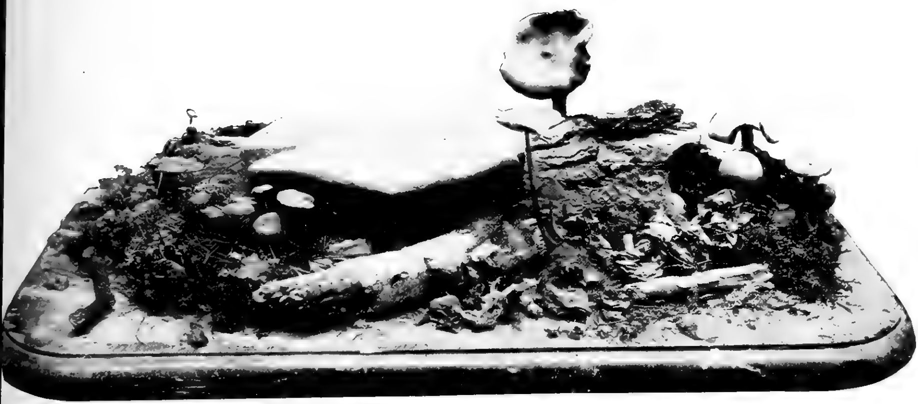
REPORT OF THE STATE BOTANIST

(During the past year the work of the office has practically passed into the hands of Dr H. D. House, assistant in botany, who took the place of S. H. Burnham, resigned, and who has prepared this report.)

Noteworthy contributions. Specimens of ten species of Crataegus have been added to the herbarium. These were collected by Dr J. V. Haberer, in central New York, and are the co-types of species described by Prof. C. S. Sargent in the report for 1912. Nearly all the 218 known species of Crataegus in this State are now represented by specimens in the herbarium. Doctor Haberer has also contributed four new species of Antennaria, to be described later by Dr E. L. Greene of Washington, D. C., a specialist upon that group. Doctor Haberer's set of plants also includes several other species either new to the State or new to central New York. Mr A. Olsson of Gloversville has collected and presented to the herbarium a large number of Fulton county plants containing several additions to the flora of the State and to Fulton county, the most interesting being a small orchid, Ophrys australis (Lindl.) House.

Dry weather damage to maples. About the middle of July several inquiries were received concerning damage to maple foliage. The first noticeable effect was a bronzing of the leaves, followed by the withering and death of the leaves when they turned brown but remained attached to the limbs, thus causing a very unsightly appearance. Most of the complaints apparently considered the damage due to either fungus or insect enemies of the tree. By the last of July the damage seems to have been generally noticed on shade and park maples throughout most of the State. A personal examination of some of the badly affected trees in towns of the central part of the State and about Albany resulted in an explanation of the damage.

July was ushered in by about ten days of unusually hot weather, following a considerable period of drought, with high temperatures prevailing on some days. While the week of July 6th was a little cooler, the drought continued, and in fact the precipitation for the entire summer was far below normal. On July 12th and 13th there occurred a strong hot and dry westerly and southwesterly wind, which continued with greater or less strength for several days.



A group of fungi cast in wax

The maple is well known as a very shallow rooted tree and the effect of the dry wind upon transpiration in the leaves is very marked in the case of any tree. It is apparent that the period of drought preceding the early part of July had reduced the available water of the soil to a minimum, so that the factors favoring transpiration (that is, dry, hot winds) which followed, greatly exceeded the power of the trees to absorb water from the soil which was actually deficient in moisture. Such a condition of affairs was particularly active in the case of maples along streets, highways, in parks or other situations where the soil was not protected by litter or undergrowth from drying out.

The leaves of the maple being unable to maintain the high rate of transpiration necessary under such conditions, were susceptible to the chemical activity of the sun's rays, causing the bronzing effect, a chemical change of the cell contents, somewhat analogous to what takes place normally in autumn when the leaves turn to shades of red or yellow. In many cases this state was followed by withering and death of the leaves, as sufficient moisture was not available to revive the leaves and to maintain their turgidity, which alone keeps them under ordinary conditions from collapsing.

That the dry weather and dry winds mentioned were responsible for the widespread damage seems probable also from the fact that the trees in situations of permanently damp soil, as in deep woodlands, suffered little or not at all; and of the trees affected, the greatest damage seems to have been on the side exposed most directly to the wind. Elms, having deeper-going roots, did not suffer so much as the maples, although considerable damage to their foliage was noticed in the case of some trees growing in dry soils. The leaves of the elm also possess a thicker epidermis and are better adapted by structure to withstand the factors like wind and heat which favor excessive transpiration and its subsequent damage.

The injury to maple and elm foliage thus noted is not likely to be permanent, nor is it likely that the trees thus affected will suffer from more than a slight setback. The damage consists chiefly in the unsightly appearance of the foliage. Local and even widespread occurrence of this sort of damage has frequently been reported in former years but not with such severity as during the past season.

A new fungus enemy of the maple. Several ornamental sugar maples at Glen Cove were observed by Mr F. E. Willets to be suffering from the attack of a fungus which caused the death of numerous twigs and branches, so that by August the trees were quite unsightly with the accumulation of dead twigs and brown leaves upon them. The fungus has been identified as Steganosporium piriforme (Hoff.) Cd., and it is said to have been destructive to maples in a town in southern Minnesota at one time. It seems, however, not to have been previously noted in New York State. It is not usually regarded as a serious enemy of the maple and its destructive work at Glen Cove may be due to a combination of circumstances, not the least of which was the weakened condition of the trees due to the excessive and prolonged drought.

Weather and fungi. Numerous observations in former years have led to the conclusion that unusually dry seasons were productive of but few forms of fleshy fungi, and Doctor Peck makes special comment upon the abundance and variety of fungi following a damp or rainy summer (Report for 1912, page 9). The season of 1913 seems to furnish abundant support to his conclusions for in most parts of the State few fleshy fungi developed during the summer season of 1913, although numerous common ones appeared late in the fall and a large crop of field mushrooms followed favorable late summer rains in most localities. Many correspondents have concurred in attributing the scarcity of fleshy species during the summer to the unusually dry weather.

Condition of the collections. The collections having been moved to the new Museum quarters early in the year, much time was necessarily occupied in properly arranging the herbarium and duplicate specimens in the new metal cases.

The collections of fungi made by the staff or received through contributions during the past year have been placed in cardboard boxes suitable for their reception and arranged in their proper places in the herbarium. The collections (345 in number) include 55 specimens of fungi and 290 specimens of ferns and flowering plants, collected in the counties of Albany, Madison, Rensselaer, Oneida, Onondaga, Schenectady and St Lawrence.

Specimens were contributed from the counties of Fulton, Herkimer, Monroe, Oneida, Onondaga, Queens, New York, Richmond, Washington and Wyoming.

Correspondents have contributed extralimital specimens collected in Alabama, Canada, California, Colorado, Connecticut, District of Columbia, Illinois, Maryland, Minnesota, New Hampshire, New Jersey, North Carolina, Oregon, Pennsylvania, Utah, Washington, Wisconsin, Wyoming, and Porto Rico and Germany.

The number of species of which specimens have been added to the herbarium from current collections and contributions is 128, of which 62 were not before represented in the State herbarium. Of these, 6 are considered new or hitherto undescribed species.

In addition, 2622 specimens have been placed in pasteboard boxes, labeled and properly incorporated into the herbarium from the stored material. The following synopsis shows the number of such specimens now added to the herbarium, but heretofore stored away in bundles and not easily accessible:

	NEW YORK	EXTRALIMITAL
Agaricaceae	1160	293
Polyporaceae	333	205
Boletaceae	260	140
Other families	118	113
Total	1871	751

The total number of specimens added to the herbarium, from all sources, is therefore 2740. This large addition is made possible by the enlarged space now available for the herbarium in its new quarters.

A list of the names of the added species (not including those added from the stored material) shows which species are new and which are not new to the herbarium.

The number of those who have contributed specimens of plants is 33. This list includes the names of those who sent specimens for identification only, if the specimens were of such character as to make them desirable additions to the herbarium.

The number of identifications made is 830; the number of those for whom they were made, 110.

IV

REPORT OF THE STATE ENTOMOLOGIST

The State Entomologist reports that two leaf feeders attracted general notice the past season, namely, the *apple tent caterpillar* and the allied *forest tent caterpillar.* The former, devouring the leaves of many orchard and wild cherry trees, was easily recognized by the large nests in the forks of the limbs. It was particularly injurious in the upper Hudson and Mohawk valleys. The latter pest, distinguished by the somewhat diamond-shaped, silvery white spots down the back, defoliated extensive areas of oaks on Long Island, attacked the sugar maples in the upper Hudson valley and stripped poplars in the Adirondacks. The probabilities of such injuries were foreseen last year and timely warnings issued. A number of rare or particularly interesting species have been observed during the year, and brief notes concerning a number of them are given in the Entomologist's report.

Petroleum compounds as insecticides. The serious condition of many sugar maples, following the application of miscible oils in 1911 and similar trouble in several apple orchards in 1912, was followed up the past season by studies of some cases and these, in connection with certain experiments, have resulted in confirming the Entomologist's opinion as to the cause of the trouble. This is a matter of much practical importance, since the injudicious use of these materials may jeopardize the existence of hundreds of valuable shade or fruit trees. The details of this work are given in the Entomologist's report.

Fruit tree pests. The studies and experiments of the last four years on the *codling moth* were continued. In midsummer some fruit growers became apprehensive of severe injury by larvae of the second brood. Examinations failed to disclose a substantial basis for such fears, and this opinion was confirmed in October by observations made in the orchards of Messrs W. H. Hart of Arlington and Edward Van Alstyne of Kinderhook. The owners sprayed under strictly commercial conditions and with no expectations that the trees would be subjected to a test later. There was a good crop and it was found that from 95 to 97 per cent of the entire yield were worm-free as a result of one timely spraying.

A small parasite has been exceedingly abundant and widely distributed in orchards infested by *San José scale,* and in not a few instances has been an important factor in reducing the numbers of the pest. Observations show that in most cases the trees in unsprayed orchards were seriously injured in earlier years and, as a rule, he believes that fruit growers must continue to rely upon applications of lime-sulphur washes for the control of this pernicious enemy.

Injuries by *red bugs*, two very similar species of which are known to occur in New York, were so abundant in one orchard near Poughkeepsie as to deform about one-third of a large crop of greenings. A brief account of this outbreak is given in the Entomologist's report.

The work of the *pear thrips*, one of the newer fruit pests, was studied in the vicinity of Athens, and a marked localization of injury observed as in earlier years. A detailed account of this insect has been given in the Entomologist's report for 1912.

The *pear psylla* is a pest of considerable importance, especially in the western part of the State, and occasionally very injurious in the Hudson valley. Incidentally the practical value of late spring applications of a lime-sulphur wash for the control of this insect was demonstrated in a badly infested orchard near Athens.

A new grape enemy which may become of considerable importance to growers in the Niagara section, in particular, has been discovered. It may be known as the *banded grape bug*. Its work is described and a discussion of its habits and the best methods of control are given in the Entomologist's report.

A number of other insect pests of fruits have been studied and records concerning them are given in a series of classified notes.

Gipsy moth. The small colony of the gipsy moth discovered last year appears to have been completely exterminated. This occurrence proves, in a concrete manner, the ever present possibility of the insect becoming established in New York territory, and amply justifies the maintenance of rigid precautions to prevent this. Evergreens and shrubbery grown in sections where gipsy moth is known to occur should be examined most carefully; especially is this true of the former. The presence of broken egg masses usually means the occurrence of living eggs in the packing material or about the roots of the plants in the same bale or box, and a due regard for the public welfare necessitates the destruction of the shipment or the part of the shipment exposed to infestation of this character.

Brown-tail moth. There is little to report concerning the brown-tail moth, though the danger of its establishing itself in the State has not decreased. It is only a question of time before this occurs. The winter nests are so characteristic that there should be little difficulty in recognizing the pest and at the outset preventing its becoming extremely abundant.

Grass and grain pests. The white grub outbreak of last year has largely abated, partly at least as a result of various natural causes. The studies of last year have been continued. The most interesting development was the discovery of many large, beneficial maggots, probably a species of Erax, which were abundant in fields badly infested by white grubs the preceding year, and at the time of observation last spring, nearly free from the pests.

A rare or usually overlooked corn pest, the *lined corn borer*, was destructive in Ulster county fields. A full discussion of this relatively new insect is given in the Entomologist's report.

The discovery of the *European wolf* or *grain moth* in a local seed warehouse adds another to the list of important grain insects. A careful study has been made of this insect and a detailed discussion appears elsewhere.

Shade tree insects. Observations show that the comparative immunity from severe injury by the *elm leaf beetle* the past season is probably due to the exceptionally cool weather in June, a time when the laying of eggs by this pest is at its height and the period when adverse climatic conditions might be expected to exert a maximum influence. There have been some cases of very severe injury locally here and there, due probably to a decreased vitality of the trees and a speedy destruction of the abnormally small leafage. It is undoubtedly true that the more thorough spraying by certain communities during the last few years has been most beneficial. The apparent check of the past season is presumably temporary and any extended reliance thereupon is considered inadvisable.

The *false maple scale* has been the cause of a number of complaints, though it has been distinctly less numerous than in recent years. It was extremely abundant during late summer in one locality at Mount Vernon.

The *tulip tree scale*, a pest occasionally numerous, was unusually injurious in the vicinity of New York City. Several natural enemies were noted preying upon this species.

Forest pests. Work has been continued upon the *hickory bark beetle*, and field observations by the Entomologist lead him to believe that the period of severe injury for the vicinity of New York City has largely passed. His investigations of previous years and the studies of this season indicate the practicability of protecting the more valued trees by applications made shortly after the beetles have entered the bark. The probable efficacy of this treatment by no means lessens the advisability of cutting and burning badly infested wood before the borers can mature and escape.

The extensive plantings of white pine in recent years have given the *white pine weevil* almost ideal opportunities for multiplication and, as a consequence, there have been numerous complaints regarding the work of this insect. The Entomologist, in cooperation with Mr Waldo C. Johnston of Cooperstown, conducted a practical test of the value of collecting the weevils by hand. It was found that four collections could be made for about $1.25 an acre where the trees were not more than 3 feet high and, as a result, no weevils were to be seen later. There are reasons for believing this to be a practical and possibly a profitable method of controlling the pest in such plantings. It is planned to continue the investigations of this important pest.

Original studies were also made of the *spotted hemlock borer,* an insect which destroyed several hundred valuable hemlocks in the New York Botanical Gardens, and one which has killed many trees in the Appalachian region. A detailed account of this borer is given in the Entomologist's report.

The *Rhododendron clearwing* and the *pitted Ambrosia beetle* were also studied. The first deforms and weakens the valuable Rhododendron, while the latter may destroy a considerable proportion of one or more beds of this shrub.

The work of the *two-lined chestnut borer,* a pernicious enemy of both chestnut and oak, was observed in several localities about New York City and appropriate recommendations made. A detailed account of this pest has been given in New York State Museum Memoir 8.

The Entomologist has taken advantage of the recent outbreak by *bark beetles,* to study the general conditions which may result in serious injury by these borers. A careful examination of weather records, especially those relating to precipitation, tends to support the belief that a series of annual droughts may so weaken the trees as to produce conditions very favorable for the multiplication of the borers. A discussion of the data is given in connection with an account of the hickory bark beetle.

Flies and mosquitos. The interest in the control of the *house fly* and the subjection of the *mosquito* has continued. Several warning notices were sent out early in the year and a brief folder on the house fly was prepared, the latter being widely circulated in early summer.

Gall midges. Studies of gall midges have been continued and a number of species and three new genera described. The practical character of this work is illustrated by the description of one midge which is considered a most important natural enemy in controlling the red spider on cotton, and a consultation has been held with Prof. Henry Tryon of the " Prickly Pear (Traveling) Commission " respecting the introduction of certain gall midges into Queensland, in the expectation that they might become important agents in practically freeing large areas from the introduced and obnoxious prickly pear. The Entomologist's report contains a detailed account of a *Cactus midge* which may prove of great value in Australia, though regarded as a pest under certain conditions in this country. The *rose midge*, an important enemy of the rose grower, has caused considerable apprehension in the vicinity of Rochester on account of its injuries to young plants.

Publications. A number of brief popular accounts regarding such common pests as the house fly, apple tent caterpillar and forest tent caterpillar have been widely circulated through the press. The most important publications, aside from the report of last year, are: The Gall Midge Fauna of Western North America; Studies in Itonididae; and several papers describing new species of gall midges.

Removal. The moving of the collections and their establishment in the new quarters in the Education Building involved a large amount of work, which necessarily restricted activities along other lines and must continue so to do until the insects are permanently rearranged. The removal was accomplished with practically no breakage or loss of either specimens or equipment and with comparatively little hindrance to the regular office routine.

Faunal studies. This phase of entomology has received some attention almost from the establishment of the office and has an important bearing upon practical work, since data of this character make possible the fixing of boundaries beyond which there is little probability of injurious species maintaining themselves in numbers. Earlier unpublished studies have resulted in fixing approximate boundaries for the various life zones in the State. It has been the policy for some years to collect in representative areas whenever opportunity offered and much valuable material has been secured in this manner. Collections in the Adirondacks, begun by the late Dr J. A. Lintner, have been continued. The past summer collections were made in several Adirondack localities and at Wells. These data are now being prepared for publication.

Collections. A special effort has been made the past season to secure specimens of the work and early stages of various injurious forms, since biological material is a most important component of economic collections and indispensable in elucidating the habits and life histories of the various species. The State collection now contains a large amount of such material, invaluable because of the associated data. Many miscroscopic preparations of smaller insects have been made and incorporated in the collections as in earlier years.

Much labor has been expended upon the rearrangement of the collections, an undertaking which has been hampered to some extent by insufficient case or tray room. This work, while time consuming and in a certain measure unproductive, is a necessary preliminary to effective studies in the future; otherwise more time would be lost in endeavoring to find misplaced specimens than would be required to put the collection in order in the first place.

Material provision for the care of the collections is essential. The pinned insects are in boxes or trays in wooden cases. There are not enough of the former to permit the specimens being properly arranged, and the latter should be replaced by steel cases and more provided to accommodate the additional boxes and trays required. The biological material is in an even less satisfactory state. It is in shallow, wooden trays and difficult of access because of the lack of space. There is need of a modern series of metallic trays for the accommodation of such specimens. Some equally satisfactory provision should be made for the large collection of microscopic slides, many of them containing types of species, and therefore impossible of duplication. The constantly increasing collection of photographic negatives requires a metallic filing case of approved design.

Nursery inspection. The nursery inspection work conducted by the State Department of Agriculture has resulted in the Entomologist being requested to make numerous identifications and also advise in regard to the policy which should be pursued by the State. Many of the specimens submitted for name were in poor condition, and as they may represent any stage in insect development and frequently originate in a foreign country, such determinations are laborious, time consuming and require for their successful prosecution a large collection and many entomological works, both domestic and foreign. The correct identification of such material is very important, since the disposal of large shipments of nursery stock depends in considerable measure upon the character of the infestation.

Miscellaneous. Cooperation with the Division of Visual Instruction has been continued and additions made to an excellent and somewhat extended series of photographs, mostly of injurious or common insects or their work.

V

ZOOLOGY

In spite of the temporary lack, or inaccessibility, of many things essential to the work of the zoology section, substantial progress has been made in restoring an orderly arrangement of the collections and in acquiring the equipment necessary for meeting the requirements of a zoology exhibit much larger and more varied than could be attempted in the former quarters. In the early part of the fiscal year, the removal of the collections and outfit of the zoology section was successfully accomplished. The time and labor previously devoted to packing and preparing the collections proved well spent; the packed material was all handled rapidly and easily and arrived in good condition. On account of the delay in delivering the zoology storage cases, boxes and wrappings have been obliged to do long service as storage. While by no means adapted for protection against insects, depredations from that source seem to have been effectually warded off by opening up the boxes and examining the specimens as soon as warm weather came on, and putting in each box a plentiful supply of naphthalene. No damage from insects has been found in the material thus far taken out.

The special groups of birds and animals having more or less elaborate accessories, such as prepared or artificial plants, celluloid or glass representing water, etc., presented great difficulties in moving on account of their bulk and liability to injury. They were carefully transported without packing, but not without considerable damage, due largely to the partial dismantling made necessary by the narrow and crooked stairway and lack of an elevator in Geological Hall.

The group of fresh-water fishes prepared by Mr Klein while taxidermist at this Museum was found most difficult to handle. The large sheet of celluloid representing the surface of the water cracked, causing considerable damage, apparently because of the sudden change in temperature due to moving it in cold weather, every care having been taken in handling it.

The large group of black bears acquired several years ago and temporarily set up at the State Normal College for lack of room in Geological Hall, was also moved to the Education Building, but on account of its large size, it had to be entirely dismantled and nearly all the accessories replaced. The moose group, which had been in storage since its delivery in Albany, was also moved but not set up, owing to the delay in delivering the cases.

To accomplish the difficult task of setting up and restoring these groups, the services of Mr B. M. Hartley, of New Haven, were obtained. During the four months he was at the Museum, the damaged and dismantled groups were put in shape again and two large nesting groups (goshawks and duck hawks) were prepared from material previously acquired from the collection of Mr S. H. Paine, of Silver Bay, and other smaller exhibits were finished. The skeleton of the finback whale was assembled and hung in the zoology hall by Mr C. E. Mirguet, of Washington, by whom the skeleton was originally mounted.

One of the important parts of the year's work was in adding to the equipment of the taxidermist's room so that the work of preparing the specimens and accessories for the bird and animal groups could be carried on. The water power air compressor used in Geological Hall proved a failure in the new quarters because of its worn-out condition and because of the lower water pressure in its new location, and has been replaced with a much more powerful portable electric compressor which will be available for a great variety of uses. Other needed additions to the taxidermist's outfit, notably a carpenter's work bench, a drill press and other tools, a galvanized iron box and cover for the relaxing chest and a wooden tank for preserving fluid were also made.

The collection of birds' eggs and nests has been sorted out, cataloged and so packed that the specimens suitable for exhibition will be easily accessible. The alcoholic material has been gone over and cared for, and made accessible for study and comparison. Though useful for such purposes, it is not for the most part of a character desirable for exhibition. It will be kept in storage cases in the zoologist's room, and specimens prepared in ways more attractive to the public will be used for exhibition.

Under the conditions that have prevailed, it has been impossible to devote much time and money to increasing the collections, but a number of important additions to the exhibition collections of mammals, birds, birds' nests and eggs and fishes have been received, notably a pair of pumas and a pair of fishers previously ordered from Ward's Natural Science Establishment and a number of native fishes obtained in the local markets and mounted by the museum taxidermist. The most valuable single specimen received is the skin of a large buffalo bull from the Blue Mountain Forest Preserve, presented by Mr Austin Corbin, which has been mounted at Ward's

Natural Science Establishment and will be used in a group with several other specimens already in our possession.

Birds of New York. The completed text of volume 2 of Birds of New York, the publication of which has been delayed on account of the illness of Professor Eaton, the author, was sent to press in the summer and it is expected will be ready for delivery by the first of May or June. This volume covers the land birds and, as the game and water birds were included in volume 1, the completion of the work in hand as volume 2 of Museum Memoir 12, will bring to an end the present representation of all species of birds occurring in the fauna of New York, including visitants and migrants, with a complete illustration in color of every species. Volume 1 was received with such general approbation and appreciation, it is believed that volume 2, which covers the birds coming under more general daily observation of the larger public, will meet even a greater need than its predecessor. Volume 2 carries, besides the descriptions and illustrative matter, a series of general chapters on the habits and general ecological relations of birds and the part they play in human society and culture. Occasion is taken at this time to make announcement of the fact that volume 1 was offered to the public at $3 a volume; volume 2, which is somewhat larger than volume 1, carrying more text matter and a greater number of color plates, will be sold at the same price to all who have received volume 1, but otherwise at $4.

Monograph of the New York mollusca. The work of preparing the monograph of the New York mollusca, which is in the charge of Dr H. A. Pilsbry of the Philadelphia Academy of Sciences, has gone forward and the author reports an increasing number of illustrations made, together with the preparation of considerable additional text matter. It is probable that the entire work will be brought to completion within the coming year.

Myriapods of New York. The late Frederick C. Paulmier, while zoologist of the Museum, prepared and annotated a checklist of the myriapods of New York, and this list was supplemented by notes and memoranda, together with an index of the genera, made by Professor George H. Chadwick while occupying the same position on the Museum staff. It has seemed well to bring this undertaking to completion and Dr Roy W. Miner of the American Museum of Natural History has very kindly consented to take over the manuscripts and memoranda with the purpose of putting them in final form as an illustrated compendium of these animals as they occur in the State.

VI

REPORT OF THE ARCHEOLOGIST

The fiscal year ending September 30, 1913 has been unusual in the history of the archeology section of the State Museum. During the year the general display cases for archeological and ethnological material have been installed, but the large group cases for the ethnological series of Iroquois culture phases have reached only the stage of plans. This circumstance prevents any definite attempt to fill the other cases, so soon to be moved, rearranged and covered during the building of the group cases. A temporary display of the ethnological material, however, demonstrated that the archeological and ethnological divisions will be cramped for exhibition room unless the greater portion of the eastern mezzanine hall is taken over for a hall of comparative and special area archeology. Plans have already been made to fill this hall with archeology cases.

From the Museum rehabilitation fund several important collections of archeological specimens have been acquired. This encouraging fact again makes the State Museum the repository of an extraordinary collection of cultural artifacts of the New York aborigines. Through careful purchases and wise selections of large collections from special localities, the archeological series will surpass the former exhibit destroyed in the Capitol fire. The more adequate means now at hand for exhibiting these specimens will make possible an exhibit of vast importance. Definite plans have already been drawn up in view of a scientific display of these artifacts.

It must be definitely understood that, in the vulgar sense, no relics or curios will be exhibited. The curious object devoid of adequate data will have no room in these cases, the plan being to show visually the arts, industries, crafts, ceremonies, means of livelihood and burial customs of the race or races, tribes and nations that preceded the white man in the occupation of this territory. The plan is to make an educational exhibit of culture history and culture development. The collections as exhibited must live, in the sense of being valuable modes of instruction in the prehistory of New York. All the various collections acquired have been thoughtfully studied with this object in mind. It is hoped this plan, when carried out, will establish the educational value of the archeological exhibits. We have the material, though it is highly desirable that it be constantly added to, for it is by no means as yet complete.

The special interest inherent in this collection is that we are able to link the aboriginal period through its gradual stages of transition to the Indians still living in the State today. Valuable collections like that acquired from Raymond C. Dann of Fairport show the Seneca culture at an interesting period of transition. The so-called "stone age" is linked with the "age of iron."

Collections purchased. During the year the Archeologist visited all the principal collectors who had indicated a willingness to sell their specimens to the State Museum. This examination has led to the acquisition of the following collections:

	Number of specimens
R. D. Loveland, Watertown	1965
Charles P. Oatman, Liverpool	775
Alva S. Reed, Livonia	646
Ward E. Bryan, Elmira	1092
R. E. Van Valkenburg, Mount Upton	331
C. A. Holmes, New Berlin	652
Raymond G. Dann, Fairport	1662
Frederick H. Crofoot, Sonyea	9647
Smaller collections	600
Total	17370

The localities represented are the territory adjacent to the eastern end of Lake Ontario, the upper waters of the Hudson, the Chenango valley, the southern end of Canandaigua lake, the valley of the Susquehanna near Elmira, the Genesee valley and the various sites in Ontario and Monroe counties. Other collections from important centers are under consideration. The material so acquired does not represent merely surface finds, for the Reed, Oatman, Loveland and Dann collections are largely the result of excavations.

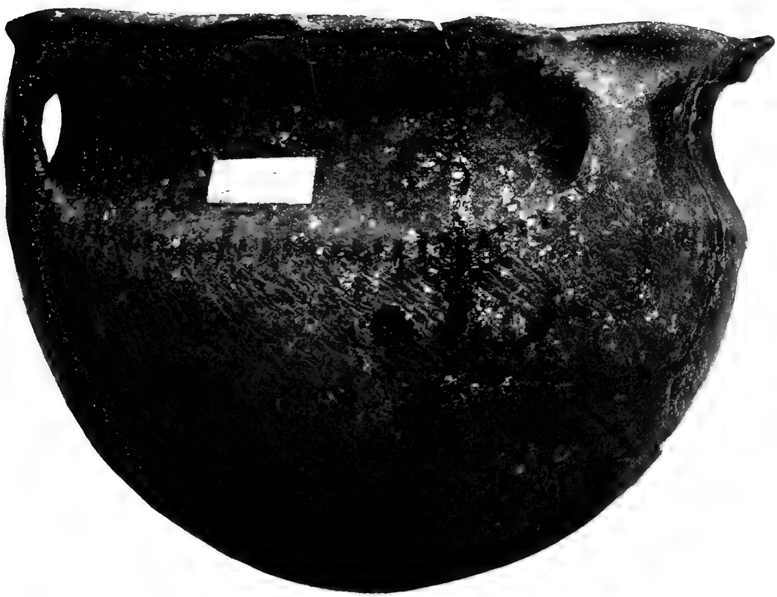
To describe in detail the various collections acquired during the year would be a lengthy task and require much special study involving a considerable period of time.

For the purposes of a general report, the sketches of each collection as found below will be sufficiently descriptive.

The Raymond Dann collection results from excavations made on the John Dann farm three-fourths of a mile south of Honeoye Falls, Monroe county. The site lies along Totiacton creek and covers a large acreage, probably 30 or 40, with scattering evidences of occupation all about. Here, during the third quarter of the 17th century, was a large Seneca village and graveyard. Mr John Dann believes

Animal effigy pipes from the Dann Collection, Honeoye Falls. The two larger pipes at the top have brass or copper eyes

Types of pipes from the Dann Collection, Honeoye Falls



Clay vessels with ears from the Dann Collection, Honeoye Falls

this site to be one of the several Totiacton villages. There is every evidence of a continued contact with Europeans and the artifacts of the so-called stone age mingle with those of European manufacture, such as brass, iron, lead, crockery, glass and bone.

Much of the material came from refuse pits and dumps, but by far the greater portion was taken from the numerous graves on the sloping hillside. The objects found by Mr Dann were carefully cataloged, giving thereby an added value. An interesting variety of pipes is contained in this collection. Of greater interest, however, is the fine collection of pottery vessels, some of which have unique features, for instance, handles or ears. Among the shell ornaments are many quarts of wampum beads, many effigies, disks, crescents and cylindrical and spheroidal beads. The bone implements include a fine series of combs having figures carved at the top, awls, effigy figures of the human form, cylindrical beads and tortoise carapaces. The stone implements include the usual array of flints, anvils, hammers and pitted stones.

The proof of European contact is found in the European wampum, glass beads, objects of brass (as kettles, chains etc.), iron knives, lead and pewter.

By this collection it is possible to illustrate the art of the Senecas in all the various substances in which they wrought and then to show side by side the objects brought by the traders to supplant the native artifacts. The goods of the white man were superior and were therefore eagerly sought. Native industries gradually decreased and they became dependent upon implements and utensils that they themselves did not and could not produce. A temporary arrangement of the Dann collection illustrates this, showing the decadence of native art and industry resulting from contact.

An earlier Seneca site is illustrated by the Alva Reed collection. This collection is the result of digging into the refuse pits and side hill dumps of an ancient Seneca stronghold near the town of Richmond Mills, Ontario county. The site is upon a high hill overlooking the Hemlock valley. The site itself is well protected by the high walls of a creek on one side, a long slope on the west side and a ravine to the south. There are indications of palisades that still further protected the place. No graves have been found on this site although on one of our surveys we found human remains near the surface in the stiff clay at the upper end of the "fort." Graves were later found across the ravine by Frederick Houghton, but no objects other than human bones were discovered in the graves.

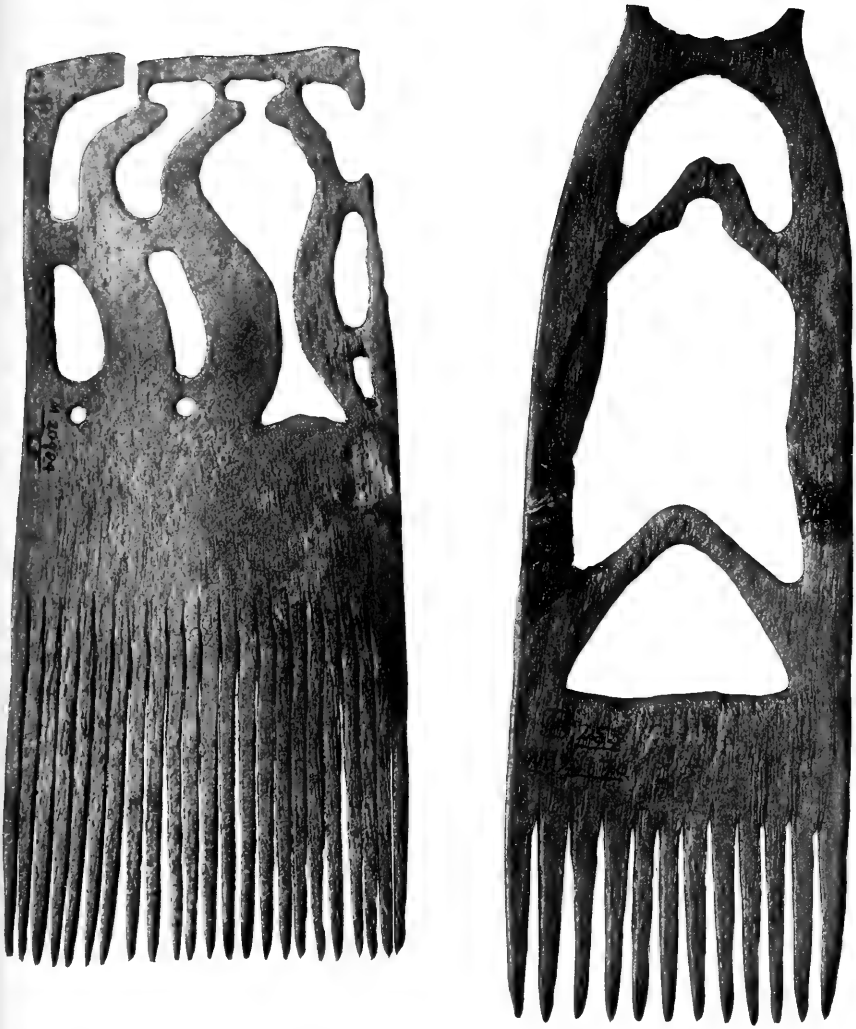
Mr Reed, who made the collection through many years of digging at his leisure hours, has been careful to collect and catalog with method. He found no objects of European manufacture and no signs that the occupants of what he terms "the old fort" had ever seen the white man. The collection embraces good series of shell, bone, antler, stone and clay objects. It is especially rich in fine bone implements and early shell ornaments. The pottery unfortunately is mostly fragmentary. The special value of this collection lies in the fact that it may with reasonable certainty be called precolonial Senecan. It is therefore a good type-collection of this period and is valuable as a base for comparison.

A mixed collection from Livingston county is that made by Mr Fred H. Crofoot of Sonyea. It is the result of a surface examination of some forty sites up and down the Genesee valley from the Honeoye Junction to Mount Morris, and of all the tributaries within this region. Many stages of occupation are represented and occupations beginning with the Esquimaux-like through the early Algonkian, the mound culture, the later Algonkian, the early and later Iroquoian into the colonial period.

One of the thickly populated centers of the early Iroquoian peoples is the area bounded on the west by the east shore of Lake Ontario and on the north and northeast by the St Lawrence. This geographical area is embraced in the present county of Jefferson. Here have been a succession of occupations with the precolonial Iroquois leaving the greater portion of cultural artifacts. Several large collections have been made there, with those made by R. D. Loveland and Charles Oatman leading in objects of interest. Earlier small collections are those made by Dr R. W. Amidon, Doctor Getman and Captain Oldham. The Museum acquired these smaller collections between 1906 and 1909. This year the Museum has been enabled to obtain both the Loveland and Oatman collections. Each collection is rich in fine examples of clay pipes, more than 250 being embraced in both. Some have been carefully restored from the broken fragments, thus showing almost exactly the original forms. The range of ornamentation and relief decoration is wide and on the whole is consistently Iroquoian. No entire clay vessels were found in this locality, but the collections contain thousands of valuable fragments. Bone and antler objects are numerous and of good quality.

From the region drained by the Susquehanna and its tributaries we have acquired three small but not unimportant collections —

Antler combs and effigies from the Dann Collection, Honeoye Falls



Antler combs from the Dann Collection, Honeoye Falls

those of Ward E. Bryan of Elmira, R. E. Van Valkenburg of Mount Upton and C. A. Holmes of New Berlin. Here, as might be expected, are many evidences of Algonkian occupation. Some of the specimens appear to be early types as illustrated by the weathered argillete and limestone chipped implements.

Mr D. D. Luther during the year sent in 440 specimens from an early Algonkian site near Naples, Yates county. Although

Stone Face from Chemung County

many of the specimens are fragmentary, for purposes of comparison the collection is highly interesting. It was through Mr Luther that the Museum has acquired the fine objects from the site near Middlesex. These specimens are largely tablet gorgets, stone tubes, shell beads and a copper implement. The burials appear similar in type to a certain Ohio culture.

Ethnology. Two trips were made to the New York reservations and some valuable specimens of historic Iroquoian art obtained.

Among these specimens were ceremonial objects of the Eagle or Bird dance, dance rattles and paraphernalia, carved bowls, wood spoons and similar ornaments. Decorated clothing was obtained at Allegany and husk objects, notably moccasins, at Cattaraugus.

Year by year the native artifacts used by the Iroquois of New York and Ontario are diminishing in number and variety. Makeshifts are frequently employed, as for example, tin can rattles for horn rattles, fringed canvas masks for corn-husk masks and a tin dipper for the ceremonial ladle. Only a few old persons remain who remember the ancient arts of weaving and quill decoration. Thus the field is constantly growing more barren and it is only with great effort, combined with good fortune, that desirable objects of ethnological interest are obtained. Flying trips on the reservation are not satisfactory means of collecting. A residence of several months for the express purpose of collecting specimens will be found more conducive of results. Thus the short time actually devoted this year to collecting was remarkably productive.

As is customary, this year some effort was made to add to our store of folk tales, myths and texts, but little time could be given to this task. Some corrections to manuscripts already at hand were made. Our important manuscripts on Iroquois ethnology must receive early attention with the idea of a thorough revision and publication. Students of ethnology in general eagerly await the facts that we have to give. The amount of work ahead in this direction alone represents much activity and time for the future.

Public interest. It is gratifying to note the increasing value of this section of the Museum to the public. Although the accessions are not yet on exhibition, numerous students make personal visits and the specimens are made available for study. The specially valuable locality collections afford a unique means for comparison. Distribution of types and specimens may be studied here as in no other institution. The gradual realization of these facts is constantly bringing inquiries relative to the aboriginal occupation of the State.

Numerous letters are received requesting information on various subjects, such as the history of the New York Indians, myths, games, customs, rituals, religion, language, names, music, present condition, distribution etc. etc.

Many requests have come for accurate and appropriate Indian names. The intended use of these names has ranged from names for camp fire girls clubs, estates and boats, to names for lakes, hills, springs, and other geographical features. At the request of Hon.

George Foster Peabody, State Commissioner of Saratoga Springs, appropriate Indian names were selected for certain springs at Saratoga. These names are from the Algonkian or Iroquoian languages and may be verified as correct by any student of these tongues.

The publications relating to archeology and ethnology continue to be in demand. The public call has exhausted the supply of several of these bulletins.

The degree with which this section of the Museum may be useful as a source of information is shown by the very active interest taken by educators, historians, ethnologists, sociologists and writers of fiction, in the Iroquois confederacy. Scarcely any one of these refers to the colonial history of New York without weaving in the history of the Iroquois league and its unique influence. Our archeological and ethnological sections have thus become sources of information and as this fact becomes better known, are attracting increasing attention. The completion of the Museum exhibits will naturally stimulate this interest to the highest degree.

