# "Limestones, Dolomites, and Marbles" 

Including Limestones, Dolomites, and Marbles of the various States and Territories (two separate lists starting on pp. 374 and 392) (circa 1886)

From Part II. "The Rocks, Quarries, and Quarry Regions of the United States," in The Collection of Building and Ornamental Stones in the U.S. National Museum: A Hand-book and Catalogue<br>By George P. Merrill, Curator, Department Lithology and Physical Geology<br>From Annual Report of the Board of Regents of the Smithsonian Institution...Year ending June 30, 1886, 1887.

Note: This book, The Collection of Building and Ornamental Stones in the U.S. National Museum: A Hand-book and Catalogue, is available on Google Books at this link: https://books.google.com/books?id=bdsOAAAAYAAJ\&dq=\"collection+of+building+and+or namental+stones+in+the+us+national+museum\%22\&source=gbs_navlinks_s

Note: The U.S. states covered in the two Limestones, Dolomites, \& Marbles sections include: Alabama, Arkansas, California, Colorado, Delaware, Florida, Georgia, Illinois, Iowa, Kansas, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, the Montana territory, Nebraska, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Texas, Utah, Vermont, Virginia, and Wisconsin.

This excerpt, which begins on the next page, is presented on the Stone Quarries and Beyond web site. http://quarriesandbeyond.org/

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## D.-LIMESTONES AND DOLOMITES.

(1) CHEMICAL COMPOSITION AND ORIGIN.

Pure limestone consists entirely of calcium carbonate. In point of fact, however, none of our limestones are chemically pure, but all contain more or less foreign materials, such as magnesia, oxides of iron, silica, clay, bituminous matter, miea, tale, and other minerals.

In composition, texture, and general appearance, limestones vary almost indefinitely. They may be hard, compact, fine-grained rocks of almost flint-like texture, or, again, coarsely porous, oolitic, or crystalline, the crystals varying in size from too small to be visible to the naked eye to an inch or more in length.

Pure limestone is white in color, but water blue, gray, green, pink, red, and black varieties are common, the colors being dependent upon various impurities, such as the oxides of iron and carbonaceous matter caused by animal and plant remains. The pink and red colors are caused by iron oxides, while the blue, gray, and black varieties owe their hues to the prevailing carbonaceons matter. The green color of some of the Vermont marbles appears to be due to talc.

Limestones are regarded by geologists as of either chemical origin or as resulting from the deposition of organic remains, such as shells and corals. Of the first kind are the tufas and travertines; of the second, the fossiliferons limestones, such as the encrinital stones of Ohio and the shell marbles of Tennessee. Either variety may have undergone the change called metamorphism, and all traces of their origin have been destroyed.

Limestones occur in stratified beds among rocks of all geological ages, from the Archrean to the most recent. The majority of those used for building and ornamental work belong either to the Cambrian, Silurian, Devonian, or Carboniferous ages.

## (2) VARIETIES OF LIMESTONES AND DOLOMITES.

The following list includes all the principal varieties of limestone popularly recognized, the distinctions being founded upon their structure, chemical composition, and mode of origin :

Crystalline limestone. Marble.-An entirely crystalline, granular aggregate of calcite crystals. The crystals are usually of quite uniform size in the same marble, but often vary widely in those from different lo-
calities. The fine-grained white varieties which appear like loaf sugar are called saccharoidal. Common statuary marble is a good example of this variety.

Compact common limestone.-A fine-grained crystalline aggregate which to the eye often appears quite homogeneous and amorphous. It is rarely pure, but contains admixtures of other minerals, giving rise to many varieties, to which particular names are given. Lithographic limestone is an extremely fine-grained crystalline rock, with but a small amount of impurities, and of a drab or yellowish hue. Bituminous limestone contains a considarable proportion of bitumen, caused by decomposing animal or vegetable matter. Its presence is easily recognized by the odor of petroleum given off when the rock is freshly broken. Hydraulio limestone contains 10 per cent. and upwards of silica and usually some alumina. When burnt into lime and made into mortar or cement it has the property of setting under water. Oolitic limestones are made up of small rounded coneretionary grains that have become cemented together to form a solid rock. These little rounded grains resemble the roe of a fish; hence the name, from the Greek word aün, an egg. Where tho grains are nearly the size of a pea the rock is ealled pisolite. Such a rock is now in process of formation along the shore of Pyramid Lake, Nevada. Oolitic limestones suitable for building purposes are quite abuudant in Iowa, Indiana, and Kentucky.

