

81. Kpun. Ingagemjut tribe, Katmai. Stone ax. From old dwelling.
82. Tsha-ki-un. Same. Stone hatchet.
83. Kuk-i-glu-ak. Stone arrow-head from a small unnamed island off Kukak Bay, in Shelikof Straits. I was informed by the native who collected this relic that he saw a great many skulls and other relics on the summit of the islands; also a great many skulls and other human bones, as well on the top as also on the foot of the hill. This island is said to have been a refuge by the natives formerly when invasions were made by natives from the westward. The native told me that he reached the top by climbing an old wooden ladder formerly in use, and that there are a great number of depressions in the ground, indicating former dwellings. The reason he did not bring more was that his comrades objected to it, fearing bad luck in their hunt after sea-otters.
84. Kuk-i-glu-ak. Stone arrow in bone socket, collected by a native on Semidi Islands (South Island), near sea-lion rookeries.
85. Ka-bu-tak. Ka-loch-mjut tribe. Karluk. Kodiak Island. Stone chisel.
86. Agai-uch-ku-dat. Kei-ich-wich-mjut tribe. Katmai. Wooden masks (ancient).
87. Agai-uch-ku-dat. Wooden masks (ancient).
88. Agai-uch-ku-dat. Wooden masks hidden in caves near beaches.
89. Sha gu-jak. Igagemut tribe. Orlova. Wooden hunting hat worn on sea by otter-hunting parties.
110. Tshau-jak. Musical instrument. Tai-ich-nag-mjut tribe. Lesnoi Island.

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**ON THE COLLECTION OF MAINE BUILDING STONES IN THE  
UNITED STATES NATIONAL MUSEUM.\***

**By GEORGE P. MERRILL.**

The large extent of coast-line of the State of Maine, composed of granitic rocks of a kind suitable for building purposes, renders possible the shipment and transportation of the quarried rock at rates much lower than would otherwise be attainable, the quarries being frequently situated so near the water's edge that little, if any, handling is necessary prior to loading upon the vessel. This favorable circumstance, together with the excellent quality of the rock obtainable, led to the early opening of very numerous quarries both on the mainland and the adjacent islands, and hence at the present time we find Maine granites in very general use in nearly every city of importance in the country, even as far west as California, frequently to the almost entire exclusion of perhaps equally good material close at hand.

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\* Collected under the superintendency of the Tenth Census, 1880.

According to the returns furnished by the special agents in the employ of the building-stone department of the Tenth Census, there were during the years 1880-'82 some eighty-three quarries of various kinds of building stone in the State, situated chiefly either immediately on the coast or within easy reach of tide-water. The product of these quarries, as may readily be imagined by one at all acquainted with the geological features of the State, is largely granitic; slate is, however, quarried quite extensively in the eastern part of the State (Piscataquis County), and quarries of diabase are worked in a few cases. All the varieties of rock at present regularly quarried and used for building purposes may be classed under the following heads:

Biotite granite.

Biotite muscovite granite.

Hornblende granite.

Hornblende biotite granite.

Biotite gneiss.

Biotite muscovite gneiss.

Diabase.

Olivine diabase.

Argyllite or slate.

Representative specimens of all these varieties have been received at the National Museum and properly dressed for purposes of exhibition and comparison. Thin sections have also been prepared and submitted to microscopic examination, with the results given in the following pages. It is perhaps to be regretted that tests of the compressive strength of these stones could not have been made in this connection. It is, however, safe to say that, so far as can be judged from the specimens received at the Museum, any and all of them are of sufficient strength for all ordinary purposes of construction. There is, indeed, scarcely a poor stone in the collection, although of course some are much better than others.

#### GRANITE.

Of the eighty-three quarries already mentioned seventy-four are of granite or gneiss. All the Maine granites, so far as observed, are composed of three principal minerals, quartz, orthoclase, and plagioclase,\* besides which there is always present, in such abundance as to give specific character to the rock, one or more of the minerals muscovite, biotite, or hornblende, while apatite and magnetite can nearly always be detected in microscopic proportions. As a common though not so constant an accessory, there is also frequently present, in quantities so small as to require the microscope for their determination, one or more

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\* No attempt has been made to determine the exact species of triclinic feldspars in these rocks; hence they are referred to (microcline excepted) under the general term *plagioclase*.

of the minerals zircon, epidote, sphene, rutile, microcline, and iron pyrites.

In color these granites vary from very light to dark gray or nearly black, according to the amount and kind of mica or hornblende they contain, or from light pink to red, according to the color of the included orthoclase. In texture they vary from fine even-grained rocks, in which the various mineral ingredients are not easily distinguishable by the naked eye, to coarsely granular rocks, in which twin crystals of orthoclase an inch or more in length are frequently seen. The quartz of these rocks never occurs in perfect crystals, but rather as crystalline grains filling the interspaces of the other minerals. As seen under the microscope in thin sections, it presents always a perfectly fresh and undecomposed appearance, and frequently contains numerous inclusions of small transparent crystals, the exact nature of which cannot be determined. In nearly every case it contains innumerable minute cavities or pores, some of which are empty while others contain the usual liquid and rapidly-moving bubble.

In the majority of these granites orthoclase is the prevailing constituent, and not infrequently the one above all others to produce color and structural variations, as when in coarse, red crystals it gives color to the red granites of Calais, Jonesborough, and other localities; or as large snowy-white crystals, twinned after the Carlsbad law it produces the porphyritic structure so often seen in the granites of Mount Waldo and East Blue Hill.

As seen under the microscope, the orthoclase always presents a more perfect crystalline form than the quartz, having evidently been the first to crystallize when the cooling process began, and hence its growth in any particular direction was less impeded. It is often quite turbid and opaque through decomposition, and included impurities, such as shreds of mica, hornblende, or opaque granules of unknown nature. When the light is shut off from below the stage of the microscope, and the section viewed by reflected light only, it appears as a white, snowy mass, in strong contrast with the black, glassy surface of the quartz. The triclinic feldspars (microcline excepted) occur usually in smaller crystals than the orthoclase, and are much less opaque through impurities and decomposition.

Hornblende, when present, is rarely in perfect crystals, but more often in imperfect and distorted forms, bearing numerous inclusions of biotite, apatite, and magnetite. In thin sections it varies from light yellow to deep green in color.