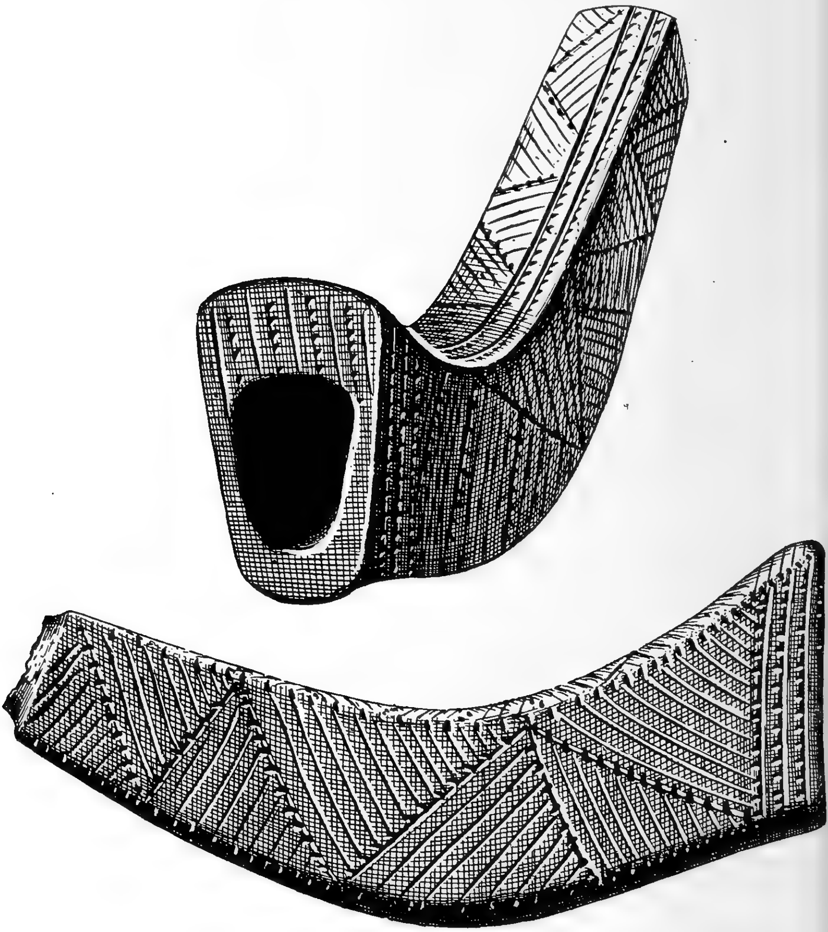
NOTES ON CERTAIN ACQUISITIONS

From Irondequoit creek has come a unique clay pipe. It was collected by Mr B. Benro and acquired through the courtesy of Frank H. Ward of Rochester. Mr Benro found it protruding in the bank of the creek about 3 feet below the surface. The form of the pipe as shown in the accompanying figure is like that of a flattened war club or stone axe handle. It is flattened on each side with a curved surface on the back side (away from the smoker). The material is a compact clay, well baked and tempered with sand containing mica. There is a fracture in the pipe just below the curve, and the nipple or mouthpiece has been broken off. The decoration is the familiar angular pattern made by filling the triangles with parallel lines, using one side of the triangle as the base parallel. Short lines more deeply incised, or long dots, are found at each end of these triangles and seem to represent the stitching of quills on birch bark. There is a stitched seam on the front (toward the smoker) of the pipe, near the left side. The back and left side of the pipe are more neatly decorated, as if done first. The top edge of the bowl is decorated on the back and two sides with three parallel lines at the edges of which are "long dots" or "stitch markings."

The bowl is about 2¾ inches deep and extends to the bend. The capacity of this bowl is greater than the usual Iroquois pipe.

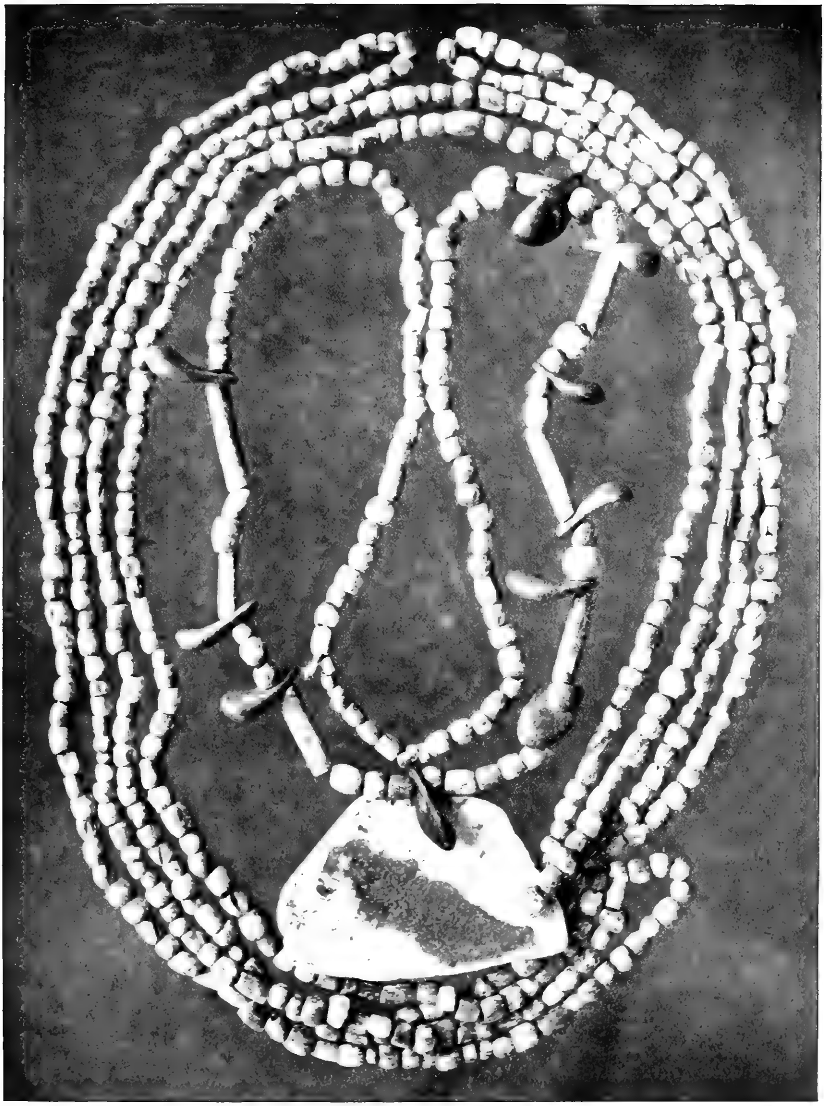
The pipe is so balanced despite its bend that it will stand upon its bowl. In a collection of several hundred Iroquoian pipes in the State Museum, none approaches the Irondequoit pipe in form.

Some very fine specimens of pre-Iroquoian art have come to the Museum from the eastern shore of Canandaigua lake. The site



THE IRONDEQUOIT PIPE

covers a small hillside and consists of an ancient burial plot, though the skeletons are not placed in any degree of regularity, as to location, nor are the graves numerous. The culture represented is similar to that of the mound-building Indians of New York and Ohio.



String of shell beads, elk teeth and shell disk from a site in Middlesex on Canandaigua lake

Articles from Middlesex site. Stone tubes, broken amulet, crude clay pipe, bar-amulet, stone tube

Articles from the Middlesex site. Bone pendant, antler awl, slate gorget, copper chisel and portion of ivory dagger blade

Artifacts from this culture are found in certain portions of New York State but usually associated with small mounds or stone graves. The State Museum has records of several such sites but unfortunately has never been able to excavate one. No trained observer has watched or recorded these accidental finds. It is to be hoped that in the future it may be possible to supplement the bare objects with their meager data of discovery, by excavating such sites under scientific oversight.

In one grave opened up in a gravel bank, near Middlesex, two entire stone tubes and one broken specimen were found. With these was a crude clay pipe with a short stem and small bowl, an awl lance head of antler, a bone pendant and a small copper chisel.

In another grave opened this year was a large black slate gorget of the two-hole type, a double-tailed "bird stone" and the middle portion of a dagger or blade made of mastodon tusk. No other specimen made of such material has been found in the State, as far as is known to the Museum. The gorget is one of the largest in our collections, measuring 6 inches in length, 4 inches in width at top and 3½ inches at the bottom. The sides are only slightly convex, but both top and bottom are arcs of circles. The central point of each arc is the perforation most distant from it. The center of each hole is equidistant from the edge immediately below it. The perforations are all so exactly placed on the gorget that each is the midway point in a line drawn perpendicularly.

The gorget seems to be divided in approximate fifths with each hole at a point from each end, about two-fifths of the length. The distance between the holes is $1\frac{5}{16}$ inches. These measurements are given only for the sake of description to show the exactness with which the specimen was made. The surface is covered with arborescent crystals of some carbonate, though originally there was a high polish.

The range of pipe forms and pottery as illustrated by the specimens from Jefferson county and contained in the Oatman and Loveland collections, presents a fairly good view of precolonial Iroquoian ceramic art. The pipes are of especial interest because they break away from purely utilitarian forms in outline and conventional decoration. The modeling on many represents human and animal forms, sometimes quite natural, and in other instances conventionalized.

The Iroquoian clay pot, judged by the specimens in these collections, is usually a fine piece of work, in the sense that the clay has been carefully prepared, tempered and modeled. Iroquois pottery in texture and durability is superior to Algonkian pottery. The body of the pot, in general, is that of a flattened globe with a constructed neck that flares into a wide collar, either round or, more generally, squared with upward projecting tips at each corner. This collar is generally decorated with triangular patterns made of parallel lines. Some of the older potsherds show cord or paddle markings all over the outer surface.

The parallel lines in triangular patterns seem to imitate porcupine quill decorations on birch bark and indeed the form of the pot seems to follow the stitching of a birch bark receptacle. The dots or indentations about the base of the neck indeed seem to point out the place where the upper portion of the bark collar was sewed to the lower portion. This idea was suggested in the early writings of Frank Cushing. As far as has been discovered, however, the New York Iroquois did not use birch bark receptacles. Theirs were of elm bark, a much rougher material but more durable. No circular or curved designs are found on Jefferson county Iroquois pottery, the only exception being round dots, punched on, singly or in angular patterns. Jefferson county Iroquois pipes of clay are superior to any found among contiguous stocks. They were molded with their stems and were not designed for long wooden stems. There are several types of pipes as may be seen on the accompanying plate. The simplest forms are the trumpet " pipe " and the pipe with the collar about the top of the bowl, composed of several parallel rings, like coiled cord. Other forms are the square topped pipe, the so-called Huronian, and pipes with human and animal effigies on the bowls. These effigy pipes in concept and form oddly resemble the pottery of the Mississippi valley. The caps shown on the heads of effigies are shaped like the old-fashioned beehive. Even designs of face painting are shown and the bear or wolf skin robe is shown over the Indian's head.

Trumpet bowls are found on the early Erie, Onondaga and Mohawk sites, and ringed collar is found on Seneca, Neuter and Huron sites.

Strangely, Iroquois stone pipes are not similar to their clay pipes. As far as decoration and modeling are concerned, they might have been made by another stock. There may be a few exceptions, but in general, the rule applies. An example is the long-tailed animal effigy pipe bowl, studied with much care by Lieutenant G. E. Laidlaw, and reported in the publications of the Ontario Provincial Museum. Many of these stone pipes appear to have been carefully kept; possibly they expressed the art of the earlier Iroquois and were kept as ceremonials or as heirlooms.

Clay pipes from Jefferson county. Loveland Collection

VII

PUBLICATIONS

A list of the scientific publications issued during the year 1912–13, with those now in press and treatises ready for printing, is attached hereto. The publications issued cover the whole range of our scientific activities. They embrace 1391 pages of text and 184 plates.

ANNUAL REPORT

1 Ninth Report of the Director, State Geologist and Paleontologist for the fiscal year ending September 30, 1912. 214p. 50pl.

Contents

MEMOIRS

Paleontology

2 The Eurypterida of New York. By John M. Clarke and Rudolf Ruedemann. 1912. 2 vols. 628p. 88pl.

Contents

BULLETINS

Geology and Paleontology

3 No. 162 The Lower Siluric Shales of the Mohawk Valley. By Rudolf Ruedemann. 1912. 151p. 15pl.

Contents

4 No. 166 The Mining and Quarry Industry of New York State. By D. H. Newland. 1913. 114p.

Contents

Archeology

5 No. 163 The Code of Handsome Lake, the Seneca Prophet. By Arthur C. Parker. 1913. 144p. 23pl.

Contents

Entomology

6 No. 165 Report of the State Entomologist for the fiscal year ending September 30, 1912. 1913. 264p. 14pl.

Contents

Botany

7 No. 167 Report of the State Botanist for the fiscal year ending September 30, 1912. 1913. 76p. 4pl.

Contents

In press

MEMOIRS

8 Birds of New York, volume 2

BULLETINS

Geology and Paleontology

9 The Geological History of New York State
10 Geology of Saratoga Springs and Vicinity
11 Geology of the North Creek Quadrangle
12 Geology of the Attica-Depew Quadrangles
13 Geology of the Syracuse Quadrangle

Entomology

14 Report of the State Entomologist for the fiscal year ending September 30, 1913

VIII

REPORT ON THE COLLECTION OF COINS, MEDALS AND PAPER MONEY

These collections, by action of the Regents, were transferred to the custody of the State Museum after the Capitol fire, and the following is a report on their present condition.

Catalog of 1856. The only existing record of this collection was issued by the State Library for the year 1856 (dated 1857). In this catalog the numerical contents of the collection are stated as follows: coins (all metals), 1697; medals, 234; paper money, 320.

Fire losses from the collection of 1856. A checking of the record of 1856 by an expert numismatist shows that of the materials above listed the following are the losses: coins, 897; medals, 197; paper money, all. The losses therefore were, for the coins over 50 per cent; medals, about 80 per cent; paper money, 100 per cent.

Coins not in the catalog of 1856. In the salvage from the fire there are, not recorded in the catalog of 1856, 2376 coins and 57 medals. The total number of coins and medals in the salvage is 3270.

General condition of the coin collection. The condition of this collection is bad. With the exception of a very few articles in gold which have been on deposit in the National Commercial Bank, Albany, since 1881, nearly every specimen has suffered, and the majority of them irreparably. This has been due in the first instance to oxidation and discoloration in fire, aggravated by improper treatment of much of the material when first rescued.

Value of this collection. On an expert estimate of the face value of all the coins and the market value of all United States coins, it appears that the face value of the entire collection is approximately $725; that the market value of the *American coins* of all metals is $499.

General character of the collection. This collection is composed of a small number of gold coins and medals of considerable worth, most of them of American coinage, but some of other countries; a large number of silver coins in rather bad condition, and a very great majority of copper coins from all countries of the world and of very little worth. The value of the collection (such as it is) lies in its *United States coins and medals*, very few of which are of superior quality or great rarity. These total about 1500.

Alternative suggestions in regard to the coin collection. These suggestions are of necessity based on the recognized demoralized condition of the collection and are submitted without recommendation. Attention, however, is invited to the fact that this collection has evidently been largely made without any or only very occasional expenditures of State moneys. They have come by gift and it is very probable that like gifts will continue, especially of commemorative medals struck in this and other countries. It would seem that the University should be at least receptive of such gifts whether or not expenditures for the collection be approved.

1 Any action whatever regarding the collection may be suspended and the collection kept as it is at the present time, subject to additions by gift.

2 The collection might be sold as a whole, with the specific permission of the Legislature, the returns therefor to revert to the State treasury.

3 The collection might be deposited on temporary or permanent loan with any society that the Regents might choose to designate, subject to the permanent supervision of the collection by the Board of Regents.

4 *Gift.* It appears very doubtful, in the opinion of the law officer of the Department, whether even the Legislature could empower the Board to dispose of the collection by gift.

5 *Possibility for the development of the collection.* It may be worth while to consider whether it would not be a proper policy to maintain and build up a representative collection of American coinages. The nucleus therefor now in the custody of the Board is considerable in number although it lacks in quality that which would be required by the connoisseur. Still these examples of American coinages are of such a kind as to indicate satisfactorily their varieties, so far as these extend. Very slight occasional expenditures could be made to acquire additional material and the balance of the collection, not American, could be utilized by way of exchange for the purpose of acquiring solely American coins. Should this suggestion seem a reasonable one, it is well to supplement it by recognition of the evident fact that there is a large degree of public interest in American coinages and that it might be the people of the State may desire to have here in the Regents' custody a representative array of such coins which could be made accessible to students for purposes of comparison and study. The possibility of converting all the other parts of the entire collection into substantial support for the enlargement of the American collection would seem to give this suggestion reasonable encouragement.

IX

STAFF OF THE DEPARTMENT OF SCIENCE

The members of the staff, permanent and temporary, of the Department of Science as at present constituted are:

ADMINISTRATION

John M. Clarke, Director
Jacob Van Deloo, Director's Clerk
Paul E. Reynolds, Stenographer

GEOLOGY AND PALEONTOLOGY

John M. Clarke, State Geologist and Paleontologist
David H. Newland, Assistant State Geologist, *Curator of Geology*
Rudolf Ruedemann, Assistant State Paleontologist, *Curator of Paleontology*.
C. A. Hartnagel, Assistant in Geology, *Curator of Stratigraphy*
Robert W. Jones, Assistant in Economic Geology, *Assistant Curator of Industrial Geology*
D. Dana Luther, Field Geologist
Herbert P. Whitlock, Mineralogist, *Curator of Mineralogy*
George S. Barkentin, Draftsman
H. C. Wardell, Preparator, *Assistant Curator of Paleontology*
John J. Bryan, Stenographer
Charles P. Heidenrich, Mechanical Assistant
Joseph Bylancik, Page

Temporary experts

Areal geology

Prof. H. P. Cushing, Adelbert College
Prof. C. H. Smyth, jr, Princeton University
Prof. James F. Kemp, Columbia University
Prof. W. J. Miller, Hamilton College
Dr C. P. Berkey, Columbia University
G. H. Hudson, Plattsburg State Normal School
Dr W. O. Crosby, Massachusetts Institute of Technology
Prof. George H. Chadwick, St Lawrence University
James C. Martin, Princeton University

Geographic geology

Prof. Herman L. Fairchild, University of Rochester
Prof. James H. Stoller, Union College

Paleontology

Edwin Kirk, Washington, D. C.

BOTANY

Charles H. Peck, State Botanist
Homer D. House, Assistant, *Curator of Botany*

ENTOMOLOGY

Ephraim P. Felt, State Entomologist
D. B. Young, Assistant State Entomologist, *Curator of Entomology*
Fanny T. Hartman, Assistant, *Assistant Curator of Entomology*
Anna M. Tolhurst, Stenographer
Charles W. Swim, Clerk

ZOOLOGY

Willard G. Van Name, Zoologist, *Curator of Zoology*
Arthur Paladin, Taxidermist

Temporary experts

Prof. E. Howard Eaton, Canandaigua
Dr H. A. Pilsbry, Philadelphia
Charles E. Mirguet, Rochester
B. M. Hartley, West Haven, Conn.

ARCHEOLOGY

Arthur C. Parker, Archeologist, *Curator of Archeology and Ethnology*
Noah T. Clarke, Technical Assistant, *Assistant Curator of Archeology and Ethnology*

Temporary assistant

Howard A. Lansing, Albany

X

ACCESSIONS

ECONOMIC GEOLOGY

Collection

Newland, D. H. Albany

Building stones from southeastern New York	5
Feldspar crystallized and massive, Bedford	3
Large beryl crystal, Bedford	1
Ground feldspar, Bedford	1
Molding sands from Albany and Rensselaer counties	15
Red slate, with quartz veinlets, Washington county	1
Iron ores and wall rocks, Adirondacks	20
Anorthosite, building stone, Keeseville	5

Jones, R. W. Albany

Clay, sand and brick, Mechanicville	5
Fire clay, Shenandoah	2
Talc, Shenandoah	2
Paving and building bricks, clays etc., Corning	13
Molding sands, Albany and Greene counties	2
Evaporated salt, Ithaca	3
Cement and cement materials, Portland Point	6
Sand-lime brick and raw materials, Glens Falls	3
Building brick and crude clays, Glens Falls	8
Building bricks, raw materials, etc., Troy	15
Clays, sands and brick, Kreischerville	21
Clays, sands and brick, Long Island	20
Building brick, drain tile, etc., Albany	19
Feldspar, quartz and beryl, Bedford	9
Emery and garnet, Peekskill	5
Natural cement and cement rock, Kingston	7
Paving and building brick, Catskill	4

Donation

Onondaga Coarse Salt Association. Syracuse

Exhibit of solar salt	7

International Acheson Graphite Co. Niagara Falls

Artificial graphite	11

The Carborundum Co. Niagara Falls

Exhibit of carborundum, aloxite, emery etc	25

Alpha Portland Cement Co. Cementon, Pa.
Exhibit of cement and cement materials................. 9
Clinton Metallic Paint Co. Clinton
Metallic Paint 2
Furnaceville Iron Co. Ontario Center
Samples of Clinton ores................................ 2
Alpha Portland Cement Co. Martin's Creek, Pa.
Portland cement and raw materials...................... 7
Glens Falls Portland Cement Co. Glens Falls
Exhibit of cement and cement materials................. 9
William Connors Paint Mfg. Co. Troy
Crude and finished mineral paints...................... 6
Pepson, Charles. Albany
Old sewer tile from Phoenix Place, Albany.............. 2
St Lawrence Talc Co. Natural Bridge
Crude and ground talc.................................. 3
Pass, James, Onondaga Pottery Co. Syracuse
Exhibit illustrative of pottery manufacture............ 31
Emerson-Norris Co. New York
Artificial stone from Tuckahoe marble.................. 6
Norton Company. Worcester, Mass.
Exhibit of alundum, crystolon etc., from plants at Niagara Falls 36
United States Gypsum Co. Chicago, Ill.
Exhibit of gypsum and gypsum products from Oakfield... 14
German Kali Works, Inc. New York
Specimens of German potash salts, including hartsalz, sylvinite, kainite and carnallite...................... 20
Cheever Iron Ore Co. Port Henry
Iron ore, concentrates and tailings.................... 3
Benson Mines Co. Benson Mines
Iron ore, concentrates and tailings.................... 3
Hinckley Fibre Co. Hinckley
Pyrite from Cole mine, St Lawrence county.............. 1
Atlantic Terra Cotta Co. New York
Architectural terra cotta, Staten Island plant......... 12
New York State Sewer Pipe Co. Rochester
Floor tiles, conduit and sewer pipe.................... 9
St Lawrence Pyrite Co. De Kalb
Pyrite, crude ore and concentrates..................... 6
Blake, P. X. Potsdam
Polished granite slab from Parishville................. 1

North River Garnet Co. North River
Garnet rock and garnet concentrates.................... 4
Keystone Emery Mills. Frankford, Pa.
Crude and prepared emery from Peekskill............ 4
Witherbee, Sherman & Co. Mineville
Exhibit of ores, concentrates and tailings.............. 10
Retsof Salt Co. Scranton, Pa.
Rock salt, crude and prepared........................ 5
International Salt Co. Scranton, Pa.
Exhibit of brine salt................................. 4
Asbestos & Asbestic Co. Ltd. Asbestos, P. Q.
Large blocks of serpentine veined with asbestos.......... 2

GENERAL GEOLOGY

Collection

Clarke, John M. Albany
Calcite vein, faulted, Percé, P. Q...................... 1
Jones, R. W. Albany
Weathered limestone and pegmatite, Shenandoah, N. Y. 3
Newland, D. H. Albany
Banded gneiss, Dublin, Westchester county............ 2
Folded and faulted Yonkers gneiss, Kensico............ 2
Graphic granite, Bedford.......................... 2

Donation

Kelley Island Lime & Transportation Co. Cleveland, O.
Large limestone slab, glaciated........................ 1
Vermont Marble Co. Proctor, Vt.
Polished slab of faulted marble from True Blue quarry.. 1

MINERALOGY

Donation

Wait, Charles. Crown Point
Wernerite in calcite (large), Crown Point.............. 1
Manchester, James G. New York City
Pectolite, apophyllite and stilbite (large), West Paterson, N. J.. 1
Clarke, John M. Albany
Halite, Alfeld, Prussia............................... 1
Amphibole (Jade), locality?........................ 1

Ruedemann, R. Albany

Gypsum, Brunswick, Germany........................ 11
Celestite, Jena, Germany............................ 2

Purchase

Law, E. S. Schenectady

Quartz on limestone, Sprakers........................ 1
Quartz crystals, Sprakers 14

Foote Mineral Co. Philadelphia, Pa.

Stibnite, Iyo, Japan.................................. 1
Stibnite, Felsobanya, Hungary......................... 1
Stibnite, Wuchow, China............................... 1
Galena, Colquechaca, Bolivia.......................... 1
Galena, Benthen, Prussia.............................. 1
Galena, coated with marcasite, Prussia................ 1
Chalcopyrite on dolomite, Granby, Mo.................. 1
Chalcopyrite on dolomite, Siegen, Prussia............. 1
Chalcopyrite and pyrite, Bingham, Utah................ 1
Chalcopyrite, Ugo, Japan.............................. 1
Pyrite, Saratoga mine, Col............................ 1
Pyrite, Franklin, N. J................................ 1
Pyrite, York county, Pa............................... 1
Marcasite, Joplin, Mo................................. 1
Marcasite altered to limonite, Richland county, Wis.... 1
Tetrahedrite, Kapnic, Hungary......................... 1
Tetrahedrite, Felsobanya, Hungary..................... 1
Tetrahedrite, Ouray county, Col....................... 1
Rutile in quartz (polished), Japan.................... 1
Corundum (sapphire), Butte, Mont.................. 1 lot
Pickeringite, Tucumcari, N. M......................... 1
Iron (Josephenite) water-worn pebbles, Oregon....... 1 lot
Sphalerite, translucent cleavage, Chivera, Mexico...... 1
Boulangerite, Oberlahr, Prussia....................... 1
Anorthoclase (crystals), Sardinia................. 1 lot

Krantz, Dr F. Bonn, Germany

Calcite, St Goar, Prussia............................. 1
Calcite, Andreasberg, Germany......................... 1
Calcite with dolomite and quartz, Baden, Germany...... 1
Calcite, Pribram, Bohemia............................. 1
Calcite (twinned crystals), Durham, England........... 1
Calcite (twinned crystals), Egremont, England......... 2

Calcite (large group), Egremont, England.............. 1
Calcite (unique crystals), Egremont, England.......... 1
Calcite (large crystals colored red), Egremont, England.. 1
Calcite (pyramidal crystals), Wisby, Sweden........... 1
Calcite (large group), Poretta, Italy.................... 1
Calcite on quartz, Guanajuato, Mexico................. 1
Calcite (lilac colored), Guanajuato, Mexico............ 1

PALEONTOLOGY

Donation

Allardyce, Mrs Constance. Port Stanley, Falkland islands
Devonic fossils from Pebble island, Falkland islands.... 25

Grant, Colonel C. C. Hamilton, Ontario
Siluric fossils, Hamilton................................ 8

Hobart College, The trustees of
(On indefinite loan) Castoroides ohioensis. The original skull described by Hall & Wyman and obtained in the pleistocene marshes near Clyde..................... 1

Kelly, F. Helderberg Cement Co.
Trilobites from Howes Cave quarry..................... 1

Moore, Prof. E. S. State College, Pa.
Graptolites from Spring Creek formation (Beekmantown) of Pennsylvania 6

Post, W. J. Harriman
Mastodon tusk found about 2 miles south of Harriman station (Erie R. R.), Orange co....................... 1

Purchase

American Museum of Natural History. New York
Restoration of the skeleton of the Permic reptile Eryops. 1
Devonic fishes from Migouasha, P. Q................. 20

Gebhard, W. D. Schoharie
Collection of fossils from the Schoharie valley (Inventory to be given in next report)

Fink, Alvin J. Dayton, Ohio
Collection of trilobites.............................. 200

Kinnear, W. T. Kirkbuddo, Forfar, Scotland
Upper Siluric and Lower Devonic fishes from Scotland... 11

Krantz, Dr F. Bonn, Germany
European trilobites from various localities.............. 25

Ward's Natural Science Establishment. Rochester
Proetus rowi from the Hamilton shales........... 1

Collection

Hartnagel, C. A.
Fossils from the Ordovicic-Siluric series of Arisaig, Nova Scotia 300

Exchange

Carnegie Museum (Dr C. R. Eastman)
Restorations of Devonic fishes........................ 6

ENTOMOLOGY

Donation

Hymenoptera

Crawford, G. W. Ballston Spa. Lophyrus abbotii Leach, Abbott's pine sawfly, larvae on pine, October 1

Lossoe, F. R. Troy. Janus integer Norton, current stem borer on currant, February 21

Smith, F. A. Ticonderoga. Kaliofenusa ulmi Sund., European elm leaf miner, larvae on elm, June 4

Chase, F. Loon Lake. Hylotoma pectoralis Leach, birch sawfly, larvae on birch, July

State Department of Agriculture. Trichiosoma tibialis Steph., European hawthorn sawfly from England, cocoon on rose, November 27. Same as preceding, cocoon on barberry from Flushing, February 27

Bethel, E. Denver, Col. Aylax pisum Walsh, gall on Lygodesmia juncea, September 30

Gardner, Mrs E. P. Canandaigua. Through S. H. Burnham. Rhodites gracilis Ashm., regal rose gall, galls on Rosa blanda, September 29. Same as preceding, October 5. Also R. globulus Beutm., globular rose gall, gall on rose, October 5

Bethel, E. Manitou, Col. Myrmecocystus melliger Llave, honey ant, adult, November 30

Coleoptera

de Vyver, J. James. Bronxville. Eccoptogaster quadrispinosa Say, hickory bark borer, larvae on hickory. January 28

Matthiessen, C. H. Irvington. Corthylus punctatissimus Zimm., pitted Ambrosia beetle, adult on Rhododendron, September 13

Goodyear, Charles. Tarrytown. Same as preceding, work, October 1

Hilligas, William. Rensselaer. Cryptorhynchus lapathi Linn., mottled willow borer, grubs and work on poplar, June 18

Gillett, J. R. Kingston. Lixus concavus Say, rhubarb curculio, adult, March 31

Anderson, E. H. Mount Kisco. Pissodes strobi Peck, white pine weevil, work on pine, January 20

Pease, E. R. Poughkeepsie. Same as preceding, larvae and work on pine, July 14

Iceland, Mrs A. C. Middletown. Galerucella luteola Müll., elm leaf beetle, adults in house, May 28

Tilly, G. W. Mechanicville. Nodonota tristis Oliv., strawberry root worm, adult on strawberry, June 23

McDonough, W. F. Albany. Typophorus canellus Fabr., strawberry root worm, May 8

Sullivan, J. J. Valley Mills. Chrysochus auratus Fabr., gold gilt beetle, adults, November 6

Von Schrenk, Hermann. St Louis, Mo. Neoclytus erythrocephalus Fabr., adult and work on ash, September 3

Van Deusen, Mrs C. A. Hudson. Chion cinctus Dru., banded hickory borer, adult, March 16

State Department of Agriculture. Euphoria inda Linn., bumble flower beetle, adult on apple, September 4

Robertson, W. D. Rosyln. Allorhina nitida Linn., green June beetle, adult, July 3

Farrar, E. R. South Lincoln, Mass. Anomala lucicola Fabr., light-loving grapevine beetle, adult, July 7

Miller, W. S. East Greenbush. Lachnosterna fusca Froh., white grubs infested by the peculiar fungus, Cordyceps ravenelii Berk., February 14

Saugerties Manufacturing Company. Saugerties. Sitodrepa panicea Linn., drug store beetle, larvae, adults and work in account book, June 12

Coffin, C. A. Locust Valley. Agrilus ? bilineatus Web., two-lined chestnut borer, work on oak, October 30

Merkel, H. W. Scarsdale. Melanophila fulvoguttata Harr., spotted hemlock borer, larvae on hemlock, December 2

Downer, J. New York City. Same as preceding, January 30

Torbert, C. L. Syracuse. Same as preceding, bark of hemlock, May 16

McMillan, Charles. Cambridge. Dicerca divaricata Say, divaricated Buprestid, adult, June 20. Also Alaus oculatus Linn., owl beetle, adult, June 20

Titus, E. V. Glen Cove. Same as preceding, July 28

State Conservation Commission. Lake Clear. Anatis 15-punctata Oliv., 15-spotted lady beetle, adult on balsam, June 9

Lacky, Andrew. Johnsburg. Dytiscus harrisii Kirby, water beetle, adult, September 17

Diptera

Gillett, J. R. Kingston. Frontina frenchii Will., adults, March 31

Smith, W. F. White Plains. Bibio albipennis Say, white-winged Bibio, larvae on stable manure, March 28

Albright, Thomas. New Baltimore. Contarinia pyrivora Riley, pear midge, larvae on pear, May 7

Theobald, F. V. Wye, Kent, England. Same as preceding, adult, September

McAtee, W. L. Carlisle, Miss. Thecodiplosis ananassi Riley, galls and larvae on cypress, October 29

Garman, H. Louisville, Ky. Clinodiplosis florida Felt, gall on oak, May 27

Goodyear, Charles. Tarrytown. Same as preceding, June 13

Frost & Bartlett Co. Roslyn. Monarthropalpus buxi Lab., box leaf miner, larvae on box, August 21

Latham, Roy. Orient Point. Hormomyia crataegifolia Felt, coxcomb thorn gall, gall on Crataegus, August 12

Gardner, Mrs E. P. Canandaigua. Cincticornia pilulae Walsh, oak pill gall, gall on oak, October 5

McAtee, W. L. Riverdale, Md. Same as preceding, October 24

Shelter, Henry. Springwater. Schizomyia coryloides Walsh and Riley, clustered grape gall, gall on grape, August 8

Cosens, A. Toronto, Ont., Can. Lasioptera corni Felt, ocellate dogwood gall, gall on Cornus, September 21

Jackson & Perkins Company. Newark. Dasyneura rhodophaga Coq., rose gall midge, larvae on rose, July 16

Rorty, Mrs P. A. Goshen. Dasyneura communis Felt, galls on red maple, October 9

Garman, H. Lexington, Ky. Same as preceding, May 27

Bethel, E. Denver, Col. Rhabdophaga strobiloides Walsh, pine cone gall, gall on willow, September 30

Merkel, H. W. Scarsdale. Camptomyia tsugae Felt, larvae on hemlock, December 2

Siphonaptera

Sherwood, Miss Marcia J. Barker. Ceratophyllus gallinae Schrk., hen flea, adults in hens' nests, May 29

Heilman, J. R. Poughkeepsie. Ctenocephalus canis Curtis, house flea, adult, August 26

Lepidoptera

Goodyear, Charles. Tarrytown. Laertias philenor Linn., pipevine swallowtail, larva on Dutchman's pipe, June 24

Carl, Miss Nina. Breesport. Automeris io Fabr., Io caterpillar, larvae on sweet clover, August 27

Cushman, R. L. Yonkers. Same as preceding, larva on corn, September 4

Reed, C. M. Sinclairville. Halisidota caryae Harr., hickory tussock moth, larvae on hickory, September 27

State Department of Agriculture. Rochester. Peridroma margaritosa Haw., var. saucia Hubn., variegated cutworm, larvae on apple and grass, July 15

Bartlet, Miss Isabella M. New Hamburg. Xylina antennata Walk., green maple worm, larva on linden, May 19

Clark, C. A. Castleton. Same as preceding, larvae on apple, June 9

Von Schrenk, Hermann. St Louis, Mo. Papaipema ? merriccata Bird, stalk borer, larvae on May apple, May 13

Reed, C. M. Sinclairville. Datana integerrima Grote & Rob., black walnut caterpillar, larva on hickory, September 27

Heilman, J. R. Poughkeepsie. Schizura concinna Sm. & Abb., red-humped apple caterpillar, larvae, July 8

Carl, Miss Nina. Breesport. Hemerocampa leucostigma Sm. & Abb., white-marked tussock moth, larvae on wisteria, August 27

Levison, J. J. Brooklyn. Malacosoma disstria Hübn., forest tent caterpillar, eggs, December 17

Appleton, F. R., jr. Jericho. Through State Forester. Same as preceding, larvae on oak, May 26

Hechler, Charles. Roslyn. Same as preceding, May 30

Terry, S. S. Elizabethtown. Same as preceding, cocoons, June 21

Wynkoop, Irving. Granville. Same as preceding, larvae and cocoons on maple, June 23

Seely, J. A. Ogdensburg. Same as preceding, eggs on apple, September 5

Dunwald, Peter. Rio. Cladora atroliturata Walk., imago, April 11

Interstate Tree Treating Company. Mount Vernon. Anisopteryx pometaria Harr., fall canker worm, males, females and eggs, December 3

Dunwald, Peter. Rio. Phigalia titea Cram., imago on forest trees, April 11

Bartlet, Miss Isabella M. New Hamburg. Erannis tiliaria Harr., ten-lined inch worm on linden, May 19

Niles, H. W. Rye. Through State Department of Agriculture. Lagoa crispata Pack., flannel moth, caterpillar on apple, September 18

Cooper, Mrs E. H. Saratoga Springs. Acoloithus ? falsarius Clem., cocoons on Virginia creeper, September 5

Harris, A. G. Pelham. Zeuzera pyrina Linn., leopard moth, larva, May 31

Goodyear, Charles. Tarrytown. Same as preceding, larvae, September 4

Merkel, H. W. New York City. Sesia rhododendri Beutm., Rhododendron clearwing, work and larvae on rhododendron, September 29

Schoonmaker, C. B. Stone Ridge. ? Crambus caliginosellus Clem., larvae on corn, June 19

State Department of Agriculture. Westchester County. Pinipestis zimmermanni Grote, pine tip moth, work on Austrian pine, July 1

Eberle, F. W. Albany. Tinea granella Linn., European wolf moth, larvae on sweet corn, November 13

Ward, G. E. Ravena. Tmetocera ocellana Schiff., bud moth, larva on apple, April 16

Haney, Theodore. Ravena. Same as preceding, larva on apple, April 17

Jansen, C. B. Kingston. Same as preceding, larva on plum, April 26

Hunt, Fred. Kingston. Same as preceding, larva on pear, April 28

Vincent, H. B. Old Chatham. Same as preceding, April 30

St John, Clyde. Canajoharie. Same as preceding, May 15

Collamer orchard. Hilton. Through State Department of Agriculture. Archips argyrospila Walk., fruit tree leaf roller on apple, July 7

Lintner, George. Squirrel Island, Me. Tortrix fumiferana Clem., spruce bud moth, larva, adult and work on spruce, July 6

Gardiner, Mrs J. T. Northeast Harbor, Me. Same as preceding adults on spruce, July 15

Levison, J. J. Brooklyn. Eulia politana Haw., pine tube builder, work, November 12

Goodyear, Charles. Tarrytown. Coleophora limosipennella Dup., elm case bearer, work on elm, June 24

Albright, M. C. West Coxsackie. Coptodisca splendoriferella Clem., resplendent shield bearer, larvae and cases on apple, January 22

Hicks, Isaac & Son. Westbury. Argyresthia thuiella Pack., Arbor vitae leaf miner, pupae on Arbor vitae, June and October 4

Torbert, E. L. Syracuse. Phyllonoryter hamadryadella Clem., white-blotch oak leaf miner, larval mines on oak, May 28

de Vyver, J. James. Mount Vernon. Same as preceding, work on oak, October 22

Corrodentia

Gardner, J. H. Fort Covington. Caecilius pedicularius Linn., nymph and adult, October 14

Hemiptera

Miller, Mrs M. S. Boonville. Philaenus lineatus Linn., lined spittle insect on grass, June 23

Pierce, D. C. Hamburg. Through State Conservation Commission. Phylloxera caryaecaulis Fitch, hickory gall aphid, galls on hickory, June 20

Paine, H. S. Glens Falls. Same as preceding, July 10

Coffin, J. W. L. Katonah. Through State Conservation Commission. Chermes pinicorticis Fitch, pine bark aphid, adult on white pine, December 6

State Department of Agriculture. Brentwood. Same as preceding, adult on pine, May 5

Neilson, Miss N. Nyack. Same as preceding, June 18

Crosby, M. S. Rhinebeck. Through State Conservation Commission. Chermes abietis Linn., spruce gall aphid, galls on spruce, January 20

Harris, S. G. Tarrytown. Same as preceding, gall on Norway spruce, June 16

Laney, C. C. Rochester. Same as preceding, June 17

Gott, P. V. D. Goshen. Same as preceding, July 10

Miller, Mrs M. S. Boonville. Chermes strobilobius Kalt., woolly larch aphid, adults and eggs on larch, June 23

Nill, John. Star Lake. Chermes floccus Patch, galls on spruce, August 23

Frost & Bartlett Company. Stamford, Conn. Tetraneura ulmisacculi Patch, English elm pouch gall, galls on Ulmus campestris, June 5

Goodyear, Charles. Tarrytown. Pemphigus ulmifusus Walsh, slippery elm gall, gall on elm, June 24

Frost & Bartlett Company. Stamford, Conn. Same as preceding, August 23

Cox, Townsend, jr. Setauket. Pemphigus tessellata Fitch, alder blight, adults on soft maple, July 5

Harrer, Richard. New York City. Schizoneura lanigera Hausm., woolly apple aphis, aphis on apple, November 5

Patten, G. M. Poughkeepsie. Same as preceding, adults on apple, June 28

Seely, J. A. Ogdensburg. Same as preceding, young on apple, September 5

Rose, J. F. South Byron. Longistigma caryae Harr., hickory aphis, adults, June 4

Latham, Roy. Orient Point. Aphis maidis Fitch, corn leaf aphis on corn, November 2

Conkling, C. S. Gouverneur. ? Nectarophora solanifolii Ashm., potato plant louse on potato, September 27

State Conservation Commission. Lake Clear. Mindarus abietinus Koch., balsam aphid, work on balsam, June 9

Terry, S. S. Elizabethtown. Same as preceding, adults and work on balsam, June 21

Nill, John. Star Lake. Through State Conservation Commission. Same as preceding, June 14

Woolworth, C. C. Castleton. Gossyparia spuria Mod., elm bark louse, females on elm, June 13

Neilson, Miss N. Nyack. Same as preceding, adults on elm, June 18

Voorhis, A. M. Nyack. Phenacoccus acericola King, false maple scale on hard maple, October 18

Harrer, Richard. New York City. Same as preceding, November 5

Naramore, N. J. Ossining. Same as preceding, adults on bark, February 17

Patten, G. M. Poughkeepsie. Same as preceding, adults on maple, June 28

de Vyver, J. James. Bronxville. Same as preceding, females and young on sugar maple, September 26

Goodyear, Charles. Tarrytown. Pulvinaria acericola Walsh, adults on Cornus, June 13 and 24

Towson, C. R. New York City. Through State Conservation Commission. Pulvinaria vitis Linn., cottony maple scale, adults and eggs on soft maple, June 14

George, E. L. New York City. Same as preceding, June 18

Macey, Carleton. Hewlett. Same as preceding, July 14

Devers, M. J. Hoosick Falls. Same as preceding, adults on sugar maple, July 15

Livingston, J. H. Tivoli. Toumeyella liriodendri Gml., tulip tree scale, adults and young on tulip, February 1 and 5

Powell, Mrs T. W. Flushing. Same as preceding, August 15

Goodyear, Charles. Tarrytown. Same as preceding, adults and young on tulip, September 4

Latham, Roy. Orient Point. Eulecanium lintneri Ckll. & Benn., sassafras soft scale, adults and young on sassafras, July 21

Stene, A. E. Kingston, R. I. Eulecanium rugosum Sign., quince soft scale, adults on quince, June 3

Porter, E. H. New York City. Coccus hesperidum Linn., soft scale, adults on fern, May 29

Huested, P. L. Blauvelt. Physokermes piceae Schr., spruce bud scale on spruce, January 29

Dummett, Arthur. Mount Vernon. Same as preceding, eggs on Norway spruce, June 12

Hammond, Benjamin. Hudson Heights, N. J. Chionaspis euonymi Comst., Euonymus scale, adults on privet, probably Ligustrum bota, November 21

Haney, Theodore. Ravena. Chionaspis furfura Fitch, scurfy scale, eggs, April 17

Levison, J. J. Brooklyn. Chionaspis pinifoliae Fitch, the pine leaf scale, adult on Austrian and white pine, November 12

Terry, S. S. New York City. Same as preceding, adults on pine, July 12

Seaver, F. J. Diaspis echinocacti Bouché, Cactus scale, adults and young on cactus, from Porto Rico, September 30.