Travertine, or Calo Sinter, is limestone deposited by running streams and springs. It occurs in all gradations of textare from light flaky to a compact roek fit for building. A light, porous cale sinter has been deposited by the Mammoth Hot Springs of Yellowstone National Park, some of which is nearly pure carbonate of lime and snowy white in color. Travertine occurs in great abundance at Tivoli, in Italy, from whence it was quarried in building ancient Rome. The exterior of the Amphitheatrum Flavium, or Colosseum, the largest theater the world has ever known, was of this stone, as was also the more modern structure of St. Peter's, in the same city.* The Latin name of the stone was lapis Tiburtinus, of which the word "travertine" is supposed to be a corruption.

So far as is known the beds of this country are of limited extent and, with one or two exceptions, unfit for any kind of structural purpose. The pearls white and red "onyx" marble from San Luis Obispo and Suisun City, Cal., are properly travertine; so are also the celebrated "Mexican onyx" and so-called "Oriental alabaster" from Egypt.

Stalactite and stalagmite are the names given to the deposits of limestone on the roofs and floors of caves. Such are often beautifully crystalline and colored by metallic oxides, giving rise to beautifal marbles, which are incorrectly called onyx, as are also the travertines, from which they differ only in method of deposition.

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## LIMESTONES COMPOBED LARGELY OF ORGANTC REMAINS.

Fossiliferous limestones.-Many limestones are made up wholly or in part of the fossil remains of marine animals, as is shown in the accompanying figure, which is drawn from a magnified section of a limestone of the Cincinnati group from near Hamilton, Ohio.


In some cases the remains are retained nearly perfect; again the entire fossil may have been replaced by crystalline caleite. In other instances stones are found which are made up only of casts of shells, the original shell material having decayed and disappeared, as in the Eocene limestone from North Carolina. Many of the most beautiful marbles belong to the group of fossil limestones, as, for instance, the red and white variegated Tennessee marbles. Crinoidal limestones are made up of fossil crinoidal fragments.

Shell limestones or shell sand-rocks as they are called by some authorities, are made up of shells usually much broken, though sometimes almost entire. The well-known coquina from Saint Augustine, Fla., is a good illustration of this variety. Coral rock is of the same natare, excepting that it is composed of fragments of corals. Chalk is a fine white limestone composed mainly of the minute shells of foraminifera.

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MAGNESIAN LIMESTONES; ALSO CALLED DOLOMITIC LTMESTONES.
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Under this head are included those limestones which contain 10 per cent. and upwards of carbonate of magnesia. They may be finely or coarsely erystalline; light, porous, or compact; fossiliferous or non-
fossiliferous; in short, may show all the variations common to ordinary limestones, from which they can usually be distinguished only by chemical tests. Many marbles are magnesian, as will be noticed by reference to the tables. When the carbonate of magnesia in a limestone rises as high as 45.65 per cent. the roek is no longer called magnesian limestone, but-

DOLOMITE, *

This in its typical form is a crystalline granular aggregate of the mineral dolomite, and is usually whitish or yellowish in color. It ean in its typieal form be distinguished from limestone by its increased hardness $(3.5-4.5)$ and specific gravity (2.8-9.95). It is also less soluble, being scarcely at all acted on by dilute hydrochloric acid. Dolomite shows all the peculiarities pertaining to limestones, both in color and texture, and a chemical analysis is often required to distinguish between them. The pure white marble from Cockeysville, Md., is a dolomite, but by the eye alone can not be distinguished from the white crystalline limestones (marbles) of Vermont. The red-mottled marbles of Malletts Bay, Vt., are also dolomites, as are the white marbles of Lee, Mass., and Pleasantville, N. Y.

In composition there is no essential difference between a limestone or dolomite and what is popularly called a marble, but for convenience sake the subject will be here treated in two parts, the first to include those of this class of rocks as are put upon the market as marbles, and the second the rocks of the same composition but unfit for finer grades of bnilding and ornamental work and known popularly as simply limestones.
(3) LIMESTONES AND DOLOMITES. MARBLES,

Under the head of marbles then are here ineluded all those rocks consisting essentially of carbonate of lime (limestone) or carbonate of lime and magnesia (magnesian limestone and dolomite) that are susceptible of receiving a good polish and are suitable for ornamental work.