The micas usually occur in irregular laminae, destitute of crystalline outline, though the muscovite is frequently met with in slender rhombic prisms, which are often inclosed in the orthoclase. Biotite is the more common mica in the Maine rocks, and in its unaltered state is of a smoky brown or yellow color in thin sections and strongly dichroic. Frequently, however, it is more or less altered into a greenish chloritic

product, when its dichroic properties are greatly lessened. It bears numerous inclosures of apatite and magnetite.

Apatite, which is present more or less in nearly all the granites and gneisses, occurs nearly always in minute colorless hexagonal prisms, frequently inclosed in the mica or hornblende, and showing usually one or more lines of fracture at right angles with their length. Epidote appears either as minute colorless perfect crystals or as larger irregular grains of a faint greenish color, and slightly pleochroic, as is seen in the hornblendic granite of Mount Desert. Zircons occur rather sparingly in many of these granites in the form of square prisms, too minute to allow an accurate determination of their optical properties, but nevertheless easily recognizable by their strong relief and peculiar iridescent polarization colors.

Magnetite is present, so far as observed, in all the Maine granites, occurring as small opaque grains, often without crystalline form, or again in small perfect octahedrons. It is usually present only in microscopic proportions, though occasionally in sufficient abundance to be visible to the unaided eye as opaque lusterless grains on a polished surface. It is found in greatest abundance in those rocks which bear hornblende or biotite as their characterizing accessory, while in those in which muscovite is a prevailing constituent it is almost entirely lacking. In but few of the rocks examined does iron pyrites occur in sufficient quantity to be of any practical importance. It can ordinarily be seen only with the microscope, though occasionally visible to the naked eye as small glistening brassy-yellow specks on a broken surface of the stone.

Sphene is a very common accessory in many of the Maine granites, occurring usually as small grayish rounded or irregular grains without crystalline form, though occasionally the characteristic wedge-shaped crystals are seen. It is but faintly pleochroic, and polarizes in dull colors.

*Biotite granite.*—The great majority of the Maine granites are of this kind. They vary usually from light to dark gray in color, though pinkish and red varieties are quarried in a few instances. At Red Beach, near Calais, there is quarried a coarse reddish rock, very compact and hard, which from a simple examination with the unaided eye is seen to be composed of coarse red orthoclase, a nearly white or cream-colored plagioclase, smoky quartz, and a few small shreds of mica. An examination of a thin section with the microscope does not greatly increase the number of constituent minerals. The feldspars are seen to be quite opaque, as is the case with all the red granites, and the quartz is quite free from the minute colorless inclusions above referred to. The mica, which is usually of a greenish color, in thin sections, is very evenly disseminated throughout the rock and in very small shreds, bearing numerous inclosures of magnetite. A few small apatite crystals are as usual present. The rock is quite poor in plagioclase. This beautiful rock is fully equal if not superior in beauty and durability to much of

the so-called Scotch granite so extensively used for monuments and ornamental work.

The red granite of Jonesborough in general appearance agrees closely with the Red Beach rock, and under the microscope is found to differ only in its increased amount of plagioclase. The evenness of the grain and the occurrence of the mica only in small amount and in minute flakes are matters of practical importance, since they allow the production of a more perfect surface and lasting polish than would otherwise be possible. These granites are both used extensively for monumental purposes, and have but few blemishes, chief among which are the black patches to be noticed later.

At West Sullivan a compact gray granite of medium texture is extensively quarried, which is used largely for building and paving purposes. It is an excellent stone, and corresponds in general appearance very closely with that produced at the quarries of the Blaisdell Bros., in the town of Franklin.

The Somesville, Mount Desert, granite is of coarse texture and of a slight pinkish tinge, due to the orthoclase which is often present in crystals of sufficient size to give the rock a slight porphyritic structure. The feldspars as seen under the microscope are quite turbid and opaque, and the mica is often greenish, occurring only in small, ragged shreds. Very many magnetite granules were noticed in this rock, as well as a few zirconous and irregular grains of sphene, which are often partially inclosed in the mica folia. A red granite is also found at Somesville which is hornblende, and will be noticed further under the head of hornblende granites.

From the vicinity of East Blue Hill have been received some of the most beautiful of the gray granites quarried in the State. As a general thing these granites are of rather coarse texture and uniform gray color, though many of them are rendered porphyritic through the prevalence of large snow-white twin crystals of orthoclase scattered throughout the finer gray groundmass composing the rock. For monumental purposes this porphyritic variety is one of the most beautiful of our gray granites. A portion of the granite from this region is of a pinkish color, similar to that of Mount Desert. As seen under the microscope, the biotite in the East Blue Hill rock is often altered into a faint bluish-green product scarcely at all acted upon by polarized light, and bearing very numerous inclosures of black opaque grains and needle-like bodies, which are doubtless magnetite. All stages of alteration are found, from the strongly dichroic smoky-brown biotite, with scarcely a trace of magnetite, to the greenish, almost isotropic substance penetrated in every direction by the magnetite needles. A little muscovite is often present, as well as a few zirconous.

The Deer Isle granite is quite coarse and of a gray color. Large pinkish orthoclase crystals make up the bulk of the rock, and but little mica is present. The rock bears a strong resemblance to that of the

coarser varieties of Vinalhaven and that of Hurricane Island, for which it might readily be mistaken. It however differs microscopically in containing muscovite, garnet, and epidote, and no hornblende, as do both of these rocks.

Two varieties of granite are quarried at Mount Waldo, in the town of Frankfort. Both are light-gray rocks, frequently porphyritic through large white orthoclase crystals. Both varieties are of the same mineral composition, the difference being simply one of texture, one being quite coarse and somewhat porphyritic, while the other is much finer and of more even texture. As would naturally be expected, the finer grade is the better and more durable rock, the coarser variety being more liable to crumble. The mica occurs in large flakes, which the microscope shows to be frequently pierced by small crystals of apatite. A part of the mica is greenish in color and contains a few small faintly pleochroic grains of epidote. An occasional flake of white mica was noticed in this rock, and there is present the usual sprinkling of magnetite granules, together with an occasional cube of pyrite. Quarries were opened at Mount Waldo in 1853, and single blocks 80 by 40 by 20 feet have been taken out and afterward cut up. It is estimated that blocks 150 by 50 by 12 feet could be obtained if desired. The rock has been used largely in the building of forts on the coast of Maine, but is also used for all purposes, both ornamental and otherwise, to which granite is usually applied. It is a beautiful stone when polished.