Barron, Leonard. Garden City. Diaspis carueli Targ., Juniper scale, adults on Arbor vitae, June 23

Cockerell, T. D. A. Los Banos, P. I. Drosicha lichenoides Ckll., fig scale on Ficus nata. Coll. C. F. Baker, 1912, cotypes, October 22

Niles, T. F. Through State Department of Agriculture. Aonidia lauri Bouché, Bay tree scale on Bay tree, October

State Department of Agriculture. Albany. Aspidiotus perniciosus Comst., San José scale, adults and young on rose, January 15

Albright, M. C. Coeymans. Same as preceding, young on elm, March 3

Bullard, T. E. Schuylerville. Same as preceding, adults and young on pear, July 8

Doyle, H. M. Oswego. Aspidiotus ostreaeformis Curt., European oyster scale, adult on apple, May 15

Stubing, F. J. Mount Vernon. Aspidiotus osborni Newell & Cockerell, oak scale, adults on white oak, October

Gordinier, H. W. Troy. Lepidosaphes ulmi Linn., oyster shell scale on poplar and maple, December 9

Strickland, L. F. Lockport. Neurocolpus nubilis Say, adult on sumac, July 12. Also Paracalocoris scrupeus Say, nymphs on grape, June 13 and July 12

Griffith, L. C. Lynbrook. Lygus pratensis Linn., tarnished plant bug, adults on crysanthemum, September 4

Plecoptera

Atwood, G. G. Albany. Pteronarcys ? biloba Newm., May 8

Blunt, Miss Eliza S. New Russia. Pteronarcys proteus Newm., giant stone fly, adult, June 6

Thysanoptera

Brooks, F. M. Athens. Euthrips pyri Dan., pear thrips, adults, April 25

Thysanura

Rodgers, E. H. Mount Kisco. Through State Department of Agriculture. Schoturus nivicola Fitch, snow flea, adults, December 26

Acarina

Hunter, Miss Louise. Cornwall. Eriophyes quadripes Shimer, gall on maple, May 12

Bethel, E. Denver, Col. Eriophyes abnormis Garm., gall on linden, September 30

Barron, Leonard. Garden City. Bryobia pratensis Garm., red spider, adults and eggs on Arbor vitae, June 23

ZOOLOGY

Donation

Mammals

Corbin, Austin. New York
Buffalo bull, Bison bison (Linnaeus) 1

Hartley, B. M. New Haven, Conn.
Jumping mouse, Zapus hudsonius (Zimmerman) . 4

Taylor, H. L. Albany
Newfoundland caribou, Rangifer terrae-novae Bangs, head

Birds

Newland, D. H. Albany
Night heron, Nycticorax nycticorax naevius (Boddaert) 1

Birds' eggs

Philips, Mrs J. Kay. Menands
Brown pelican, Pelecanus occidentalis Linnaeus 1
Night heron, Nycticorax nycticorax naevius (Boddaert) 1
Spotted sandpiper, Actitis macularius (Linnaeus) 3
Ruffed grouse, Bonasa umbellus (Linnaeus)... 10
Mourning dove, Zenaidura macroura carolinensis (Linnaeus) 1
Cooper hawk, Accipiter cooperi (Bonaparte). 1
Flicker, Colaptes auratus luteus Bangs..... 3

Night hawk, Chordeiles virginianus (Gmelin).	1
Kingbird, Tyrannus tyrannus (Linnaeus).....	1
Crested flycatcher, Myiarchus crinitus (Linnaeus)...........................	2
Phoebe, Sayornis phoebe (Latham)...........	5
Crow, Corvus brachyrhynchos Brehm......	11
Cowbird, Molothrus ater Boddaert............	1
Red-winged blackbird, Agelaius phoeniceus (Linnaeus).................................	4
Meadow lark, Sturnella magna (Linnaeus)....	2
Orchard oriole, Icterus spurius (Linnaeus)....	2
Purple grackle, Quiscalus quiscula quiscula (Linnaeus).................................	6
Chipping sparrow, Spizella passerina (Bechstein).................................	4
Vesper sparrow, Pooecetes gramineus (Gmelin).................................	2
Savannah sparrow, Passerculus sandwichensis savanna (Wilson)..................	5
Song sparrow, Melospiza melòdia (Wilson)..	4
Cliff swallow, Petrochelidon lunifrons (Say).................................	2
Cedar waxwing, Bombycilla cedrorum Vieillot.................................	1
Catbird, Dumatella carolinensis (Linnaeus).	9
Veery, Hylocichla fuscescens (Stephen)....	2
Bluebird, Sialia sialis (Linnaeus).............	4

Birds' nests and eggs

Van Name, W. G. Albany

Common tern, Sterna hirundo Linnaeus	16	eggs
Roseate tern, Sterna dougalli Montagu	5	"
Night heron, Nycticorax nycticorax naevius (Boddaert)..................nest and	3	"
Night heron, Nycticorax nycticorax naevius (Boddaert).................	5	"
Woodcock, Philohela minor (Gmelin) nest and	3	"
Spotted sandpiper, Actitis macularius (Linnaeus).....................	3	"

Fish hawk, Pandion haliaetus carolinensis (Gmelin)	2 eggs
Chimney swift, Chaetura pelagica (Linnaeus)	nest and 2 "
Whippoorwill, Antrostomus vociferus (Wilson)	2 "
Kingbird, Tyrannus tyrannus (Linnaeus)	nest and 4 "
Phoebe, Sayornis phoebe (Latham)	nest and 5 "
Least flycatcher, Empidonax minimus (Baird)	nest and 4 eggs
Blue jay, Cyanocitta cristata (Linnaeus)	nest
Bobolink, Dolichonyx oryzivorus (Linnaeus)	nest and 5 eggs
Cowbird, Molothrus ater Boddaert	1 egg
Red-winged blackbird, Agelaius phoeniceus (Linnaeus)	nest and 4 eggs
Orchard oriole, Icterus spurius (Linnaeus)	nest and 4 "
Purple grackle, Quiscalus quiscula quiscula (Linnaeus)	nest
Goldfinch, Astragalinus tristis (Linnaeus)	nest and 5 eggs
English sparrow, Passer domesticus (Linnaeus)	nest and 6 "
Vesper sparrow, Pooecetes gramineus (Gmelin)	nest and 4 "
Savannah sparrow, Passerculus sandwichensis savanna (Wilson)	nest
Seaside sparrow, Passerherbulus maritimus (Wilson)	nest and 4 eggs
Chipping sparrow, Spizella passerina (Bechstein)	4 "
Field sparrow, Spizella pusilla (Wilson)	nest and 3 "
Song sparrow, Melospiza melodia (Wilson)	nest and 5 "
Towhee, Pipilo erythrophthalmus (Linnaeus)	nest and 2 "

Barn swallow, Hirundo erythrogastra Boddaert . . . . nest
Cedar waxwing, Bombycilla cedrorum Vieillot . . . . nest and 4 eggs
White-eyed vireo, Vireo griseus (Boddaert) . . . . nest and 3 "
Yellow-breasted chat, Icteria virens (Linnaeus) . . . . nest and 4 "
Yellow-breasted chat, Icteria virens (Linnaeus) . . . . nest and 3 "
Redstart, Setophaga ruticilla (Linnaeus) . . . . nest and 4 "
Catbird, Dumatella carolinensis (Linnaeus) . . . . nest and 4 "
Brown thrasher, Toxostoma rufum (Linnaeus) . . . . nest and 5 "
House wren, Troglodytes aedon Vieillot . . . . 6 "
Wood thrush, Hylocichla mustelina (Gmelin) . . . . nest and 4 "
Robin, Planesticus migratorius (Linnaeus) . . . . nest
Bluebird, Sialia sialis (Linnaeus) . . . . . nest and 3 eggs

Fish

Gloeckner, William. Albany
Red horse mullet, Moxostoma aureolum (Le Sulur) 1

Invertebrates

Pearse, A. S. Madison, Wis.
Compound ascidian, Botryllus schlosseri (Pallas) 1
Van Alstyne, William T. New York
Collection of foreign shells and corals

Purchase

Mammals

Hartley, B. M. New Haven, Conn.
Rat, Epimys norvegicus (Erxleben) 2

Leach, B. J. Averill Park
Weasel, Mustela noveboracensis (Emmons).. 1
Ward's Natural Science Establishment. Rochester
Puma, Felis couguar Kerr.................... 2
Fisher, Martes pennanti (Erxleben)........... 2

Birds

Barker, Fred. Parker's Prairie, Minn.
Caspian tern, Sterna caspia Pallas............. 1
American merganser, Mergus americanus Cassin. 1
Red-breasted merganser, Mergus serrator Linnaeus.. 1
Lesser snow goose, Chen hyperboreus (Pallas). 2
Canada goose, Branta canadensis canadensis (Linnaeus)................................... 1
Bittern, Botaurus lentiginosus (Montagu)... 1
Black-crowned night heron, Nycticorax nycticorax naevius (Boddaert).................. 1
Wilson phalarope, Steganopus tricolor Vieillot. 1
Western sandpiper, Ereunetes mauri Cabanis.... 2
Long-billed curlew, Numenius americanus Bechstein.................................... 1
Black-breasted plover, Squatarola squatarola (Linnaeus)................................... 2
Sharp-shinned hawk, Accipiter velox (Wilson). 1
Pigeon hawk, Falco columbarius Linnaeus..... 1
Pileated woodpecker, Phloeotomus pileatus abieticola (Bangs)........................ 2
Hartley, B. M. New Haven, Conn.
Bluebird, Sialia sialis (Linnaeus).............. 1
Milton, B. New Haven, Conn.
Starling, Sturnus vulgaris Linnaeus........... 1
Vernon, M. L. Troy
Robin, Planesticus migratorius (Linnaeus) albino.. 1

Fishes

Purchased in Albany markets
Atlantic salmon, Salmo salar Linnaeus............ 1
Pike, Lucius lucius (Linnaeus)............... 1
Chub mackerel, Scomber colias Gmelin......... 1

Striped bass, *Roccus lineatus* (Bloch)	1
Sea bass, *Centropristes striatus* (Linnaeus)	1
Sheepshead, *Archosargus probatocephalus* (Walbaum)	1
Sea trout, *Cynoscion regalis* (Bloch and Schneider	1
Summer flounder, *Paralichthys dentatus* (Linnaeus)	1

ETHNOLOGY

Purchase

Women's leggings, beaded (3 pairs)	6
Towesas rattle, made of box turtle	1
Turtle rattles, greatfeather dance	2
Husk faces used by Husk Face Company	2
False face, medicine mask	1
Small baskets	2
Husk basket	1
Berry basket	1
Beaded belt or sash	1
Snowshoes — short type	2
Baby board, Onondaga	1
Bark bowl	1
Wooden spoons	3
Worsted belt or sash	1
Paddles	4
Eagle wands (2 sets)	2
Eagle dance rattles, of gourds (set)	1
Eagle rattles, of horn (set)	1
Wooden spoon	1
Plum stone dice (set)	1
Peach stone dice (set)	1
Bone dice (set)	1
Calabash rattle	1
Gourd rattle	1
Drum and carved stick	1
Beaded sash	1
Old spoons of carved wood	4
False face	1
Husk basket	1
Husk jug or bottle	1

Brooches	2
Gambling bowl	1
Bark rattle	1
Old paddle	1
Pot hook of twisted wood	1
Woodchuck hide	1
False face	1
Turtle rattle	1
Pair earrings (natural silver)	1
Feast bowl	1
Silver rings	2

A. A. Schmidt. Albany

Indian bead-work bag	1

ARCHEOLOGY

Purchase

The R. D. Loveland Collection. Watertown.

Bone and horn arrow-heads	39
Stone axes	2
Bone awls	380
Banner stone	1
Copper bead	1
Small quantity charred corn	..
Celts	85
Small stone dart	1
Stone disks, diameter 4″ to 5″	4
Bone fish hook	1
Phalanges	70
Gorgets	9
Gouges	7
Bone and horn harpoons	6
Hammer stones	25
Slate knives	11
Stone mortars	6
Mullers	30
Parts of antlers, worked	16
Human arm bone, worked	1
Small stone pigment bottle	1
Tattooing bone	1
Bone needles	8
Bone paddles or spatulas	1
Stone paddles or spatulas	1

Steatite plummet	1
Slate plummet	1
Stone pestles	3
Stone pendants	7
Stone balls	14
Part of turtle carapace, perforated	1
Worked bears' teeth	9
Clay pipes	139
Steatite pipes	4
Bone spear heads	2
Skull	1
Parts of clay pipes	7 qts.
Potsherds	about 350
Clay disks	41
Stone disks	18
Small stone ornaments	6
Beaver teeth, worked	6
Small stone cones	2
Small flat round stone, on one side effigy of human face	1
Bone shuttles	6
Stone pick	1
Stone hatchet, perforated	1
Antler spoon	1
Several lumps mineral paints	4
Small quantity charred wood	3
Clay pot	1
Stone paint grinder	1
Saucer-shaped dish from human skull	1
Stone and slate beads	298
Various small bone objects, worked	..
Stone net sinkers	19
Antler spoon	1
Shell beads	37
Unfinished stone and slate beads	38
Bone beads	75
Arrow points	147
Spear heads	16
Bone punches	3
Plum pits, perforated	3
Gun flints	4

The Raymond G. Dann Collection. Honeoye Falls

Clay pipes	36
Stone pipes	3
Flint spear heads	27
Gun flints	85
Copper arrow points	16
Red catlinite pipe	1
Stone axes	7
Celts	16
Stone maul	1
Flint scrapers	12
Gorgets	3
Shell beads	9
Flint drills	3
Flint knives	13
Chert arrow points	247
Bone awls	6
Bone punch	1
Bone harpoon	1
Bone pins	4
Bone shuttles	2
Sinew stone	1
Stone war clubs	2
Banner stones	2
Stone pestles	3
Stone gouges	4
Wolf tusk necklace, 91 teeth	91
Red stone bead necklace	223
Metal spoon, round bowl, figure of human on end of handle	1
Shell disk	1
Shell object, flat discoidal base, 1¼" shaft from one side	1
Bear tusk necklace, 56 teeth	56
Carved shell necklace, 78 pieces	78
Bracelet of copper wire	1
Necklace of carved shell, 91 pieces crescent shape	91
Carved shell necklace, 18 pieces	18
Shell necklace, 30 pieces	30
Tortoise shell rattles	2
Cylindrical shell ornament	1
Shell ornament, representation of turtle	1
Shell ornament, representation of duck	1

Shell ornament, representation of owl	2
Small human figure, horn	1
Small cup-shaped stone	1
Small stone saucer-shaped object	1
Iron scissors, rusted	1
Carved shell necklace, 31 pieces	31
String of 38 discoidal shell ornaments	38
Carved shell, representation of duck	1
Shell necklace, crescent shape pieces	61
Discoidal shell object	1
Long shell beads	7
Perforated tortoise carapace	1
String of shell beads	16
Four strings glass beads	..
String red stone beads	22
Loose wampum and other beads	..
One-half pint wampum shells	..
White glazed pottery vase, European, top broken	1
Copper finger rings	9
String wampum beads and wolf teeth	58
Flint lock from gun	1
Remnant of flint lock	1
Pottery ornament, head of duck	1
Iron tube 5¼″ long	1
Lead ladle	1
Small piece beaver skin, 2″ x 2½″	1
Small round bells, copper	2
Small copper bells	4
Iron wire bracelet, small coil copper wire attached	1
Oblong shell beads, white	7
Small maskette, white shell	1
Trade pipe, bowl broken and large part of stem missing	1
Fragments of worked shell, white, four pieces	4
Shell ornaments and fragmentary pieces	18
Mother of pearl ornament	1
Bone, crescent shape pieces	6
Copper jingles	2
Copper chain, length 37½″	1
Small piece graphite	1
Small fragment leather, copper bead insertion	1
Small figures of animals, bone	4

Lead bullets	175
Copper thimble	1
Copper kettles	4
Earthen vessels	7
Brass kettles	3
Horn and bone combs	17
Brass spoon	1
Iron knife	1
Iron tomahawks	2
Lead spoon	1
Wooden spoons	5
Bone spoons	3
Shell ornaments	5
Horn knife handles	8
Iron implements, wedge shape	3
Stone implements	10
Shell pendant	1
Bear tusks	2
String wampum and other beads, multi-colored, 60 yards.	

The Fred H. Crofoot Collection. Sonyea

Copper axe	1
Celts	810
Stone implements	19
Stone axes	212
Stone war clubs, heads	242
Hammer stones	254
Brass kettles	2
Cylindrical stone pestles	174
Bell pestles	8
Iron axes	11
Mullers	199
Copper bullets	38
Stone balls, picked	59
Flint drills	138
Bone awls	11
Large clay council pipe	1
Stone mauls	29
Sinew stones	47
Stone net sinkers	46
Stone gouges	17
Flattened pitted stones, several pits on one side	7

Stone mortars	4
Flint arrow and spear heads	5832
Flint scrapers	642
Brass arrow heads	2
Small earthen pot	1
Flint knives	676
Bear teeth	6
Gun flints	53
Small stone mortar and ball	1
Bone whistle	1
Silver brooches	4
Silver totem	1
Copper pipes	2
Steatite platform pipe	1
Copper spear head	1
Gorgets	20
Parts of gorgets	27
Banner stone	1
Parts of banner stones	11
Copper beads	4
Iron knives	17
Iron scrapers, spoon shaped	2
Turtle back stone	1
Iroquois clay pipe	1
Steatite paint cup	1
Lead seal	1
Flint semi lunar knives	3
Stone tube	1
Shell gorget	1
Bone scrapers	2
Games, stones	2

The C. A. Holmes Collection. New Berlin

Iron axes	2
Flint arrow points, drills, spear heads, scrapers......about	550
Flint knives	6
Gun flint	1
Gorgets	6
Stone pestles	10
Crude chipped flint fragments	33
Stone net sinkers	10
Celts	11

Hammer stones	8
Stone axes	2
Stone war clubs	2
Sinew stone	1
Small mortar	1
Muller	1
Bell pestle	1
Plaster cast Mound Builders pipe	1
Plaster cast large spear head	1
Stone gouges	3
Banner stones	2

The W. E. Bryan Collection. Elmira

Small oblong stone, effigy of human face on one side	1
Small bottle, charred cover	1
Potsherds	138
Stone net sinkers	59
Crude chipped stone implements	7
Celts	66
Stone mortars	2
Bone awl	1
Parts of gorgets	6
Flint knives	25
Stone pestles	14
Lapstone	1
Stone gouges	2
Pieces of steatite, parts of pots	54
Flint spear heads	4
Flint scrapers	13
Flint drills	38
Part of banner stone	1
Arrow points	604
Gun flints	4
Stone balls	2
Mullers	4
Hammer stones	33
Stone war clubs	12
Iron axe	1

The R. E. Van Valkenburg Collection. Mount Upton

Shell disks, center perforation	5
Flint drills	5
Flint scraper	1

Flint knives	3
Flint spear head	1
Smoothing or lapstone	1
Stone pestles	6
Flint harpoon	1
Mullers	2
Stone net sinkers	27
Worked stones	29
Sinew stones	2
Celts	2
Hammer stones	43
Flint arrow points	203

The Charles P. Oatman Collection. Liverpool (Collected in Jefferson county)

Clay pipes	93
Steatite pipes	4
Diminutive clay cup, diameter about 1¼″	1
Small clay effigy of human head	1
Small clay effigy of human head, part missing	1
Small bone from mouth of sturgeon	1
Small oblong flat bone fragment, worked, two perforations	1
Part of lip of platform pipe, red catlinite	1
Miniature bone paddle, 4½″ long	1
Clay pipe fragments	about 150
Bone awls	251
Bone and horn arrow points	39
Worked phalanges	57
Bone beads	53
Celts	68
Bone bodkins	8
Bone harpoons	7
Shell beads	5
Stone mortars	2
Small pieces perforated skull	2
Hammer stones	7
Bone knives	3
Mullers	15
Copper beads	4
Stone beads	6
Small quantity charred wood	..
Pieces of pigment	4

The Alva S. Reed Collection. Livonia

Miniature bone effigy, human foot	1
Shell ornaments	10
Shell beads	61
Shell implements	1
Copper bead	1
Stone beads	8
Small pieces bones, notched	2
Clay bead	1
Shell gorget	1
Bone harpoons	5
Bone needles	13
Bone whistle	1
Bone pitching tools	13
Bone ornament	1
Bone fish hooks	5
Brass arrow point	1
Worked animal teeth	70
Bone implements	16
Worked antlers	2
Bone beaming tools	6
Bone awls	52
Bone arrow point	1
Bone shuttle	1
Bone beads	71
Bone pendants	2
Flint arrow points	about 300

McCombs, Mrs F. A., Rushville

Broken adult female skull	1
Broken abnormal juvenile skull	1
Stone tubes	3
Gorget	1
Small copper celt	1
Antler punch	1
Ivory blade, broken	1
Amulets	2
Strings shell beads	2

The Vander Veer-Auringer Collection, from headwaters of the Hudson, Warren county

Glass and bone string beads	75
Copper thimble	1

Small crescent-shaped bone ornament, two perforations	1
Brass arrow point	1
Small lead bird effigy	1
Stone spatula	1
Bone jingler	1
Bar amulets	3
Large bell mortar, stone	1
Double stone mortar	1
Mullers	7
Sinew stones	2
Stone pestles	8
Stone grinder	1
Stone war clubs	4
Stone balls	5
Part of banner stone	1
Flint knives	41
Flint gouge	1
Celts	5
Flint pick	1
Hammer stones	14
Stone spades or hoes	4
Stone axes	14
Stone paint grinder	1
Stone net sinkers	10
Crude chipped stone fragments	50
Iron axe	1
Iron ball	1
Steel trade arrow or lance	1
Gun flints	2
Eskimo knives	16
Worked steatite fragments	6
Bone punch	1
Flint drills	10
Bone implement	1
Flint scrapers	24
Flint spear heads	41
Flint arrow points	168
Bone awls	5
Pigment lumps, small	3
Brass bracelets	2

Collection

The D. D. Luther Collection. Naples

Small red stone effigy of human face	1
Smoothing or lapstones	13
Stone gouge	1
Stone pestles	10
Stone sinkers	50
Stone balls	3
Muller	1
Stone mortar	1
Celts	6
Stone war clubs	2
Hammer stones	226
Stones, worked	35
Potsherds	27
Flint arrow points	60
Flint scraper	1
Gun flints	2
Clay pipe	1

APPENDIX

THE ORIGIN OF MAN

(Adapted from a paper by Dr E. Rivet, of the Museum d'histoire naturelle, Paris)[1]

The progress of recent investigations into the prehistory of the human race has plainly shown that the common expression which has come into use as the summation of the evolutionist theory of the origin of man, "man is descended from the ape," is not only unfortunate but untrue. When this expression became current it attracted attention and controversy by its implied defiance of traditional doctrines, and this very fact has given it a certain popularity, made it the target of polemic discussions and has indeed cast ridicule upon the fundamental scientific principle of evolution. The responsibility for the diffusion of this formula rests in part upon scientific men themselves. The time is not far past when such men as Haeckel and Mortillet imagined and even portrayed the precursor of man as a strange compromise between man and the anthropoid, and to these imaginary creatures they gave some such significant names as Pithecanthropus or Anthropopithecus, and Schaafhausen made out the man of Neanderthal to be a sort of man-ape.

The views of Haeckel and contemporary writers were not, however, without excuse. After the first discoveries relative to fossil man had been made, they were prone to believe that the problem of our origin was of quite simple solution; but this is not at the present time so regarded. The new data acquired in the course of late years show that the problem is much more complex than it has appeared to be. It is this fact that I wish specially to lay emphasis upon in bringing together here what we now know with scientific certainty regarding this matter and the conclusions which it is legitimate to draw therefrom.

It is well known that the history of the earth has been divided by geologists into four great periods, Primary, Secondary, Tertiary and Quaternary. The first era is characterized by a fauna composed of invertebrate animals and of the lower vertebrates; the Secondary era is the era of reptiles; the Tertiary and Quaternary eras those of the mammals. The Tertiary era has been divided

[1] Printed in *Biologica,* March 15, 1914.

GEOLOGICAL DIVISIONS	CLIMATE	CHARACTERISTIC ANIMALS	INDUSTRY	HUMAN OR ANTHROPOMORPHIC TYPES
Quaternary: Recent or Holocene	Like that of the present	Living species and domestic animals	Metals. Neolithic Azilian	*Homo sapiens*
Quaternary: Early or Pleistocene: Upper....	Postglacial period Climate cold and dry	Fauna of the Steppes Abundance of Reindeer	Magdalenian Solutrian Aurignacian	*Homo sapiens*.......... Cro-Magnon-type, Chancelade-type
Quaternary: Early or Pleistocene: Middle...	Climate cold and moist Glacial advance Climate cold and moist	Mammoth Hairy rhinoceros Reindeer	Mousterian Acheulian	*Homo sapiens*.......... Grimaldi-type *Homo neanderthalensis*.... Gibraltar. 1848; Neanderthal. 1856; La Naulette. 1866; Spy. 1886; Malarnaud. 1889; Krapina. 1899; La Chapelle-aux-Saints. 1908; La Moustier. 1909; La Ferrassie. 1909–10; La Quina. 1911
Quaternary: Early or Pleistocene: Lower....	Interglacial period Climate mild Glacial advance Climate cold and moist	Hippopotamus *Elephas antiquus*	Chellian	*Homo heidelbergensis* *Eoanthropus dawsoni*
Tertiary: Upper Pliocene	Interglacial period Climate warm Glacial extension Climate cold and moist	*Elephas meridionalis*	Eolithic (?)	*Pithecanthropus erectus*

also into four periods, Eocene, Oligocene, Miocene and Pliocene. In our present theme only this last and most recent period, the Pliocene, interests us. At this epoch the climate of Europe was warm and its fauna included such a characteristic animal as the northern elephant. The Quaternary, also, has been divided into the present Quaternary or Holocene, characterized by a climate and a fauna very like those of the present, and into an ancient Quaternary or Pleistocene. The latter comprises three periods: Lower Pleistocene, with a mild climate, during which the hippopotamus and the Elephas antiquus abounded in our region; the Middle Pleistocene, with a cold and humid climate, the fauna of which included the mammoth, the hairy rhinoceros and the reindeer; finally, the Later or Upper Pleistocene, with a cold, dry climate, often called the *Reindeer age,* on account of the extreme abundance of this animal. Toward the end of this epoch the fauna was very like that of the steppes.

Thus arranged, what are the discoveries relating to man and his predecessors which have been made in the different beds corresponding to the divisions just enumerated? It is believed that we have found traces of the existence of man, or at least of a being resembling man, in the Tertiary epoch, shown by the discovery of incised bones and, in many places, of stones which bear traces of use, the so-called *eoliths.* These eoliths have given rise to lively discussions, but today, thanks to the work of MM. Boule and Breuil, it is proved that flints may acquire the aspect of stones intentionally retouched merely by the effect of contusion in torrential waters or under the pressure of the rocks themselves, and it is admitted now almost unanimously that even if a human being living in the Tertiary epoch actually made use of stones, it would be impossible, in the present state of our knowledge, to distinguish them from those which have been bruised and broken by the action of natural causes. It has, moreover, not been proved that incisions found on certain Tertiary bones are the work of man. Of the being who might have modeled these eoliths or made these incisions, there has not, thus far, been found in our country the slightest vestige, and the expression of Nadaillac in 1885 is today the exact truth: "Man might have been able to live during Tertiary times. Nothing in the climate or geologic conditions, nothing in the fauna or in the flora is opposed *a priori* to his existence then, but up to the present time there is no known fact, no discovery, no proof which can really permit us to affirm this with any degree of certitude."

I have not as yet taken account of the famous discovery made in Java in 1891–92 by Dr Eugene Dubois of certain fragmentary bones, a calvarium, a femur and a molar of a being which has received the name of Pithecanthropus erectus. The age of these bones has been discussed at length and is not yet definitely determined, but it does not seem to carry us back to an epoch earlier than the period of transition from the Pliocene to the Pleistocene. They are nevertheless the most ancient anthropomorphic remains which we possess and I shall have to refer later to their interpretation.

Up until 1907 we knew the human being who lived in Europe during the Lower Pleistocene only by his industry, but, in the course of the last three years, two sensational discoveries have brought us the first definite proof of the physical characteristics of this being. There was, first of all, the discovery in 1907 of a lower jaw in the sands of Mauer, near Heidelberg; then in 1912 the discovery of a portion of the cranium and the lower jaw in the gravels of Piltdown, in Sussex.

Much more numerous and more important are the documents which we possess relating to the man of the Middle Pleistocene. Following the chronological order and retaining only the undebated and undebatable examples, we may cite: the cranium of Gibraltar, 1848; the calvarium of Neanderthal, 1856; the jaw of La Naulette, 1866; the cranium and bones of Spy, 1886; the jaw of Malarnaud, 1899; the multiple debris of Krapina, 1899; the skeleton of La Chapelle-aux-Saints, 1908; the skeleton of Moustier, 1909; the two skeletons of La Ferrassie, 1909–10; and, finally, the skeleton of La Quina, 1911.

From the epoch intermediate between the Middle Pleistocene and the Later Pleistocene there have been reported two skeletons discovered in the lower beds of one of the caves of Grimaldi, near Menton, and described by M. Verneau. Finally, the Later or Upper Pleistocene has furnished so many evidences of fossil man that a list of them would be too long to give here.

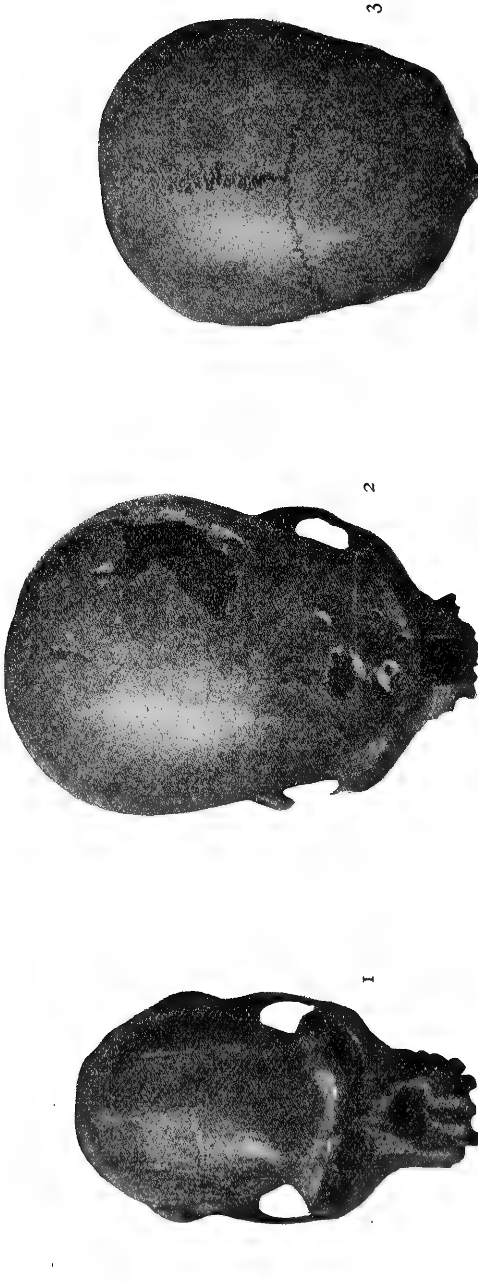
This is a summary of the paleontologic human documents which we possess today. Let us now see the data which the study of these precious remains affords for the determination of the morphology of our ancestors.

A rapid examination shows, first of all, and this is a capital point, that man of the Later Pleistocene had already the characters of living man, or, in other words, to employ the language of the systematists, that at that epoch he entered into the group of Homo sapiens. True enough, even then he afforded a large variety of types analogous to if not identical with those which we find today: the Grimaldi-type with negroid characters very strongly expressed; the Chancelade-type which approaches the type of the Eskimo; and, finally, the Cro-Magnon-type, much more widely diffused and whose descendants Professor Verneau has found among the almost contemporary Guanchos of the Canary islands. It is fair then to say that living humanity was already in possession of its essential traits and even of its principal varieties in the Later Pleistocene. Because of this fact our study finds itself restricted to human fossils of the Middle and Early Pleistocene. The Middle Pleistocene man, which has generally been designated

Jaw of the Heidelberg man (Homo heidelbergensis)

by the name of Homo neanderthalensis, is actually very well known morphologically, thanks to the beautiful work of M. Boule.

We know much less of the man or the anthropoid creatures which preceded Homo neanderthalensis; in fact, we have as documents here only insufficient and scattered bone fragments. The lower jaw, the only relic of the creature to which the name of Homo heidelbergensis has been given, is remarkable for the association which it presents of pithecoid and human characters. It is striking throughout by its massive appearance, by the large size of its ascending branches and by the complete absence of a chin. The mandibular angle is truncated, the semilunar groove but slightly marked, the coronoid apophysis obtuse and with rounded edges, the articular surface of the condyle much



Superior surface of the crania of (1) the chimpanzee, (2) the fossil man of La Chapelle-aux-Saints, (3) a Frenchman.

Side views corresponding with the foregoing.

extended. Finally, if the bone is placed on a horizontal plane it will be seen that there is a large open space under the median symphysis. All these characters give this jaw more the aspect of an anthropoid than of a human jaw, and it is certain that if it had been deprived of its alveolar border it would have been greatly to the embarrassment of paleontologists; but the teeth are distinctly human and the canines no more prominent than the adjoining teeth.

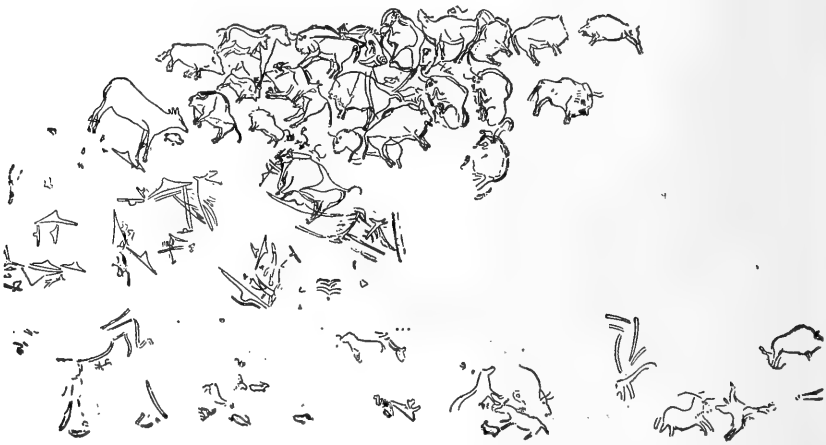
Again, we find the association of such pithecoid and human characters, in a fashion perhaps still more pronounced, in Eoanthropus dawsoni; that is to say, in the being whose remains have been discovered at Piltdown. Morphologically, this jaw is the jaw of a chimpanzee, and the recent discovery of the canine tooth notably more developed than the human canine accentuates this resemblance; but the cranium, as far as one is able to judge from the deteriorated condition in which it was found and after somewhat varying reconstructions which have been made of it, is much more allied to the cranium of the existing man than to that of Homo neanderthalensis.

With Pithecanthropus erectus the phenomena are inverted. Here, in fact, are a femur and a molar which are clearly human, while the cranium is very far removed from the cranium of H. sapiens. Its aspect recalls that of the cranium of the Middle Pleistocene man, although it exaggerates those characters. The orbital ridge is sharper and consequently more pithecoid, the frontal more depressed, the vault more depressed, the occipital region more prominent and, finally, the cerebral capacity, which in Homo neanderthalensis is 1400 cubic centimeters, in Pithecanthropus certainly did not exceed 1000 cubic centimeters. In Pithecanthropus we have reached the most ancient known representative of human beings or anthropomorphs which excavations of the last fifty years have brought us. It is now necessary for us to inquire how it is possible, in the present state of science, to interpret these documents and with their help to solve the problem of the origin of man.

Homo neanderthalensis constitutes naturally the keystone of the whole edifice which we attempt to construct with the elements I have briefly described, because chronologically it is the first positively human being different from living man which has reached us, and especially because it is best known to us.

The morphological study of this fossil brings out two capital facts: one, the extraordinary homogeneity of the ethnic type which it represents, the other, the profound difference which exists between it and the human beings which immediately followed it.

Wherever discoveries have been made of remains of the Middle Pleistocene man, whether in Croatia, in Prussia, in France, or in the south of Spain, everywhere the type shows a remarkable uniformity which contrasts in a singular way with the ethnic polymorphism of later epochs. However long may have been the period of geological times in which the race lived, all discoveries of Homo neanderthalensis show only a slight evolution, manifesting itself by noticeable skeletal variations. Everywhere and always it remains like itself.



Miniature diagram of frescoes from the ceiling of Altamira cavern, showing how the figures are thrown together with little regard for composition or position.

After Cartailhac and Breuil *Courtesy American Museum of Natural History*

The absence of the morphological link between Homo neanderthalensis and Homo sapiens is a fact no less remarkable. It is, moreover, like a corollary of the first. When one compares the Middle Pleistocene man with the Later Pleistocene man (of Grimaldi, Chancelade or Cro-Magnon) or even with the lowest representatives of living humanity, it is evident that back of these superficial similarities relating to certain isolated particulars one can not bring forward sufficient evidence of conformity of characters to establish any admissible morphological affinity between Homo neanderthalensis and Homo sapiens.

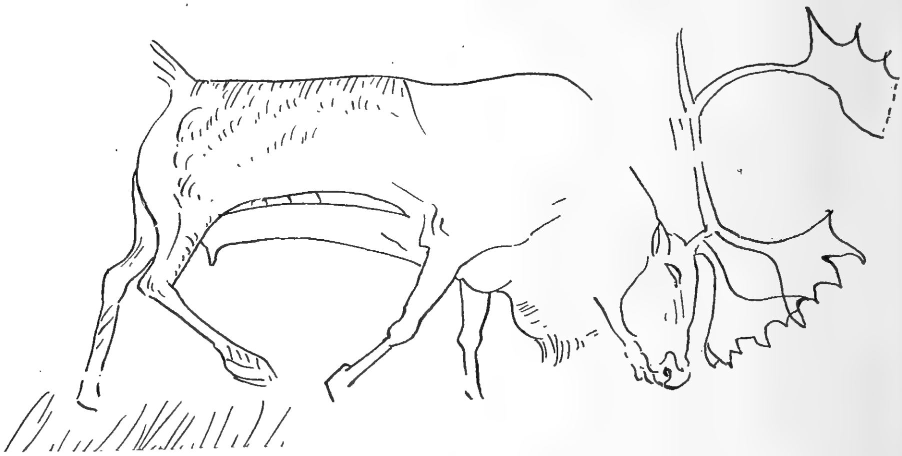
It is a remarkable fact that this morphologic hiatus coincides with a culture hiatus, as has been strongly insisted on by the Abbé Breuil. Homo neanderthalensis had an extremely rudimentary industry in which nothing of the slighest esthetic tendency has revealed itself. On the contrary, the man of the Upper Pleistocene possessed very varied culture; with equal skill he worked in stone, reindeer antlers and bone, and finally and especially he appears to have been a marvelous artist whose multiple productions in sculpture, engravings, designs and paintings are often veritable chefs d'oeuvre.

Far from finding a satisfactory term of passage between the cranium of La Chapelle-aux-Saints and the crania of Grimaldi or

Magdalenian painting from the cave of Altamira

Cro-Magnon, one finds no transition between the fragmentary Mousterian civilization and the admirable cultures of the Aurignacian, Solutrian and Magdalenian man. In order to concede any relation between these types or between these industries, it is necessary to suppose that at the end of the Middle Pleistocene a mutation was produced which abruptly transformed Homo neanderthalensis into Homo sapiens. Need I say that this hypothesis can no more be seriously entertained than the creationist hypothesis? In reality this morphologic and industrial hiatus simply proves that living man, like the man of the Upper Pleistocene of which he is the issue, was not the direct descendant of Homo neanderthalensis; that the latter represents a divergent line of the genus Homo which became extinct before the present era, while Homo sapiens represents the development of another line which paleontological discoveries made up to the present time do not permit us to follow into the Middle Quaternary.