Alabama.-Beds of marble of great beauty are stated to occur nlong the Cahawba River in Shelby County of this State. The colors ennmerated are gray with red veins, red and yellow, buff with fossils, white erystalline, clouded with red and black. A black variety veined with white occurs on the road from Pralls Ferry to Montevallo and on Six Mile Oreek. Other good beds are stated to occur on the Huntsville road about 19 miles from Tuscaloosa and at Jonesborough, the latter rock being compact and of a red and white color; the same strata occurs at Village Springs. On Big Sandy Creek good marbles ocenr similar tothose on the Cahawba. $\dagger$ None of the above are actively quarried, and the writer has had the opportunity of examining but a single

[^1]specimen; that a small block of fine and even texture, pure white color and excellent quality, said to be from near Talladega.

Arkansas.-Black and variously colored marbles mottled with white fossil shells and erinoids are stated by Owen " to occur in Independence, Van Buren, Searcy, Carroll, and Marion Counties. The author has seen none of the material and has no more definite information on the subject than that given above.

California.-Owing to the violent geological agencies that have been in operation since the formation of the marble deposits in this State, the stones found are said to be so broken and shattered in nearly every case that it is impossible to obtain pieces of large size free from cracks and flaws.t Near Indian Diggings, in Eldorado County, there occurs a fine-grained white, blue-veined marble that closely resembles the Italian "bardiglio," from the Miseglia quarries, but that the groundmass is lighter in color. It has been used only for grave-stones and to but a slight extent at that. In Kern County are deposits of marbles of various shades, but all so broken and shattered as to be very difficult to work. Near Colfax, in Placer County, are also beds of a dark bluegray mottled magnesian limestone that takes a good polish and might be utilized as marble. Other deposits oceur in Los Angeles, Monterey, Nevada, and Plumas Counties, but none of them are at present worked. The most beautifnl of all the California marbles is the massive aragonite, or so-called "onyx," from San Lais Obispo. This stone, which is, as I understand, a travertine, is identical in composition and structure with the celebrated Oriental alabaster (wrougly so-called) from Blad Recam, near the ravine of Oned Abdallah. In color it is pearly white, and it is made up of fine, wavy parallel bands like the lines of growth upon the trunk of a tree. This stone is now being quite extensively introduced for small stands and ornamental work, which are often of exquisite beanty. No other travertines that can compare with this are at present quarried in the United States, though a beautiful variety is found in extensive deposits at Teeali, State of Puebla, Mexico.

Another travertine marble oceurs in very limited amounts near the town of Suisun, Solano County. The quarry lies in a low hill near the town, and has been quite extensively worked, but no large pieces of even texture are obtainable, which is of course a drawback to its extensive use. $\ddagger$

Specimens of this stone received at the National Musenm are of a dull red or amber-yellow color, resinous luster and somewhat porous. A far more beantiful stone, but which also occurs in very limited amounts, is found near the falls of the Sacramento River in Siskiyou County. This is also aragonite and is of a beautiful emerald-green color. The color is however so delicate that pieces of considerable thickuess (an

[^2]inch or more) must be used in order to appear to advantage. The stone is found, as I am informed by Mr. J. S. Diller, of the U. S. Geological Survey, in a narrow seam in the gneissoid roeks of the region, and there is very little probability of its ever being obtainable in pieces of more than a foot or so in length.

Prof. H. G. Hanks, in a paper recently read before the San Francisco Microscopical Society, describes, under the name of "Inyo" marble, a pure white crystalline dolomite occurring in the White and other mountains of the Inyo range in this State. It is regarded by him as an excellent stone, and one promising of future usefalness. Besides this he mentions a yellow brecciated marble found at Tehachipi, in Kern County, and a black marble found near Colfax. The author has seen none of these stones.

Colorado.-No marbles are as yet quarried in this State, but the Museum collections show a small piece of a black white-veined breccia from Pitkin that might rival the imported "Portoro" from the Monte d'Arma quarries in Italy, if occurring in sufficient abundance. Concerning the extent and character of the formation the anthor knows nothing. In the marble yards of Denver the author was shown during the summer of 1886 a fine chocolate-colored stone, somewhat resembling the more uuiform colors of Tennessee marble, which was stated to have been brought from near Fort Collins, in Laramie County, where it oceurred in great quantities; also a fair grade of white blue-veined marble from Gunnison County, A beautifal breccia marble is stated* to occur in abundance a few miles north of Boulder City.