The granites from the numerous quarries about Vinalhaven all have biotite as the characterizing accessory, though in many of them more or less hornblende is present.\* They vary in texture from very fine to coarse, and are mostly dark gray in color, though the coarser varieties are sometimes of a pinkish tinge, owing to the presence of a flesh-colored orthoclase. In thin sections the feldspar of this rock is seen to be nearly all orthoclase, but little plagioclase being present. The microscope brings to light small apatite, magnetite, and zircon crystals, invisible to the unaided eye. These are all compact, safe working stones, and take a good polish. They are extensively used both for building and ornamental purposes in all the leading cities throughout New England and the West. Quarries were first opened at Vinalhaven about the year 1850. The largest single block ever taken out was the obelisk for the General Wool monument at Troy, N. Y., which measured when dressed 60 by  $5\frac{1}{2}$  by  $5\frac{1}{2}$  feet. It is stated that at the "Harbor Quarry" a single block 240 feet long by 32 feet wide and 8 feet in thickness might be obtained if desired.

The rock of Hurricane Island closely corresponds to that of Vinal-

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\* In Hitchcock's "Report on the Geology and Natural History of Maine," 1862, p. 265, the Vinalhaven rock is referred to as a "peculiarly fine-grained syenite of good color," &c. In none of the specimens received at the Museum from this locality, however, does hornblende play more than a secondary part, and in the majority of cases does not appear at all. Hence, all are classed as biotite granites.

haven, especially to the coarser variety from the "Harbor Quarry." Like the Vinalhaven rock, it too contains a small amount of hornblende, with zircon, apatite, sphene, and magnetite in microscopic proportions. The minute fluidal cavities in the quartz of this rock are often seen arranged in regular wavy lines. A single block now loosened from the quarry, 80 feet long by 40 feet deep and 25 feet wide, shows the immense masses in which this stone occurs.

The Swanville granite is a very pretty, fine, dark-gray stone, so closely resembling the finer varieties from Vinalhaven that a special description is unnecessary.

At South Thomaston two varieties of biotite granite are quarried. The one a dark-gray rock of medium fineness of texture, closely resembling the finer varieties of the Saint George rock and also that of Round Pond, in Lincoln County, in external appearance: the other a coarse gray rock containing large white feldspars and much mica in folia of considerable size. The finer variety contains, in microscopic crystals, microcline, muscovite, epidote, apatite, sphene, and magnetite, while the coarser differs in its lack of microcline and in containing small quantities of hornblende and pyrite. The variety from the locality known as Spruce Head, in spite of its coarse texture and abundant mica, is said to weather well and hold its color most excellently.

The Dix Island granite is a coarse, gray rock, containing scattering crystals of a flesh-colored feldspar. It contains a large proportion of quartz, and is consequently hard and rather brittle. A part of the feldspar of this rock shows under the microscope the peculiar network structure characteristic of microcline. Muscovite, epidote, sphene, and magnetite are present in small proportions, visible only with the microscope.

The Wayne granite is a coarse stone of quite uneven texture, containing large crystals of faintly flesh-colored orthoclase and an abundance of mica. Some hornblende is also present, which accounts for the name syenite as locally applied. The specimen received from this locality is rather below the average of the Maine granites. It is not extensively quarried. Its use is principally local.

The Canaan granite is coarse, dark gray, and of rather uneven texture. It contains a large amount of black mica and scattering crystals of hornblende. It is not a handsome stone, although it works well and takes a good polish. It is used principally for underpinnings in the near vicinity.

At Brunswick two varieties of granite, a coarse and a fine, are quarried on a small scale, principally for local use. The color of the finer variety is very uniform but of a slight yellowish cast on a polished surface. Both varieties contain muscovite in considerable abundance. The finer stone from the quarry of N. Cripps has been used in the construction of the Bowdoin College chapel, First Parish church, Portland, and several other large buildings in the State.

The granite quarried at Pownal is a beautiful, fine, even-grained gray

stone, easy to work and apparently admirably adapted for all kinds of work, both ornamental and otherwise. Considerable discretion is however needed in selecting this rock, since in many portions of the quarry the *sap* has penetrated to a depth of several inches and entirely ruined the stone for architectural purposes. Much of the granite in this locality also is so charged with iron pyrites that a short exposure to the atmosphere causes it to become spotted with innumerable iron-rust stains that are very unsightly. This stone was extensively used in the construction of the new capitol building at Albany, N. Y., but owing to the defects already mentioned its principal use is for paving in cities in the near vicinity. The stone occurs in the quarry usually in thin sheets, and splits out very readily. A single slab 90 feet in length, 4 feet in width, and 20 inches in thickness, has been split out, and much larger could be obtained if desired.

The granites from the various Biddeford quarries are all practically identical. They are coarse, gray rocks of quite even texture and good working qualities, closely resembling the granites from East Blue Hill. The chief accessory minerals are muscovite, apatite, magnetite, and pyrite. These granites are extensively used in the construction of Forts Preble and Scammel and in various light-houses and sea-walls along the coast of New England.

The rock quarried at Bryant's Pond, in Oxford County, is a fine, dark-gray granite containing much black mica and a little hornblende, together with an abundance of plagioclase. Thin sections of this rock show numerous grains of sphene of a brownish-gray color, and usually of a rounded or very irregular form. Magnetite, apatite, and zircon occur in microscopic proportions. This stone is employed chiefly for railroad work.

The Saint George granites are all of fine, even texture, and of a gray color, being very similar in every respect to the South Thomaston stone just mentioned. They are compact and free-working stones, taking a good polish, and are extensively used for building, paving, and ornamental work. A dark-gray hornblendic rock is also quarried here. This will be noticed later.

The Waldoborough, Lincoln County, granite is of a fine texture and in color varies from light to dark gray. It is a good working stone and takes a good polish, but is not extensively quarried, and is used principally for underpinnings and cemetery work. The lighter variety contains much white mica, and might well be classed under the head of biotite muscovite granite. The Round Pond rock is much darker, finer, and of a somewhat gneissoid structure. It contains a large amount of black mica, which, however, is evenly disseminated in small laminae throughout the mass of the rock. By the microscope small shreds of muscovite, together with scattering crystals of apatite, zircon, sphene, magnetite, and iron pyrites are brought to light, the pyrites frequently being visible to the naked eye as small, brassy-yellow specks on a broken face of the rock.