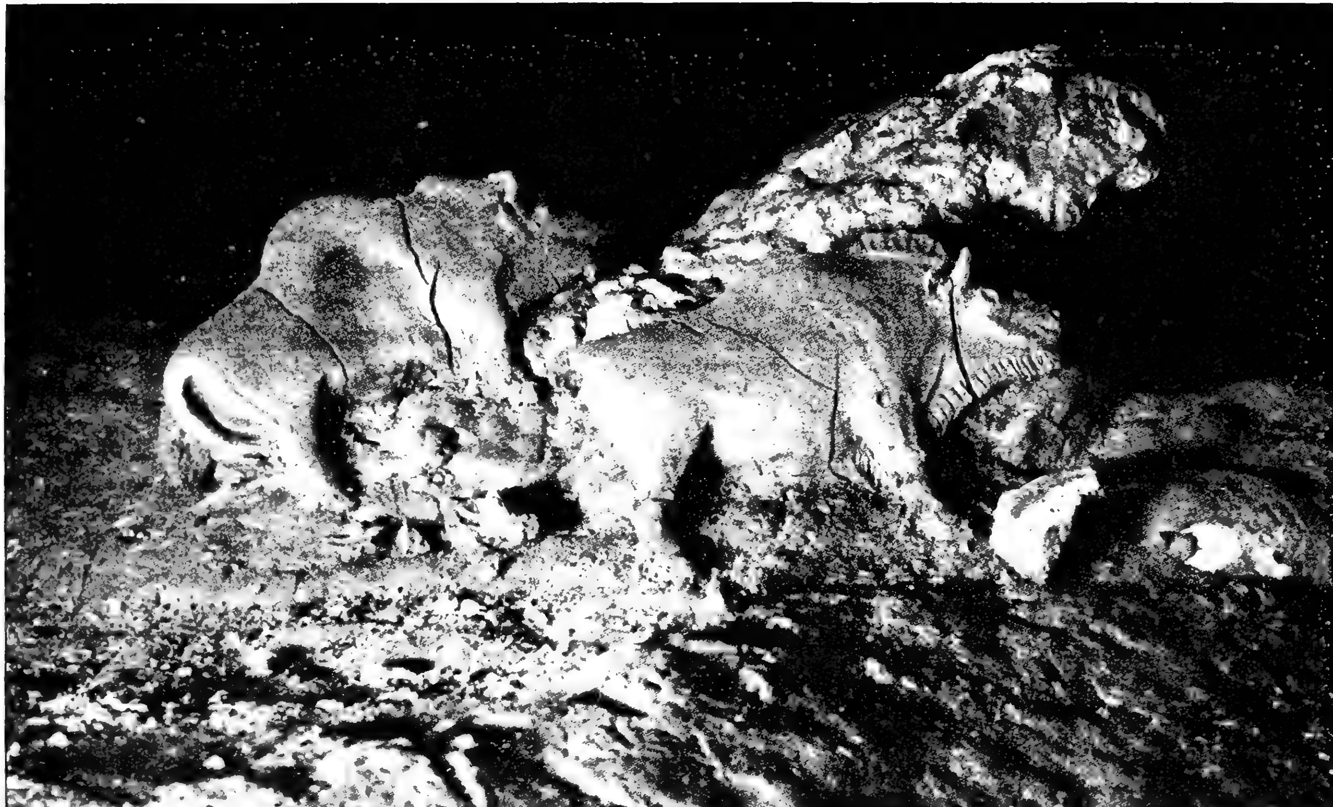
The recent discoveries at Piltdown and Heidelberg have a definite bearing on this hypothesis; although greatly different in many details of structure from the Homo neanderthalensis, the Heidelberg jaw nevertheless does not present any essential differences from the latter. It is without doubt more robust, shows more pronounced primitive characters, but M. Boule has shown that it might well be adapted to the cranium of La Chapelle-aux-Saints



A reindeer grazing, from the cavern of Kesslerloch near Thayugen, Switzerland, engraved on a shaft-straightener. A Magdalenian masterpiece.
After Sollas *Courtesy American Museum of Natural History*

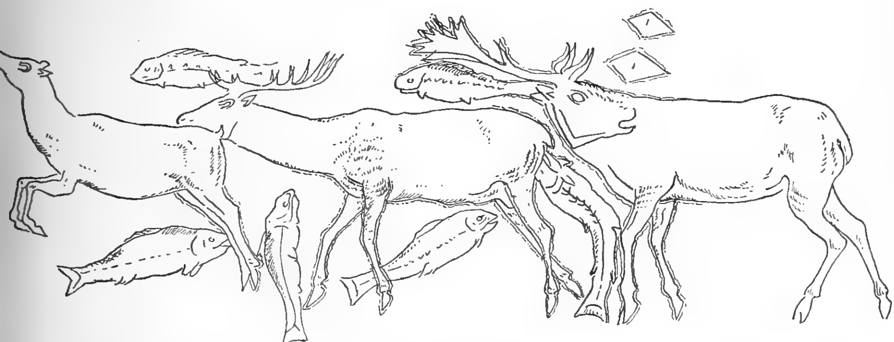
without sensibly changing its general aspect, and if we consider that it carries us back to an epoch anterior to that in which the man of the Middle Pleistocene lived, we can see in it one of the primitive stages of the latter; or, otherwise speaking, we may suppose that Homo heidelbergensis represents in the Lower Pleistocene the ancestral form of Homo neanderthalensis.

The discovery at Piltdown is of more delicate interpretation and this is because of the fragmentary condition of the remains. The jaw is distinctly pithecoid, although the cranium appears much more related to that of recent man than to that of the Homo neanderthalensis. At first sight one can not fail to be surprised



Group of two Bisons, modeled in clay. From the cavern of Tuc d'Audoubert

at the association in the same individual of simian and human characters so emphatically developed, and when one considers that the first are localized in the mandible, the second in the cranium, it is reasonable to question whether the sands of Piltdown may not have furnished the bones of two different individuals, an anthropoid and a man. The improbability of this hypothesis, which has been suggested by savants of distinction, of course, *a priori,* can not be escaped. It is necessary, nevertheless, to remark that as yet no anthropoid has been discovered in the European Lower Pleistocene. If the duality of the Piltdown discovery is rejected, Eoanthropus dawsoni would be one of the surprising synthetic forms of which paleontology has revealed to us the existence in other fossil groups. In any case, if the reconstructions submitted



Engraving on horn, partly restored, from the cavern of Lorthet, regarded as one of the finest examples of Magdalenian art.
After Ray Lankester *Courtesy American Museum of Natural History*

by the English anthropologists are exact, this being can not in any wise, on the basis of its cranial characters, take its place in the phylum of Homo neanderthalensis, and it will be logical to suppose that it represents the ancestral form from which Homo sapiens has been derived by an evolution whose stages have escaped us in the course of the Middle Pleistocene. We should have thus found at the opening of Quaternary time, the duality of types which we have vainly searched for in the Middle Quaternary. Their discovery would be here of great interest. Nevertheless, it is necessary to await other evidence before drawing any conclusions regarding this.

The absence of all remains of Homo sapiens in the Middle Quaternary can be explained in a quite simple manner. A certain number of paleontologists, among them notably M. Boule, are disposed to believe that we have not yet found our direct ancestor in the Middle Pleistocene, it is really because that creature did not exist in our regions at that time, and that he invaded them only during the last period of the early Quaternary, bringing with him his magnificent civilization. In this hypothesis the country of origin of this creature would be probably Asia, from which so many later invasions departed toward Europe.

The discovery of the remains of Pithecanthropus in Java long ago turned the attention of paleontologists in this direction toward an epoch in which the problem of the origin of man does not present itself with its present complexity. It was in Asia, it is supposed, that the development took place of the hypothetical being, the probable parent of Pithecanthropus, from which was descended Homo neanderthalensis, and which later in its turn gave origin to Homo sapiens. We have seen that the second part of this hypothesis is not favored at the present time, but it is recognized that the first part can still be defended with serious arguments. It is certain, in fact, that, *morphologically,* the cranium of Pithecanthropus affords an excellent passage term between the great apes and the man of the Middle Quaternary. At the same time nothing proves that, *phylogenetically,* it represents the transition between the Pliocene ancestors of those apes and itself, for one must bear in mind that it is with the anthropoids of those ancient epochs and not with the living anthropoids that the affinity must be searched for and demonstrated, and in the absence of documents we have no evidence bearing on this point.

Another conception consists in seeing in Pithecanthropus a Gibbon of great size. This rests in part upon morphologic comparisons and in part also, as M. Boule has remarked, on the frequent occurrence in the geological epoch to which the Java fossil belongs of gigantic animals whose living representatives are of greatly reduced dimensions. Pithecanthropus would stand to the Gibbons as Megatherium and the Glyptodon of America do to the Armadillos and the Sloths, the Diprotodon of Australia to the Marsupials, the Trogontherium of Europe to the Beavers, the Megaladapis of Madagascar to the Lemurs. Consequently Pithecanthropus could not properly be attached to the human line but is related to a different line, that of the anthropoids; and just as Homo neanderthalensis represents a divergent branch and terminal of the genus Homo, Pithecanthropus erectus would be a divergent branch and terminal from the trunk of which have issued the great anthropomorphic apes.

In resumé, the incontestable advances of paleontology have everywhere served to clear up these later discoveries. They have given precision to the problem of the origin of man, although without bringing any definite and final solution. Recent discoveries have established the fact that there developed in Europe during the Lower Quaternary, a human type absolutely different from the modern type, having certain pithecoid characters more marked than the lowest contemporaneous races, but nevertheless unquestionably meriting the name of man. The interpretation of these discoveries leads us to suppose that at the same time with this inferior creature there probably existed another human type (of which the Piltdown skull is perhaps the first evidence as yet known), the evolution of which comes out in the human races of the Later Quaternary, and consequently in the living races. But nowhere in *Europe*, so far as we have gone back into the past, have we yet found an anthropoid form from which might have issued the various types of the genus Homo.

Man has then behind him a long series of ancestors of human form of which we have as yet recognized only a few.

All that we know today of the history of the fossil apes proves that, as in the human branch, the simian branch plunges back into the depths of the past, with no present fact known that permits us to fix upon the epoch at which these two branches united into one common trunk.

The most ancient Primates known appeared in the Lower Eocene, near the opening of the Tertiary era, in North America, as creatures of a generalized type, on account of which it is very difficult to distinguish them from certain contemporary animals which it is necessary to place at the origin of other orders, such, for example, as the Insectivores. The most differentiated among them may be related to the living Lemurs. These Primates living primitively on the North American continent or in a boreal American-European continent, probably emigrated in part toward South America where they gave origin to the Platyrhine apes, partly toward Europe where they are known to have appeared during the Middle Eocene and to have multiplied in the Upper Eocene and Lower Oligocene, afterward passing into Asia, then into Africa, and finally to Madagascar where they have given birth to the various species of Lemurs in this island.

The discoveries made at Fayoum in Egypt in 1910 and studied by Schlosser, show that in the course of the Oligocene these lower types of Primates gave rise to forms which have been regarded in part as the ancestors of the Catarhine apes and, in part, of the anthropoids. In fact, it is at about this epoch that the differentiation took place, for on leaving the Miocene all the remains of apes discovered present very close affinities with the living species: I may cite for the Miocene epoch the Pliopithecus antiquus, a close ally of the gibbons, the Mesopithecus pentelici, intermediate between the macaque and the Semnopithecus, and for the Plio-Miocene epoch the Cynocephalus subhimalayanus, which is a true baboon; the Palaeopithecus sivalensis, which presents the characters both of the orang and of the chimpanzee; the Sivapithecus indicus which has certain affinities with the gorilla. In the Pliocene, and much more emphatically during the Pleistocene, the identity of the fossil with the living species must be regarded as probable.

It is then evident that the human phylum and the simian phylum have developed in parallel lines, each dividing and subdividing ever since time of extremely ancient date, and without paradox one may say that if Homo neanderthalensis had had, like ourselves, a curiosity in regard to his origin, the problem he set before himself would be almost in the same terms as that which presents itself to us. That at a geological epoch still more remote, so far back that our present knowledge will not permit us to fix it with precision, these two phyla were but one, losing themselves then in a common ancestor, we can not doubt. That paleontology will bring us some day documents which will permit us to establish the complete chain of this double genealogy, human and simian, the capital discoveries of the last years permit us to hope. One must give credit to the science which has already resolved so many secrets of dead nature, and we may affirm now that when this work is complete, man and the ape will appear as the ultimate forms of lines which have evolved independently for so long a time that there has never been any veritable parent of both.

Karl Vogt said he would rather be a perfected ape than a fallen angel. We do not have to choose between these alternatives. We know that man is neither one nor the other.

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The University of the State of New York

New York State Museum

JOHN M. CLARKE, Director

PUBLICATIONS

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Museum annual reports 1847–date. *All in print to* 1894, 50c *a volume,* 75c *in cloth;* 1894–*date, sold in sets only;* 75c *each for octavo volumes; price of quarto volumes on application.*

These reports are made up of the reports of the Director, Geologist, Paleontologist, Botanist and Entomologist, and museum bulletins and memoirs issued as advance sections of the reports.

Director's annual reports 1904–date.

1904. 138p. 20c.
1905. 102p. 23pl. 30c.
1906. 186p. 41pl. 25c.
1907. 212p. 63pl. 50c.
1908. 234p. 39pl. map. 40c.
1909. 230p. 41pl. 2 maps, 4 charts. *Out of print*
1910. 280p. il. 42pl. 50c.
1911. 218p. 49pl. 50c.
1912. 214p. 50pl. 50c.

These reports cover the reports of the State Geologist and of the State Paleontologist. Bound also with the museum reports of which they form a part.

Geologist's annual reports 1881–date. Rep'ts 1, 3–13, 17–date, 8vo; 2, 14–16, 4to.

In 1898 the paleontologic work of the State was made distinct from the geologic and was reported separately from 1899–1903. The two departments were reunited in 1904, and are now reported in the Director's report.

The annual reports of the original Natural History Survey, 1837–41, are out of print.

Reports 1–4, 1881–84, were published only in separate form. Of the 5th report 4 pages were reprinted in the 39th museum report, and a supplement to the 6th report was included in the 40th museum report. The 7th and subsequent reports are included in the 41st and following museum reports, except that certain lithographic plates in the 11th report (1891) and 13th (1893) are omitted from the 45th and 47th museum reports.

Separate volumes of the following only are available.

Report	*Price*	*Report*	*Price*	*Report*	*Price*
12 (1892)	$.50	17	$.75	21	$.40
14	.75	18	.75	22	.40
15, 2v.	2	19	.40	23	.45
16	1	20	.50	[*See* Director's annual reports]	

Paleontologist's annual reports 1899–date.

See first note under Geologist's annual reports.

Bound also with museum reports of which they form a part. Reports for 1899 and 1900 may be had for 20c each. Those for 1901–3 were issued as bulletins. In 1904 combined with the Director's report.

Entomologist's annual reports on the injurious and other insects of the State of New York 1882–date.

Reports 3–20 bound also with museum reports 40–46, 48–58 of which they form a part. Since 1898 these reports have been issued as bulletins. Reports 3–4, 17 are out of print, other reports with prices are:

Report	*Price*	*Report*	*Price*	*Report*	*Price*
1	$.50	11	$.25	21 (Bul. 104)	$.25
2	.30	12	.25	22 (" 110)	.25
5	.25	13	*Out of print*	23 (" 124)	.75
6	.15	14 (Bul. 23)	.20	24 (" 134)	.35
7	.20	15 (" 31)	.15	25 (" 141)	.35
8	.25	16 (" 36)	.25	26 (" 147)	.35
9	.25	18 (" 64)	.20	27 (" 155)	.40
10	.35	19 (" 67)	.15	28 (" 165)	.40
		20 (" 97)	.40		

Reports 2, 8–12 may also be obtained bound in cloth at 25c each in addition to the price given above.

Botanist's annual reports 1867–date.

Bound also with museum reports 21–date of which they form a part; the first Botanist's report appeared in the 21st museum report and is numbered 21. Reports 21–24, 29, 31–41 were not published separately.

Separate reports for 1871–74, 1876, 1888–98 are out of print. Report for 1899 may be had for 20c; 1900 for 50c. Since 1901 these reports have been issued as bulletins.

Descriptions and illustrations of edible, poisonous and unwholesome fungi of New York have also been published in volumes 1 and 3 of the 48th (1894) museum report and in volume 1 of the 49th (1895), 51st (1897), 52d (1898), 54th (1900), 55th (1901), in volume 4 of the 56th (1902), in volume 2 of the 57th (1903), in volume 4 of the 58th (1904), in volume 2 of the 59th (1905), in volume 1 of the 60th (1906), in volume 2 of the 61st (1907), 62d (1908), 63d (1909), 64th (1910), 65th (1911) reports. The descriptions and illustrations of edible and unwholesome species contained in the 49th, 51st and 52d reports have been revised and rearranged, and, combined with others more recently prepared, constitute Museum Memoir 4.

Museum bulletins 1887–date. 8vo. *To advance subscribers, $2 a year, or $1 a year for division* (1) *geology, economic geology, paleontology, mineralogy;* 50c *each for division* (2) *general zoology, archeology, miscellaneous,* (3) *botany,* (4) *entomology.*

Bulletins are grouped in the list on the following pages according to divisions.

The divisions to which bulletins belong are as follows:

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2	Botany	59	Entomology	116	Botany
3	Economic Geology	60	Zoology	117	Archeology
4	Mineralogy	61	Economic Geology	118	Geology
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7	Economic Geology	64	Entomology	121	Director's report for 1907
8	Botany	65	Paleontology	122	Botany
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—— & Clarke, John M. v. 8 pt 1 Introduction to the Study of the Genera of the Paleozoic Brachiopoda. 16 + 367p. 44pl. 1892. $2.50.

—— & Clarke, John M. v. 8 pt 2 Paleozoic Brachiopoda. 16 + 394p. 64pl. 1894. $2.50.

Catalogue of the Cabinet of Natural History of the State of New York and of the Historical and Antiquarian Collection annexed thereto. 242p. 8vo. 1853.

Handbooks 1893–date.

New York State Museum. 52p. il. 1902. Free.

Outlines, history and work of the museum with list of staff 1902.

Paleontology. 12p. 1899. *Out of print.*

Brief outline of State Museum work in paleontology under heads: Definition; Relation to biology; Relation to stratigraphy; History of paleontology in New York.

Guide to Excursions in the Fossiliferous Rocks of New York. 124p. 1899. *Out of print.*

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Entomology. 16p. 1899. *Out of print.*

Economic Geology. 44p. 1904. Free.

Insecticides and Fungicides. 20p. 1909. Free.

Classification of New York Series of Geologic Formations. 32p. 1903. *Out of print.* Revised edition. 96p. 1912. Free.

Geologic maps. Merrill, F. J. H. Economic and Geologic Map of the State of New York; issued as part of Museum Bulletin 15 and 48th Museum Report, v. 1. 59 x 67 cm. 1894. Scale 14 miles to 1 inch. 15c.

—— Map of the State of New York Showing the Location of Quarries of Stone Used for Building and Road Metal. 1897. *Out of print.*

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New York State Museum

JOHN M. CLARKE, Director

Museum Bulletin 174

THE MINING AND QUARRY INDUSTRY OF NEW YORK STATE

REPORT OF OPERATIONS AND PRODUCTION DURING 1913

BY

D. H. NEWLAND

230869

ALBANY

THE UNIVERSITY OF THE STATE OF NEW YORK

1914

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The University of the State of New York

Department of Science, July 21, 1914

Dr Augustus S. Downing

Acting Commissioner of Education

SIR: I beg to communicate herewith for publication as a bulletin of the State Museum, the annual report on the Mining and Quarry Industry of New York State, which covers the operations and production during the year 1913.

Very respectfully

JOHN M. CLARKE

Director

THE UNIVERSITY OF THE
STATE OF NEW YORK

Approved for publication this 24th day of July 1914

Augustus S. Downing

Acting Commissioner of Education

University of the State of New York Bulletin

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THE MINING AND QUARRY INDUSTRY OF NEW YORK STATE

REPORT OF OPERATIONS AND PRODUCTION DURING 1913

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INTRODUCTION

The year 1913 was marked by general activity among the leading branches of the mining and quarry industry of the State. Productive operations were stimulated by a strong demand, especially during the first six months; in the latter part of the year, however, a reactionary tendency became manifest and conditions were rather unsettled toward the close. On the whole it was a period of large output, but of rather moderate prices.

The value of the ores and mineral materials, in their crude or first prepared forms, aggregated the sum of $41,598,399. This was larger than the total returned for any preceding year by several millions of dollars, and represented a gain of about 14 per cent over the corresponding figures for 1912, which were $36,648,382. In view of the average ruling prices for the different materials, which were by no means as high as they had been in the earlier years, the record was exceedingly favorable and showed a real expansion in the productive capacity of the enterprises.

A further index of the year's activity may be had from the tonnage of ores and minerals hoisted from underground workings.

Iron ores, pyrite, rock salt, gypsum, graphite and talc are wholly or mainly produced by mining operations in the strict sense, as contrasted with open-cast methods; the total quantity of these materials raised in 1913 was 3,156,643 tons against 2,722,648 tons in 1912.

The products on which the valuations above mentioned are based number over thirty in all and with few exceptions represent the materials as they come from the mines and quarries without elaboration or manufacture, except so much as is necessary to put them in marketable form. They do not include secondary products like iron and steel, sulphuric acid, aluminum, carborundum, calcium carbide, alkali products, etc., the manufacture of which constitutes a very large industry with an annual output that has a much greater value than that returned by the industries covered in this report.

Among the metallic minerals found in the State, iron ore is the most important from an industrial standpoint. The gross output of this ore last year was 1,606,196 long tons. After allowance for concentration, which is practised by the Adirondack mines, there remained a total of 1,217,899 long tons of shipping ore which had a value of $3,870,841, as compared with 1,057,702 long tons valued at $3,349,095 for the year 1912. Both the mines in the Clinton belt in the middle of the State and those in the Adirondacks increased their output, but the latter to a greater extent. Exploration of the iron ore continued to receive attention and further advances in this field may be looked for in the future.

The clay-working industries generally did not have a very prosperous season, as the demand for structural materials was rather quiet. The aggregate output of all classes of clay materials was valued at $12,077,872, about the same figure as in 1912, but there was actually a falling off in clay-building materials like brick and terra cotta. The decline in these branches, however, found compensation in the gains reported in the paving brick and pottery branches. A very large development of the paving brick industry is to be expected in the next few years, as a result of the increasing demand for use of the more permanent materials in highway construction.

The cement industry, especially the portland branch, showed a marked advance. The output of portland cement exceeded 5,000,000 barrels for the first time since the establishment of plants in the State, the actual quantity being 5,146,782 barrels with a value of $4,873,807. The natural cement trade on the other hand was on a decreasing scale and the production amounts to but 193,975 barrels valued at $95,565, a mere fraction of the former output.

The stone products, inclusive of granite, limestone, marble, sandstone and trap, were valued at $6,763,054, a gain of about 11 per cent in the total for the year. There was a decline in the value of the building stone quarried, and also of the monumental material, but a gain in the production of crushed stone, paving blocks and other materials used in street work. More than one-half of the total was contributed by the limestone quarries.

One of the historic industries of the State is that based on the salt deposits which were the object of enterprise in colonial times and have contributed steadily for more than a century. Complete records of the production are available from the year 1797 to date. In 1913 the output amounted to 10,819,521 barrels with a value of $2,856,664, which was in excess of the quantity reported in any previous year.

An output of 532,884 tons of gypsum set a new figure also for that material which has been of steadily increasing importance in the local mining field. The product is mainly employed for the manufacture of stucco and wall plasters, but has application also in agriculture and cement manufacture. The value of the output was $1,306,143.

Natural gas showed one of the largest gains recorded for the year; the quantity produced was 9,155,429,000 cubic feet valued at $2,549,227, or a gain of nearly 40 per cent which may be considered remarkable in view of the long-continued development of the local field. Petroleum, the only other mineral fuel that occurs in workable quantity in New York State, was produced in Allegany and Cattaraugus counties to the extent of 916,873 barrels with a value of $2,255,508. In respect to prices, the year was a notable one, as the prices for crude oil averaged nearly $2.50 a barrel for the whole twelve months, but the quantity was below the usual figure.

Among the other branches of the mineral industry that shared in the year's returns were those of talc, graphite, garnet, pyrite, slate, mineral paints, mineral waters, emery, feldspar, molding and building sand, sand-lime brick, diatomaceous earth, marl, apatite, and mica. Talc ranks as one of the more important of these, with an output of 63,000 short tons valued at $551,250, mostly from mines in St Lawrence county. Garnet for abrasive uses comes from Essex and Warren counties and the product last year amounted to 4665 short tons with a value of $145,445. Pyrite for acid manufacture is mined in St Lawrence county; graphite of the finest crystalline grade is obtained in Essex county; and feldspar for pottery and other uses in Westchester and Essex counties. The only material added to the list of the preceding year was mica, of which a small quantity was obtained in Essex county.

Mineral production of New York in 1912

PRODUCT	UNIT OF MEASUREMENT	QUANTITY	VALUE
Portland cement	Barrels	4 495 842	$3 488 931
Natural-rock cement	Barrels	287 693	142 165
Building brick	Thousands	1 205 704	6 776 602
Pottery	....	....	2 876 762
Other clay products	....	....	2 389 731
Crude clay	Short tons	8 583	18 980
Emery	Short tons	589	6 479
Feldspar and quartz	Short tons	28 584	115 419
Garnet	Short tons	4 112	117 325
Graphite	Pounds	2 628 000	142 665
Gypsum	Short tons	506 274	1 186 845
Iron ore	Long tons	1 057 702	3 349 095
Millstones	....	....	15 358
Metallic paint	Short tons	8 012	72 176
Slate pigment	Short tons	1 750	12 800
Mineral waters	Gallons	9 682 447	760 847
Natural gas	1000 cubic feet	6 564 659	1 882 297
Petroleum	Barrels	782 661	1 338 350
Pyrite	Long tons	58 137	286 577
Salt	Barrels	10 502 214	2 597 260
Sand and gravel	....	....	2 549 729
Sand-lime brick	Thousands	21 231	133 736
Roofing slate	Squares	9 738	83 222
Slate manufactures	....	....	Nil
Granite	....	....	202 096
Limestone	....	....	3 510 445
Marble	....	....	241 847
Sandstone	....	....	1 280 743
Trap	....	....	483 863
Talc	Short tons	61 619	511 437
Other materials [1]	....	....	74 600
Total value	....	....	$36 648 382

[1] Includes apatite, diatomaceous earth, marl and zinc ore.

Mineral production of New York in 1913

PRODUCT	UNIT OF MEASUREMENT	QUANTITY	VALUE
Portland cement	Barrels	5 146 782	$4 873 807
Natural cement	Barrels	193 975	95 565
Building brick	Thousands	1 099 861	6 038 658
Pottery	....	....	3 367 187
Other clay products	....	....	2 672 027
Crude clay	Short tons	6 291	17 411
Emery	Short tons	611	7 332
Feldspar and quartz	Short tons	25 680	113 765
Garnet	Short tons	4 665	145 445
Graphite	Pounds	2 250 000	112 500
Gypsum	Short tons	532 884	1 306 143
Iron ore	Long tons	1 217 899	3 870 841
Millstones	....	....	13 130
Metallic paint	Short tons	7 950	78 200
Slate pigment	Short tons	2 200	15 026
Mineral waters	Gallons	9 448 348	806 298
Natural gas	1000 cubic feet	9 155 429	2 549 227
Petroleum	Barrels	916 873	2 255 508
Pyrite	Long tons	54 903	242 065
Salt	Barrels	10 819 521	2 856 664
Sand and gravel	....	....	2 584 266
Sand-lime brick	Thousands	22 225	143 345
Roofing slate	Squares	6 109	53 074
Slate manufactures	....	....	Nil
Granite	....	....	335 642
Limestone	....	....	3 852 678
Marble	....	....	252 292
Sandstone	....	....	1 321 272
Trap	....	....	1 001 170
Talc	Short tons	63 000	551 250
Othe materials [1]	....	....	66 611
Total value	....	....	$41 598 399

[1] Includes apatite, diatomaceous earth, marl and mica.

CEMENT

The cement industry greatly improved its position last year when it experienced the first really sustained prosperity that it has had in a long time. There was a strong demand, sufficient to keep all the mills busy at full capacity. The higher level of prices, which was firmly held throughout the year, afforded a fair margin of profit to manufacturers, most of whom had operated at a minimum profit if not with actual loss in the three preceding years. The recent period of price-cutting and unrestrained competition for markets found some plants in a weak position financially or technically; these either succumbed to the pressure or were reorganized on a better basis, so that as a whole the industry is now in a healthier state than ever before.

The New York portland cement plants, with one or two exceptions, successfully withstood the critical test. No doubt they fared somewhat better than most mills by reason of the exceptionally good home market that enabled them to dispose of much of their product without going into other territory, as there has been a very large amount of construction work in progress in the State by reason of the highway and canal improvements. The Hudson river district also has a natural outlet in the western section of New England which no other manufacturing center reaches on an equal basis. In consequence of these relative advantages the local industry has been able not only to hold its own in the trade, but has actually increased its output steadily from year to year.

The present favorable situation of the cement industry may be said to be the outcome of a market change which began in the season of 1912. In the early part of the year conditions were almost on the point of demoralization so far as prices are concerned, with quotations on the basis of 60 cents a barrel in bulk at the mill. Such prices furnished an incentive to buying, so that the surplus held by the manufacturers diminished rapidly and helped to strengthen the market from month to month. Prices were raised in the spring and again in the summer and with other advances later on raised the basis to 90@95 cents mill quotation which obtained in the month of December. The actual sales for the year, however, did not average so high as the market prices would indicate, owing to the fact that a considerable portion of the output is sold on contract. Within the year 1913 the market held steadily around the high mark reached in the preceding season. The New York City basis was $1.58 a barrel inclusive of package for standard brands, or $1.18 in bulk. The State plants received somewhat higher prices in their local markets. The average for the whole output was 95 cents. In 1912 the average was 78 cents a barrel.

At the close of the past season stocks were lower than at the beginning, the plants being practically denuded of any marketable surplus. There was good prospect of a continued steady demand for the early part of the current season. The removal of the former tariff of 32 cents a barrel probably will serve to prevent any material increase in prices over the present level since that would encourage importations from Germany, Belgium and England. With prices under $1 a barrel there seems to be no danger of a general invasion by foreign brands, although in periods of depression those countries may sell more or less in the seaboard markets.

In the natural cement trade conditions have not been so favorable and the few plants now engaged in that branch reported a somewhat smaller output than in 1912. The decline of the industry has meant a great loss to many communities, although its effects generally have been counterbalanced by the gain of portland cement manufacture. The natural cement product for a long time averaged around 4,000,000 barrels a year, and the industry continued in a flourishing condition down to about the year 1900 when the cheapening of the cost of portland cement brought on competition that caused the closing down of most plants.

The output of cement in the State last year reached record figures; the total as compiled from the individual reports amounted to 5,340,757 barrels. In the preceding year, the combined production of portland and natural cement was 4,783,535 barrels and in 1911 it was 3,691,373 barrels. The value of the output was also larger than that of any previous year.

As shown in the accompanying tables, the portland industry accounted last year for a total of 5,146,782 barrels, as compared with 4,495,842 barrels in 1912, or a gain of 650,940 barrels. The value of the output was $4,873,807 against $3,488,931 in 1912. The average value for the product, based on the mill prices for the year, was 95 cents a barrel against 77.6 cents a barrel. There were eight mills in operation during the year, one more than in 1912.

The output of natural cement amounted to 193,975 barrels valued at $95,565, the greater part having been made by a single plant in the Rosendale district of Ulster county. The total for 1912 was 287,693 barrels with a value of $142,165. The average price received was thus about 50 cents a barrel in 1913, the same as in 1912. Aside from Ulster county the only other county which was represented in the industry was Onondaga with three small producers.

Production of cement in New York

YEAR	PORTLAND CEMENT		NATURAL CEMENT	
	Barrels	Value	Barrels	Value
1893	137 096	$287 725	3 597 758	$2 805 387
1894	117 275	205 231	3 446 330	1 974 463
1895	159 320	278 810	3 939 727	2 285 094
1896	260 787	443 175	4 181 918	2 423 891
1897	394 398	690 179	4 259 186	2 123 771
1898	554 358	970 126	4 157 917	2 065 658
1899	472 386	708 579	4 689 167	2 813 500
1900	465 832	582 290	3 409 085	2 045 451
1901	617 228	617 228	2 234 131	1 117 066
1902	1 156 807	1 521 553	3 577 340	2 135 036
1903	1 602 946	2 031 310	2 417 137	1 510 529
1904	1 377 302	1 245 778	1 881 630	1 207 883
1905	2 117 822	2 046 864	2 257 698	1 590 689
1906	2 423 374	2 766 488	1 691 565	1 184 211
1907	2 108 450	2 214 090	1 137 279	757 730
1908	1 988 874	1 813 622	623 588	441 136
1909	2 061 019	1 761 297	549 364	361 605
1910	3 364 255	2 939 818	292 760	147 202
1911	3 416 400	2 930 434	274 973	134 900
1912	4 495 842	3 488 931	287 693	142 165
1913	5 146 782	4 873 807	193 975	95 565

A further gain in the production of portland cement may be anticipated for the immediate future. The plant of the Millen Portland Cement Co at Jamesville, Onondaga county, ran only a part of the past season, having been placed in operation for the first time in the spring. The cement is made from limestone quarried by the Solvay Process Co., nearby, who thus dispose of the smaller sizes of stone unsuitable for use in their alkali plant. The limestone, with the shale which is obtained from a local bank, is fed directly into ball mills without any preliminary crushing. From there it passes to tube mills and to the kiln. The plant was designed for a capacity of 700 barrels a day, but will probably exceed that figure when under full headway.

The portland cement mills in the State now use hard limestone exclusively as the basis of the cement mixture. The use of marl has been discontinued, and the last marl plant, which was operated by the Marengo Portland Cement Co., at Caledonia, was sold last year and dismantled.

CLAY

BY ROBERT W. JONES

The clay-working industries experienced a rather poor season in 1913. In the structural branches conditions fluctuated very markedly; at times the demand for building brick was fairly good, but such periods were followed by sudden slumps which left the market overstocked and brought prices down to a lower basis. The consequence was that the output of clay structural materials was smaller than in the preceding year and conditions at the close of the season were not auspicious for any great revival of activity in the immediate future.

The decline of output in the structural branches, however, was counterbalanced by a gain in the paving brick and pottery industries so that the year's total was somewhat larger that the output recorded in 1912. The combined value of all the products made in the State was $12,077,872, as compared with $12,043,095 in 1912.

The following table presents the figures of production for the different clay-working industries as they have been reported by the individual plants. The classification is somewhat different than that followed heretofore, necessitating some changes in the figures for the years 1911 and 1912.

Production of clay materials

MATERIAL	1911	1912	1913
Common brick	$5 310 511	$6 666 945	$5 938 922
Front brick	132 792	109 657	99 736
Vitrified paving	388 479	382 984	576 970
Hollow brick	82 217	42 575	44 265
Fireproofing	229 627	230 833	276 053
Terra cotta	718 700	1 139 291	1 113 322
Fire brick and stove lining	413 500	380 005	371 408
Drain tile	202 292	122 571	134 199
Sewer pipe	138 258	77 644	154 646
Pottery	2 196 054	2 876 762	3 367 187
Miscellaneous	20 179	13 828	1 164
Total	$9 832 609	$12 043 095	$12 077 872

There were two hundred four companies and individuals active in the clay-working industries last year. Of this number, one hundred fifty-nine were engaged in the production of common building brick, of which the number made was 1,090,506,000, valued at $5,938,922, against 1,190,374,000 in 1912 valued at $6,666,945. Front brick also showed a decline, with a value of $99,736 against $109,657; fire brick and stove lining fell off, $371,408 against $380,-005; and terra cotta showed a decline, $1,113,322 against $1,139,291 in the preceding year. The product of paving brick, on the other hand, increased over 50 per cent, the output having a value of $576,970, as compared with $382,984 in 1912; and pottery also showed a notable increase.

The production was distributed among 36 counties of the State. Onondaga county had the largest clay-working industry and reported an output valued at $1,613,395, a gain of $245,050 for the year. Ulster county occupied second place with a production of $1,077,655, all common building brick. Erie county with a production of $1,000,055 displaced Rockland county from third place. The production from Rockland county amounted to $820,475. Cattaraugus, Chautauqua and Greene counties made considerable increases due principally to the greater activity in the paving brick industry. Other counties reporting a gain over 1912 were Albany, Cayuga, Livingston, Monroe, Niagara, Ontario, Queens and Schenectady.

The basis of New York's clay-working industry is the widespread occurrence of common clays that are adapted to the manufacture of building brick, drain tile and materials of that class. These clays are found at the surface, being of glacial derivation and are usually of blue color, weathering to yellow on exposure. They burn readily and yield a product of reddish color. In addition there are extensive beds of shales, especially in the Devonic formations, which are valuable for the manufacture of paving brick and pressed building brick. The deposits of white-burning clays are quite restricted and occur only in certain localities on Long Island and Staten Island.

Production of clay materials by counties

COUNTY	1911	1912	1913
Albany	$470 503	$457 694	$473 325
Allegany	9 000	*a*	....
Broome	....	....	*a*
Cattaraugus	171 013	231 156	275 763
Cayuga	15 724	3 740	5 800
Chautauqua	166 322	113 315	147 451
Chemung	76 169	79 510	*a*
Clinton	....	....	*a*
Columbia	284 475	381 888	307 571
Dutchess	648 151	665 082	634 043
Erie	755 602	810 516	1 000 055
Greene	139 578	202 306	290 116
Jefferson	*a*	3 630	....
Kings	602 756	574 805	539 002
Livingston	70 295	125 642	200 248
Monroe	325 849	246 264	278 145
Montgomery	*a*	14 400	*a*
Nassau	105 740	119 708	109 051
New York	*a*	56 884	*a*
Niagara	25 426	22 357	55 469
Oneida	95 605	85 897	84 714
Onondaga	912 982	1 368 345	1 613 395
Ontario	255 298	341 617	470 638
Orange	565 152	615 155	472 465
Queens	402 398	613 605	651 328
Rensselaer	173 564	169 179	151 202
Richmond	470 591	723 875	588 534
Rockland	747 040	994 967	820 475
St Lawrence	....	....	*a*
Saratoga	393 490	516 632	460 223
Schenectady	486 327	539 928	579 158
Steuben	149 649	181 663	*a*
Suffolk	73 750	92 150	81 000
Ulster	829 035	1 296 779	1 077 655
Warren	*a*	17 875	*a*
Washington	10 350	19 620	14 625
Wayne	*a*	*a*	*a*
Westchester	297 997	344 798	290 256
Other counties *b*	102 778	12 113	406 165
Total	$9 832 609	$12 043 095	$12 077 872

a Included under other counties.
b In 1911, aside from counties marked *a*, are included Clinton, Genesee, St Lawrence, Tompkins and Wayne counties. In 1912, aside from counties marked *a*, are included Clinton, St Lawrence, Tompkins and Wayne counties. In 1913 are included all counties marked *a*.

COMMON BUILDING BRICK

A larger proportion of the common brick is made by the soft mud process which in spite of its defects seems destined to remain the chief method of manufacture in New York State for many years to come. The deposits of soft plastic clays in the Hudson valley will continue to afford the main basis of the industry, since many of the clay banks are not suited to any other process. New York and its environs may be expected to supply the largest outlet for material of this class as it has in the past.

Besides the brick made by the soft mud process, the term "common brick" also includes the ungraded red brick manufactured in stiff mud machines and a small product of vitrified shale brick, the latter made by the paving brick operators. Statistics covering the production of common brick for the last two years are shown in the accompanying table.

Production of common building brick by counties

COUNTY	1912		1913	
	Number	Value	Number	Value
Albany	69 100 000	$381 694	66 700 000	$370 425
Broome	....	....	*a*	*a*
Cattaraugus	770 000	5 506	800 000	8 000
Cayuga	....	....	800 000	4 800
Chautauqua	3 040 000	20 483	5 352 000	35 962
Chemung	12 300 000	79 510	*a*	*a*
Clinton	....	....	*a*	*a*
Columbia	69 434 000	381 888	58 585 000	307 571
Dutchess	122 085 000	665 082	120 770 000	634 043
Erie	43 184 000	277 696	56 899 000	380 153
Greene	36 573 000	199 360	26 976 000	143 466
Livingston	....	....	*a*	*a*
Monroe	26 083 000	171 266	19 747 000	99 064
Montgomery	3 200 000	14 400	*a*	*a*
Nassau	15 399 000	105 048	15 997 000	102 531
Niagara	3 114 000	22 357	8 067 000	55 469
Oneida	12 525 000	79 575	11 860 000	78 088
Onondaga	16 985 000	119 134	19 800 000	139 150
Ontario	2 500 000	16 250	2 000 000	16 000
Orange	113 363 000	615 155	96 493 000	472 465
Rensselaer	13 800 000	76 452	12 600 000	75 550
Richmond	33 297 000	175 358	29 507 000	147 540
Rockland	184 595 000	994 967	156 281 000	820 475
St Lawrence	....	....	*a*	*a*
Saratoga	103 210 000	516 632	91 745 000	458 723
Steuben	....	....	*a*	*a*
Suffolk	15 200 000	92 150	13 500 000	81 000
Ulster	231 550 000	1 296 779	197 801 000	1 077 655
Warren	3 575 000	17 875	*a*	*a*
Washington	....	....	*a*	*a*
Westchester	53 582 000	327 698	52 525 000	275 756
Other counties *b*	1 910 000	14 630	25 701 000	158 036
Total	1 190 374 000	$6 666 945	1 090 506 000	$5 938 922

a Included under other counties.
b Includes in 1912 Cayuga, Clinton, Jefferson, Livingston, St Lawrence, Tompkins and Washington counties. In 1913 includes all counties marked *a*.

Hudson river region. The brickyards of the Hudson river section operated during the last season under rather adverse conditions. The stock of brick on hand at the end of 1912 was comparatively high, amounting to 312,004,000 as compared with 250,000,000 for 1911. The mild winter and spring, however, permitted considerable activity in building operations so that the stock of unsold brick was rapidly reduced and the active brick-making season of the Hudson valley opened with a comparatively small amount of brick in storage. The continuation of the mild weather favored manufacturing operations and the yards opened to their full working capacity. Many plants that had been idle for several seasons were again placed in operation. By the middle of the summer there was a noticeable slackening of building operations in response to the general business situation and the demand for brick from that time began to decline, becoming more restricted as the season advanced. Thus the New York market was soon overstocked and the operators were carrying large quantities of burned and unburned brick. Many of the smaller manufacturers closed their yards and the others generally reduced operations. It is estimated that the sales of Hudson river common brick in the New York market during the year were 642,950,000, as compared with 758,800,000 in 1912. The average wholesale price was $6.125 against $6.75 in the preceding year.

The statistics of production for the nine counties that send the greater part of their output to the New York City market are as follows:

Output of common brick in the Hudson river region in 1912

COUNTY	NUMBER OF OPERATORS	OUTPUT	VALUE	AVERAGE PRICE PER M
Albany	12	69 100 000	$414 600	$6 00
Columbia	5	69 434 000	381 888	5 50
Dutchess	17	122 085 000	665 082	5 45
Greene	6	36 573 000	199 360	5 45
Orange	8	113 363 000	615 155	5 43
Rensselaer	4	13 800 000	82 800	6 00
Rockland	23	191 595 000	1 063 352	5 55
Ulster	21	231 550 000	1 296 779	5 60
Westchester	6	52 844 000	318 422	6 03
Total	102	900 344 000	$5 037 438	$5 60

Output of common brick in the Hudson river region in 1913

COUNTY	NUMBER OF OPERATORS	OUTPUT	VALUE	AVERAGE PRICE PER M
Albany	12	66 700 000	$370 425	$5 55
Columbia	5	58 585 000	307 571	5 25
Dutchess	18	120 770 000	634 043	5 25
Greene	7	26 976 000	143 466	5 32
Orange	8	96 493 000	472 465	5 00
Rensselaer	4	12 600 000	74 550	5 97
Rockland	21	156 281 000	820 475	5 25
Ulster	24	197 801 000	1 077 655	5 50
Westchester	7	52 525 000	275 756	5 24
Total	106	788 731 000	$4 176 406	$5 37

The Hudson valley yards that ship by water have a total machine capacity of about 11,000,000 brick a day. This is the output of 500 soft mud machines. The principal districts include Haverstraw, Kingston and Dutchess Junction, but there are one or more plants at a number of other places.

In the Haverstraw district last year twenty-one companies were active and reported a total of 156,281,000 brick valued at $820,475. This comprised the entire output of Rockland county. The plants are situated along the Hudson river from the southern limits of Haverstraw north through Grassy Point and North Haverstraw, a distance of about 3 miles. Most of the yards are operated under lease; consequently there are many changes in management from year to year, though there has been no increase in the number of yards or machines during late years. At the present time there are twenty-six different yards. The total available machine capacity of the yards is 2,948,000 daily which gives this district the greatest available capacity of any in the Hudson valley. Coal is used almost exclusively for fuel. One yard uses crude oil for the preliminary heating of the kiln, followed by bituminous coal and forced draft. Sixteen yards dry by the open method, five use pallets exclusively, one is equipped with pallets and an extension steam tunnel, two are equipped with covered yards, and two have a combination of covered and pallet yard. Four yards use clay dredged from the river bottom while the rest have pits and banks west of the yards. In a few cases, the pit and molding sands come from the same local sources.

The Kingston district occupies the river front for a distance of about 12 miles and includes the yards at Port Ewen, Kingston, East Kingston, Glasco, Saugerties and Malden, with a total of twenty-one operating companies. The production, during the season, from the twenty-five yards controlled by these companies, amounted to 196,301,000 having a value of $1,068,655. The total production from Ulster county during 1913 amounted to 197,801,000 with a value of $1,077,655. The methods of manufacture are somewhat different from those used in the other sections of the Hudson valley, especially in regard to mining and tempering the clay. One yard operates with clay dredged from the river bottom. The circular tempering pit, which has been discarded by many Hudson river producers on account of the higher labor cost, is in use at many of the Kingston yards. The open yard seems to be the favorite method of drying, as it is in exclusive use in eighteen yards. Two yards combine this method with steam drying, and five are equipped with pallets. There are no covered yards now in use. Anthracite coal is the only fuel used in burning. Transportation is entirely by water and the output is disposed of in New York City with the exception of a few yards which ship entirely to Jersey City and Hoboken. The available machine capacity of this district is 2,904,000 daily.

The district which includes Dutchess Junction, in Dutchess county, produced during 1913 a total of 112,723,000 brick with a value of $591,796. The total production of Dutchess county during the same period was 120,770,000 with a value of $634,043. With a few exceptions, the crude material is the ordinary soft, sandy blue clay similar to that found at Verplanck Point and Haverstraw. The total available machine capacity of this district is 1,936,000 a day from an equivalent of eighty-eight machines. Circular tempering pits are not used; all the material at the sixteen plants is prepared in rectangular soak pits.

Six producers of common brick in Westchester county reported a total production of 52,525,000, with a value of $275,756. This includes also a small amount of ornamental soft mud brick. The entire production was made in ten yards. The district which extends along the river front from Croton Point north through Georges island to Verplanck point has a total available daily machine capacity of 1,122,000 equivalent to the production from fifty-one machines producing at the rate of 22,000 each. The clay is a grayish blue, sandy material requiring very little water in tempering. Five yards use the open method of drying, three are equipped with pallets and two with covered yards. Circular tempering pits are in use on two yards, the others using the rectangular pit exclusively. The total available kiln capacity is approximately 2000 arches, or about 70,000,000 brick. Coal is used for fuel in six yards.

Long Island and Staten Island. The common brick industry in the Long Island and Staten Island section depends upon the use of glacial clays found along the coast. The soft mud process is usually employed. On account of the low elevation most of the clay is mined from pits and the working face is usually not over 10 or 12 feet. Gravel and boulders are intermixed with the clay to an extent that sorting and crushing are necessary before the material is put in the soak pits. The sandy Cretaceous clays that occur here are employed to some extent for common brick; they require very little preparation and in some cases are used without any addition of sand. Four of the operators have pallet yards, one employs a combination pallet and open yard, one has a steam tunnel, and one a direct-heat tunnel. The fuel is chiefly wood. The production in 1913 was 59,004,000 brick valued at $331,071. The total available machine capacity is about 387,000 a day. The product is marketed locally and in the New England States.

Erie county. The district around Buffalo made an output of 56,899,000 common brick in 1913, considerably more than in 1912. The soft mud process was used for more than half of the product. The clays are found in shallow beds and the methods of treatment are similar to those employed in the Hudson valley. The market is entirely local.

FRONT BRICK

Front brick include four grades and are made by two different processes. The ordinary red front brick are simply a graded common brick, made by the stiff mud process under practically the same conditions as those obtaining in the manufacture of the common variety. Greater care, however, is exercised in burning, and the product is carefully sorted as to color. The crude materials should be of uniform composition. Buff front brick are made in the same way from clays that burn white or bluff. Richmond county affords the only output of such brick. Rough-faced, tapestry or corduroy brick are made by the producers of paving brick and are burned to vitrification along with the latter materials. This grade occupies from two to six courses at the bottom of the kiln where the temperature does not rise high enough for the thorough vitrification required in paving brick. They are never repressed and the roughened surface is secured by means of a wire placed near the die of the machine so that it drags over the surface of the clay ribbon as this comes from the machine. The dry-pressed front brick constitute the fourth class. All varieties are burned in circular or rectangular down-draft kilns. The total production of front brick in 1913 was 9,355,000 valued at $99,736, a slightly smaller number than was reported for 1912.

COMMON HOLLOW BRICK

The common hollow brick were made by nine producers last year who reported an output of 7,631,000 valued at $44,265. The methods of manufacture are practically the same as those used for hollow building blocks. Clays or shales are employed in a stiff mud machine, the brick being end cut. At one place the bricks are formed with a tile press. There are two forms — headers and stretchers. They are used chiefly for the construction of an inside veneer over common building brick or fireproofing. The demand comes mostly from the larger cities and is supplied in most cases by local plants.

FIREPROOFING

Fireproofing, which has come into such favor among architects and builders during late years, has had in the State of New York a fairly constant growth since 1907. As reported to this office, the product is known under the various names of terra cotta lumber, fireproofing, hollow tile and hollow building block. It includes many different shapes and sizes that are used in the construction of side walls, floors, arches and partitions, but not common hollow brick. This last article is used mostly as a veneer and not in the main construction. The shapes and sizes of the blocks vary, though it is the usual case to make one face with an area of one square foot. The product is sold mainly by the ton, but in small construction work the prices may be quoted by the square foot. The number of air spaces varies from one to nine.

On account of fire protection, comparative great strength, low repair costs, low first cost as compared with the present prices of lumber, and its control of sudden changes in outside temperature, the product has lately been used to a great extent as a material in the construction of private dwellings. Faced with cement, stucco or a veneer of front brick, a building of this material is practically indestructible by fire. For inside purposes, whenever it is necessary to nail woodwork, the blocks are made porous by the addition of sawdust during the process of manufacture. This is the variety usually reported as terra cotta lumber. For foundation work a special block is made with a salt glaze, rock finish face.

The product as manufactured in this State is made by the stiff mud process. Both clays and shales are used, either separately or mixed, depending upon local conditions. While the clays of the Hudson valley are not usually suitable for the manufacture of stiff mud products, there are local beds, especially among the delta deposits, that can be employed for this purpose. Such deposits occur near the mouth of the Mohawk river and are utilized for the manufacture of both fireproofing and common hollow brick. The calcareous clays of the western section of the State are also used, and the shales of the extreme western section are especially adapted. The soft plastic clays are prepared for manufacture by first passing through a disintegrator, which is practically a pug mill, without the addition of water. Coal screenings, sand and grog of crushed burned brick may be added at this point. The mixture then goes to a set of rolls, then to the pug mill, and finally to the machine. The shales are usually pulverized in a dry pan, water is added and the material then passed through a wet pan as a substitute for the pug mill. While the horizontal auger machine is usually used in the manufacture, the tile press is also employed. Drying is carried on in steam, waste heat, or direct heat tunnels and also in a covered pallet yard. The product is burned in round down-draft kilns using bituminous coal. Burning requires about five days. The finished product goes mostly to outside markets and generally on contract. There were seven firms actively engaged in the manufacture of fireproofing during 1913 in this State. The production of fireproofing, exclusive of common hollow brick, in the last four years has been as follows: 1910, $256,820; 1911, $229,627; 1912, $230,833; 1913, $276,053.

TERRA COTTA

Terra cotta is manufactured in this State to a large extent, although all the materials except some of the clays used in the glazes are brought in from outside sources. At one time the Staten Island clays were employed in a local plant. The value of the yearly outturn has recently exceeded $1,000,000, having been $1,113,322 in 1913 and $1,139,291 in 1912.

DRAIN TILE

The production of drain tile in New York State is carried on by thirteen firms who operate on a small scale. The output barely suffices to supply local markets. It is made mostly from soft plastic clays by a stiff mud process under the same conditions as those described for hollow brick and fireproofing. The output in 1913 has a value of $134,199.

POTTERY

Pottery stands second in the list of clay products in importance, and the industry has shown a steady growth. The crude materials for the finer grades are mainly imported from abroad or from other States, although the red earthenware products contain local clays. The following table gives the values of the different pottery materials as reported by the individual producers. The value assigned in the porcelain electric supplies includes also the value of the metal fixtures which amounts in the average to about 30 per cent of the whole.

Value of production of pottery

WARE	1911	1912	1913
Stoneware	$39 095	$46 024	$37 077
Red earthenware	32 495	29 697	35 790
Porcelain and semiporcelain	1 048 872	1 038 428	1 143 835
Electric and sanitary supplies	1 026 517	1 727 553	2 100 985
Miscellaneous	49 075	35 060	49 500
Total	$2 196 054	$2 876 762	$3 367 187

THE MANUFACTURE OF PAVING BRICK IN NEW YORK STATE

With the activity in State, county and municipal road construction, there has developed an insistent demand for a paving material that will stand the hard usage of modern traffic. Various methods of construction have been tried on the highways, and it may be said that the test of experience is favorable to the use of vitrified paving brick whenever the traffic is sufficient to warrant the high first cost of the material. When properly laid, paving brick give good satisfaction as to durability, appearance and low repair cost. Their use in this country does not date back much further than 30 or 40 years, but they have steadily gained in popularity and no doubt are destined to play a much more important part in future road construction than in the past.

The manufacture of paving brick requires first of all a clay that can be vitrified without difficulty and when so treated possess great hardness and toughness. Experimentation has demonstrated that the consolidated clays known as shales yield the best results in these respects, and consequently such clays are almost universally employed, although in certain cases the admixture of other clays may be needed to impart all the desired qualities to the product.

In its shale formations New York State has an inexhaustible and widely distributed resource which may be made the basis of an industry large enough to supply all the local requirements in paving material of the best quality. The value of the resource has been recognized by private enterprise, and for the last twenty-six years paving brick has been manufactured on an increasingly large scale, with a production last year of 35,666,000 having a value of $576,970. The local product comes in competition with that made in Pennsylvania, Ohio, Michigan and other states, and the test of experience generally appears to justify the opinion that the brick made in the New York plants compare favorably with the best in the market.

Practically the whole of the southern half of the State, between the meridian of Buffalo and Albany and the Pennsylvania state line, is underlain by formations that include shale among the more important members. Not all of these, however, are adapted to paving brick manufacture, since the requirements in this case are much more restricted than in most branches of the clay-working industry. It may be said that the shales best suited for this purpose are found in the higher or more southerly formations which are generally recognized under the names of the Hamilton, Portage and Chemung groups. All these are distributed in belts that extend east and west across the central and lower tiers of counties. There are a great number of sites where the shales outcrop in force and appear to be adaptable to the purpose in view, but it would require detailed investigations in the field and some experimentation to determine just what localities offer the best advantages. The chemical analyses of clays and shales give comparatively little information as to their working qualities in the manufacture of paving brick. The following table of analyses is given, however, in an attempt to show something of the composition of the various clays and shales that have been used, are used, or may have some future application in the manufacture of vitrified ware.

Analyses of New York State shales and clays

	1	2	3	4	5	6	7	8
SiO_2	58.44	64.30	44.74	67.29	52.30	68.00	52.70	56.00
Al_2O_3	27.45	33.60	18.70	15.85	18.85	15.00	21.48	22.50
Fe_2O_3			4.25	6.16	6.55	12.00	7.02	6.70
CaO	1.16	1.46	11.25	.95	3.36	.....	3.49	1.20
MgO	2.23	1.30	1.29	.19	4.49	.....	.44	1.40
Na_2O, K_2O	.....	.....	1.20	8.71	6.00	.....	2.27	3.70
SO_3	.....	.....	2.78	.....	.....	.....	.....	.....
CO_2	.....	.....	.....	.....	.....	.....	3.20	.....
H_2O	.....	.....	9.25	.....	.....	.....	7.46	.....

1 Hamilton shale, Portland Point. From U. S. G. S. Bul. 522.
2 Hudson shale; analysis quoted from same report.
3 Clay, Warners. From N. Y. State Mus. Bul. 35.
4 Shale, Hornell. Same reference.
5 Shale, Warners. Same reference.
6 Shale, Cairo. Same reference.
7 Clay, Catskill. From Percival Golden & Son, Catskill.
8 Average of 50 clays and shales used in paving brick, quoted from "Vitrified Paving Brick," 1895.

Success in brick manufacture commercially depends to a great extent upon shipping facilities and the ability to reach the important markets at a low cost. This becomes evident when the bulk of the material is considered in connection with its value. It is also highly essential that the plant be placed near a cheap fuel supply, which in this State means soft coal. For that reason the western counties which are traversed by the railroads leading to the Pennsylvania bituminous fields have certain advantages. The cost of fuel ranks next to the item of labor in the expense of manufacture. Of the total costs, labor probably constitutes from 50 to 60 per cent. Detailed figures are almost impossible to secure in the manufacture of paving brick. The actual cost in the local plants is very close to \$10 or \$11 a thousand. The selling prices of paving brick, for a number of years past, have averaged around \$16 a thousand at the plant.

The distribution of plants now active, or recently active, in the industry affords an idea as to the widespread extent of the natural resources. There are ten of these plants, situated at the following localities: one at Binghamton, Broome county; one at Catskill, Greene county; one at Elmira, Chemung county; one at Corning, Steuben county; two at Olean, Cattaraugus county; one at Hornell, Steuben county; one at Jamestown, Chautauqua county; one at

Newfield, Tompkins county; and one at Syracuse, Onondaga county. The first attempt to use the shales of this State was in 1888 when the Elmira Shale Brick Co., at Elmira, began the manufacture of brick. Some of the undeveloped but still promising sites are found in the central section of the State, such as along the shores of Cayuga lake, north of Ithaca, and in the vicinity of some of the other Finger lakes, where the shales are so situated that they can be readily investigated and cheaply worked, and also in Erie county, a section that is well supplied with cheap fuel, has both water and rail transportation and is close to the important markets.

Methods of manufacture. There are three kinds of material used in the manufacture of paving brick: fire clays, soft plastic clays, and shales. The fire clays generally give a product of light brown or yellow color, the plastic clays and shales a dark brown or red color. The industry in this State makes use only of the soft plastic clays and shales.

The crude materials are mined chiefly with the pick and shovel, though several companies are using steam shovels for loading. In most cases the plant has been placed fairly close to the open cut so that the material can be sent to the crushers by gravity without the necessity of a long haul. In two plants, however, there are hauls respectively of one and ten miles by rail. Hand sorting has to be resorted to at several localities in order to remove the thin layers of coarse-grained sandstone and limestone.

In nearly all cases the material receives a preliminary crushing in jaw or gyratory crushers before it is sent to the dry pan. It is reduced in the dry pan to a size that will pass a 3-16 inch mesh, then screened and the oversize returned to the pan for further grinding. The pulverized material then goes to the storage bins. The dry pan consists of a revolving slotted or perforated iron plate having a rim about one foot in height around the side. Two heavy iron mullers resting on edge, revolving by friction against the bottom plate, crush the material.

From the storage bins the pulverized material goes to the pug mill where the necessary water is added to form a stiff mud. The pug mill consists of a semicylindrical, horizontal trough of metal through the center of which revolves a shaft, furnished with steel arms, so set as to mix thoroughly the dry material and water and to feed it continually forward to the brick machine.

The brick machine, generally known as the auger machine, consists of a heavy tapering steel barrel set directly under the pug mill or combined with the pug mill on a single base. The material from the pug mill is forced by the auger under great pressure through this tapering barrel and issues from a die at the end in a solid column, the size depending upon the method to be used in cutting. With side-cut bricks the column has a cross-section of about 4½ by 10 inches, and with end-cut bricks 4 by 4½ inches. The column of stiff mud is forced along over a cutting table where it is cut by means of piano wire into bricks of such dimensions that, allowing for repressing, drying and burning, will produce a finished product of a standard size. Twelve bricks are usually made at one cut. From the cutting table the product is taken by a continuous belt either to the represses or direct to the double-deck cars preparatory to drying. Lugs are a necessity on paving bricks and are either formed by the process of repressing or at the time of cutting.

The product now goes to the drying tunnels where a temperature sufficient to dry the bricks in about 24 hours is secured either by the use of steam, waste heat from the kilns, or by direct heat. The bricks lose in moisture about 20 per cent of their original weight in the process of drying. The cars have a capacity of from 450 to 500 bricks and traverse a distance of about 100 feet between the time of entering and leaving the drying tunnels.

Burning, which is probably the most important branch of the industry, is carried on in down-draft or in continuous kilns, using bituminous or anthracite coal with or without a forced draft. Kilns and methods of burning vary. The kiln in most common use, known as the rectangular down-draft kiln, has inside dimensions of about 80 feet in length by 18 feet in width and 12½ feet in height with ten or more fireplaces on each side. The fireplaces are built in such a manner that the heat reaches the top of the kiln first, passes down through the green brick, then through the floor and by a system of flues to the stack. The proper burn is recognized almost entirely by the settle of the brick. Kilns are set about 27 bricks high, the bricks separated from each other by a thin layer of sea sand, and burned from 10 to 12 days until the material settles from 12 to 15 inches. On account of the difference in kiln temperature between the top and bottom it is the usual custom to set the first two to six layers with either common, side-walk, or rough-faced front brick that do not require so high a temperature to burn as do the paving brick.

A circular down-draft kiln is also used in the burning of paving brick. The kiln, in this case, has an inside diameter of from 20 to 30 feet and a height of about 14 feet, and is usually furnished with eight fireplaces having individual stacks or all drawing to one stack.

It would seem from experience that the circular down-draft kiln has some advantages in temperature regulation. The continuous kiln in use for the burning of paving brick, in this State at present, is of the Haight type. This consists in form of two rectangular kilns placed in parallel position and connected at both ends by a semicircular extension of the same cross-section. The kiln is divided into fifty-five chambers and after the original fire is started it is a continuous operation of setting, burning, cooling, and emptying. This kiln is top fired, using bituminous coal, the fire being controlled and regulated by dampers. The waste heat, in cooling, is carried over to a forward chamber and assists in drying. As soon as a compartment is burned, the fire is transferred ahead to the next and the first begins to cool. In this manner, the fire is carried completely around the kiln.

With one exception, railroad transportation is the only method available for the shipment of the finished product to the markets. The local brick are sold in New York, New England and the Southern States.

The figures in the following table show the annual production of vitrified brick in New York State from 1897 to date. The figures for 1897 and 1898 are taken from the "Mineral Industry," those for 1899 to 1903 inclusive from the "Mineral Resources of the United States," and those from 1904 to date from the publications of the New York State Museum.

YEAR	QUANTITY	VALUE	VALUE PER M	NUMBER OF PLANTS
1897	19 849 000	$209 124	$10 53	....
1898	18 233 000	177 968	9 75	....
1899	32 233 000	342 845	10 60	....
1900	29 943 000	347 671	11 61	....
1901	29 950 000	342 342	11 46	....
1902	27 009 000	322 250	11 93	....
1903	16 797 000	220 296	13 11	....
1904	16 351 000	210 707	12 88	8
1905	13 984 000	180 004	12 87	6
1906	11 472 000	178 011	15 51	5
1907	12 296 000	184 306	14 98	4
1908	14 570 000	211 289	14 50	5
1909	12 278 000	207 970	16 27	3
1910	19 762 000	333 511	16 88	4
1911	23 993 000	388 479	16 19	4
1912	18 249 000	382 984	15 78	5
1913	35 666 000	576 970	16 17	6

Foster Paving Block Co., Binghamton. This plant began to operate in May 1913, under the name of the Binghamton Paving Block Co. The plant, which is situated about 2 miles north of Binghamton, on the line of the Delaware & Hudson railroad is of the most modern construction. The shale in use is the blue and brown variety from the Chemung formation, which alternates with thin beds of blue sandstone. There is a little surface clay which is taken as it comes with the shale, no attempt being made to separate the two materials. The equipment consists of two dry pans, one high-speed machine, waste heat dryer and six rectangular down-draft kilns. It is the intention of the company to increase the number of kilns to twelve. The products consist of wire-cut lug paving block, common vitrified brick and rough-faced brick. When completed, the plant will have an estimated daily output of 75,000 brick.

Tidewater Paving Brick Co., Catskill. This plant, situated so as to have only water transportation, secures its supply of red Chemung shale at Cairo, a distance of 10 miles from the village of Catskill. Transportation is by means of a narrow gauge steam road. The supply of soft plastic clay, which is a necessary addition to this shale, is brought from a distance of about a mile. The product consists of repressed paving brick, common vitrified and rough-faced brick. The shale is pulverized in dry pans and stored in bins until ready for the machine. Two machines are in use, one for paving brick and the other for common and rough-faced brick. Steam tunnels are used in drying and the product is burned in rectangular down-draft kilns. The Haight type continuous kiln, formerly in use, has been dismantled as the haul from the machine was too long for the economical production of paving brick. Anthracite coal, pea size, is used with a steam forced draft in burning.

Elmira Shale Brick Co., Elmira. This plant is not operating and has been dismantled of machinery used in the manufacture of paving brick.

Brick, Terra Cotta and Tile Co., Corning. This company is engaged in the manufacture of terra cotta, paving brick and common vitrified brick. The shale, which is of a bluish color, is obtained about a mile from the plant. Clay is not mixed with the shale. The material is pulverized in dry pans and the green bricks are dried with steam heat or hot air. Burning is accomplished in circular down-draft kilns with bituminous coal. Railroad transportation is the only method available for the finished product.

Sterling Brick Co., Olean. This property, situated in East

Olean, produces a patent lug, wire-cut paving brick. No common or rough-faced brick are made. The shale is transported from the bank to the mill in side dump cars, a distance of about 1500 feet. The entire face of shale, including the small amount of surface clay, is used. From the storage bins the crude material goes to two dry pans, is then screened and the oversize returned for further grinding. The pulverized material is elevated to bins and then goes to the pug mill and machine, of which there is one. The plant is equipped with fourteen tunnels for drying. Soft coal is used for fuel. Two types of kilns are being used, of which six are rectangular and five circular down-draft. The kilns are set twenty-seven high with green brick and settle 12 inches in burning. The daily production from the plant is about 30,000 hard brick.

Allegany Valley Brick Co., Olean. This plant, also situated at East Olean, is so arranged that the crude material goes through the mill to the machine by gravity. Shale is used entirely, except for a small amount of surface clay. Natural gas is used for power. From the pug mill the material goes to two machines, one used for paving brick and the other for common brick. The lower two layers of each kiln are set with common brick. Drying requires about 24 hours, using waste heat. The drying equipment consists of sixteen tunnels holding twenty-eight cars each. There are six rectangular down-draft kilns, using soft coal. The green brick are set twenty-six high and settle 12½ inches with a twelve days' burn. The daily output is about 22,000 repressed paving brick.

Preston Brick, Hornell. This property, which was destroyed by fire several years ago, has not been rebuilt. Shale was used entirely. Dry pans were used for crushing and wet pans for tempering. The plant was equipped for the manufacture of a repressed brick. Drying was accomplished by the use of waste heat and the product was burned in circular down-draft kilns, of which there were six.

Jamestown Shale Brick & Paving Co., Jamestown. This property has been in successful operation for many years and was one of the first to make paving brick in the State on a commercial scale. The brown and green Devonic shale is secured from a large open cut near the plant. A steam shovel is used in loading the material onto cars. The shale is first crushed in a gyratory crusher and then transferred by means of a belt conveyor and elevator to storage bins. From here it goes to four dry pans, then is elevated to bins and thence to the pug mill. The plant is equipped with one high speed machine making both paving brick and common brick. The paving brick are all repressed. Drying is accomplished in steam tunnels having a combined capacity of 400 cars. There are five rectangular down-draft kilns, each having a capacity of 190,000, and one Haight continuous kiln of fifty-five chambers, each chamber having a capacity of 15,000 paving and common brick. Bituminous coal is used as fuel. The green bricks are set twenty-two high with paving and six lower layers in common brick. They settle about 15 inches with a ten or eleven days' burn. The daily output is about 66,000.

F. C. Campbell, Newfield. This plant was situated about a mile north of the village, along the line of the Lehigh Valley R. R. The mixture of clay and shale was ground in dry pans, then screened and formed in an auger machine. All paving bricks were side cut and repressed either by hand or power. Tunnel dryers were used and the material was burned in down-draft and continuous kilns, using coal. The plant has not been in operation for many years.

New York Paving Brick Co., Syracuse. This plant, situated at Geddes, was the only one in this State to make a paving brick entirely from clay. The material was brought from Three River Point on the Oswego. The product was formed in a soft mud machine and a stiff mud plunger machine. In the latter case the material was repressed. The green bricks were dried in tunnels using waste heat and burned in rectangular and circular down-draft kilns. The product was sold mostly in the local markets. At present no paving bricks are being made by this company.

New York State Plant, Elmira. The construction of a paving brick plant to be operated by prison labor is contemplated in an enactment by the last Legislature. A site for the plant has been selected in the vicinity of the State Reformatory at Elmira. The local shales are said to have given satisfactory results when manufactured and burned under working conditions. It is proposed to use the product in the southern tier of counties which are almost devoid of other materials for highway construction of permanent character.

EMERY

The emery business, which is confined to a few small operations near Peekskill, has not been very active in the last year or two. The shipments during 1913 as reported by the companies to whom they were made, amounted to 611 short tons, valued at $7332. In 1912 the shipments were reported as 589 short tons valued at $6749, and in the earlier years were still larger, reaching as high as 1500 tons at one time.

The Peekskill emery is a hard, dense rock of rather variable composition and dark gray to black color. It occurs in small lenses, bands and irregular masses in the area of basic igneous rocks that outcrops south and east of Peekskill. The emery bodies are found mainly in the northern section of the area and apparently near the contact of the igneous, or Cortland, series with the sedimentary schists. They represent without much doubt segregations within the intrusive mass similar to the titaniferous magnetites that occur within the gabbros and anorthosites of the Adirondacks. The surrounding sediments may have been absorbed more or less into the igneous mass on its way to the surface, thereby contributing some of the aluminum which has crystallized out in the form of corundum and spinel. The intrusion took place after the deposition of the Hudson River strata which are made up largely of argillaceous materials.

The emery is a mixture of corundum, spinel and magnetite, with more or less of the silicate minerals that are found in the wall rocks. The proportion of the oxids varies greatly. In some places magnetite constitutes nearly the whole mass and such bodies have been worked in the past for their iron, though not with much success. Spinel (hercynite) is intimately associated with the magnetite, though its presence is seldom to be established without microscopic examination, being in finely divided particles scarcely distinguishable from the latter in the hand specimens. Its occurrence may account for the high aluminum percentages shown in analyses of the magnetites, even in the absence of corundum. The latter is a fluctuating constituent, constituting as much as 50 per cent of the emery in places, but usually considerably less. It appears in the form of thin prismatic crystals which are set off by reason of their light color and their relatively large size from the magnetite and spinel. The mines consist of open cuts on the outcrop of the bodies, occasionally supplemented by a single underground level reached through an adit. They have little permanent equipment, being too small to warrant any considerable outlay for machinery; consequently there is a lack of stability and system to the operations.

The present source of supply is mainly from one or two properties on the northern border of the Cortland area. The Keystone Emery Mills and the Blue Corundum Mining Co. have been the principal shippers of recent years. There are a number of mines in the section north of Dickinson hill and south of the east-west highway leading out of Peekskill, but most have been closed either on account of exhaustion or the unsuitable character of the material. Some of the more extensive workings are on the farms of John Buckbee and Oscar Dalton.

FELDSPAR

The commercial production of feldspar is based on the occurrences of pegmatite that are found within the crystalline formations of the Adirondacks and southeastern New York. Pegmatite is a coarsely textured variety of granite in which the individual minerals — feldspar, quartz and mica — form crystals and masses many times larger than in ordinary granite. It occurs in dikes and bosses intrusive in the country rocks and usually associated with large bodies of granite, of which the dikes are offshoots. Such dikes range from a foot or less to 100 feet thick and are often traceable for long distances along the strike. The bosses appear as rounded or lenticular bodies with diameters of several hundred feet in some instances; most of the workable bodies have the form of bosses rather than the elongated tabular shape characteristic of dikes.

The feldspar found in pegmatites may be one of the potash varieties, that is, either orthoclase or microcline, or one of the soda-lime species such as albite, oligoclase and andesine. Very commonly both potash and soda-lime feldspar are found in the same occurrence. Microcline is by far the most frequent variety of the potash feldspars in the New York localities. It is distinguished from orthoclase by its striated appearance, but does not differ chemically from the latter. The potash varieties are the ones commonly used in pottery, but albite is preferred for some purposes as in glazing of tiles and terra cotta on account of its lower temperature of fusion.

For pottery purposes it is an advantage to have the feldspar in well-segregated crystals so that it can be readily freed from the accompanying minerals. The separation has to be effected by handsorting and cobbing. In the pegmatites which are quarried for pottery spar, the crystals range up to 3 or 4 feet in diameter. The pegmatites of finer texture and those in which the minerals are intimately intergrown have application principally for roofing materials.

Quartz is an important ingredient of all pegmatites and if obtainable in pure condition is also of value. It is an important byproduct, for example, of the Kinkel quarries at Bedford. It occurs in irregular masses, seldom showing any traces of crystal form, and is of gray, white or pink color. When intergrown with the feldspar to any extent it detracts from the value of the latter for pottery use, though quartz has to be added to the pottery mixture.

The other constituents of pegmatite include biotite and muscovite, one or both of which are nearly always present, and also hornblende, pyroxene, garnet, tourmaline, magnetite, pyrite, epidote, titanite and beryl. Black tourmaline is almost invariably in evidence in the Adirondack pegmatites. These constituents may be of determinative importance with reference to the commercial uses of pegmatite, since if disseminated through the body they preclude the extraction of high-grade material.

The feldspar quarries in present operation are situated in Essex and Westchester counties. In the latter county are included the quarries near Bedford which are the principal producers of ground spar for pottery, enamel and glass manufacture. They are operated by P. H. Kinkel & Son and the Bedford Feldspar Co. The former company produces also a large amount of quartz which is shipped to Bridgeport for manufacture into wood filler.

The quarries in Essex county which are situated at Ticonderoga and Crown Point produce unsorted pegmatite which is used for roofing material. The Barrett Manufacturing Co. and the Crown Point Spar Co. are the operators.

The output of feldspar of late years has ranged from 10,000 to 15,000 tons annually, but in the last two years has shown a considerable advance through the increased shipments of ground spar. In 1912 the product amounted to 24,584 short tons valued at $106,419, by far the largest that had been recorded in the State. In 1913 the production fell off about 25 per cent and amounted to 19,680 tons with a value of $99,765. The prices recorded for the product depend upon the quality of the material and the state of preparation. The best selected crude spar brings from $4.50 to $5 a ton. Ground spar for enamel and glass manufacture is worth $6 to $8 and ground pottery material $8 to $10 a ton. The unsorted crushed pegmatite sells for about $3 a ton.

GARNET

The production of garnet for abrasive uses represents a specialized and rather limited branch of the mining industry. Garnet has certain physical qualities which make it an ideal abrasive for some classes of work, notably in leather manufacture, and there is little likelihood that it will be displaced in the trade by other abrasive materials. But the market is not capable of absorbing more than a few thousand tons a year, at least on the present basis of prices. The production in New York State for many years has ranged between 4000 and 5000 short tons, the largest recent output having been in 1907 when it amounted to 5709 short tons, and the average selling prices have remained steady at around $30 to $32 a ton for the standard grades of crystallized garnet.

The important qualities of abrasive garnet seem to be those of hardness, toughness and cleavage. In hardness, the different garnet species vary considerably, and most of the garnet that is mined for abrasive uses is almandite (iron-alumina garnet) which has a hardness of 7—7.5 on the mineral scale, or between that of quartz and topaz. Well-crystallized material which is relatively free of impurities has greater strength and stands up better under conditions of service than the finely granular mineral or that containing inclusions of other minerals. The common impurities of garnet are chlorite, mica, hornblende and pyroxene. It is an advantage, also, if the garnet possesses a parting or imperfect cleavage so that it breaks with one or more plane surfaces. Much of the Adirondack garnet shows a well-developed parting, and the faces often present a sharp chisel-edge that is not usual in any other natural abrasive. Color, of course, is not a criterion of value, but abrasive manufacturers express a preference for the darker shades which in the crushed product appear almost a ruby red. The garnet crystals should also be sufficiently large so that when they are freed from their matrix by crushing or other means, they will afford a desirable assortment of sizes. The normal result of milling operations is to produce an excess of the finer sizes.

Notwithstanding the wide distribution of garnet as a common component of the metamorphic rocks, especially the gneisses and schists, there appear to be few localities where the material has the essential qualities and occurs in sufficient quantity to be commercially valuable. In this country the most productive deposits are found in the Adirondacks. North Carolina and New Hampshire have supplied small quantities in recent years, and there are mines, now inactive, in Maine, Massachusetts, Connecticut and Pennsylvania. A description of the local deposits and the methods employed in their exploitation will be found in earlier issues of this report.

For the last four or five years the domestic supply of the mineral has been supplemented by imports amounting to a few hundred tons annually of Spanish garnet. This garnet is said to be of placer origin and is obtained by washing the sands of certain streams in the province of Almeria. According to the American counsel at Madrid (Daily Consular and Trade Reports, March 13, 1914) there were three producers of such garnet in 1911, and their output amounted to 600 tons. As nearly all the output comes to the United States, it is evident that the application of garnet for abrasive uses is not generally recognized in the European countries and, so far as known, no other garnet-mining industry has been established. The Spanish garnet is too fine in size to be a rival of the American product. The present value of the product is stated to be $7.75 a ton at the mines and the expense of shipment to the seaboard $6.65 a ton, so that it can be laid down in this country at $20 a ton.

The output of garnet in 1913 was of the usual proportions. The Adirondack mines contributed the greater part as heretofore, their production having been 4665 short tons with a value of $145,445. There were three active mines, including those of the North River Garnet Co., H. H. Barton & Sons Co., and the Warren County Garnet Mills, all situated in the vicinity of North Creek, Warren county.

Reports from the collector of customs at Boston, New York and New Orleans show that a total of 547 short tons of abrasive garnet with a value of $8078 was imported in 1913. The imports for 1912 were 548 tons valued at $9271. The exports from Almeria are stated by the consular agent to have been 1239 tons, which seems to indicate that the garnet is now finding a market elsewhere than in the United States.

GYPSUM

There was a further advance in the gypsum production last year, thus continuing the record of almost uninterrupted growth which has marked the recent course of the industry. The main developments of late have been in the western section of the gypsum district where the output is used largely by local plants for the manufacture of plaster of paris and various products of which that is the basis. The use of gypsum plasters has grown tremendously in the last decade or so and seems likely to continue to expand in the future with the increasing application of improved methods of building construction.

The tabulation of statistics of the industry is attended with some difficulty, owing to the various stages of preparation which the gypsum undergoes before entering the market. Some companies sell the lump rock just as it comes from the mines, in which case the material is crushed, ground or further treated by other companies before it is consumed. The mines or quarries in Onondaga county supply lump rock which is ground for agricultural plaster in local mills, or which is shipped to other points for manufacture. One quarry in that county furnishes rock for a local portland cement plant. In the western district some of the rock is shipped in crushed condition to portland cement manufacturers, but the larger portion is calcined at the mines and either sold as stucco or is further manufactured into various materials like wall plaster, finishing plaster, plaster board and hollow partition blocks.

The statistics for the present report show the production of crude rock and some of the first-hand products. The output of lump gypsum is the fundamental factor, of course, in estimating the mining activity. The first-hand products include lump and crushed gypsum sold by the mines for use in portland cement, or for manufacture into plaster of paris by plants outside the district. The greater part, as given under the second item of the table, represents the gypsum sold to portland cement plants. There is also a small quantity of gypsum sold in finely ground form for use in agriculture and known as land plaster. The third class of products that is reported by the mining companies includes stucco and prepared wall plasters, but it does not embrace any materials of further manufacture like board or blocks.

The conditions in the industry last year were fairly prosperous, considering the general state of business which on the whole was rather quiet. The sales to portland cement plants were slightly larger than in the preceding years, and were made at somewhat higher prices. The prices received for crushed gypsum have ruled very low owing to competition, some of the product having been sold as low as $1.30 a ton at the mines which can hardly yield a fair profit to the companies. An increase in the production of calcined plasters reflected a good demand for the various structural materials of gypsum, although the building trade generally was not very active. An increasing proportion of the product is being used by the producing companies in the manufacture of plaster board and partition blocks.

Production of gypsum

MATERIAL	1912		1913	
	SHORT TONS	VALUE	SHORT TONS	VALUE
Total output, crude..........	506 274	....	532 884	....
Sold crude..................	178 499	$240 784	183 579	$265 879
Ground for land plaster......	8 213	17 779	8 521	17 807
Wall plaster, etc. made.......	267 889	928 282	306 206	1 022 457
Total..................	....	$1 186 845	....	$1 306 143

The production of 532,884 short tons of rock gypsum, reported by the mines and quarries for 1913, was the largest on record. In 1912 the output was 506,274 tons and in 1911, 446,794 tons. Up to the year 1900 the average annual output was less than 50,000 tons, and the output in the entire country previous to that time did not reach the quantity reported by the New York mines for last year.

Few changes occurred in the list of active mining companies in 1913. The number of mines and quarries under operation was nine as compared with ten in the preceding year. In Onondaga county the Fayetteville Gypsum Co., which formerly worked the Severance quarry, discontinued production; the Akron Gypsum Co., of Akron, Erie county, also went out of business. The property of this company has been taken over by the Akron Gypsum Products Corporation of Buffalo, and the mines and mill will probably resume activity during the current season. At Union Springs, Cayuga county, the quarries were operated by the Cayuga Gypsum Co., for the supply of rock to the portland cement trade, and mainly to the plant of the Cayuga Portland Cement Co., at Portland Point, to which the rock is shipped by rail. The mill of the Consolidated Wheatland Plaster Co. near Mumford, was destroyed by fire in the spring of 1913.