The Kennebunkport rock is a coarse, dull-gray granite, in which the feldspar is nearly all orthoclase and very impure and muddy. The small cavities in the quartz are very abundant. Biotite occurs only in small, very ragged shreds, often altered into a greenish product, and bearing numerous irregular inclosures of yellowish-green epidote. Spheue abounds in well-defined wedge-shaped crystals, which stand out in bold relief from the surface of the section. Apatite, zircon, and magnetite are present in small scattering crystals. The stone works well and takes a good polish. Its principal markets are the larger cities in Maine and New Hampshire.

Very many of these biotite granites contain numerous masses or nodules of a darker color and finer texture than the rock itself, they frequently appearing as black patches on a polished surface. These are of all sizes up to a foot in diameter. They sometimes occur with sharp, distinct outlines, or again merge gradually into the surrounding rock with no definite line of demarkation. Some of them possess a fine, even texture, while others are rendered slightly porphyritic in structure through included crystals of plagioclase of considerable size. Under the microscope they are all found to consist essentially of the same minerals as the rocks in which they occur, although in a more finely crystalline state and different proportions; biotite usually prevails and causes the dark color of the patch. Very many of them, however, are penetrated in every direction by innumerable, minute, colorless, needle-like crystals, an exact determination of which, on account of their small size, is impossible. Many of the included larger crystals of feldspar, which, so far as observed, are always triclinic, have their angles rounded away, and are reduced to mere oval grains. Such nodules are usually regarded as of concretionary origin.\* The finer texture and darker color of these patches render them very conspicuous, and in some of the quarries many fine blocks of granite are rendered entirely unsuited for finely finished or polished work on account of their abundance.

*Hornblende granite.*—This is rather a rare building-stone in Maine, though extensively quarried in other States. Its production is at present confined to Otter Creek, Mount Desert, where a beautiful coarse red rock is quarried, which on a superficial examination somewhat resembles the biotite granites of Calais and Jonesborough, though lacking the cream-colored feldspar and consequent speckled appearance characteristic of these rocks. Orthoclase predominates over all other constituents, and is deep-red in color. Under the microscope the feldspars are so opaque that their optical properties can be determined only approximately. The hornblende occurs in small broken fragments and

\* See "On Concretionary Patches and Fragments of other Rocks contained in Granite," by J. A. Phillips, Quarterly Journal of the London Geological Society, Vol. XXXVI, 1880, pp. 1-22. Also, "On the Black Nodules in the Maine Granites," by G. P. Merrill, this vol., p. 137.

very imperfect crystals of a deep-green or yellowish color, and often much altered into a greenish-yellow chlorite. Numerous small square prisms of zircon are included in the hornblende or scattered about in close proximity. Epidote is abundant in quite large irregular masses or flakes. It is of a faint, greenish-yellow color, and plainly pleochroic. Magnetite in this rock is not particularly abundant, though occurring in rather large grains. The quartz contains very numerous cavities, which are, however, exceedingly minute.

This rock is very compact and hard, but works well and takes an excellent surface and polish. It is of finer texture than the Scotch red granites, and bears a closer resemblance to red granite of the Bay of Fundy than to any other at present in the collection. If the specimen received at the Museum is a fair sample of the rock at the quarry, it is certainly a most excellent stone.

*Hornblende biotite granite.*—The quarrying of this variety of granite is confined to rather limited areas, specimens having been received from but two localities, Saint George and Lincoln. The Saint George rock is of fine texture, and dark gray in color, nearly black on a polished surface, the dark color being due to the abundance of hornblende and black mica. By the unaided eye the rock is readily seen to be composed principally of quartz, feldspar, hornblende, and biotite, with scattering grains of magnetite and iron pyrites. It is quite poor in quartz, and under the microscope the prevailing feldspar is seen to be a triclinic variety. Hornblende is very abundant, and occurs in quite perfect crystals, which are deep green and yellow in thin sections and strongly dichroic. Biotite is less abundant than the hornblende, and it incloses numerous magnetite grains and apatite crystals. It is quite pure, and of a light straw color in thin sections, varying to deep brown as the stage of the microscope is revolved. Occasional grains of epidote and sphene were noticed, and, more rarely, shreds of chlorite, resulting from the alteration of the hornblende. Numerous grains of calcite are readily distinguished in the thin section occupying the interspaces of the other minerals, and the powdered rock effervesces distinctly in dilute acids. So large an amount of this mineral must have an important action upon the weathering properties of the rock.

Lincoln. The rock quarried at Lincoln, although of nearly the same mineral composition, is wholly unlike that of Saint George in appearance, being of much lighter color and coarser texture. Large white and slightly flesh-colored twin crystals of orthoclase, quartz, hornblende, mica, and in a few instances grains of pyrite, are all readily distinguishable by the naked eye, while with the microscope are brought to view the usual amounts of apatite and magnetite, with, more rarely, small zircons, wedges of sphene, and irregular grains of epidote. The sphene is brownish in color, and the crystals quite large. The hornblende is deep green and yellow, in thin sections, and some of the smaller crystals show quite perfect basal outlines. Biotite is very abundant and in large

flakes. In external appearance this rock is very much like the coarser varieties of the Biddeford granite.

*Muscovite biotite granites.*—The granite of Augusta and Hallowell has long been justly celebrated for its beauty and fine working qualities. It is a fine, light-gray rock, the uniformity of whose texture is often broken by the presence of large white crystals of microcline, which inclose small, rounded grains of quartz. Biotite and muscovite occur in abundance, and in about equal proportions, but in small flakes, the muscovite appearing as small, silvery-white, glistening particles on a broken surface of the rock. Under the microscope three feldspars are readily distinguished—orthoclase in imperfect crystals and irregular grains, an abundance of plagioclase, and microcline in large plates filled with cavities and inclosures of muscovite and quartz. In the thin sections the quartz inclosures are usually circular in outline and are pierced in every direction by minute, thread-like crystals of rutile, in polarized light showing up in strong contrast with the beautiful basket-work structure of the inclosing microcline. All the feldspars are quite fresh and pure. The quartz is in small, irregular grains, containing but few cavities, but innumerable threads of rutile. The biotite occurs in small shreds, without any attempt at crystalline form, while the muscovite, although usually in larger, irregular laminae, is also sometimes found in small, perfect, rhombic prisms. A few apatite crystals are present, together with occasional garnets, which in thin sections are always destitute of crystalline form, appearing as rounded or oval nearly colorless bodies traversed by many irregular lines of fracture. They are quite free from impurities, though occasionally containing inclosures of biotite. As is usual in muscovite-bearing rocks but little magnetite is present; in two cases only grains of pyrite were noticed.

This is one of the best working of the Maine granites, and is used very extensively, not only for building and monuments, but is carved into statues like marble. The rock is properly a gneiss, but showing no signs of stratification in the hand specimen is classed here as a granite. As illustrative of the great extent of the quarries, it is stated that blocks 200 feet in length, by 40 feet in width and 8 feet in thickness, can be broken out in a single piece if so desired.

The rock quarried at North Jay is practically identical with that of Hallowell, and need not be further noticed here. The Lincolnville rock is a trifle darker, but otherwise appears nearly the same. All closely resemble the well-known granite of Concord, N. H.

#### GNEISS.

The composition of gneiss is identical with that of granite, from which it differs only in structural modifications, its characterizing feature being that it possesses a laminated or stratified appearance due to the arrangement of the individual crystals constituting the accessory minerals (mica and hornblende). It is therefore scarcely necessary to go into a special

description of any of these, since what has been said in regard to the granites will apply equally well to the gneisses. At present they seem to be quarried only to a limited extent and in but few localities. At Turner a biotitic gneiss of medium texture is quarried, in which a few grains of sphene were noticed. At Jefferson a fine gray gneiss is quarried which contains both biotite and muscovite, the latter occurring frequently as slender prisms inclosed in the orthoclase. Epidote is also present in irregular grains as well as a little apatite.

At Chesterville a fine gray gneiss is quarried, which somewhat closely resembles the Jefferson stone both in appearance and mineral composition.

On account of its laminated structure gneiss splits readily from the quarry in slabs of any desirable thickness. Its distinct grain, however, causes it to work unevenly in different directions, and it is not so well suited for purposes of general construction as granite. It is best suited for curbing and the rough work of foundations.

#### DIABASE.

Under the name of black granite, diabase is quarried at three localities in the State—Indian River, in the town of Addison, Addison Point, and Vinalhaven.

The Indian River rock is nearly black in color and of a texture too fine to allow an accurate determination of its true character by the unaided eye. Under the microscope it is found to consist essentially of plagioclase and augite, although considerable hornblende and mica are present. The hornblende, without doubt, results from the alteration of the augite, since abundant examples are to be seen in which the centers of crystals are nearly colorless, unaltered augite, while the borders are plainly hornblendic. The mica is sufficiently abundant to be recognizable to the naked eye, and is of a smoky-yellow, or at times copper-red, color, in thin sections. Apatite is abundant in the usual colorless prisms.

The Addison Point rock closely resembles that of Indian River in external appearance, but shows a marked difference in structure under the microscope. Olivine is present in abundant, rounded, colorless grains, traversed by numerous irregular curvilinear lines, and frequently much altered into serpentine. Hornblende and chlorite are both present as in the Addison Point rock, and evidently derived from the augite. Titanic iron is abundant and often much altered, taking on fan-shaped and other fantastic forms.

An olivine-bearing diabase is also quarried at Vinalhaven. It is a hard, compact rock, quite fresh-appearing in thin sections, although containing a little of both hornblende and chlorite as alteration products. Some mica is also present.

Magnetite is so abundant in all these diabases as to be very noticeable as black, lusterless grains on a polished surface of the rock.

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**Vol. VI, No. 12. Washington, D. C. Oct. 5, 1883.**

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Owing to their fine, homogeneous texture these rocks are great favorites for monuments and ornamental work, for which they are extensively used. Their somber colors, however, render them rather undesirable for general building purposes.

## SLATE.

Slates of very good quality are extensively quarried at Munson and Brownville, Piscataquis County. So far as observed they are blue-black in color, of fine, even texture, tough, and split readily into thin plates suitable for roofing purposes, for which they are principally used. They are also well adapted for mantels and fire-places, and at one time quite a business was carried on in the manufacture of these from the so-called "marbleized slate," but which has since been discontinued.

APRIL 5, 1883.

Proc. Nat. Mus. 83—12

Table showing the varieties of building stone quarried

Location of quarry.		Owner or lessee.	Specific variety of stone.		Color.
Town.	County.		Popular name.	Scientific name.	
Red Beach.....	Washington	Maine Red Granite Company.	Red granite...	Biotite granite	Red.....
Jonesborough.....	do.....	Bodwell Granite Company.	do.....	do.....	do.....
Do.....	do.....	Not quarried.....	Trap.....	Diabase.....	Green.....
Addison.....	do.....	H. B. Nash.....	Black granite.....	do.....	Nearly black.....
Addison Point.....	do.....	Pleasant River Black Granite Company.	do.....	Olivine diabase.	do.....
Harrington.....	do.....	Not quarried.....	Granite.....	Biotite granite	Gray.....
Millbridge.....	do.....	do.....	do.....	do.....	do.....
West Sullivan.....	Hancock.....	Crabtree & Harvey.	do.....	do.....	do.....
Do.....	do.....	J. H. West.....	do.....	do.....	do.....
Do.....	do.....	J. H. Stimpson.....	do.....	do.....	do.....
Do.....	do.....	Abbott Quarry Company.	do.....	do.....	do.....
Franklin.....	do.....	Blaisdell Brothers.....	do.....	do.....	do.....
Somerville.....	do.....	C. J. Hall.....	do.....	do.....	Pinkish gray.....
Mount Desert.	do.....	do.....	do.....	Hornblende granite.	Red.....
Otter Creek,	do.....	do.....	do.....	do.....	do.....
Somerville,	do.....	Whiting & Allen.....	do.....	Biotite granite	Pinkish gray.....
Mount Desert.	do.....	do.....	do.....	do.....	do.....
East Blue Hill.....	do.....	Collins Granite Company.	do.....	do.....	Gray.....
Do.....	do.....	G. W. Collins & Co.....	do.....	do.....	do.....
Do.....	do.....	Chase & Hall.....	do.....	do.....	do.....
Do.....	do.....	Point Pleasant Quarry Company.	do.....	do.....	do.....
Deer Isle.....	do.....	Paul Thurlow & Co.....	do.....	do.....	do.....
Do.....	do.....	Owens & McGee.....	do.....	do.....	do.....
Do.....	do.....	Goss & Goss.....	do.....	do.....	do.....
Do.....	do.....	J. & C. A. Byard.....	do.....	do.....	do.....
Frankfort.....	Waldo.....	Mount Waldo Granite Works.	do.....	do.....	do.....
Prospect.....	do.....	Edward Avery.....	do.....	do.....	do.....
Swanville.....	do.....	Oak Hill Granite Company.	do.....	do.....	do.....
Lincolntonville.....	do.....	Beach Grove Granite Company.	do.....	Muscovite-biotite granite.	do.....
Lincoln.....	Penobscot.....	Jewell Granite Company.	do.....	Hornblende-biotite granite.	do.....
Vinalhaven.....	Knox.....	Bodwell Granite Company.	do.....	Biotite granite	do.....
Do.....	do.....	J. S. Black, Harbor Quarry.	do.....	do.....	do.....
Do.....	do.....	Bodwell Granite Company.	do.....	do.....	do.....
Do.....	do.....	Bodwell Granite Company, East Boston Quarry.	Black granite.	Olivene diabase.	Dark gray.....
Do.....	do.....	Bodwell Granite Company.	Granite.....	Biotite granite	Gray.....
Do.....	do.....	John S. Hopkins.....	do.....	do.....	do.....