No further progress has been made with the construction of the calcining plant at Mumford undertaken by the Delac Gypsum Products Co., as mentioned in the report for 1912. The company had secured options on gypsum lands north of Mumford which it had prospected with the diamond drill.

The search for new deposits has been carried on recently in the section west of Akron. It is reported that a test hole located near the limestone quarries, just southwest of the village, encountered only a thin bed, too small to be workable. A hole put down on the farm of W. K. Flint, 2 miles southwest of Akron and near the crossing of the West Shore and New York Central (Batavia branch) railroads, encountered the following strata:

	Feet	Inche
Soil and earth	25	......
Broken limestone	20	......
Shale, water-soaked	2	6
Broken limestone	14	6
Water seam	1	....
Limestone (flinty)	7	....
Light brown limestone	7	....
Blue shale and gypsum	5	....
Hard " ashes " (shaly gypsum)	4	....
Rock	2	....
Soft " ashes "	....	6
White gypsum	3	6

The results of mining and exploration in the gypsum belt have tended to confirm the view that the deposits are in general lenticular and that the workable bodies are separated into more or less distinct areas.[1] Between such areas in which the gypsum attains a thickness of 4 feet and upward may intervene considerable stretches in which the beds are very thin or else so interleaved with shale that they have no commercial value. In some parts of the belt two or more workable seams occur, separated by shale.

So far the surficial portion of the gypsum belt alone has been explored and that in a very incomplete way. There are still possibilities of uncovering profitable rock in the unexplored sections lying between the developed areas. In the western sections where the gypsum is rarely more than 5 or 6 feet thick it is seldom found exposed at the surface. This is ascribable to the fact that the gypsum weathers very rapidly, much more quickly than the overlying limestones, and it has been largely removed near the surface. As a rule, the full thickness of the gypsum bed does not appear until it is covered by 40 or 50 feet of rock, which with the average rate of inclination means a mile back from the projected line of outcrop. Consequently, the lack of gypsum at the surface is no indication that beds may not be found further south under cover.

Under the conditions the work of prospecting has to be carried on entirely by drilling. A core drill, armed with either diamonds or hardened steel shot, is employed so as to secure accurate records of the rocks penetrated and samples of the gypsum for testing. The results obtained with a churn drill have little value beyond proving the possible presence of gypsum.

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[1] For details of the distribution of the gypsum deposits, see N. Y. State Museum Bul. 143.

IRON ORE

The local iron mines made a good record in 1913. The showing in fact was better than might have been expected from the conditions of the ore markets. The inquiry for ores was not so active as in some of the preceding years and developed a declining tendency with the season's advance. Prices, in comparison with the earlier level, were low.

The actual product of furnace ores was 1,217,899 long tons. This represented a good gain over the total reported for 1912 and has not been exceeded in the recent records. The value of the output was $3,870,841, as compared with $3,349,095 in 1912.

The magnetite mines produced 1,097,208 long tons with a value of $3,635,670 and the hematite mines 120,691 tons with a value of $235,171. The hematite all came from the Clinton belt. There were no shipments from the mines near Antwerp, nor of limonite and carbonate from southeastern New York.

Production of iron ore in New York State

YEAR	MAGNETITE Long tons	HEMATITE Long tons	LIMONITE Long tons	CARBONATE Long tons	TOTAL Long tons	TOTAL VALUE	VALUE A TON
1893	440 693	15 890	35 592	41 947	534 122	$1 222 934	$2 29
1894	....	......	......	......	242 759	....	....
1895	260 139	6 769	26 462	13 886	307 256	598 313	1 95
1896	346 015	10 789	12 288	16 385	385 477	780 932	2 03
1897	296 722	7 664	20 059	11 280	335 725	642 838	1 91
1898	155 551	6 400	14 000	4 000	179 951	350 999	1 95
1899	344 159	45 503	31 975	22 153	443 790	1 241 985	2 80
1900	345 714	44 467	44 891	6 413	441 485	1 103 817	2 50
1901	329 467	66 389	23 362	1 000	420 218	1 006 231	2 39
1902	451 570	91 075	12 676	Nil	555 321	1 362 987	2 45
1903	451 481	83 820	5 159	Nil	540 460	1 209 899	2 24
1904	559 575	54 128	5 000	Nil	619 103	1 328 894	2 15
1905	739 736	79 313	8 000	Nil	827 049	2 576 123	3 11
1906	717 365	187 002	1 000	Nil	905 367	3 393 609	3 75
1907	853 579	164 434	Nil	Nil	1 018 013	3 750 493	3 68
1908	663 648	33 825	Nil	Nil	697 473	2 098 247	3 01
1909	934 274	56 734	Nil	Nil	991 008	3 179 358	3 21
1910	1 075 026	79 206	4 835	Nil	1 159 067	3 906 478	3 37
1911	909 359	38 005	5 000	Nil	952 364	3 184 057	3 34
1912	954 320	103 382	Nil	Nil	1 057 702	3 349 095	3 17
1913	1 097 208	120 691	Nil	Nil	1 217 899	3 870 841	3 18

The actual tonnage hoisted at the mines was considerably larger than the quantity of furnace ore reported, since much of the product from the Adirondack magnetite mines undergoes concentration before shipment. A ton of concentrates which has an average tenor of 65 per cent iron represents from a little over one to three tons of crude ore, according to the character of the deposit. The reports for 1913 show that the total quantity of magnetite hoisted was 1,485,501 long tons, or 52 per cent more than the production of furnace ore. The total tonnage of ore of all kinds hoisted was 1,606,196, as compared with 1,430,998 in 1912.

The list of mining companies that were active during the year included for the Adirondack region: Witherbee, Sherman & Co., and Port Henry Iron Ore Co., Mineville; Cheever Iron Ore Co., Port Henry; Chateaugay Ore & Iron Co., Lyon Mountain; Benson Mines Co., Benson Mines. In southeastern New York the producers were Hudson Iron Co., Fort Montgomery, and the Sterling Iron & Railway Co., Lakeville. The output of hematite was made by C. H. Borst, Clinton; Furnaceville Iron Co., Ontario Center; and Ontario Iron Co., Ontario Center.

Mineville. The Mineville properties made a large output, although operations were reduced for a time by labor troubles. The quantity of ore raised by the two companies was 906,399 long tons, nearly the maximum record, but the average grade was somewhat lower than in earlier years, as an increased proportion came from the deposits of concentrating ore. The active mines included the Joker-Bonanza, Harmony, Barton Hill and Smith groups of Witherbee, Sherman & Co., and 21, Clonan and Welch shafts of the Port Henry Iron Ore Co.

The development of the Sherman mine, on the northern end of the ore zone as at present defined, was started by Witherbee, Sherman & Co., during the year. This mine and the Hall mine nearby were discovered many years ago, but have not been actively worked, as they are somewhat remote from the main group. The ore occurrence, however, is very similar to that of the more southerly deposits.

Work in the Joker-Bonanza property has been centered mainly upon the sheetlike deposit underlying the Old Bed proper. The two shafts have been carried down to the lower zone, but the output is mainly hoisted through the Joker. Exploration with the diamond drill has disclosed the existence of magnetite in undeveloped ground on the borders of the main bodies, but its relation to the latter and economic importance are as yet undetermined.

The Barton Hill mines have furnished a large output of concentrating ore, running from 30 to 35 per cent iron. The output is treated in a separate mill which was placed in operation in the fall of 1912. The mill concentrates are of Bessemer grade, carrying about .025 phosphorus with 65 per cent iron. About 1000 tons crude ore are handled each day in this mill alone which is the latest of the Mineville concentrating plants and which marks an advance in arrangement and equipment over its prototypes. A full description of the mill has been given by J. S. Pellett in the Engineering and Mining Journal.[1]

Lake Sanford. A furnace test of the titaniferous magnetites which occur in this part of Essex county is planned for the current season by the MacIntyre Iron Co. The ore for the test will be shipped to the Cedar Point furnace at Port Henry. The trial will be made with regular working charges and continued sufficiently long to demonstrate the behavior of the material under conditions of commercial practice. A small mill has been erected at the mines and about 15,000 tons of ore were taken out last year for treatment. The main difficulty that has confronted the owners in their experimental work is the remote situation of the property which necessitates a long and expensive haulage of all materials to or from the nearest railroad point.

Lyon Mountain. It is probable that the output of the mines at Lyon Mountain will soon be considerably enlarged. The Chateaugay Ore & Iron Co. has decided upon undertaking certain improvements which will lead to the introduction of a new system of underground work and provide an increased hoisting capacity. The principal feature of the new plans is an inclined shaft which it is intended will serve as the main opening for future mining and development and will take the place of the several inclines in use heretofore. The new shaft will be concrete lined and have four compartments, of which three will be for hoisting and one for an air and manway. It will be put down in the footwall 20 feet or more below the vein. From the shaft, access to the ore will be had through cross-cuts and levels established at every 300 feet. Instead of the room and pillar system now used, a method of shrinkage stopping will be employed. The ore will be loaded by gravity into mine cars and electrically hauled to the shaft bins. Reaching the surface in skips, the ore will be first crushed down to 1.5 inches at the shaft by passing through crushers and rolls and then taken

[1] March 14, 1914.

to the mill. The reduction at the shaft house will enable the mill to handle half as much ore again as it now treats. The improvements will provide an ultimate hoisting capacity of over 3000 tons a day, but this can not be fully utilized until additional milling capacity is provided. The ore bodies at Lyon Mountain are among the largest in the State and are notable for their low content in phosphorus and sulphur. They are lean, carrying only 30 to 35 per cent iron, but there has always been an active demand for the concentrates which command prices above those paid for ordinary ores.

Cheever mine. This mine has continued in successful operation, making an average of 500 tons of concentrating ore a day, taken in part from the old slopes, but mainly from new ground developed by the present management.

Croton mine. Construction work was begun in 1912 with a view to reopening the Croton mine and to its operation on a large scale. The plans for the new enterprise, as drawn up by the Croton Magnetic Iron Mines, call for a concentrating plant that will handle 1500 tons crude ore a day, with an outturn, it is expected, of about 500 tons concentrates. The mill is designed for the use of the Gröndal wet process, supplemented by sintering to reduce the sulphur content. Experiments with the ore are reported to have indicated that concentrates averaging 64 per cent iron can be made by crushing to 20 mesh; the sulphur content of the sintered product is .3 per cent and the phosphorus .03 per cent, well within the Bessemer limit. The foundations of the mill were completed within the year. If the original plans are carried out this will be the first plant of its kind in the State, and should afford some interesting material for comparison with the magnetic concentrating plants of the Adirondacks which are all based on dry methods.

The Croton mine is opened on a large body of low-grade magnetite which is a part of an ore zone that extends some 5 miles in a southwest direction from the village of Brewster. The mine is about in the middle of the zone, while the Brewster mine lies at the north and a third mine is near the south end and one-half mile west of Croton Falls. Work has been carried on at different times, the last period of previous activity beginning in 1899 and continuing for a few years. Magnetic concentration was practised in the later operations, but the sulphurous nature of the ore, and particularly the presence of pyrrhotite, presented difficulties that could not then be readily overcome. The magnetite body has been tested for a length of 2500 feet and is opened by a tunnel 1400 feet at an average depth of 135 feet from the surface. The ore is not sharply defined from the wall rock in most places, but shades over into it through a gradual decrease in magnetite having the same nonmetallic constituents. The width to which the workings are carried ranges from 50 or 60 feet to 100 feet or a little more. In its general features the ore body resembles some of the Adirondack deposits, and this resemblance is heightened by the fact that the immediate walls as well as the gangue matter are constituted of syenitic gneiss which has very similar characters to the syenitic ore-bearing gneisses of the Adirondacks.

Forest of Dean. This mine is in the Highlands of Orange county and was active throughout the year except for a temporary shutdown in the fall. Under the present management, that of the Hudson Iron Co., who took over the property in 1905, the operations have been extended and the ore shipments increased until for the last four years they have been at the highest rate in the history of the property. There is no apparent diminution in the size of the ore body as the workings have been deepened, so that the prospects for the future seem as good as at any time in the past. The workings are 3000 feet long on the trend or pitch of the deposit and give an almost complete cross-section throughout the distance; few magnetite bodies are so well exposed for the study of their physical features and underground geology.

The Forest of Dean has had a long history. According to the early records of Orange county, mining on the deposit began about 1756 and it was one of the sources of iron ore supply during the Revolutionary War. It thus ranks with the Sterling mines, also in Orange county, as among the oldest iron ore properties in the county that are still in operation. In the early period of activity production must have been small. Mather in his report on the "Geology of the First Geological District" of 1842 states that excavations had been made over a breadth of about 150 feet, which from the context seems to mean that the body had been worked as an open cut for that distance along the strike. The output up to that time is estimated by Mather to have been not less than 40,000 tons. From 1865 to 1894 the mine was owned and operated by the Forest of Dean Iron Ore Co., and the output in that period was something over 500,000 tons. The production has acquired more importance in the recent period of operations.

In form the deposit is a long shoot, with its principal axis following the northeasterly trend of the country rocks but inclined downward at an angle of 19°. The inclination or pitch holds very uniform throughout the entire distance, although the shaft which generally follows the bottom of the ore has a slightly steeper pitch at the start. In cross-section it is heart-shaped, having two lobes which converge below and are separated above by a horse of granite. On the outcrop the deposit appeared to be a double vein, as shown in a section included in Mather's report already mentioned. The lobes are somewhat unequally developed, the southerly one being the higher. The whole mass has a steep dip toward the southeast conformity with the lamination of the country gneiss. In structure the deposit may be compared to a narrow synclinal fold slightly overturned, the wings of which terminate abruptly a short distance above the arch. That the body has actually been folded, however, is not at all certain from any evidences so far presented; the relation of the ore to the country gneisses is also in doubt.

The gneiss is a laminated biotite-feldspar-quartz rock which shows banding in lighter and darker layers. It belongs to a very common type of the gneissic rocks exposed in the Precambric belt of southeastern New York and northern New Jersey. Its derivation is not known, as in fact the Precambric rocks of this section of the State have been studied only in a preliminary way. The banding which seems at first suggestive of sedimentary affinities, on closer study is seen to be due in part to the injection of lighter granitic material along the planes of lamination. In the vicinity of the ore body the gneiss has been so permeated with granitic material that the latter predominates over the gneiss itself. The horse of granite which apparently follows the ore all the way from the surface is a solid mass of this intrusive of a somewhat coarser type than the average. It is composed of pink and green feldspars and quartz, with magnetite as the only dark mineral of importance. The granite is also seen in places along the two walls and occasional stringers and bodies of it are found within the ore itself. The deposit has been a locus of igneous activity, a feature that has been noted by the writer to be frequent in many of the other deposits of Orange county. Its significance with respect to the origin of the ore body in question can not now be stated, if there is indeed any connection between the intrusive and the formation of the deposit. The possibility that the magnetite has been introduced in its present place as a result of igneous action, however, may be considered as an alternative to the sedimentary theory of origin until more definite knowledge on the subject is obtained.

Some interesting trap dikes occur in the mine. They cut all the rocks including the magnetite and have been described by Professor Kemp as belonging to the camptonite class. A rather curious feature observed in some of these is the presence of calcite distributed through the mass in small rhombohedra; this mineral occurs also in some of the ore. The largest dike is about 6 feet thick and crosses the ore body diagonally.

The ore from the Forest of Dean mine is medium grained, inclining to a shotlike texture, and unlike most of the magnetites in this part of Orange county is quite free of admixture with silicate minerals. It requires only rough sorting to prepare it for the furnace; the waste is nearly all granite. The sorted ore carries 60 per cent or a little more, of iron.

MICA

The production of mica has never attained the basis of a settled industry in this State, although small quantities are extracted from time to time in an experimental way or as a secondary product in the mining of other minerals. The occurrences illustrate the general types of deposits which have commercial importance elsewhere as sources of mica and are distributed over the two great crystalline rock areas of the Adirondacks and the southeastern Highlands, being found in Orange, Putnam and Westchester counties in the Highlands, and in Saratoga, Essex, St Lawrence, Jefferson, Herkimer and other countries in the northern area. It is the purpose of the present article to give some particulars regarding the character and economic features of the deposits which hitherto have received little more than casual attention.

Mica is a general term for a group of minerals, of which three varieties find commercial use. These include muscovite, biotite and phlogopite. Muscovite is often called white mica, in allusion to its transparent quality, but it is not necessarily light or highly transparent, though the best commercial kinds are thus characterized. Some muscovite from the Adirondack pegmatites has a smoky gray color, nearly as dark as some examples of biotite. Chemically it contains potassium and sodium as basic elements, and is therefore an alkali variety. Biotite, as a rule, has a dark brown to nearly black color, but occasionally is sufficiently light to be transparent in thin sheets. Iron is present in considerable amounts and with the dark color renders it unsuitable for many purposes. Phlogopite is a magnesium variety, containing no iron, but less transparent usually than the best muscovite. Its color is amber or yellow, sometimes red or of a greenish tinge. It is employed for the same purposes as muscovite, but seems to be even preferred to the latter in electrical work. The distinction of the different varieties of mica when not apparent from outward appearance requires the use of a polarizing microscope, supplemented possibly by chemical tests to determine the nature of the basic elements.

Muscovite and biotite are allied in their occurrence, both being important ingredients of the crystalline silicate rocks such as granite, and many gneisses and schists. Typical granite contains both varieties. The commercial sources of the two minerals, however, are limited to pegmatites, those modifications of granite in which the minerals are coarsely crystallized and irregularly distributed. Pegmatite is found in rather limited bodies, usually in dikes or lenses, which have intrusive relations with the country formations, more rarely as irregular masses within normal granites. The dikes or lenses range from very small examples, a few inches or a foot or two thick, up to bodies several hundred feet in diameter and of much greater length. They afford feldspar, quartz and other commercial materials in addition to mica.

Phlogopite is seldom if ever found in granite pegmatites, but its occurrence in New York is practically restricted to crystalline limestones where it appears to represent a secondary product of metamorphism, probably in most cases as a result of contact influences exerted by igneous intrusions. It is associated with such other minerals as amphibole, pyroxene, wernerite, tourmaline, fluorite, titanite and apatite. The mineral association varies from place to place and the occurrence of phlogopite is quite irregular or bunchy, or else restricted to a definite part of the contact zone. According to the report of Cirkel [1], the commercial phlogopite deposits of Canada are associated with pyroxene which penetrates country gneisses and limestones in the form of dikes, the pyroxene being regarded as an igneous rock. There is no resemblance to such conditions in the Adirondack occurrences, though pyroxene is a frequent accompaniment of the mica. The minerals rather have resulted from a conversion of the limestones by mineralizing solutions and vapors given off by granite intrusions and they gradually disappear with increas-

[1] "Mica, Its Occurrence and Uses." Mines Branch, Department of the Interior, Ottawa, 1905.

ing distance from the contacts, giving way to normal crystalline limestones. There is little regularity in the shape of such contact zones; in fact a highly irregular form may be said to be the prevailing one. Their nature and mineral content are even more variable than in the case of pegmatites.

The working of mica deposits in this State, as well as in most sections of the country, has been a rather uncertain business. Of necessity, it involves small-scale individual operations. The technical difficulties surrounding the industry are such that they do not admit of the methods employed in other branches of mining and the adoption of labor-saving devices that might tend to reduce costs. Labor conditions, therefore, exercise a great influence upon the course of mining operations. The principal mining activity in this country at present is in North Carolina, where according to the article by Sterrett in *Mineral Resources* for 1912, volume 2, there are probably as many as a hundred separate mines and prospects, many worked by farmers in the off-season of their labors. As the entire output of the country in recent years has been well under $400,000 annually, the average outturn from the individual mines evidently is very small. India contributes most of the mica consumed in the United States, though Canada is an important source of the electrical grades. It has been stated (*Mineral Industry* for 1912) that the cost of labor in the production of mica in India is about one-sixth of the labor cost in the domestic mines.

The quality of mica depends upon a great many factors which can be estimated accurately only by the expert. Of the three varieties, biotite has more limited use than the others and the market does not warrant mining operations for its production alone. It is obtained mainly as a by-product in the working of pegmatites for feldspar. Owing to its iron content it is not much used for electrical insulation which is the prinicpal application for the colored micas. Muscovite, having the greatest transparency, is preferred for glazing and for lamp chimneys, shades and similar purposes. The larger sizes only can thus be used. For electrical insulation in motors and dynamos, phlogopite seems to find the most favor on account of the softer nature of that variety, it is said. Much of the electrical mica is used in the form of "micanite" which consists of small sheets cemented and compressed into boards. The presence of inclusions of iron oxid, usually magnetite, which is quite common in muscovite and phlogopite, is stated by Sterrett to have no injurious effect upon the quality of the electrical mica.

Much of the mica as found in pegmatites and contact zones, even when in large crystals, can not be used in sheet form on account of the numerous fractures and lines that traverse the surfaces. There is great variation in the splitting quality of mica from different places, some examples cleaving readily and cleanly even to very thin sheets and others showing a splintery surface. The average size of sheet that can be obtained largely determines the value of a deposit, since the prices rapidly decrease with the size. The waste in the splitting is sometimes turned into use by converting it into ground mica for which there exists a more or less ready market in the making of lustrous coated papers, lubricants and insulating materials.

FIELD OCCURRENCE

Orange county. Phlogopite of greenish color is found in a pyroxene rock near Lake Mombasha, town of Monroe. The locality is mentioned by Beck in the reports of the First Survey as being on the bank of the stream flowing from " Mount Basha " pond, near the Forshee iron mine. It is a contact deposit in limestone of which there are exposures in the vicinity of the mine mentioned and also farther north around the opening of the O'Neil mine. Amphibole, pyroxene, garnet and probably magnetite bodies themselves are accompanying results of the contact action. The occurrence is mentioned by Whitlock[1] as having been worked in 1903. Sheets have been mined that measured as much as three feet in diameter.

Warwick. According to Whitlock[2] muscovite occurs near Greenwood lake, 8 miles southwest of Warwick, in a pegmatite vein, the plates reaching a foot in diameter. There are numerous other occurrences of muscovite in this vicinity, as pegmatite has a wide distribution in the crystalline areas of the Highlands.

Westchester county. A deposit of mica near Pleasantville was at one time the object of mining operations. The occurrence is in pegmatite and the mica belongs to the muscovite variety. The sheets contain magnetite inclusions.

Muscovite is found in considerable quantity in parts of the Kinkel feldspar quarry at Bedford, but is not of commercial quality, except possibly for ground mica.

Putnam county. The occurrences in this county have not afforded any commercial mica so far as known.

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[1] Minerals Not Commercially Important, 23d Report of the State Geologist Albany, 1904, p. 191.

[2] Op. cit.

Essex county. Mica is found in the pegmatite bodies at Crown Point and Ticonderoga now worked. The chief variety is biotite. Occasional shipments of scrap mica recovered in the milling of feldspar are made by the Crown Point Spar Co. The material is ground and used in paint.

Large crystals of biotite have been taken from various localities in the town of Keene.

Saratoga county. A pegmatite body about 2 miles north of Batchellerville, town of Edinburg, was worked some years since by the Claspka Mining Co. for feldspar. Several tons of muscovite were taken out in the course of the operations, the mineral occurring in the spaces between the larger feldspars, or intergrown with the latter. The crystals measure up to a foot or more in diameter and half that in thickness, many bearing very perfect prismatic boundaries. Inclusions of magnetite arranged in regular lines are frequent. The muscovite has little value for sheet cutting, being much fractured and splintery.

Biotite in sheets up to 2 feet across are also found here.

Warren county. A pegmatite occurrence near Chestertown has been under development at different times and has afforded small quantities of commercial mica, including muscovite and biotite. The locality is mentioned in the *Mining and Quarry Report* for 1911 under the head of Feldspar, which also is present in marketable quality. It is 3 miles south of Chestertown on the ridge to the east of the Warrensburg road. Two openings were made over 15 years ago, and in 1913 further work was carried on by C. A. Williams who informs the writer that he secured some merchantable book mica and plans to continue operations during the current season. The main opening is a pit 15 feet wide extended for 75 or 80 feet along the course of the pegmatite which strikes northeast. The full size of the body could not be ascertained at the time the writer visited the locality as only the easterly wall was exposed. The pegmatite is a coarse aggregate of white microcline, quartz and mica. Biotite seems to be chiefly represented near the outcrop, but Mr Williams states that recent work has uncovered muscovite in larger amount. The books run to a foot or so in diameter and usually show fractures or rulings. Black tourmaline occurs sparingly in the quartz and feldspar, but it would appear that feldspar of pottery grade may be obtained with a little sorting. A smaller pit lies to the north of the other, the result of the earlier operations, and is thought to be on the same pegmatite body, in which case the occurrence must be quite extensive.

Jefferson county. Yellow mica, probably phlogopite, is found in large plates near Henderson. Muscalonge lake, town of Theresa, has afforded fine examples of crystallized phlogopite of brown color, but in small individuals.

St Lawrence county. Some fine examples of phlogopite crystals in the State Museum are recorded as having been collected from Somerville. Perfect six-sided prisms unmarked by fractures or rulings and of brown color have a diameter of 12 inches. The exact locality is not given, but it may be the same mentioned by Beck as 2 miles north of Somerville, with limestone and serpentine as the gangue materials. Judging from the samples, the occurrence is of unusual interest.

Small quantities of mica have been obtained from the town of Fine, 2 miles north of Oswegatchie. Good sheets of reddish phlogopite were shown to the writer as coming from that locality. The last work on the deposit was in 1909.

Muscovite is found in Edwards associated with the fibrous talc. It is not, however, of commercial importance.

St Lawrence county may be regarded as one of the more favorable sections for the occurrence of commercial grades of mica. Granite intrusions of great size have taken place at different times in the Precambric and on their borders may be found dikes and lenses of pegmatite intersecting the older gneisses and schists. Since the intrusion of the pegmatites there has been no great disturbance from regional-metamorphic forces so that the mica is little fractured in most occurrences, whereas the pegmatites in the central Adirondacks often show the effects of severe compression. The pegmatites carry both muscovite and biotite. The numerous contacts of limestone and granite afford favorable conditions for the occurrence of phlogopite, which, as stated, is found here and there in specimens of commercial quality, though the real importance of the deposits has never been adequately tested. The geological relations in this part of the Adirondacks are very similar to those in the mica-mining districts of Canada.

MINERAL WATERS

New York has held for a long time a leading position among the states in the utilization of mineral waters. The different springs, of which over two hundred have been listed as productive at one time or another, yield a great variety of waters in respect to the character and amount of their dissolved solids. There are some that contain relatively large amounts of mineral ingredients and are specially valuable for medicinal purposes; Saratoga Springs, Ballston Springs, Richfield Springs, Sharon Springs and Lebanon Springs are among the more noted localities for such waters. Numerous other springs are more particularly adapted for table use, containing only sufficient mineral perhaps to give them a pleasant saline taste. Both kinds of waters are generally carbonated and sold in small bottles.

Of late there has developed an important business in the sale of spring waters which can hardly be classed as mineral in the common acceptance of the word, but which are extensively consumed for office and family use in the larger towns and cities. Their employment depends upon their freedom from harmful impurities, in which feature they are generally superior to the local supplies. In so far as such waters are an article of commerce they may well be included in a canvass of the mineral water industry. They are usually distributed in large bottles or carboys in noncarbonated condition.

Character of mineral waters. Among the spring waters that contain mineral ingredients in appreciable quantity those characterized by the presence of alkalis and alkaline earth are the most abundant in the State. The dissolved bases may exist in association with chlorin and carbon dioxid, as in the springs of Saratoga county, or they may be associated chiefly with sulphuric acid, as illustrated by the Sharon and Clifton Springs.

The mineral waters of Saratoga Springs and Ballston are found along fractured zones in Lower Siluric strata, the reservoirs occurring usually in the Trenton limestone. They are accompanied by free carbon dioxid which, together with chlorin, sodium, potassium, calcium and magnesium, also exists in dissolved condition. The amount of solid constituents in the different waters varies from less than 100 to over 500 grains a bottle. Large quantities of table and medicinal waters are bottled at the springs for shipment to all parts of the country. The carbon dioxid which issues from the wells at Saratoga is likewise an important article of commerce.

The waters at Richfield Springs contain the elements of the alkali and alkaline earth groups together with sulphuric acid and smaller amounts of chlorin, carbon dioxid and sulphureted hydrogen. They are employed for medicinal baths as well as for drinking purposes. The springs issue along the contact of Siluric limestone and Devonic shales. Sharon Springs is situated to the east of Richfield Springs and near the contact of the Lower and Upper Siluric. Clifton Springs, Ontario county, and Massena Springs, St Lawrence county, are among the localities where sulphureted water occur and are utilized.

The Oak Orchard springs in the town of Byron, Genesee county, are noteworthy for their acid waters which contain a considerable proportion of aluminum, iron, calcium and magnesium, besides free sulphuric acid.

The Lebanon spring, Columbia county, is the single representative in the State of the class of thermal springs. It has a temperature of 75° F. and is slightly charged with carbon dioxid and nitrogen.

Ordinary spring waters. The greater quantity of spring waters consumed in the State belongs to the nonmedicinal, noncarbonated class, represented by such springs as the Great Bear, Deep Rock, Mount View, Sun Ray, Chemung etc. The waters are obtained either by flowing springs or from artesian wells and are shipped in carboys or in tank cars to the principal cities where they are bottled and distributed by wagons among the consumers. The essential feature of such waters is their freedom from noxious impurities. This is generally safeguarded by the care exercised in the handling of the waters which are also regularly examined in the chemical and bacteriological laboratories.

Carbon dioxid. Carbon dioxid is given off in quantity by some of the wells at Saratoga Springs, and its collection and storage for shipment constituted for many years an important industry at that place. Over thirty wells have been bored there for gas alone. The industry has now been discontinued by force of a legislative enactment; it was considered that the pumping of the wells for the production of the gas was detrimental to the other springs that were utilized solely for their waters. For some time the value of the natural gas secured from the wells exceeded that of the mineral water sales.

List of springs. The following list includes the names and localities of most of the springs in the State that are employed commercially, as shown by a canvass of the industry:

NAME	LOCALITY
Baldwin Mineral Spring	Cayuga, Cayuga county
Coyle & Caywood (Arrowhead Spring)	Weedsport, Cayuga county
Diamond Rock Spring	Cherry Creek, Chautauqua county
M. J. Spicer	Westfield, Chautauqua county
Breesport Oxygenated Spring	Breesport, Chemung county
Breesport Deep Rock Water Co	Breesport, Chemung county

NAME	LOCALITY
Chemung Spring Water Co	Chemung, Chemung county
Keeseville Mineral Spring	Keeseville, Clinton county
Lebanon Mineral Spring	Lebanon, Columbia county
Trespúr Spring	McGraw, Cortland county
Arlington Spring	Arlington, Dutchess county
Mount Beacon Spring	Mount Beacon, Dutchess county
Mount View Spring	Poughkeepsie, Dutchess county
Monarch Spring Water Co	Matteawan, Dutchess county
Elk Spring Water Co	Lancaster, Erie county
Sparkling Spring	Buffalo, Erie county
Red Rock Spring	Fine View, Jefferson county
Garden City Spring	Garden City, Nassau county
Clinton Lithia Springs, Inc	Franklin Springs, Oneida county
Glen Alix Spring	Washington Mills, Oneida county
Lithia Polaris Spring	Boonville, Oneida county
F. H. Suppe (Franklin Lithia Spring)	Franklin Springs, Oneida county
Geneva Lithia Spring	Geneva, Ontario county
Red Cross Lithia Spring	Geneva, Ontario county
Crystal Spring	Oswego, Oswego county
Deep Rock Spring	Oswego, Oswego county
Great Bear Spring	Fulton, Oswego county
White Sulphur Spring	Richfield Springs, Otsego county
Black Rock Spring	Rensselaer, Rensselaer county
Mammoth Spring	North Greenbush, Rensselaer county
Shell Rock Spring	East Greenbush, Rensselaer county
Madrid Indian Spring	Madrid, St Lawrence county
Artesian Lithia Spring	Ballston Spa, Saratoga county
Comstock Mineral Spring	Ballston Spa, Saratoga county
Mohican Spring	Ballston Spa, Saratoga county
Arondack Spring	Saratoga Springs, Saratoga county
Coesa Spring	Saratoga Springs, Saratoga county
Hathorn (Nos. 1 and 2) Springs	Saratoga Springs, Saratoga county
Saratoga Gurn Spring	Saratoga Springs, Saratoga county
Chalybeate Spring	Sharon Springs, Schoharie county
Eye Water Spring	Sharon Springs, Schoharie county
Sulphur-Magnesia Spring	Sharon Springs, Schoharie county
White Sulphur Spring	Sharon Springs, Schoharie county
Red Jacket Spring	Seneca Falls, Seneca county
Setawket Spring	Setawket, Suffolk county
Elixir Spring	Clintondale, Ulster county
Sun Ray Spring	Ellenville, Ulster county
Vita Spring	Fort Edward, Washington county
Briarcliff Lodge Association	Briarcliff Manor, Westchester county
Gramatan Spring Water Co	Bronxville, Westchester county
Orchard Spring	Yorktown Heights, Westchester co.

Production. The trade in spring waters does not lend itself to accurate statistical tabulation. A large part of the sales at present consist of the nonmedicinal or fresh waters which are distributed in the principal cities for office and table use and have a very low value. Such waters may be obtained from a distance, in which case they are sometimes shipped in tank cars, or they may come from some local spring. Their main cost to the consumer is represented in the item of transportation. There are doubtless many springs of this character that fail to make a return each year, since the list is constantly changing. Besides the waters that are sold in bottles, large quantities of mineral waters are consumed at the spring localities by the hotels, sanatoriums etc., for which no accurate statistics are obtainable.

The returns received from the spring water companies for 1913 showed total sales of 9,448,348 gallons with a value of $806,298. This was about the same quantity as was reported for 1912 when the sales amounted to 9,682,447 gallons, with a value of $760,847.

NATURAL GAS

The year 1913 witnessed unusual activity in exploratory work and drilling in the natural gas fields of the State. It does not appear that any very notable discoveries were made in the way of new pools, such as have been reported from time to time in previous years, or that the bounds of the existing fields were materially extended, yet altogether the year's activity resulted in an important increment in the supply, principally owing to intensive exploitation of the known resources.

The growth of production during the last decade has been quite remarkable and seems to evidence the capacity of the fields for still further development. The only district which has been exploited probably to the limit of its possibilities is that in northern Allegany and Cattaraugus counties where the existence of oil has furnished an incentive for exploration that has been under way for nearly half a century.

The gas pools are distributed among sixteen counties which lie mainly in the western part of the State. The counties in the extreme western section are the most productive. The four counties of Erie, Chautauqua, Cattaraugus and Allegany contribute nearly 90 per cent of the total output. They contain a large number of individual pools in different geological horizons. Chautauqua and Erie counties have come into prominence rather recently, but lead all others in regard to output. Genesee county in the last five or six years has assumed importance through the development of the field near Pavilion. The remaining counties, including Niagara, Livingston, Ontario, Schuyler, Seneca, Steuben, Monroe, Wyoming, Yates, Onondaga and Oswego, rank as relatively small producers.

In addition to the counties named there are many others in which gas has been found. Test wells are reported as having shown gas in nearly all the counties that lie between Lake Ontario and the Pennsylvania boundary, as well as in Jefferson, Oneida, Albany and other counties in the northern and eastern sections. The more permanent supplies seem to be confined, however, to the western section.

The geologic features of the gas fields have been described in several reports and papers of the New York State Museum. In particular may be noted the report of Edward Orton (Museum Bulletin 30) which described the field of northern Chautauqua county and the pools near the eastern end of Lake Ontario in considerable detail. Notes on the developments in Erie county are given in Bishop's " Structural and Economic Geology of Erie County " (Museum Report 49, vol. 2) and the oil and gas fields of southwestern New York are covered by the same writer in special papers (Museum Reports 51, vol. 2, and 53, vol. 1). Field notes of more recent date have been included in some of the issues of the mining and quarry bulletin.

Geologically the occurrence of natural gas in the State has a rather wide distribution. Flows have been encountered from as far down the column as the Potsdam sandstone and upward as far as the Portage and Chemung strata at the top of the Devonic system. The more productive horizons are in the Trenton limestone (Oswego county), the Medina sandstone (Genesee, Erie and Chautauqua counties) and the Devonic formations (Allegany, Cattaraugus and Chautauqua counties). The Medina sandstone has been the main source of supply in the more recent explorations in Erie, Chautauqua and Genesee counties.

The business of distributing the gas is in the control of relatively few companies who have pipe lines connecting the fields with the cities and communities which they supply. The Iroquois Natural Gas Co. of Buffalo is the largest single distributor and collects gas from Allegany, Cattaraugus, Chautauqua and Erie counties, with Buffalo as the principal consuming point. The Alden-Batavia Natural Gas Co. and the Pavilion Natural Gas Co. are important distributors in the Genesee-Erie county district. In Chautauqua county are a great number of small producers who supply one or two families, besides these large distributors: The South Shore Natural Gas & Fuel Co., the Silver Creek Gas & Improvement Co. In Allegany and Cattauraugus counties the Empire Gas & Fuel Co. and the producers Gas Co. have pipe lines. A rather productive field has been opened in the towns of East Bloomfield and West Bloomfield, Ontario county, the gas being distributed by the Ontario Gas Co. Among the smaller companies engaged in the business are the Consumers Natural Gas Co. with wells in the town of Dix, Schuyler county, the Baldwinsville Light & Heat Co. of Baldwinsville, Onondaga county, the Pulaski Gas & Oil Co. of Pulaski, Oswego county, and the Sandy Creek Oil & Gas Co. of Sandy Creek in the same county.

Production. The present status of the gas industry is shown by the accompanying table which gives the production for the last four years. In the earlier years it has been possible to distribute the production according to the county or district in which it was made, but with the consolidation of the pipe-line companies which has recently taken place, the output can not be readily segregated, especially in the case of the western fields where some of the companies operate in several counties.

Reports from the individual producers show the value of the gas produced in 1913 to have been $2,549,227, an increase of over 35 per cent as compared with the value reported in the preceding year. The gain was the largest reported in any single year. The actual flow from the wells was 9,155,429,000 cubic feet, against 6,564,659,000 cubic feet in 1912. There were about 1750 productive wells.

The average price received for the gas sold for general consumption was 27.8 cents a thousand, against 28.7 in 1912. The slight decrease is accounted for by the gain in the production of the western fields where the gas brings a relatively lower price than in the outlying districts which about held their own.

Production of natural gas

COUNTY	1910	1911	1912	1913
Allegany-Cattaraugus	$337 427	$402 931	$1 503 274	$2 119 824
Chautauqua	202 754	222 023	263 742	324 939
Erie[1]	717 038	813 279	*a*	*a*
Livingston [2]	60 997	73 357	81 740	70 396
Onondaga	12 733	12 972	14 260	13 488
Oswego	14 783	14 913	16 366	18 027
Wyoming [3]	65 967	7 602	2 915	2 553
	$1 411 699	$1 547 077	$1 882 297	$2 549 227

[1] Includes output of Genesee county for 1911 and part of it for 1910.
[2] Includes also Seneca, Schuyler, Steuben, Ontario and Yates.
[3] Includes Niagara.
a Erie and Genesee counties included under Allegany-Cattaraugus.

The reports received for 1913 showed a total of about 200 individual producers with 1750 wells. More than one-half the producers were in Chautauqua county, but most of them reported as having but one well utilized for a single household. Erie county had by far the largest output of any county in the State, although the actual production can not be definitely stated. The product of Erie and Genesee counties is included under that of Allegany-Cattaraugus in the first item of the table. The four counties together contributed a total of 7,392,718,000 cubic feet, with a value of $2,119,824. This represented a gain of about 2,000,000,000 cubic feet over that of 1912. The Orchard Park pool in Erie county, which was discovered in the spring of 1912, accounted for much of the increase, but the Pavilion field also made a good showing.

Pavilion field. One of the most important natural gas fields in the State of relatively recent discovery is in the vicinity of Pavilion, Genesee county. The first holes were drilled in 1906, and there are now about sixty producing wells which maintain a very steady flow. The following information in regard to the local features and developments has been contributed by W. P. Randall, engineer, of the Pavilion Natural Gas Company.

The Pavilion field lies south of the Roanoke district, in the southeast corner of Genesee county. Its boundaries are defined approximately by a line running from the southern boundary of Genesee county northerly to Bethlehem Center, thence easterly along the Telephone road through Pavilion Center to the east boundary of Genesee county, thence south on said boundary to the corner of Genesee county and thence west to the point of beginning. It comprises an area 3 miles wide north and south and 9 miles long east and west. The gas is distributed by two companies, the New York Central Gas Co. with pipes running to Batavia, Attica, Corfu, and other towns in that vicinity, and the Pavilion Natural Gas Co. which supplies Mumford, Caledonia, Le Roy, Pavilion, Warsaw, Perry, Mount Morris, Moscow and smaller places along the route. New lines are being laid by the latter company to Linwood, York, Greigsville, Retsof, Piffard, Cuylerville, Geneseo and Avon. The trunk lines convey the gas under pressure of from 60 to 125 pounds; reducing stations at the distributing points lower the pressure to the normal required for consumption.