*in Maine, and their mineral composition.*

Structure.		Geological age of formation.	Component minerals.	
As regards texture.	As regards stratification.		Essential.	Accessory and accidental.
Coarse .....	Massive .....	Archæan .....	Quartz, orthoclase, plagioclase, biotite.	Magnetite, zircon.
....do .....	....do .....	....do .....	Quartz, orthoclase, plagioclase, biotite.	Apatite, zircon, epidote, sphene, magnetite, chlorite.
Fine .....	....do .....	....do .....	Plagioclase, augite .....	Chlorite, magnetite, apatite, titanite iron.
....do .....	....do .....	Devonian .....	....do .....	Hornblende, biotite, apatite, magnucito, titanite iron, chlorite.
....do .....	....do .....	....do .....	Plagioclase, augite, olivene.	Hornblende, biotite, apatite, magnetite, titanite iron, serpentine chlorite.
Coarse .....	....do .....	Archæan .....	Quartz, orthoclase, plagioclase, biotite.	Sphene, epidote, zircon, magnetite.
....do .....	....do .....	....do .....	Quartz, orthoclase, plagioclase, biotite.	Magnetite, zircon.
....do .....	....do .....	....do .....	Quartz, orthoclase, plagioclase, biotite.	Apatite, magnetite.
....do .....	....do .....	....do .....	Quartz, orthoclase, plagioclase, biotite.	Do.
....do .....	Indistinctly laminated.	....do .....	Quartz, orthoclase, plagioclase, biotite.	Do.
....do .....	Indistinctly laminated.	....do .....	Quartz, orthoclase, plagioclase, biotite.	Do.
....do .....	Massive .....	....do .....	Quartz, orthoclase, plagioclase, biotite.	Epidote, magnetite, zircon, apatite.
....do .....	....do .....	....do .....	Quartz, orthoclase, plagioclase, biotite.	Magnetite, zircon, chlorite, sphene, orthite.
....do .....	....do .....	....do .....	Quartz, orthoclase, plagioclase, hornblende.	Epidote, zircon, magnetite, chlorite.
....do .....	....do .....	....do .....	Quartz, orthoclase, plagioclase, biotite.	Magnetite, zircon, chlorite, sphene, orthite.
Porphyritic .....	....do .....	....do .....	Quartz, orthoclase, plagioclase, biotite.	Muscovite, apatite, zircon, magnetite, chlorite.
....do .....	....do .....	....do .....	Quartz, orthoclase, plagioclase, biotite.	Muscovite, apatite, zircon, magnetite.
....do .....	....do .....	....do .....	Quartz, orthoclase, plagioclase, biotite.	Muscovite, apatite, garnet, magnetite.
....do .....	....do .....	....do .....	Quartz, orthoclase, plagioclase, biotite.	Muscovite, apatite, garnet, magnetite.
Coarse .....	Indistinctly laminated.	....do .....	Quartz, orthoclase, plagioclase, biotite.	Muscovite, apatite, garnet, magnetite, epidote, sphene.
....do .....	Indistinctly laminated.	....do .....	Quartz, orthoclase, plagioclase, biotite.	Muscovite, apatite, garnet, magnetite, epidote, sphene.
....do .....	Indistinctly laminated.	....do .....	Quartz, orthoclase, plagioclase, biotite.	Muscovite, apatite, magnetite, epidote, sphene.
....do .....	Indistinctly laminated.	....do .....	Quartz, orthoclase, plagioclase, biotite.	Muscovite, apatite, magnetite, epidote, sphene.
Coarse and fine porphyritic.	Massive .....	....do .....	Quartz, orthoclase, plagioclase, biotite.	Microcline, magnetite, apatite, pyrite, zircon, sphene, orthite.
Coarse .....	....do .....	....do .....	Quartz, orthoclase, plagioclase, biotite.	Microcline, apatite, magnetite, epidote.
Fine .....	....do .....	....do .....	Quartz, orthoclase, plagioclase, biotite.	Microcline, apatite, magnetite, epidote, hematite scales, orthite, zircon.
....do .....	....do .....	....do .....	Quartz, orthoclase, plagioclase, muscovite, biotite.	Microcline, apatite, magnetite, zircon.
Coarse .....	....do .....	....do .....	Quartz, orthoclase, plagioclase, hornblende, biotite.	Sphene, magnetite, apatite, zircon, pyrite.
Fine .....	Indistinctly laminated.	....do .....	Quartz, orthoclase, plagioclase, biotite.	Apatite, magnetite, zircon.
....do .....	Indistinctly laminated.	....do .....	Quartz, orthoclase, plagioclase, biotite.	Apatite, magnetite.
Coarse .....	Indistinctly laminated.	....do .....	Quartz, orthoclase, plagioclase, biotite.	Hornblende, apatite, magnetite, zircon.
Medium fine .....	Massive .....	Mesozoic .....	Plagioclase, augite, olivene ..	Magnetite, black mica, hornblende, apatite, titanite iron.
....do .....	Indistinctly laminated.	Archæan .....	Quartz, orthoclase, plagioclase, biotite.	Magnetite, apatite.
Coarse .....	Indistinctly laminated.	....do .....	Quartz, orthoclase, plagioclase, biotite.	Do.

Table showing the varieties of building stone quarried

Location of quarry.		Owner or lessee.	Specific variety of stone.		Color.
Town.	County.		Popular name.	Scientific name.	
Hurricane Island.	Knox . . . . .	Gen. Davis Tilson . .	Granite . . . . .	Biotite granite	Gray . . . . .
Dix's Island . . . . .	. . . do . . . . .	Dix's Island Granite Company.	. . . do . . . . .	. . . do . . . . .	. . . do . . . . .
South Thomaston.	. . . do . . . . .	M. T. Jameson & Co.	. . . do . . . . .	. . . do . . . . .	. . . do . . . . .
South Thomaston.	. . . do . . . . .	N. Stanton . . . . .	. . . do . . . . .	. . . do . . . . .	. . . do . . . . .
South Thomaston.	. . . do . . . . .	Bodwell Granite Company.	. . . do . . . . .	. . . do . . . . .	. . . do . . . . .
South Thomaston.	. . . do . . . . .	M. Sawyer . . . . .	. . . do . . . . .	. . . do . . . . .	. . . do . . . . .
South Thomaston, 4 m. e.	. . . do . . . . .	Ward & Woodard . .	. . . do . . . . .	. . . do . . . . .	. . . do . . . . .
Saint George . . . . .	. . . do . . . . .	Atlantic Granite Company.	. . . do . . . . .	. . . do . . . . .	. . . do . . . . .
Do . . . . .	. . . do . . . . .	Long Cove Granite Company.	. . . do . . . . .	. . . do . . . . .	. . . do . . . . .
Do . . . . .	. . . do . . . . .	Long Cove Granite Company.	Black granite.	Hornblende-biotite granite.	Nearly black.
Do . . . . .	. . . do . . . . .	Clark's Island Granite Company.	Granite . . . . .	Biotite granite	Gray . . . . .
Do . . . . .	. . . do . . . . .	Wild Cat Granite Company.	. . . do . . . . .	. . . do . . . . .	. . . do . . . . .
Waldoborough .	Lincoln . . . . .	Day & Otis . . . . .	. . . do . . . . .	. . . do . . . . .	. . . do . . . . .
Round Pond . . . . .	. . . do . . . . .	Brown, McAllister & Co.	. . . do . . . . .	. . . do . . . . .	. . . do . . . . .
Jefferson . . . . .	. . . do . . . . .	J. C. Glidden . . . . .	. . . do . . . . .	Muscovite-biotite gneiss.	. . . do . . . . .
Wayne . . . . .	Kennebec . . . . .	J. F. Gordon . . . . .	Syenite . . . . .	Biotite granite	. . . do . . . . .
Hallowell . . . . .	. . . do . . . . .	Hallowell Granite Company.	Granite . . . . .	Muscovite-biotite granite.	Light gray . . . . .
Augusta . . . . .	. . . do . . . . .	Kennebec Granite Company.	. . . do . . . . .	Muscovite-biotite granite.	. . . do . . . . .
Norridgewock . .	Somerset . . . . .	Lawton Brothers . . .	. . . do . . . . .	. . . do . . . . .	. . . do . . . . .
Canaan . . . . .	. . . do . . . . .	S. L. Fowler . . . . .	. . . do . . . . .	Biotite granite	Gray . . . . .
Chesterville . . .	Franklin . . . . .	J. H. Plummer . . . . .	. . . do . . . . .	Biotite gneiss	. . . do . . . . .
North Jay . . . . .	. . . do . . . . .	A. W. Woodman . . . .	. . . do . . . . .	Muscovite-biotite granite.	. . . do . . . . .
Do . . . . .	. . . do . . . . .	M. C. R. R. Co . . . . .	. . . do . . . . .	Muscovite-biotite granite.	. . . do . . . . .
Do . . . . .	. . . do . . . . .	Emerson & Bryant . . .	. . . do . . . . .	Muscovite-biotite granite.	. . . do . . . . .
Bryant's Pond . .	Oxford . . . . .	Grand Trunk Railway.	. . . do . . . . .	Biotite granite	Dark gray . . . . .
Turner . . . . .	Androscoggin.	C. H. Barrell . . . . .	. . . do . . . . .	Biotite gneiss.	Gray . . . . .
Brunswick . . . .	Cumberland	Hiram Cripps . . . . .	. . . do . . . . .	Biotite granite	. . . do . . . . .
Do . . . . .	. . . do . . . . .	A. P. Woodside . . . . .	. . . do . . . . .	. . . do . . . . .	. . . do . . . . .
Pownal . . . . .	. . . do . . . . .	T. S. Reed . . . . .	. . . do . . . . .	. . . do . . . . .	. . . do . . . . .
Biddeford . . . .	York . . . . .	Gordon & Welch . . . .	. . . do . . . . .	Biotite . . . . .	. . . do . . . . .
Do . . . . .	. . . do . . . . .	C. H. Bragdon . . . . .	. . . do . . . . .	Biotite granite	. . . do . . . . .

in Maine, and their mineral composition—Continued.