The gas is dry, nearly pure, marsh gas with less than 8 per cent of other ingredients. The pressure in the original wells was 500 pounds a square inch and has shown little diminution. Along the eastern boundary of the field and near Linwood, wells of from five to seven million cubic feet daily capacity have been drilled.

The field lies along the outcrop of the Genesee shale which is at an elevation of about 900 feet above tide. The gas flow is found at intervals in the last 30 feet of the Medina sandstone. The succession of strata explored by the wells conforms to the normal order as given in the reports of the New York State Museum, but in the western boundary of the field and near Lindon the Niagara is upturned so as to make the drilling of straight holes a difficult work. Below such disturbances the Medina gives a very limited flow, and consequently exploration in these places has been discontinued. The Niagara averages about 228 feet thick, and black water (sulphurous water from cavities in the dolomite) occurs at about the middle. Below the Niagara comes the Clinton with a thickness up to 15 feet (Wolcott limestone?) and at this point anchor packers are usually placed. The Medina sandstone is a little over 100 feet thick; on the northern and southern borders of the field it gives a limited flow of gas, the longest wells being on the eastern border and around Linwood.

A typical section in the Pavilion field is here given:

Top of flint	475	feet
Bottom of flint	625	"
Top of salt	1 072	"
Top of Niagara	1 300	"
Black water	1 415	"
Bottom of Niagara	1 500	"
Top of Medina	1 678	"
First gas	1 743	"
Second gas	1 753	"
Third gas	1 774	"
Bottom of Medina	1 775	"
Ho e bottomed	1 875	"

Altitude at mouth of well is about 1000 feet above tide.

PETROLEUM

The record of the local oil industry has been attended with features of much interest during the last year or two. The output for 1912 showed a decline of nearly 25 per cent from the average for the years immediately preceding and reached the lowest figure (782,661 barrels) that has been returned since the New York field was first fully developed. This decline took place in the face of advancing prices for crude oil, so that at first glance it would seem to indicate a permanent impairment of the productive capacity, rather than to reflect temporary conditions which might be expected to change for the better at any time. That there is really no ground for belief that the industry is destined to rapid extinction, however, is indicated by the response which the production showed in the past year as a result of increased field work under the stimulus of the improved market.

The returns of the pipe-line companies and other shippers of crude oil for the year 1913 indicated a total run of 916,873 barrels. Compared with the total already given for 1912 there was a gain of 134,212 barrels or about 17 per cent in the output. This did not quite restore the production to its earlier level, since in 1911 the yield was 955,314 barrels and in 1910 it amounted to 1,073,650 barrels, but it demonstrated that the industry is still capable of expanding its yield in response to favorable conditions. A further gain may be looked for during the current season should the market continue on the present basis.

The quotations for Pennsylvania oil, which apply as well to the output of New York wells, have advanced rapidly since the severe slump of 1910. The upward trend began to be noticeable in the early part of 1912. From the quotation of $1.35 a barrel, which ruled in January of that year, there was a steady advance month by month until by December the prevailing price was $2 a barrel. In January 1913, another advance brought the quotation to $2.05 and numerous rapid increases within a short time raised the price to $2.50, at which figure they remained undisturbed throughout the rest of 1913. It was to be expected that such remunerative figures would encourage new drilling and general activity in the producing industry, as in fact took place.

The record of field work, as compiled monthly by the Oil City Derrick, showed that 512 wells were drilled in the New York field during 1913. This was more than double the number drilled in the preceding year, when the total reported was 246 wells. In 1911 the number was 195, and in 1910 it was 283. The increment of production from the new wells amounted to 810 barrels, as compared with 278 barrels in 1912, 201 barrels in 1911 and 368 barrels in 1910. Of the number of wells completed, 48 were dry, against 66, 59 and 61 respectively in the previous years.

The output of oil in the State during the last two decades is given in the accompanying table. The figures for the years 1894–1903 have been taken from the annual volumes of *The Mineral Resources* and those for the following years compiled from reports rendered by the pipe-line companies and shippers who operate in the State. The list of these companies follows; Columbia Pipe Line Co., Union Pipe Line Co., Fords Brook Pipe Line Co., Buena Vista Oil

Co., and Madison Pipe Line Co., of Wellsville; Vacuum Oil Co., Rochester; New York Transit Co., Olean; Emery Pipe Line Co., Allegany Pipe Line Co., Tide Water Pipe Co., Limited, and Kendall Refining Co., of Bradford, Pa.

Production of petroleum in New York

YEAR	BARRELS	VALUE
1894	942 431	$790 464
1895	912 948	1 240 468
1896	1 205 220	1 420 653
1897	1 279 155	1 005 736
1898	1 205 250	1 098 284
1899	1 320 909	1 708 926
1900	1 300 925	1 759 501
1901	1 206 618	1 460 00
1902	1 119 730	1 530 852
1903	1 162 978	1 849 135
1904	1 036 179	1 709 770
1905	949 511	1 566 931
1906	1 043 088	1 721 095
1907	1 052 324	1 736 335
1908	1 160 128	2 071 533
1909	1 160 402	1 914 663
1910	1 073 650	1 458 194
1911	955 314	1 251 461
1912	782 661	1 338 350
1913	916 873	2 255 508

There have been no notable discoveries of oil pools in many years, and the productive territory remains restricted to the sections of Cattaraugus, Allegany and Steuben counties which were marked out in the early exploratory operations. The first well was drilled in Cattaraugus county in 1865 so that production has been continuous for half a century, a remarkable record for an oil field.

The oil is found in fine-grained sandstones of dark color belonging to the Chemung formation, at the top of the Devonic system. In Cattaraugus county the productive area embraces about 40 square miles, mostly in Olean, Allegany and Carrolton townships. The pools, of which the principal ones are the Ricebrook, Chupmunk, Allegany and Flatstone, occur at several horizons from 600 to 1800 feet below the surface. The oil district of Allegany county extends across the southern townships of Clarksville, Seneca, Wirt, Bolivar, Alma, Scio and Andover and is divided into several pools that are considered to be more or less independent. The Bolivar, Richburg and Wirt pools have been most productive. The oil is found at depths of from 1400 to 1800 feet. The Andover pool lies partly in the town of West Union, Steuben county, and is accountable for the production in that section.

The productive wells in the three counties number about 10,500, of which 7500 are in Allegany county, 200 in Steuben and the remainder in Cattaraugus county. All are pumped, using natural gas derived from some of them for power. The average yield is now less than one-third of a barrel a day.

SALT

The salt-producing industry experienced fairly prosperous conditions during the year 1913, as in the preceding season. Production was at a high rate in response to an active demand, and record figures were reported for the output as a whole, although in one or two branches little or no gain was registered. Along with the increased demand there was some advance in the prices of different grades of evaporated salt, a most welcome feature to the manufacturers who for a long time have had to face a continual slump in the market.

For many years the industry in this State showed the effects of a great overextension of the productive capacity. An active campaign in the exploration and development of the salt deposits was carried on during the last two decades of the last century, and the enterprises that came into existence then had a capacity far in excess of any available outlet for the products. As a consequence, competition became so keen that manufacturers realized scarcely any profits, and many were compelled to shut down their plants. Some of the mines and evaporating plants which went out of business at the time have never resumed operations. In the last decade the stress of conditions found relief through the gradual growth of the markets, so that now productive capacity and demand are more nearly balanced. Few new enterprises have been started within late years, and it would appear that there is no present need of any material addition to the productive facilities.

The history of the industry in New York dates back to colonial days, but the first authentic records of salt production begin with the year 1797, when, by an act of the Legislature the State assumed control of salt manufacture on the Onondaga Reservation. Until 1881 the evaporating works were all centered around Syracuse which derived its early importance from the salt industry. In that year, however, production began on a fairly large scale in the Warsaw district where private enterprise had succeeded in developing beds of rock salt. These afforded much richer brines than the natural brines of the Onondaga district, an advantage that proved very important in the manufacture of the artificially evaporated grades and that led to the later exclusive use of such brines in all but the solar evaporating plants. The production of rock salt by underground mining through vertical shafts began in 1885 on the property now owned by the Retsof Mining Co., situated at Retsof, Livingston county.

The statistical record of the industry shows that the output in 1797, when the first regular operations began, was 25,474 bushels, or 5095 barrels. By the year 1828 the output had reached a million bushels or 200,000 barrels, and in 1849 it had grown to over 1,000,000 barrels. The solar process was introduced in the Syracuse district in 1821, but for many years the process was subordinate to that of artificial evaporation in open kettles. After 1882 the competition of the works in the western part of the State which used brines derived from the rock salt beds began to show itself in a diminished production from the Syracuse plants, and the latter soon lost the preeminent position in the industry which they had so long held. Altogether the output of brine and rock salt in the State in the period 1797–1913 has amounted to the total of 257,622,716 barrels. As indicative of the rapid growth made in the last few decades it may be noted that the production up to 1882, when the exploitation of the rock salt beds began to be active, was 57,890,922 barrels; whereas in the period since elapsed it has amounted to 199,731,794 barrels.

The accompanying tables present the figures of production and value for recent years. The output in 1912 and 1913 is given according to grades, so far as the classification can be made without revealing the individual figures. The grades depend upon the methods of manufacture and purposes for which the salt is used. Rock salt and salt in brine consumed for the manufacture of sodium compounds appear in the last item of the detailed tables, which also include small quantities of evaporated salt not especially classified in the returns. The evaporated salt is chiefly marketed under the grades of common fine, table and dairy, common coarse, coarse solar and packers salt. Table and dairy salt includes the finest grades of artificially evaporated salt which undergo special preparation for the table and for butter and cheese making; it brings the highest market price. Under common salt are listed the other grades of fine artificially evaporated salt that are not so prepared. Common coarse represents the coarser product from artificial evaporation. Coarse solar salt is made by evaporation of brine in shallow pans exposed to the sun's heat. This process can not be closely regulated and results in a very coarsely crystallized salt that serves many of the purposes of rock salt. Packers salt includes the product sold to meat packers and fish salters.

Production of salt by grades in 1912

GRADE	BARRELS	VALUE	VALUE A BARREL
Common fine [1]	1 408 543	$519 844	$0.37
Common coarse	204 136	82 880	.41
Table and dairy	1 353 643	819 103	.61
Coarse solar	296 814	103 886	.35
Packers	72 771	30 564	.42
Other grades [2]	7 166 307	1 040 983	.15
Total	10 502 214	$2 597 260	$.247

[1] Common fine includes a small quantity of common coarse.
[2] Include rock salt, salt in brine used for soda manufacture, and small amounts of brine salt for which the uses were not specified in the returns.

Production of salt by grades in 1913

GRADE	BARRELS	VALUE	VALUE A BARREL
Common fine [1]	1 490 957	$583 757	$0.39
Common coarse	111 057	45 942	.45
Table and dairy	1 266 864	789 857	.62
Coarse solar	436 800	131 040	.30
Packers	107 293	51 895	.48
Other grades [2]	7 406 550	1 254 173	....
Total	10 819 521	$2 856 664	$.264

[1] Common fine includes a small quantity of common coarse.
[2] Include rock salt, salt in brine used for alkali manufacture, and small amounts of brine salt for which the uses were not specified in the returns.

The output in 1913 of 10,819,521 barrels of 280 pounds, or 1,514,733 short tons, was the largest on record and represents an increase of 317,307 barrels (44,423 tons) over the total reported for the preceding year, which also was a record output. The production was contributed by approximately thirty mines and works distributed over the counties of Livingston, Onondaga, Schuyler, Wyoming, Tompkins and Genesee in the relative order given of their output. Of the plants, all but two were engaged in brine salt operations.

Production of salt in New York since 1887

YEAR	BARRELS	VALUE
1887	2 353 560	$936 894
1888	2 318 483	1 130 409
1889	2 273 007	1 136 503
1890	2 532 036	1 266 018
1891	2 839 544	1 340 036
1892	3 472 073	1 662 816
1893	5 662 074	1 870 084
1894	6 270 588	1 999 146
1895	6 832 331	1 943 398
1896	6 069 040	1 896 681
1897	6 805 854	1 948 759
1898	6 791 798	2 369 323
1899	7 489 105	2 540 426
1900	7 897 071	2 171 418
1901	7 286 320	2 089 834
1902	8 523 389	1 938 539
1903	8 170 648	2 007 807
1904	8 724 768	2 102 748
1905	8 575 649	2 303 067
1906	9 013 993	2 131 650
1907	9 657 543	2 449 178
1908	9 005 311	2 136 736
1909	9 880 618	2 298 652
1910	10 270 273	2 258 292
1911	10 082 656	2 191 485
1912	10 502 214	2 597 260
1913	10 819 521	2 856 664

Occurrence of salt. The productive sources of salt are natural brines and beds of rock salt. Natural brines have been found in a number of places and in various rock formations, but the only occurrence that has had any great commercial importance is in the vicinity of Syracuse on the old Onondaga Salt Springs Reservation, which was sold to the State by the Indians in 1788. The brines are encountered in loose gravels, sands and clays which extend to depths of several hundred feet and apparently lie in a channel or basin hollowed out of the Salina rocks. The original wells were shallow, but it was later found that the strength of the brine could be increased by going deeper and wells were put down to depths of from 200 to 400 feet from which the present supplies are obtained. The borings of the underlying strata in the basin show that they contain no rock salt, and it is thought the brines are derived from leaching of beds that are found to the south of Syracuse under cover of a heavy thickness of shale.

With the exception of the salt made at Syracuse, the rock salt beds constitute the entire source of present production. The beds are found in the Salina formation, a succession of shales, limestones gypsum and rock salt, that has its outcrop along an east-west belt from Albany county to the Niagara river and is represented by a smaller separate area in southeastern New York. Test borings indicate that the salt deposits are restricted to the western section of the main belt beginning in Madison county, and that they occur at intervals from that county to Erie and Cattaraugus counties. The most easterly point where rock salt has been found is at Morrisville, Madison county. On account of its ready solubility it is rarely encountered at depths of less than about 1000 feet where the cover is sufficient to protect the beds from the action of underground waters. Since the Salina beds have a dip uniformly toward the south, the mines and wells are all located on the southern side of the outcrop which lies about the line of the 43d parallel. The dip averages 40 or 50 feet to the mile. The persistence of the salt to the south is indicated by the wells at Ithaca which reach the salt horizon at over 2200 feet depth and by test borings in northern Cattaraugus and Allegany counties which encountered salt at over 3000 feet depth. A boring at Canaseraga, Allegany county, penetrated 75 feet of rock salt beginning at 3050 feet. The western extensions of the beds in Erie county are stated by Bishop to be about on a line between East Aurora, Patchen and Boston Corners and a point 3 miles west of Springville. Brines have been found in wells at Eden valley, Gowanda and other localities to the west of the boundary, but no rock salt. In Cattaraugus county, however, rock salt is reported to have been found in a gas well situated between Cattaraugus and Gowanda.

Rock salt mines. The active rock salt mines are situated at Retsof and Cuylerville, Livingston county. Shafts have been sunk also near Le Roy, Seneca county, and at Livonia and Greigsville, Livingston county, but have not been in use for many years.

The methods of mining the salt at the two active mines are very similar. In both the bed is reached through vertical shafts of a little over a 1000 feet depth. The Sterling Salt Co. at Cuylerville has two shafts, and the Retsof Mining Co. at Retsof three, which are bottomed in a bed of salt from 20 to 25 feet thick. The workings are laid out in panels, with the main galleries running east-west. The headings are driven to the north so as to secure advantage of the dip in tramming the salt to the main haulage ways. Of the 20 feet or more of salt only about 12 feet are actually mined, the remainder being left in the roof and floor. The breast of salt is worked in two benches. The rooms are 30 feet wide, separated by equally wide pillars. There is no timbering, and of course no drainage to provide for in the workings. The salt is drilled by rotary auger drills run by compressed air. The holes are placed with a view to making the greatest proportion of lump salt, and they are charged lightly with low-grade dynamite. Charging and blasting are performed by a separate crew, with one man for each pair of drillers. The broken salt is loaded into three-ton cars which are run down to the main haulage ways and from there hauled to the shaft. At the surface the salt is crushed and the various sizes separated by screening. The coarsest lumps are sold uncrushed, principally as cattle salt. The crushed and screened salt finds use in the curing of hides, refrigeration, in the manufacture of oleomargarine, and in various other industries. An analysis of a sample of the New York salt, as given by Merrill, follows:

$NaCl$	98.701
$MgCl_2$	.055
$CaCl_2$	.018
$CaSO_4$	.484
Moisture	trace
Insoluble	.743

Brine salt. The manufacture of salt from brine is carried on either by the solar process, in which the brine is led into shallow wooden vats and there exposed to evaporation by the sun's heat, or by artificial methods which depend upon evaporation by direct fire or steam of the brine contained in kettles, pans or vats. The open kettle process of artificial evaporation was long used at Syracuse, but has now been superseded by the solar process. The methods of artificial evaporation now in general use are the grainer, open pan and vacuum pan. Some of the plants make use of only one method; others have an equipment that combines the grainers with vacuum pans or grainers with open pans.

The manufacture of solar salt at Syracuse is still an important industry in which a large number of individuals and firms are active. The product varies considerably from year to year, depending on the character of the season. The salt is marketed through the Onondaga Coarse Salt Association. It is sold in seven grades, of which six represent the different sizes of salt crystals separated by screening, as follows: Diamond C, B. C., Standard, Diamond F, B. F., and 6 mesh B. F. The finest size is 8 mesh, which is crushed to pass an eight-mesh screen. The product is used for the same purposes practically as rock salt.

The list of manufacturers of artificially evaporated salt at present includes the following: International Salt Co., with works at Myers and Watkins; Worcester Salt Co., Silver Springs; Rock Glen Salt Co., Rock Glen; Eureka Salt Co., Saltvale; Remington Salt Co., Ithaca; Watkins Salt Co., Watkins; Genesee Salt Co., Piffard; and Le Roy Salt Co., Le Roy.

The Eureka Salt Co. began the manufacture of salt in April 1913, having taken over the works at Saltvale, Wyoming county, formerly owned by the Crystal Salt Co. The plant is equipped with six open pans and two grainers and a mill for the making of table salt.

The nature of the brine used in the manufacture of salt is shown by the following analysis, of which no. 1 represents an average example of the Onondaga natural brines and no. 2 of an artificial brine from the solution of the rock salt:

	1	2
$MgCl_2$	.155	.049
$CaCl_2$	.129	.134
$CaSO_4$	.599	.349
NaCl	16.921	23.295

Literature of salt. The geological occurrence of the salt deposits has been set forth in detail by Luther in his papers, " Geology of the Livonia Salt Shaft " and " Salt Springs and Salt Wells of New York and Geology of the Salt District," published respectively in the 13th and 16th Annual Reports of the New York State Geologist. A good description of the technology of the brine salt manufacture is given by F. E. Englehardt in Merrill's " Salt and Gypsum Industries of New York," which is Bulletin 11 of the New York State Museum. Many records of salt wells are assembled in the papers by Bishop included in the 5th Annual Report of the New York State Geologist and in the 45th Annual Report of the State Museum.

SAND AND GRAVEL

The production of sand and gravel for use in engineering and building operations, metallurgy, glass manufacture, etc., is an important industry involving a very large number of individual operations. The building stone business is specially extensive as there are deposits suitable for that purpose in every section of the State, and nearly every town or community has its local source of supply. Such sand, of course, possesses little intrinsic value. The deposits of glass sands and molding sands are more restricted in their distribution and their exploitation is the basis of a fairly stable industry; certain molding sands are even shipped to distant points, as in the case of those obtained in the Hudson River region.

The sand and gravel beds of the State are mainly of glacial origin, as the whole territory within the limits of New York, in common with the northern section of the United States east of the Rocky mountains, was invaded by the Pleistocene ice sheet which removed all the loose material accumulated by previous weathering and erosion, and left in its retreat a mantle of transported boulders, gravels, sands and clays. In places these accumulations have the character of unmodified drift or morainal accumulations in which the materials are more or less intermixed, and are then of little industrial value. But more generally the deposits show a sorted stratiform arrangement due to having been worked over by the glacial streams and lakes. Such is the condition in many of the larger valleys like those of the Hudson, Champlain and Genesee where sands, gravels and clays occur separately in terraced beds extending far above the present water level. Later water action may have effected a beneficial re-sorting of the materials as instanced by the beach sands of Long Island and some of the lakes in the interior of the State.

A measure of the importance of the sand and gravel industry may be had from the accompanying table which, however, lacks something in the way of completeness and accuracy. The figures relating to the molding sand production are believed to be a close approximation to the actual amounts, but those for building sand and gravel may vary considerably from the true quantities, perhaps understating them by as much as 25 per cent. The building sand operations are so widely scattered and in many sections carried on in such haphazard or fugitive manner that it is extremely difficult to cover them all in a statistical canvass.

Production of sand and gravel

MATERIAL	1911	1912	1913
Molding sand	$420 780	$422 148	$449 224
Core and fire sand	27 484	55 910	38 571
Building sand	*b* 750 000	1 156 002	1 102 688
Other sand *a*	*b* 50 000	*b* 75 000	*b* 75 000
Gravel	479 103	840 669	918 783
Total	$1 727 367	$2 549 729	$2 584 266

a Includes glass sand, filter sand, engine and polishing sand. The amounts are partly estimated.
b Partly estimated.

Molding sand. The molding sand industry is centered in the middle Hudson valley, where there exist extensive areas underlaid by excellent grades of this sand, although small quantities are occasionally shipped from other sections of the State. The Hudson River district is notable for its supply of the finer sizes of molding sand such as are employed in stove-plate, brass and aluminum casting. These are comparatively rare in other districts in the east where molding sand is obtained and consequently the local product commands a rather wide market. The sand is shipped to the metallurgical centers in New York, New England, New Jersey, Pennsylvania and the Middle West. The favorable trade conditions have led to the development of a large and apparently prosperous industry which is the source of much revenue to a section that otherwise is restricted mainly to agricultural activities.

The distribution and methods of occurrence of the molding sand in the Hudson River district involve many interesting features which have not as yet been fully explained. A brief description of the deposits was given in the preceding issue of this report, and field observations have been collected as a basis for a more detailed paper on this subject.

The molding sand is restricted to the uplands on either side of the Hudson, at elevations of 200 feet or more above sea level. The district forms a narrow belt, usually but a few miles wide, along the river from Washington and Saratoga counties on the north to about the vicinity of Kingston, Ulster county, on the south. The belt widens out notably where important tributaries enter the Hudson, as in the section between Cohoes and Albany where it reaches westward up the Mohawk as far as Schenectady, and also at the outlet of the Hoosac and Batten kill. In the vicinity of Saratoga, Ballston and Round lakes occurs an area which appears to be subsidiary and parallel to the main belt that follows the river; it represents an old river channel and contains a succession of glacial clays and sands like that in the main valley.

The district is thus practically coterminous with the site of Lake Albany, the name given to the expanded waters which occupied the middle Hudson valley in late Pleistocene time. The series of sands and clays may be traced northward from the Hudson valley into the basin of Lake Champlain which also was flooded at the same time, but there appears to be very little of the molding sand in that section.

The molding sand forms a layer directly below the soil. The soil covering averages about a foot thick. Near the bottom it passes gradually into the molding sand through a decrease of organic matter which is indicated by the change of color from dark gray to the light yellow of the sand. In the average, the layer is from a foot to 3 feet thick. Below, it gives way very quickly to a loose "open" sand that lacks the clay bond and is usually a mixture of quartz and shale particles. This material in turn is underlaid by the characteristic Hudson river clays, brown or yellow on top and blue below. The thickness of the whole sand accumulation ranges from 2 or 3 feet up to 10 or 20 feet and in places even more.

The removal of the soil and molding sand is performed wholly by hand labor. With the excavation of the latter, the soil is usually replaced and the land is then returned to agriculture. The grading of the sand according to its quality requires a degree of experience and some skill of which the land owner himself is seldom possessed, and the production is mainly carried on by a few firms who also ship the sand to the market. The owner of the land receives a royalty figured on the basis of yield or else a round sum for the sand on the whole property.

Most of the output comes from the central part of the district from Saratoga, Albany, Schenectady and Rensselaer counties. In Saratoga county, Mechanicville, Round Lake, Elnora, Burgoyne and Schuylerville are the more important localities. In Schenectady the sand is obtained from near the city of Schenectady and also from Carman and Niskayuna. Large quantities are shipped from the vicinity of Albany and from Wemple, Selkirk, Glenmont and other places south of that city. In Rensselaer county the sand is excavated at points along the Hudson river and the Boston and Albany Railroad. The most southerly point from which shipments have been made recently is Kingston.

The sand is marketed under some five or six grades depending upon the fineness. The finest size generally is that called No. 0 and the others include 1, 2, 3 and 4, which is the coarsest. Some shippers supply also intermediate grades or half sizes. There is no absolute standard by which the material is graded and considerable variation exists between the grades furnished by different shippers.

The production of molding sand in 1913 amounted to 504,348 short tons valued at $449,224. The entire output, with the exception of a small quantity from Chautauqua and Cayuga counties, came from the Hudson river district. The returns indicated an increase of about 10 per cent in the production as compared with the preceding year when the total amounted to 469,138 short tons with a value of $422,148.

Core and fire sand. Core sand is a nearly pure quartz sand used in the cores of molds. It must possess refractory qualities and be permeable to gases. Fire sand is a refractory sand of about the same characters, employed in lining the hearths of furnaces. These sands are produced in Erie, Oneida and Queens counties. The output for 1913 was reported as 53,757 short tons valued at $38,571.

Glass sand. The requirements for sand used in glass manufacture are that it shall be practically pure quartz. Iron minerals are particularly objectionable and not more than a trace of iron is allowable. Glass sands are found in New York State in some of the beaches of the interior lakes, particularly Oneida lake, and on the shores of Long Island sound. The natural sands are washed to purify them of clay, mica, magnetite and other ingredients. At one time large quantities were produced around Oneida lake which forty or fifty years ago was an important center of window glass manufacture. At present the output is only a few thousand tons and it is all shipped to points outside the State.

Building sand. The largest quantities of sand are consumed in building and construction work for the making of concrete and mortar. Sands adapted to such purposes have a widespread occurrence, and their excavation and shipment to market is purely a local business, except in a few places which supply the larger cities.

The beach sands of Long Island afford excellent building sands which are shipped to New York City and its environs. In the interior of the State, glacial sands, which may be more or less re-sorted by river action, are mainly employed. Thus Albany derives its supply from a delta deposit within the city limits. Rochester has several sources of supply of which the principal one is the Pinnacle hills just south of the city, a deposit formed by glacial streams. The beach sands of Lake Erie are used in Buffalo.

The amount of sand and gravel used for building and construction purposes each year can only be approximated. Reports received from the principal producers who operated more or less steadily from year to year indicate a total value for these materials in 1913 of $2,021,471. This figure, however, certainly falls considerably short of the real value, possibly by as much as 15 per cent.

Other kinds. Filter sand is produced on Long Island. It is a quartz sand of medium to coarse texture, free of silt, and is employed in water filtration. The principal uses are the municipal filtration plants.

Engine sand is the sand used by railroad and traction companies for sanding the rails to prevent slipping. Almost any quartz sand that is not too coarse or admixed with clay is suitable.

Polishing sand is employed by stone cutting establishments for sawing and polishing soft building stone like marble and limestone. It is a sized quartz sand.

SAND-LIME BRICK

BY ROBERT W. JONES

During the season of 1913 there were in operation in the State of New York four plants producing sand-lime brick, with a total of 22,225,000 having a value of $143,345 at the plant, or an average of $6.40 a thousand. While the number of active plants has decreased, there has been an increase in both production and value over the preceding year when the production was 21,231,000 with a value of $133,736, an average of $6.30 a thousand.

The active producers during the last season include the Glens Falls Granite Brick Co., which in 1903 was the first to produce sand-lime brick on a commercial scale in this State; the Buffalo Sandstone Brick Co., of Buffalo and the Paragon Plaster Co., of Syracuse, which began to operate in 1904; and the Rochester Composite Brick Co., which began operations in 1905.

The commercial outlet for sand-lime brick was overestimated at first, and many entered upon the production without the necessary experience to produce a strictly first-class article. The production fell off from year to year until 1909. During 1908 it reached the lowest figure when 8,239,000 bricks were manufactured, having a value of $55,688, compared with 17,080,000 and a value of $122,340 for the year 1906. Beginning with 1909 the demand began to improve and steadily increased, due to a greater activity in building operations and to a better recognition of the value of sand-lime brick in construction. Methods of manufacture changed and the product now is a strictly high grade sand-lime brick having a calcium silicate bond. The industry of the State is concerned only with this grade of brick, there being at present no commercial production of mortar brick.

The majority of the operating plants in the State manufacture their product with the standard American dry press, though the German rotating press is represented. The crude material in all cases comes from local sources and the finished product supplies generally only the local demand. The following table shows the progress of the industry in the State. The figures for 1903, 1904 and 1905 were not obtainable.

Production of sand-lime brick

YEAR	QUANTITY	VALUE	VALUE PER THOUSAND	OPERATING PLANTS
1906	17 080 000	$122 340	$7 16	7
1907	16 610 000	109 677	6 60	9
1908	8 239 000	55 688	6 44	6
1909	12 683 000	81 693	6 31	6
1910	14 053 000	82 619	5 88	6
1911	15 178 000	92 064	6 05	5
1912	21 231 000	133 736	6 30	5
1913	22 225 000	143 345	6 40	4

STONE

The products of the quarries form a large item in the total mineral production of the State. The last few years have witnessed, however, some notable changes in the relative importance of the different branches of the stone industry. The use of cement and terra cotta has curtailed the demand for cut stone in building operations, so that this branch no longer occupies the prominent place that it once had. Similarly, the market for flagstone and curbstone has fallen off, more especially for flagstone, as a result of the favor shown for cement construction. On the other hand there has been a tremendous development of the crushed stone industry, which has practically counterbalanced the declines in the other departments.

Altogether the changes that have taken place have meant a loss industrially to the State, since the preparation of crushed stone requires a minimum of labor of the unskilled kind.

The statistics of production indicate that the year 1913 was a fairly active one for the quarry business. The total value of the materials of all kinds, as reported by the individual enterprises, was $6,763,054, as compared with $5,718,994 in the preceding year. There was thus a gain of $1,044,060 or about 18 per cent for the year. The output, however, fell below that returned for some of the earlier years and the gain does not seem to indicate any real expansion of quarry operations outside the crushing business. It is to be noted that the totals do not include any products from slate, millstone and cement quarries, for which separate statistics are published elsewhere in this report.

The granite quarries reported a considerably larger output than in 1912, but mainly in crushed stone. Of building and monumental granite, the product was a little less than in the preceding year.

The limestone quarries contributed about one-half of the total reported for the entire industry, maintaining the same relative position which they have occupied in the past. Limestone is more extensively used for crushed stone than any other kind, and it also finds a large outlet in lime making, furnace flux and for chemical manufacturing.

There was little change in the marble industry, the production having been about the same as in 1912. Building stone is the largest item in the local market, with monumental stone ranking next.

The sandstone output showed a small increase, mainly in the item of curbstone. In previous years the production had shown a marked decline owing to the decreased demand for flagstone, which is mainly quarried in the southeastern bluestone region. At one time this was a very large and flourishing branch of the industry, in fact the most important of all.

The trap quarries in the Palisades section made about their usual output, although the future of the industry is somewhat unsettled. The river quarries will eventually have to shut down, as they come within the bounds of the new Palisades park. It is possible that new quarries may be opened inland to take their place.

The production of the different kinds of stone during the past three years is given in the tables herewith.

Production of stone in 1911

VARIETY	BUILDING STONE	MONUMENTAL	CURBING AND FLAGGING	CRUSHED STONE	ALL OTHER	TOTAL VALUE
Granite........	$30 684	$11 353	*a*	$72 401	$34 195	$148 633
Limestone.....	112 082	....	$11 989	1 936 292	1 113 798	3 174 161
Marble........	171 748	79 115	....	....	27 178	278 041
Sandstone.....	327 587	....	526 074	23 883	182 562	1 060 106
Trap..........	....	....	....	896 164	3 250	899 414
Total.....	$642 101	$90 468	$528 063	$2 928 740	$1 360 983	$5 560 355

a Included under "All other."

Production of stone in 1912

VARIETY	BUILDING STONE	MONUMENTAL	CURBING AND FLAGGING	CRUSHED STONE	ALL OTHER	TOTAL VALUE
Granite........	$65 487	$19 130	*a*	$49 307	$68 172	$2 02 096
Limestone.....	108 581	....	$5 481	2 176 368	1 220 015	3 510 445
Marble........	155 411	84 511	....	....	1 925	241 847
Sandstone.....	363 055	....	615 846	45 301	256 541	1 280 743
Trap..........	....	....	....	483 863	....	483 863
Total.....	$692 534	$103 641	$621 327	$2 754 839	$1 546 653	$5 718 994

a Included under "All other."

Production of stone in 1913

VARIETY	BUILDING STONE	MONUMENTAL	CURBING AND FLAGGING	CRUSHED STONE	ALL OTHER	TOTAL VALUE
Granite........	$45 911	$17 013	*a*	$236 650	$36 068	$335 642
Limestone.....	101 198	....	$6 546	2 386 632	1 358 302	3 852 678
Marble........	127 556	81 330	....	....	43 406	252 292
Sandstone.....	285 645	....	682 984	46 267	306 376	1 321 272
Trap..........	....	....	....	1 001 170	....	1 001 170
Total.....	$560 310	$98 343	$689 530	$3 670 719	$1 744 152	$6 763 054

a Included under "All other."

GRANITE

Granite is both a specific and a general term. When used in the restricted scientific sense it means an igneous rock of thoroughly crystalline character in which the chief constituents are feldspar, quartz and mica. Such a rock has a massive appearance, that is, the constituents are uniformly distributed in every direction, and owing to the predominance of the feldspar and quartz, the color is rather light, commonly gray or pink. As a variation to the uniform distribution of the minerals, the latter may develop a plane parallel arrangement through the influence of compression when the mass was still deeply buried in the earth's crust. A granite with this parallel or foliated texture is known as a granite gneiss.

The commercial definition of granite is much broader than that given and includes almost any of the crystalline silicate rocks (usually igneous) that possess the requisite physical qualities for use as architectural or monumental stone. In most cases the commercial product is actually a granite in the true sense, but not infrequently it may be a syenite which lacks quartz, or a diorite consisting of plagioclase, feldspar and hornblende, or anorthosite which contains little else than basic plagioclase feldspar. So-called black granites are mainly gabbros and diabases with a large proportion of the iron compounds pyroxene, hornblende and magnetite.

The broader usage will be followed in the present classification, as all the above named rocks are quarried in this State. The only silicate rock not included under granite is diabase or trap which, on account of the special features surrounding its production and uses, is classed by itself.

Granites and the related igneous types are restricted to two well-defined areas in New York — the Adirondacks in the north and the Highlands in the southeast. Some account of the principal quarries in the two areas has been given in the issue of this report for the year 1911.

The production of granite in the last three years is shown in the accompanying table. The figures represent the commercial value of the output of all quarries with the exception of those operated by contractors on road improvement work, for which it is very difficult to compile any reliable figures. The total value of the granite quarried in 1913 was $335,642, as compared with $202,096 in 1912. The gain was mainly in the item of crushed stone. There was little change in the building, monumental and other kinds, aside from the crushed product.

Production of granite

VARIETY	1911	1912	1913
Building	$30 684	$65 487	$45 911
Monumental	11 353	19 130	17 013
Crushed stone	72 401	49 307	236 650
Rubble, riprap	28 162	27 861	9 722
Other kinds	6 033	40 311	26 346
Total	$148 633	$202 096	$335 642

QUARRY NOTES

Keeseville. The development of quarries in the vicinity of Keeseville was under way during 1913. The Empire State Granite Co. opened two quarries on lands of George W. Smith, about a mile west of Keeseville, near the Clintonville road, and did some exploratory work in the vicinity of Augur lake, southeast of that village. The rock in both places is anorthosite, the same as that once quarried at Keeseville under the name of "Ausable granite." The present openings west of Keeseville yield a more uniform material than the Prospect hill quarries which were the source of the product in earlier years. A notable feature of the stone which differentiates it from ordinary granites is its color — a light, translucent green on both fractured and polished surfaces. The composition, of course, is also quite distinct from that of granite proper, being characterized by a predominance of the lime-soda feldspar labradorite. This constitutes from 75 to 85 per cent of the mass. It composes most of the body where it is finely divided and also occurs in scattered crystals of larger size which lend the effect of a porphyritic texture, as the larger individuals have a dark color. Besides feldspar, there is some pyroxene, black when seen in the hand specimen, red garnet in threadlike aggregates, and ilmenite of opaque black color. The stone is remarkable for its fresh condition at the very surface, there being only a thin skin, not over one-half inch thick, of bleached material on the exposed surfaces which have been subject to weathering since Glacial time.

One of the quarries on the Smith property is on the side of a ridge which affords a working face 50 feet high. The rock is broken by joints at rather wide intervals, there being two main systems of vertical joints, the one about north-south and the other at right angles. A 12 foot diabase dike intersects the quarry face in an east-west direction. The rock is fine in texture, except for the residual crystals which range from a fraction of an inch to several inches across. At the second quarry, which is a pit opening, the rock is coarser and contains a larger proportion of residual feldspars. The joints here run southeast-northwest and northwest-southeast with a horizontal set at intervals of 3 or 4 feet. A dike of trap and one of syenite porphyry were noticed in the walls of the quarry.

On the shores of Augur lake occur extensive exposures of anorthosite; in some places cliffs rise from 75 to 100 feet directly from the lake. The material varies in texture and appearance from place to place. Some varieties have a dark color and contain a large percentage of iron-magnesia minerals in the form of pyroxene and biotite. Other types of the rock are light gray or greenish, being then more feldspathic. The places prospected by the Empire State Granite Co. are on the west side of Augur lake. Nearby is a quarry on the property of C. B. White which was worked several years ago and the product shipped to New York for use in the Criminal Courts building. The stone is of light gray color. The quarry opening is on top of a ledge 80 feet above the lake and is about 150 feet square.

The anorthosite from this section is a strong durable material, well adapted for most structural purposes. It takes a good polish and is attractive on account of its rare color. The polished samples, however, show minute hairlike fractures which seem to mark the direction of the rift and grain. Apparently their presence does not materially weaken the structure, as the crushing is equal to that of the average granite. Tests made by the office of public roads in Washington showed an ultimate strength of 20,500 pounds a square inch on a specimen from the Smith property and 18,500 pounds on a specimen from Augur lake.

Parishville. A new monumental and structural granite has been quarried at Parishville in eastern St Lawrence county. The stone has been marketed under the name of the St Regis Red Veined Granite. It has a dark red fine-grained body in which appear curved and branching veinlets of bright red color and somewhat coarse grain, but of the same mineral composition as the rest. The veining is not sharply defined but shades off on the borders and in places developes into round or irregular unclear patches which give the effect of clouds of lighter color. The appearance of a polished surface is quite attractive, as it is also rare among stones of this class. The coarser grained material is not the result of pegmatitic injection, but a variation produced from different conditions of crystallization, probably in a stage of resoftening of the original rock. The granite belongs to the Adirondack granite gneisses and is composed of feldspar, biotite and quartz, the last in rather small amount for true granite, with some hornblende, magnetite, zircon and chloritic alteration products. It is a well-preserved strong stone. A crushing test made at the Clarkson School of Technology at Potsdam showed an ultimate resistance of 20,000 pounds to the square inch. The chemical composition, as determined by L. K. Russell, is as follows:

SiO_2	66.78
Al_2O_3	13.01
Fe_2O_3	6.50
MgO	.92
CaO	1.31
Na_2O, K_2O	10.89
H_2O	.51
Total	99.92

The quarry is operated by the St Regis Red Veined Granite Co. A sample of the granite in the State Museum shows a good polish and very attractive pattern. Monumental stock is the main product.

LIMESTONE

The stone classified under the heading of limestone consists for the most part of the common grades of limestone and dolomite such as are characterized by a compact granular or finely crystalline texture and are lacking in ornamental qualities.

A smaller part is represented by crystalline limestone and by the waste products of marble quarrying which is sometimes employed for crushed stone, lime making or flux. Limestone used for the manufacture of portland and natural cement is, however, excluded from the tabulations so as to avoid any duplications of the statistics.

Limestones have a wide distribution in the State, the only region which is not well supplied being the southern part where the prevailing formations are sandstones of Devonic age. The microcrystalline varieties occur in regular stratified order in the Cambric, Lower Siluric, Upper Siluric and Devonic systems. In most sections they occupy considerable belts and have been little disturbed from their original horizontal position. On the borders of the

Adirondacks and in the metamorphosed Hudson river region, however, they have been more or less broken up by faulting and erosion and in places have a very patchy distribution.

The Cambric limestones are found in isolated areas on the east, south and west of the Adirondacks. They are usually impure, representing a transition phase between the Potsdam sandstones below and the high calcium limestones above. The lower beds of the Beekmantown formation as originally defined are now known to belong to the Cambric system. The Little Falls dolomite is perhaps the most prominent member of the Cambric limestones and is extensively developed in the Mohawk valley with quarries at Little Falls, Amsterdam, and other places. It is a rather heavily bedded stone of grayish color, suitable more especially for building purposes. In Saratoga county the Hoyt limestone is in part the equivalent of the Little Falls dolomite; it has been quarried for building stone just west of Saratoga Springs. On the west side of the Adirondacks the Theresa limestone is described by Cushing as a sandy dolomite which may in part belong to the Cambric system. It is comparatively thin and has no importance for quarry purposes.

The Beekmantown limestone, which is now taken as including the middle and upper beds of that series as earlier defined, is mostly restricted to the Champlain valley. It occurs on the New York shore in rather small areas, usually down-faulted blocks, that are the remnants of a once continuous belt. It is also represented doubtless in the basal portion of the limestone area that extends across Washington and Warren counties. The only place where it has been extensively quarried is at Port Henry where the purer layers have been worked for flux. In the Lake Champlain region it is a bluish or grayish magnesian limestone occurring in layers from a few inches to several feet thick.

The Chazy limestone is found in the same region as the Beekmantown in discontinuous areas along the eastern Adirondacks from Saratoga county north to the Canadian boundary. It attains its maximum thickness in eastern and northeastern Clinton county, and has been quarried around Plattsburg, Chazy and on Valcour island. The Chazy is the earliest representative of the Paleozoic formations characterized by a fairly uniform high calcium content; it analyzes 95 per cent or more of calcium carbonate. It has a grayish color and finely crystalline texture. The fossiliferous beds afford attractive polished material which is sold as "Lepanto" marble. It is used also for lime and furnace flux. There are old quarries on Willsboro point, Essex county. On the west side of the Adirondacks the Pamelia limestone, described in the areal reports of that section, belong to the Chazy series. It covers a considerable area in Jefferson county between Leraysville and Clayton, and has been rather extensively quarried for building stone and lime, though of subordinate importance to the Trenton limestones of that section.

In the Mohawkian or Trenton group are included the Lowville (Birdseye), Black River and Trenton limestones which have a wide distribution and collectively rank among the very important quarry materials of the State. They are represented in the Champlain valley but are specially prominent on the Vermont side; from the latter area a belt extends southwest across northern Washington county to Glens Falls in Warren county and is continued into Saratoga county. Another belt begins in the Mohawk valley near Little Falls and extends northwesterly with gradually increasing width across Oneida, Lewis and Jefferson counties to the St Lawrence river. There are isolated areas of Trenton limestone in the Hudson valley south of Albany. The limestones vary in composition and physical character according to locality and geologic position. They are often highly fossiliferous. In the northern section they are mostly gray to nearly black in color, contain little magnesia and run as high as 97 or 98 per cent calcium carbonate. The lower part of the group is heavily bedded and well adapted for building stone; the upper beds commonly contain more or less shale. They are used for various purposes including building and ornamental stone, crushed stone, lime, portland cement and flux. In the Champlain valley quarries are found near Plattsburg, Larabees Point and Crown Point; in Washington county at Smiths Basin; in Warren county at Glens Falls where there are extensive quarries that supply material for building purposes, portland cement and lime. The well-known black marble from Glens Falls is taken from the Trenton. Numerous quarries have been opened in Herkimer, Oneida, Lewis and Jefferson counties. The output of the last named quarry is specially important, including limestone for building and road construction and lime for manufacture of calcium carbide. The principal quarries in Jefferson county are at Chaumont.

The next assemblage of limestones in the order of stratigraphic occurrence includes the Clinton, Lockport and Guelph members of the Niagara group. The Clinton limestone has a variable importance in the belt of Clinton strata that extends from Otsego county a little south of the Mohawk river across the central and western parts of the State on the line of Oneida lake and Rochester to the Niagara river. East of Rochester the limestone is relatively thin, usually shaly and split up into several layers, but on the west end in Niagara county it becomes the predominant member and has a more uniform character. Large quarries have been opened recently at Pekin, Niagara county, for the supply of flux to the blast furnaces of the Lackawanna Steel Co. at Buffalo. The upper beds of bluish gray fossiliferous limestone from 10 to 12 feet thick are the purest and analyze from 90 to 95 per cent calcium carbonate. The Lockport is a magnesian limestone, in places a typical dolomite, and is rather siliceous in the lower part. It outcrops in a continuous belt, several miles wide, from Niagara Falls east to Onondaga county and then with diminishing width across Madison county. The upper layers are rather heavy and yield material suitable for building purposes, road metal and lime. There are quarries around Niagara Falls, Lockport and Rochester. It is worked to some extent in Wayne, Onondaga and Madison counties. The Guelph, also a dolomite, occupies a limited area in Monroe and Orleans counties and is worked near Rochester.

The Cayugan group includes among its members the Cobleskill, Rondout and Manlius limestones, which are economically important. They have furnished large quantities of material for the manufacture of natural cement, being the source of the cement rock in the Rosendale district and in Schoharie and Onondaga counties. The cement rock of Erie county is found in the Salina formation. The Manlius limestone is used for portland cement in the eastern part of the State.

At the base of the Devonic system appears the Helderbergian group which is very important for its calcareous strata. Limestones of this age strongly developed along the Hudson river in Albany, Columbia, Greene and Ulster counties. The Coeymans or lower Pentamerus and the Becraft or upper Pentamerus limestones afford material for building, road metal, lime and portland cement. The limestone for the portland cement works at Hudson and Greenport is obtained from Becraft mountain, an isolated area of limestones belonging to the Manlius, Helderbergian and Onondaga formations. The works at Howes Cave use both the Manlius and Coeymans limestones. Extensive quarries are located also at Catskill, Rondout and South Bethlehem.

The Onondaga limestone, separated from the preceding by the Oriskany sandstone, has a very wide distribution, outcropping almost continuously from Buffalo, Erie county, eastward to Oneida county and then southeasterly into Albany county, where the belt curves to the south and continues through Greene, Ulster and Orange counties to the Delaware river. It is in most places a bluish gray, massive limestone with layers and disseminated nodules of chert. The chert is usually more abundant in the upper beds. The limestone finds use as building stone and the less siliceous materials, also, for lime-making. Quarries have been opened at Kingston, Split Rock (near Syracuse), Auburn, Waterloo, Seneca Falls, Le Roy, Buffalo and other places.

The Tully is the uppermost of the important limestone formations and likewise the most southerly one represented in the central part of the State. Its line of outcrop extends from Ontario to Madison county, intersecting most of the Finger lakes. Its thickness is not over 10 feet, and on that account can not be worked to advantage except under most favorable conditions of exposure. For building stone it is quarried only locally and to a very limited extent. It finds its principal use in portland cement manufacture, being employed for that purpose by the Cayuga Lake Cement Co. in its works at Portland Point, Tompkins county.

Marl is a useful substitute for the hard limestone for some purposes and is rather extensively developed in the central and western parts of the State. It is found particularly in swampy tracts and old lake basins associated with clay and peat. In the Cowaselon swamp near Canastota the marl underlies several thousand acres and is said to be 30 feet thick. The Montezuma marshes in Cayuga and Seneca counties contain a large deposit which at Montezuma is 14 feet thick. In Steuben county the marls at Arkport and Dansville have been employed for lime-making. Until recently marls have been used extensively for portland cement and plants were operated at one time in the marl beds near Warner and Jordan, Onondaga county; at Montezuma, Cayuga county; Wayland, Steuben county; and Caledonia, Livingston county. Their principal use at present is for agricultural and chemical purposes.

Production. Limestone is by far the most important of the quarry materials, accounting for more than one-half of the total value returned by the quarries each year. Its importance depends upon the varied uses which it serves as well as upon its wide distribution. It is extensively employed as crushed stone for concrete and road making, as building stone, and for construction purposes generally, and in addition is an important material in chemical manufacturing and metallurgy. A large and increasing demand for limestone has recently developed in connection with agriculture for which purposes it is either burned into lime or ground into a fine powder.

The output of limestone has shown a steady gain during the last four years and in 1913 it amounted to a value of $3,852,678, much the largest on record. The total for 1912 was $3,510,445. These figures do not show the value of the stone consumed in portland cement manufacture which is a large item, or of any material quarried by contractors on road improvement work, for which no reliable data are obtainable.

The statistical canvass for 1913 showed a total of one hundred four active quarries distributed among twenty-nine counties of the State.

Production of limestone

MATERIAL	1911	1912	1913
Crushed stone	$1 936 292	$2 176 368	$2 386 632
Lime made	400 396	452 002	486 908
Building stone	112 082	108 581	101 198
Furnace flux	454 800	542 154	575 102
Rubble, riprap	20 328	10 696	26 006
Flagging, curbing	11 989	5 481	6 546
Miscellaneous	238 274	215 163	270 286
Total	$3 174 161	$3 510 445	$3 852 678

Erie county outranks all others in importance in this industry; the value of the limestone quarried in the county last year amounted to $832,579. The products are chiefly furnace flux, crushed stone and building stone. The principal quarries are at North Buffalo, Clarence and Akron.

Onondaga county is the second largest producer, with a total value of $501,506 in 1913. A large proportion of the product is quarried by the Solvay Process Co. for use as a reagent in the manufacture of alkali. The quarries operated by the company at Jamesville are very extensive and supply crushed stone as a by-product. A new producer in 1913 was the Lackawanna Stone Co. with quarries in the town of Onondaga.

The other counties reporting a value of over $100,000 in 1913 were Dutchess, Genesee, Rockland, Niagara, Warren, Albany, Clinton and Schoharie in the order of their output. The Wickwire Limestone Co. opened a flux quarry at Gasport, Niagara county.

The distribution of the production of limestone for the years 1912 and 1913 is shown in the accompanying tables.

Crushed stone. Limestone finds its principal application as crushed stone in which form it is employed for road metal, concrete and railroad ballast. There are large quarries supplying crushed stone in Erie, Genesee, Onondaga, Dutchess, Ulster, Rockland and Westchester counties. The canal, highway and other public improvements in current progress have created large markets for the material, and the production has shown a steady increase. A considerable quantity of the fines made by the crushing plants is sold for agricultural purposes as a substitute for burnt rock or lime.

The value of the crushed stone for 1913 reached a total of $2,386,632 against $2,176,368 for the preceding year. As already stated, the total does not comprise the stone crushed by contractors in temporary plants for use on the highway system. The actual quantity of stone produced by the crushing plants was 3,945,543 cubic yards, as compared with 3,559,257 cubic yards in 1912.

Lime. The value of the lime made for market last year was $486,908 as compared with $452,002 in 1912. In quantity it amounted to 110,083 short tons against 93,176 short tons in 1912. In addition there was a large output made in connection with chemical manufactures, such as alkali, carbide etc., which as it was marketed in the form of lime has been included in the tables under "Other uses." The principal lime-burning industry is in Warren, Washington, Clinton, Jefferson, Fulton, Madison and Dutchess counties. The increase shown in the last two or three years may be attributed to the growing use of lime for agricultural purposes.

Building stone. The product of building stone has diminished steadily from year to year. The output of $101,198 recorded for 1913 was less than half the total returned five years ago. The decline has been caused by the lessened demand for building stone and not to any exhaustion of the quarries. The wide use of concrete and steel construction in the cities has changed the whole market situation, reducing the sales of cut stone, but giving a great impetus to the crushed stone business.

The total value of the building stone quarried in 1913 was $101,198, as compared with $108,581 in the preceding year. Erie county, as heretofore, contributed the largest part, $56,239 against $67,912 in the preceding year. Cayuga, Onondaga, Monroe and Warren counties made smaller outputs.

Furnace flux. The metallurgical enterprises which are established in the State provide a large outlet for fluxing limestone which is mainly obtained from local formations. Nearly pure high calcium limestones are usually required for the purpose, although in iron smelting the presence of magnesia is not detrimental. The principal flux quarries are in the Onondaga limestone of Erie and Genesee counties, the Clinton limestone of Niagara county, the Precambric limestones or marbles of the Adirondacks, and the Chazy limestones of the Champlain valley. The limestones in these sections carry from 90 to 95 per cent of calcium carbonate.

The production of flux in 1913 was valued at $575,102, representing a total of 1,052,519 net tons. The corresponding figures for the preceding year were $542,154 and 1,032,481 tons. Niagara and Erie counties, which supply the iron and steel works about Buffalo, reported the largest quantities.

Agricultural lime. The use of lime on agricultural lands has become an important factor in the quarry industry. The quantity sold for the purpose is not given separately in the statistical tables for the reason that many of the quarry companies themselves do not know the amount of their product that is thus used. Much of the material sold is really a by-product of which little account is taken, as in the case of the fines and dust of the crushing plants which are now utilized, and also the inferior grades of quicklime. There are a number of quarries, however, that dispose of all or a large part of their product for agricultural lime. Altogether the quantity produced last year probably amounts to 100,000 tons, and may have been considerably more. There has been a very active inquiry for quarry lands in the State which are favorably situated for supplying this market. The material must be delivered to the consumer at a low price to make it economically available, and the tendency, doubtless, will be to develop local quarries so far as possible.

There is an inexhaustible supply of limestone well adapted for agricultural use, though the resources are by no means so distributed as to be always available as commercial quarry sites. The best limestones, that is the high-grade calcium varieties, are mainly to be found in the Precambric and early Paleozoic formations of the northern part of the State. The crystalline limestones or marbles of St Lawrence, Jefferson and Lewis counties, the Trenton limestones on the southeastern, southern and western sides of the Adirondacks, and the Chazy limestone of the Champlain valley are the more important.

Production of limestone by counties in 1912

COUNTY	CRUSHED STONE	LIME MADE	FURNACE FLUX	BUILDING STONE	OTHER USES	TOTAL
Albany	$136 690	....	....	....	....	$136 690
Cayuga	32 620	....	....	$7 330	....	39 950
Clinton	8 694	$60 521	$13 423	600	$2 881	86 119
Erie	607 107	75	246 091	67 912	2 662	923 847
Genesee	214 310	6 750	54 557	....	6 000	281 617
Greene	3 250	....	6 000	....	....	9 250
Herkimer	14 826	....	....	....	....	14 826
Jefferson	18 865	*a* 17 942	....	....	....	36 807
Lewis	1 568	35 000	....	39	2 782	39 389
Madison	33 957	....	....	766	....	34 723
Monroe	28 079	6 600	....	2 307	....	36 986
Montgomery	17 794	....	....	7 259	1 886	26 939
Niagara	....	....	192 915	1 407	2 800	197 122
Oneida	51 507	14 280	....	....	....	65 787
Onondaga	204 998	*a*	....	6 407	208 914	420 319
Rensselaer	23 974	....	....	150	....	24 124
St Lawrence	1 035	5 277	24 612	5 149	....	36 073
Schoharie	96 000	....	210	2 089	1 658	99 957
Ulster	38 375	16 360	....	....	....	54 735
Warren	46 434	207 727	....	6 441	308	260 910
Washington	....	43 350	....	300	....	43 650
Westchester	....	11 695	100	....	1 000	12 795
Other counties *b*	596 285	26 425	4 246	425	449	627 830
Total	$2 176 368	$452 002	$542 154	$108 581	$231 340	$3 510 445

a Lime made by Solvay Process Co. and Union Carbide Co. included in "Other uses."
b Includes Columbia, Dutchess, Essex, Fulton, Ontario, Orange, Rockland and Seneca counties.

Production of limestone by counties in 1913

COUNTY	CRUSHED STONE	LIME MADE	FURNACE FLUX	BUILDING STONE	OTHER USES	TOTAL
Albany	$141 583	....	....	....	....	$141 583
Cayuga	30 455	....	....	$12 552	$74	43 081
Clinton	42 861	$62 073	$17 810	450	1 255	124 449
Dutchess	433 117	18 392	....	....	....	451 509
Erie	514 619	....	251 011	56 239	10 710	832 579
Genesee	208 881	15 000	60 860	700	3 500	288 941
Greene	2 300	....	....	....	350	2 650
Herkimer	1 800	....	....	....	....	1 800
Jefferson	8 170	58 230	1 000	....	16 400	83 800
Lewis	11 971	43 602	....	114	4 471	60 158
Madison	43 365	41 571	1 380	685	1 950	88 951
Monroe	30 695	7 650	....	5 199	....	43 544
Montgomery	30 949	....	....	4 995	1 361	39 305
Niagara	22 396	....	215 498	2 810	236	240 940
Onondaga	282 425	....	....	9 581	209 500	501 506
St Lawrence	13 407	3 162	18 915	810	453	36 747
Schoharie	86 742	....	400	431	26 438	114 011
Ulster	76 071	16 010	....	....	....	92 081
Warren	32 466	154 618	....	5 435	26 082	218 601
Washington	1 500	43 000	....	250	....	44 750
Other counties	370 859	23 600	8 228	947	58	403 692
Total	$2 386 632	$486 908	$575 102	$101 198	$302 838	$3 852 678

MARBLE

Marble, in the commercial sense, like granite, includes a variety of rocks that lend themselves to building or decorative uses. Most commonly, the name signifies a crystalline aggregate of calcite or dolomite, as distinguished from ordinary limestones which at best are of indistinctly crystalline nature. At the same time it implies the feature of attractiveness by reason of color and the ability to take a lustrous polish. Rocks possessing all these features are marbles in the strict sense to which the name may be applied without qualification. Some compact or granular limestones that lack the elements of thorough crystallinity make, however, a handsome appearance when polished, and such are commercially classed as marbles. Fossil marbles, black marbles, and a few other kinds are commonly of the noncrystalline type. Serpentine marble, or verde antique, is made up for the most part of the mineral serpentine, a silicate of magnesium and iron, and is therefore not related to the varieties already described. Ophitic limestone, or ophicalcite, is a crystalline limestone or dolomite carrying grains and nodules of serpentine scattered more or less evenly through its mass. Its ornamental quality lies in the speckled or mottled pattern and the sharp contrast between the clear white mass and the greenish serpentine inclusions.

Marbles belonging to those various types find representation in the geologic formations of the State and are quarried on a commercial scale or have been so quarried in the past.

The true or crystalline varieties are limited in occurrence to the metamorphic areas of the Adirondacks and southeastern New York. They are of early geologic age, antedating the period of crustal disturbance and metamorphism which in the Adirondacks was brought to a close practically before Cambric time and which in southeastern New York was completed in the Paleozoic. This thoroughly crystalline character is in fact a development of the strong compression accompanied by heat to which they have been subjected; having been originally, no doubt, ordinary granular or fossiliferous limestones similar to those so plentifully represented in the undisturbed formations outside the regions.

The crystalline limestones of the Adirondacks are most abundant on the western border in Jefferson, Lewis and St Lawrence counties where they occur in belts up to 4 or 5 miles wide and several times as long, interfolded and more or less intermixed with sedimentary gneisses, schists and quartzites. They are found in smaller and more irregularly banded areas in Warren and Essex counties on the eastern side, but have little importance elsewhere. The ophitic limestones that have been quarried at different times belong to the same series. The marbles of the Adirondacks comprise both the calcite class with very little magnesia and the dolomite class containing high percentages of magnesia. No definite relation is apparent in regard to the occurrence of the two and both may be found in the same area and in close association.

The southeastern New York marbles occur in belts which follow the north-south valleys, east of the Hudson, from Manhattan island into Westchester, Dutchess and Columbia counties. They range from very coarsely crystalline to finely crystalline rocks, are prevailingly white in color and belong to the dolomite class. They are interfolded with schists and quartzites, the whole series having steep dips like those of strongly compressed strata. The geologic age of the southern belts is probably Precambric, but on the north and east within range of the Taconic disturbance, they may belong to the early Paleozoic.

Bodies of practically pure serpentine of considerable extent are found on Staten Island and in Westchester county near Rye; they represent intrusions of basic igneous rocks whose minerals, chiefly pyroxene and olivine, have subsequently changed to serpentine. They are not important for quarry purposes, owing to the frequency of fissures and joints and the rather somber color of the exposed parts of the masses.

The microcrystalline or subcrystalline limestones that are sometimes sold as marbles include members of the regularly bedded unmetamorphosed Paleozoic limestones, which locally show qualities of color and polish that make them desirable for decorative purposes. They range from dense granular varieties to those having a more or less well-developed crystalline texture and are often fossiliferous. Inasmuch as they have never been subjected to regional compression or been buried in the earth deep enough to become heated, the crystalline texture, when present, may be ascribed to the work of ground waters. These circulate through the mass, taking the carbonates of lime and magnesia into solution, and redeposit them in crystalline form. Originally, the limestones were accumulations of lime-secreting fossils or granular precipitates, for the most part of marine origin. Some of the localities where these unmetamorphic marbles occur are on the west shore of Lake Champlain, around Plattsburg and Chazy (Chazy limestone), Glens Falls (Trenton limestone) and Becraft and Catskill (Becraft limestone).

Production. The production of marble in 1913 was carried on in Clinton, St Lawrence, Warren, Dutchess and Westchester counties by a total of eight quarries. The quarries in the vicinity of Gouverneur, St Lawrence county, contributed the larger quantity of building and monumental stone; the operative companies in that section include the St Lawrence Marble Quarries, Northern New York Marble Co. and Gouverneur Marble Co. In southeastern New York the Dover Marble Co. was active as heretofore in the production of building and decorative marble. The output was about the same as in the preceding year and had a value of $252,-292.

Production of marble

VARIETY	1911	1912	1913
Building marble	$171 748	$155 411	$127 556
Monumental	79 115	84 511	81 330
Other kinds	27 178	1 925	43 406
Total	$278 041	$241 847	$252 292

SANDSTONE

Under sandstones are included the sedimentary rocks which consist essentially of quartz grains held together by some cementing substance. Among the varieties distinguished by textural features are sandstones proper, conglomerates, grits and quartzites.

Of the sedimentary rocks which occur in the State, sandstone has the largest areal distribution, while in economic importance it ranks second only to limestone. Nearly all the recognized stratigraphic divisions above the Archean contain sandstone at one or more horizons. The kinds chiefly quarried are the Potsdam, Hudson River, Medina and Devonic sandstones. A few quarries have been opened also in the Shawangunk conglomerate and the Clinton and Triassic sandstones.

The Potsdam of the Upper Cambric is the lowest and earliest in age of the sandstones that have a fairly wide distribution and are utilized for building purposes. The most extensive outcrops are along the northern and northwestern borders of the Adirondacks, in Clinton, Franklin, St Lawrence and Jefferson counties. Other exposures of smaller extent are found in the Lake Champlain valley and on the southeastern edge of the Adirondack region. These latter areas represent the remnants of a once continuous belt that has been broken up by folding, faulting and erosion. The Potsdam sandstone has in many places the character of a quartzite, consisting of quartz grains cemented by a secondary deposition of quartz, and then is a very hard, tough and durable stone. The quartzite from St Lawrence county has sustained a crushing test of more than 42,000 pounds to the square inch. The color varies from deep red to pink and white. The principal quarries are near Potsdam and Redwood, St Lawrence county, and Malone and Burke, Franklin county. Besides building stone, which is the chief product, there is some flagstone sold, mainly by the quarries at Burke, for shipment to Montreal.

The so-called Hudson river group is essentially a group of sandstones, shales, slates and conglomerates, ranging in age from the Trenton to the Lorraine, but which have not been sufficiently studied to permit the actual elimination of the various members on the map. The group is exposed in a wide belt along the Hudson from Glens Falls southward into Orange county and also in the Mohawk valley as far west as Rome. The sandstone beds are usually fine grained, of grayish color and rather thinly bedded. Over wide stretches they provide practically the only resource in constructional stone and consequently they have been quarried at a great number of places to supply the local needs for building and foundation work. Some of the stone is crushed for road metal and concrete.

The Medina sandstone is found along the southern shore of Lake Ontario from the Niagara river east to Oswego county; in central New York it is represented by a coarse conglomeratic phase called the Oneida conglomerate. As developed in the western part of the State, where it is principally quarried, it is a hard fine-grained sandstone of white, pink and variegated color. The pink variety is specially quarried for building stone and has an excellent reputation. Many of the larger cities of the country and most of the important towns and cities of the State contain examples of its architectural use. The large quarries are situated in Orleans county, near Albion, Holley and Medina, along the line of the Erie canal, but there are others at Lockport and Lewiston, in Niagara county and at Brockport and Rochester in Monroe county. The Medina sandstone also finds extensive applications for curbing and flagging and for paving blocks. It is employed more extensively for the latter purpose than any other stone quarried in the State.

The Shawangunk conglomerate is more widely known for its use in millstones than for constructional purposes. It outcrops along Shawangunk mountain in Ulster county and southwesterly into New Jersey, with an outlier near Cornwall, Orange county. The quarries near Otisville have supplied considerable quantities of stone for abutments and rough masonry.

The Clinton sandstone is mainly developed in central New York, being absent from the Clinton belt in the western part of the State. It forms ledges of considerable extent on the south side of the

Mohawk valley from Ilion to Utica and beyond. It consists of reddish brown and gray sandstones, of medium texture and hardness. The stone has been used for foundations and building in Utica and other places in the vicinity.

Of the Devonic formations which cover about one-third the whole area of the State, the Hamilton, Portage, Chemung and Catskill contain important sandstone members serviceable for quarry operations. These sandstones are popularly known as bluestones, a name first applied in Ulster county where they are distinguished by a bluish gray color. They are for the most part fine grained, evenly bedded, bluish or gray sandstones, often showing a pronounced tendency to split along planes parallel to the bedding so as to yield smooth, thin slabs. For that reason they are extensively used for flag and curbstone, and a large industry is based on the quarrying of these materials for sale in the eastern cities. Most flagstone is produced in the region along the Hudson and Delaware rivers, where there are convenient shipping facilities to New York, Philadelphia and other large cities. The Hudson River district includes Albany, Greene and Ulster counties, but the quarries are mainly situated in the area that includes southern Greene and northern Ulster, with Catskill, Saugerties and Kingston as the chief shipping points. The Delaware River district includes Sullivan, Delaware and Broome counties; the shipping stations are along the Erie and Ontario and Western railroads. The sandstone of this section ranges from Hamilton to Catskill age. In the area to the west the quarries are confined to the Portage and Chemung groups, with the most important ones in the Portage. There are large, well-equipped quarries near Norwich, Chenango county, and Warsaw, Wyoming county, which produce building stone for the general market. Numerous small quarries are found in Otsego, Chemung, Tompkins, Tioga, Schuyler, Steuben, Yates, Allegany, Cattaraugus and Chautauqua counties.

Production of sandstone. Sandstone is the second most important quarry material in the State, the value of the annual product being exceeded only by that of limestone. Its importance largely depends upon its uses for street work — flagging, curbing and paving blocks — although some of the local sandstones find extensive employment as building materials.

The Devonic sandstones, which are collectively known as bluestone, are more widely quarried than the other kinds; their production is carried on throughout the southern part of the State by a large number of individuals and companies. With few exceptions, the quarries are small, giving employment only to two or three workmen each and having very little in the way of mechanical equipment. Such small enterprises are particularly characteristic of the Hudson River and Delaware River regions where much of the flagstone and curbstone is produced. Many of the quarries are worked intermittently by farmers in the off season of their usual occupation. The stone is hauled down the hillsides to the railroad sidings or the river docks where it is purchased by middlemen who ship it to the eastern markets. The stone from the Hudson River district is mainly shipped by barges from Kingston and Saugerties. In the interior it is shipped by rail. A statistical canvass of such small enterprises is a matter of great difficulty and is likely to afford very unreliable results. Consequently, it has been the practice in this report to secure information so far as possible from the dealers who purchase the stone for shipment to the large wholesalers and consumers in the cities.

The production of sandstone during the last two years is shown in the accompanying tables which give its distribution also among the leading districts.

The combined value of all the sandstone quarried in 1913 was $1,321,272, against $1,280,743 in 1912. The total is exclusive of any sandstone quarried by contractors for use on the State highway system, for which it is impossible to assign any accurate value.

Of the value given, a little more than one-half was returned by the quarry companies operating in the bluestone districts, in exact figures $753,510. This industry showed a slight decline, as compared with the preceding year when the output had a value of $824,-949; the decrease resulted from the lessened activity in the building stone business in Chenango and Wyoming counties. The trade in flagstone and curbstone was about the same proportions as in the preceding year. The product of these materials amounted in value $503,607 and consisted of 1,094,643 linear feet of curb and 1,546,845 square feet of flagstone.

Sandstone other than bluestone represented a value of $567,762, against $455,794 in 1912. The largest item in the total was paving blocks valued at $239,389, as compared with $188,802 in 1912. Orleans county alone reported an output valued at $467,636 which was much larger than the figures from the preceding year.

Production of sandstone in 1912

DISTRICT	BUILDING STONE	CURBING AND FLAGGING	PAVING BLOCKS	CRUSHED STONE	RUBBLE, RIPRAP	ALL OTHER
Bluestone						
Hudson river	$9 674	$270 544	....	$4 000	$10 000	$1 216
Delaware river	42 944	220 601	....	....	5 367	997
Chenango co	85 622	4 876	....	....	250	2 237
Wyoming co	151 255	5 488	....	660	483	1 100
Other districts	5 955	1 680	....	....	....	....
Total bluestone	$295 450	$503 189	....	$4 660	$16 100	$5 550
Sandstone						
Orleans co	$35 660	$99 074	$185 432	$1 551	$6 732	$12 356
Other districts	31 945	13 583	3 370	39 090	15 930	12 080
Total sandstone	$67 065	$112 657	$188 802	$40 641	$21 653	$24 436
Combined total	$363 055	$615 846	$188 802	$45 301	$37 753	$29 986

Production of sandstone in 1913

DISTRICT	BUILDING STONE	CURBING AND FLAGGING	PAVING BLOCKS	CRUSHED STONE	RUBBLE, RIPRAP	ALL OTHER
Bluestone						
Hudson river	$5 977	$238 724	....	$2 250	$3 400	$11 094
Delaware river	51 611	251 080	....	250	3 029	....
Chenango co	66 645	7 523	....	....	....	817
Wyoming co	97 776	1 200	....	180	1 138	....
Other districts	5 636	5 080	....	....	100	....
Total bluestone	$227 645	$503 607	....	$2 680	$7 667	$11 911
Sandstone						
Orleans co	$21 636	$170 725	$230 397	$2 124	$23 791	$19 963
Other districts	36 364	8 652	8 992	41 463	4 655	....
Total sandstone	$58 000	$179 377	$239 389	$43 587	$27 446	$19 963
Combined total	$285 645	$682 984	$239 389	$46 267	$35 113	$31 874

The quarries in the Medina belt reported a good business, especially in the materials used for street work. Medina blocks are recognized as among the more durable and satisfactory paving materials, and they should find a wider market with the growth of public interest in improved methods of highway construction. They are now mainly employed in city streets, but they are well adapted for any highways which bear a heavy traffic. Their cost at the quarries is about $1.50 a square yard, or a little more than paving brick. With the completion of the barge canal, which traverses the district from east to west, the quarries will be able to reach a much larger territory than heretofore.

TRAP

Trap is not a distinct rock type, but the name properly belongs to the fine-grained, dark-colored igneous rocks that occur in intrusive sheets and dikes. In mineral composition it differs from most of the igneous rocks that are classed in the trade as granite by the prevalence of the basic plagioclase feldspars and the higher percentages of the iron magnesia minerals, while it contains no quartz. Some of the so-called "black granites," however, are trap. The name is sometimes applied to fine-grained rocks of granitic or syenitic composition and sometimes even to rocks of sedimentary derivation, but such usage is misleading and indefensible.

The particular value of trap is due to its hardness and toughness. Its fine, compact, homogeneous texture gives it great wearing powers and it is eminently adapted for road metal and concrete of which heavy service is required. The principal product, therefore, is crushed stone. It has been used to some extent, also, as paving blocks, but these are rather difficult to prepare, since trap very seldom shows any capacity for parting comparable to the rift and grain structures of granites. As a building stone it finds very little application, probably on account of its somber color. The expense of cutting and dressing trap is also an obstacle to its employment for building or ornamental purposes.

The trap quarried in New York State is properly a diabase. Its mineral composition varies somewhat in the different occurrences, but the main ingredients are plagioclase, feldspar and pyroxene, with more or less of amphibole, olivine, magnetite and some times biotite. The texture is characteristic, for the feldspar forms lath-shaped crystals which interlace and inclose the pyroxene and other ingredients in the meshes, and it is this firmly knit fabric which gives the stone the qualities of strength and toughness.

The largest occurrence of trap in New York is represented by the Palisades of the Hudson and the continuation of the same intrusion which extends southward through New Jersey onto Staten Island and is also encountered in the interior of Rockland county. The Palisades are the exposed edge of a sill or sheet of diabase that is intruded between shales and sandstones of Triassic age. The sheet is several hundred feet thick, in places nearly 1000 feet, and in general seems to follow the bedding planes of the sedimentary strata which dip to the west and northwest at an angle of from 5° to 15°. The outcrop is narrow, seldom over a mile, and in places is limited to a single steep escarpment. The principal quarries are near Nyack and Haverstraw at the base of the cliffs. Other quarries have been opened near Suffern, Rockland county, on an isolated intrusion, and also near Port Richmond, Staten Island, at the southern end of the Palisades sill.

Trap occurs in numerous places in the Adirondacks, but mostly as narrow dikes. It is especially common in Essex and Clinton counties where there are many thousands of dikes that range from a few inches to 20 or 30 feet thick. On the southern border of the region are a few dikes of notable size, such as that in the town of Greenfield, Saratoga county, and at Little Falls in the Mohawk valley. A quarry has been opened in the Greenfield occurrence for the supply of crushed stone.

The quarrying of trap along the face of the Palisades in Rockland county probably will soon be discontinued, as it is designed to purchase the quarry properties for the Palisades Interstate Park. The lands to be included within the park extend from the river line to the top of the Palisades. So far only the Manhattan Trap Rock Quarry has been taken over, but negotiations are proceeding for the acquirement of the other quarries along the river front.

The future of the industry in this section is somewhat unsettled. It is not unlikely that new quarries may be opened on top of the ridge and in the interior of Rockland county, though the facilities for production and shipment in that section can scarcely be equal to those of the present localities.

Production of trap

MATERIAL	1912		1913	
	CUBIC YARDS	VALUE	CUBIC YARDS	VALUE
Crushed stone for roads....	283 628	$207 957	631 134	$499 776
Crushed stone for other purposes..................	391 681	275 906	640 165	501 394
Total..............	675,309	$483 863	1,271,299	$1 001 170

The production of trap in 1913 was large, in response to the demand for crushed stone in road improvement work. The statistics show a big increase over the reported output for 1912, but the gain did not reflect any actual extension of quarry facilities; the output in 1912 was abnormally low.

TALC

The talc mines in the Gouverneur district, St Lawrence county, had an active year, although operations were hampered somewhat by the long drought that prevailed in the late spring and summer. The talc is all used in ground form and its preparation involves a gradual reduction in crushers, rolls, ball mills and cylinders, which is carried out in plants located on the Oswegatchie river above Gouverneur. This river has splendid water power sites, but the flow is very unequally distributed so that in dry seasons the available power is reduced to a fraction of the average amount. The condition of low water has been a recurrent one in recent years, and the talc industry is vitally consumed with the plans for the regulation of the stream which have been prepared recently by the State Conservation Commission.[1] Cheap power is a necessity, since the grinding operations otherwise would enhance the costs to a prohibitive figure. Talc competes with a number of materials which are substituted for it whenever the prices rise above a certain level. In the present conditions the mill output in the Gouverneur district is probably only from one-half to two-thirds of the capacity under continuous full power.

[1] "Power Possibilities on the Oswegatchie River," Albany, 1914.

The talc industry was established in the late seventies of the last century. From shipments of a few hundred tons the output had expanded to over 4000 tons by 1880 and to over 40,000 tons by 1890. In the following decade it increased to 60,000 tons; in the last 15 years, however, it has remained practically stationary, fluctuating between the limits of 60,000 and 70,000 tons according to the character of the season. The total shipments from the first have amounted to something over 1,500,000 tons, valued altogether at about $13,000,000. The demand has improved of late years, and it is probable that the market would absorb even larger quantities than are now offered.

The uses of fibrous talc are varied, but its most important application is in the paper trade where it is consumed by manufacturers of writing, book and newsprint paper as filler. According to J. S. Diller,[2] recent conditions in the paper trade point to an improved market for the better grades of American talc. Its principal competitor is German clay. Experience with its use in paper seems to show that it is retained to a larger extent than clay and that it is also a better absorbent of ink. The mineral fibers also help to strengthen the paper stock.

The Gouverneur talc industry was described at some length in the issue of this report for 1911. In the last two years a new supply of talc has come into prominence through mining operations in the vicinity of Natural Bridge, where deposits of a massive or finely granular talc have been developed. The deposits apparently are restricted to a relatively small area, rather than distributed over a long belt, as in the Gouverneur district, and seem to be the result of local contact metamorphism from the intrusion of granitic rocks into limestones. They are not made up of talc exclusively, but contain various hydrated magnesian silicates, inclusive of talc, serpentine and a mineral of the chlorite family. An analysis of a small sample by R. W. Jones showed the following percentages:

SiO_2	48.16
Al_2O_3	7.43
Fe_2O_3	3.15
MgO	27.44
CaO	.25
H_2O+	11.06
H_2O-	2.68
	100.17

[2] Mineral Resources of the United States, 1912, 2: 1142–43.

The deposits at Natural Bridge have been worked during the past two years only and are still in process of development. The St Lawrence Talc Co., Inc., the owner, has a mill on the property and ships all the product in ground form, which is consumed in paper manufacture and for other purposes. The mill has been recently enlarged and improved. The equipment includes conical mills and tube mills such as have been described in the article on the Gouverneur district in the report for 1911.

The operative mills in the Gouverneur talc district were those of the Ontario Talc Co., the Uniform Fibrous Talc Co., the Standard Talc Co., and the International Pulp Co. The latter worked Mines 2½ and 3 at Talcville and the Wight mine near Sylvia lake, besides drawing from its reserve at the Arnold mines. The Wight and Arnold properties formerly belonged to the Union Talc Co., and were taken over by the International Company a few years ago. The Standard Talc Co. worked the mine that formerly belonged to the United States Talc Co., and shipped the product to New Jersey for milling. The Uniform Fibrous Talc Co. continued the underground development of its mine at Talcville where in the last two or three years it has opened a very good body of talc. The Ontario Talc Co. operates a property in the center of the district near Fullerville.

The North Country Corporation has been engaged during the past year in opening deposits near Sylvia lake, town of Fowler. The property has been previously prospected by the Dominion Co., and will now be equipped for active production. It lies near the Balmat and Wight mines of the International Pulp Co.

The output of talc by the several companies above named amounted last year to 63,000 short tons, valued at $551,250. This was somewhat more than in 1912 when the total was 61,610 tons with a value of $511,437. Prices averaged a little higher than in the preceding year.

Production of talc in New York

YEAR	SHORT TONS	VALUE	YEAR	SHORT TONS	VALUE
1882	6 000	$75 000	1898	54 356	$411 430
1883	6 000	75 000	1899	54 655	438 150
1884	10 000	110 000	1900	63 500	499 500
1885	10 000	110 000	1901	62 200	483 600
1886	12 000	125 000	1902	71 100	615 350
1887	15 000	160 000	1903	60 230	421 600
1888	20 000	210 000	1904	65 000	455 000
1889	23 476	244 170	1905	67 000	519 250
1890	41 354	389 196	1906	64 200	541 600
1891	53 054	493 068	1907	59 000	501 500
1892	41 925	472 485	1908	70 739	697 390
1893	36 500	337 625	1909	50 000	450 000
1894	50 500	454 500	1910	65 000	552 500
1895	40 000	320 000	1911	65 000	552 500
1896	46 089	399 443	1912	61 619	511 437
1897	57 009	396 936	1913	63 000	551 250

ZINC

There were no commercial shipments of zinc ore last year from deposits within the State, although a quantity of blende was extracted in the course of underground development at Edwards. The product was held for mill treatment. The results of recent activity in the search for zinc ores in southern St Lawrence county have been quite favorable, and there is good prospect that a stable mining industry will be developed there in the near future. The industry will be a small one, but with the exceptional conditions for cheap mining and milling it should prove profitable. The main obstacle that has presented itself thus far in the development of the district is incident to the character of the ore which is usually a fine-grained mixture of blende and pyrite in a limestone gangue. The separation of the pyrite and blende has proved more difficult than was anticipated and has necessitated a good deal of experimental work at the expense of commercial operations.

The developments so far have been carried on by the Northern Ore Co., who some time ago acquired properties in the vicinity of Edwards, the terminus of a branch railroad from Gouverneur that serves the talc district. The company has concentrated attention upon outcrops of blende on the Brown farm, but has other holdings that show more or less ore. The progress of underground work has been related in previous issues of this report, more particularly in those for 1911 and 1912. During the last year the company extended the mine workings containing No. 1 shaft to a total depth of 450 feet, which is the deepest point to which exploitation has been carried. There is a good showing of ore at the bottom. This shaft has been sunk along a band or lens of nearly solid blende and pyrite that at the surface is 4 or 5 feet thick. Lateral drifts extend from the shaft at intervals of 100 feet, of which the largest on the 350 foot level extends a distance of 542 feet. A second shaft northeast of No. 1 has been carried down to 220 feet depth, along an ore body that is 10 feet thick at the bottom and has been developed for a distance of 175 feet from the shaft.

A few hundred tons of the crude ore were shipped in 1911, but the principal grade is too lean and mixed with pyrite to be merchantable without mill treatment. The company has experimented with a process of magnetic separation and constructed a mill for carrying out the process on a working scale. Up to the present season the experiments have not been thoroughly successful.

Besides the occurrences described, zinc blende exists at a number of localities in the vicinity of the talc deposits in the towns of Fowler and Edwards, St Lawrence county. One of the first discoveries was made on the Balmat place near Sylvia lake, a locality described in the reports of Emmons for the First Geological Survey. It is probable that the blende is accompanied by considerable galena which seems to have been the mineral sought for in the earlier operations. The ore proved too complex to be treated by the methods then in use. Other occurrences in this region are on the property of the Dominion Talc Co., near Sylvia lake, the Streeter farm northeast of the Balmat, the Tamlin place east of the Balmat, the McGill farm 2 miles southwest of Edwards, and the Cole place near the Potter talc mine.

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