Structure.		Geological age of formation.	Component minerals.	
As regards texture.	As regards stratification.		Essential.	Accessory and accidental.
Coarse .....	Indistinctly laminated.	Archæan ...	Quartz, orthoclase, plagioclase, biotite.	Hornblende, apatite, zircon, magnetite, sphene.
...do .....	Indistinctly laminated.	...do .....	Quartz, orthoclase, plagioclase, biotite.	Microcline, muscovite, apatite, magnetite, epidote.
Fine .....	Indistinctly laminated.	...do .....	Quartz, orthoclase, plagioclase, biotite.	Microcline, muscovite, epidote, apatite, sphene, magnetite.
...do .....	Indistinctly laminated.	...do .....	Quartz, orthoclase, plagioclase, biotite.	Microcline, muscovite, epidote, apatite, sphene, magnetite.
Medium .....	Indistinctly laminated.	...do .....	Quartz, orthoclase, plagioclase, biotite.	Hornblende, sphene, epidote, apatite, magnetite, pyrite.
...do .....	Indistinctly laminated.	...do .....	Quartz, orthoclase, plagioclase, biotite.	Hornblende, sphene, epidote, apatite, magnetite, pyrite.
...do .....	Indistinctly laminated.	...do .....	Quartz, orthoclase, plagioclase, biotite.	Hornblende, sphene, epidote, apatite, magnetite, pyrite.
Fine .....	Indistinctly laminated.	...do .....	Quartz, orthoclase, plagioclase, biotite.	Muscovite, magnetite, apatite, rutile-like needles in quartz.
...do .....	Indistinctly laminated.	...do .....	Quartz, orthoclase, plagioclase, biotite.	Microcline, muscovite, magnetite, apatite, rutile-like needles in quartz.
...do .....	Indistinctly laminated.	...do .....	Quartz, orthoclase, plagioclase, hornblende, biotite.	Apatite, sphene, epidote, magnetite, pyrite, calcite.
...do .....	Indistinctly laminated.	...do .....	Quartz, orthoclase, plagioclase, biotite.	Microcline, muscovite, magnetite, apatite, rutile-like needles in quartz.
...do .....	Indistinctly laminated.	...do .....	Quartz, orthoclase, plagioclase, biotite.	Microcline, muscovite, magnetite, apatite, rutile-like needles in quartz.
...do .....	Indistinctly laminated.	...do .....	Quartz, orthoclase, plagioclase, biotite.	Microcline, muscovite, magnetite, apatite.
...do .....	Indistinctly laminated.	...do .....	Quartz, orthoclase, plagioclase, biotite.	Muscovite, apatite, zircon, sphene, magnetite, pyrite.
...do .....	Laminated.	...do .....	Quartz, orthoclase, plagioclase, muscovite, biotite.	Apatite, epidote, pyrite.
Coarse .....	Massive	...do .....	Quartz, orthoclase, plagioclase, biotite.	Hornblende, apatite, zircon, magnetite, sphene.
Fine .....	Indistinctly laminated.	...do .....	Quartz, orthoclase, plagioclase, muscovite, biotite.	Microcline, apatite, garnets, very little magnetite, pyrite, rutile needles in quartz.
...do .....	Indistinctly laminated.	...do .....	Quartz, orthoclase, plagioclase, muscovite, biotite.	Microcline, apatite, garnets, very little magnetite, pyrite, rutile needles in quartz.
Medium .....	Massive	...do .....	Quartz, orthoclase, plagioclase.	Hornblende, epidote, magnetite, sphene.
Coarse .....	Indistinctly laminated.	...do .....	Quartz, orthoclase, plagioclase, biotite.	Microcline, muscovite, garnet, apatite, magnetite.
Fine .....	Indistinctly laminated.	...do .....	Quartz, orthoclase, plagioclase, biotite.	Microcline, garnet, rutile needles in quartz.
...do .....	Massive	...do .....	Quartz, orthoclase, plagioclase, muscovite, biotite.	Microcline, garnet, rutile needles in quartz.
...do .....	...do	...do .....	.....	Microcline, garnet, rutile needles in quartz.
...do .....	...do	...do .....	.....	Microcline, garnet, rutile needles in quartz.
...do .....	Indistinctly laminated.	...do .....	Quartz, orthoclase, plagioclase, biotite.	Hornblende, apatite, sphene, magnetite
Medium .....	Laminated.	...do .....	Quartz, orthoclase, plagioclase, biotite.	Apatite, magnetite, zircon.
Fine .....	Massive	...do .....	Quartz, orthoclase, plagioclase, biotite.	Muscovite, apatite, magnetite.
...do .....	...do	...do .....	Quartz, orthoclase, plagioclase, biotite.	Muscovite, apatite, magnetite.
...do .....	...do	...do .....	Quartz, orthoclase, plagioclase, biotite.	Apatite, magnetite, pyrite.
Coarse .....	...do	...do .....	Quartz, orthoclase, plagioclase, biotite.	Do.
...do .....	...do	...do .....	Quartz, orthoclase, plagioclase, biotite.	Do.

Table showing the varieties of building stone quarried

Location of quarry.		Owner or lessee.	Specific variety of stone.		Color.
Town.	County.		Popular name.	Scientific name.	
Biddeford.....	York .....	C. H. & A. Goodwin.	Granite.....	Biotite granite	Gray .....
Do.....	do .....	Gooch & Haine .....	do .....	do .....	do .....
Do.....	do .....	J. M. Andrews .....	do .....	do .....	do .....
South Berwick, 7 m. n. w.	do .....	A. L. Goodwin .....	do .....	do .....	do .....
Kennebunkport, 8 m. n.	do .....	George W. Ross .....	do .....	do .....	do .....
Kennebunkport, 8 m. n.	do .....	Francis Day .....	do .....	do .....	do .....
Kennebunkport	do .....	Leavitt & Downs .....	do .....	do .....	do .....
Do.....	do .....	Smith & Walker.....	do .....	do .....	do .....

NOTE.—The matter given in the first four, eighth, and ninth columns of

in Maine and their mineral composition—Continued.

Structure.		Geological age of formation.	Component minerals.	
As regards texture.	As regards stratification.		Essential.	Accessory and accidental.
Coarse.....	Massive ....	Archaean ...	Quartz, orthoclase, plagioclase, biotite.	Apatite, magnetite, pyrite.
...do .....	...do .....	...do .....	Quartz, orthoclase, plagioclase, biotite.	Do.
...do .....	...do .....	...do .....	Quartz, orthoclase, plagioclase, biotite.	Do.
...do .....	Indistinctly laminated.	...do .....	Quartz, orthoclase, plagioclase, biotite.	
...do .....	Massive ....	...do .....	Quartz, orthoclase, plagioclase, biotite.	Apatite, sphene, zircon, magnetite.
...do .....	...do .....	...do .....	Quartz, orthoclase, plagioclase, biotite.	Apatite, sphene, zircon, magnetite.
...do .....	...do .....	...do .....	Quartz, orthoclase, plagioclase, biotite.	Apatite, sphene, zircon, magnetite.
...do .....	...do .....	...do .....	Quartz, orthoclase, plagioclase, biotite.	Apatite, sphene, zircon, magnetite.

the table is from the returns furnished by the special agent of the Census.