Connecticut.-In the northern part of Litchfield County, near the Massachusetts line, in the town of Canaan, East Canaan, and Falls Village, there oceur massive beds of a coarsely crystalline white dolo mite, which have in years past furnished valuable building marbles, though recently they have been but little worked. The stone is said to weather well and to be obtainable in large blocks eminently suited for building, but like the Lee dolomite it frequently contains crystals of white tremolite, which weather ont on exposure. It is therefore not so well suited for finely finished or monumental work. The State-Honse at Hartford is the most important structure yet made from this material.

As already noted (ante, p. 288), it was at Marble Dale, in the town of Milford, in this State that marble quarrying was first systematically undertaken in this country, and at one time (1830) not less than fifteen quarries were in active operation in the vicinity. So far as can be learned not a single one of these is now being worked.

Delavare.-No marbles are at present quarried in this State, but a coarse white dolomite is found near Hockessin, New Uastle County. This, so far as can be judged from the single specimen examined, might be used for general building, though not well suited for ornamental work.

[^3]Georgia.-An important belt of marble is said to extend through the counties of Cherokee, Pickens, Gilmer, and Faunin in the northern part of this State, the material varying in color from pure white through blue and variegated varieties, some of which are remarkably beantiful. Variegated marbles also occur in the counties of Polk, Floyd, Whitfield, Catoosa, Ohattooga, Gordon, Murray, Barton, and Walker; chocolatered varieties similar to the marbles of Tennessee are said to occur in abundance in Whitfield County, the bed in Red Clay Valley extending in utinterrupted continnity for 10 miles, and varying from one-fourth to one-half a mile in width.* Of the beds above mentioned those in Pickens County are at present the most important and the ouly ones that have been worked to any extent, quarrying having quite recently been commenced here by the Perseverance and Georgia Marble Companies. Specimens of these marbles forwarded to the National Museum show them to be of uniform texture, but coarse, much coarser than the Vermont marble, which in other respects they much resemble. They are soft, work readily, and acquire an excellent surface and polish. In color they vary from snow white and pink to black and white mottled. The pink variety is unique as well as beantiful, and there is at present nothing like it produced in other parts of the country, though in color it closely resembles the pink marble from Cherokee and Macon Counties, N. O., to be noticed later. It is, however, coarser.

The ready working qualities of these stones, the fact that owing to the mildness of the climate the works can be in operation at all seasons of the year, together with the remoteness of regions where similar marbles are produced, all point to a rapid development of an extensive quarrying industry in this part of the country.

Iowa.-The calcareous rocks of Iowa are, as a rule, non-crystalline, dull in color, and with few qualities that render them desirable for oruamental purposes. But few of them are pure limestone, but nearly all contain more or less magnesia, iron, or clayey matter; very many of them being true dolomites.

Near Charles City, in Floyd County, on the banks of Cedar River, are extensive quarries in the Devonian (Hamilton) beds of magnesian limestones, certain strata of which furnish a coral marble at once unique and beautiful. The prevailing color of the stone is light drab, but the abundant fossils vary from yellowish to deep mahogany brown. These last, which belong to the class of corals called Stomatophora, are very abundant and of all sizes up to 18 inches in diameter. As seen on a polished surface imbedded in the fine, drab, non crystalline paste of the groundmass, they present an appearance totally unlike anything quarried elsewhere in America-an appearance at once grotesque and wonderfully beautiful. The stone admits of a high polish, and would seem excellently adapted for all manner of interior decorations if obtainable in blocks sufficiently uniform in texture. A small amount of argilla-
ceous matter and scattering particles of amorphous pyrite, which are oceasionally visible, render its adaptability to outdoor work decidedly doubtful. The stone is known commercially as "Madrepore marble." A polished slab 2 by 4 feet is in the collections of the National Museum.
The light yellowish, buff, or brown sub-Carboniferous magnesian limestone, quarried near Le Grand in Marshall County, also contains massve layers beautifully veined with iron oxide, and which are suitable for ornamental purposes, though it is not considered suitable for monuments and other work subject to continnous exposure. I have not seen samples of this material, though it is well spoken of by White.* It is popularly known as "Iowa marble." The only other stone which, so far as I am aware, has ever been utilized for ornamental purposes is the so-called "Iowa City," or "Bird's-eye marble." This is nothing more than fossil coral "(Acervularia Davidsoni) imbedded in the common Devonian limestone and often perfectly consolidated by carbonate of lime so that it may be polished like ordinary marble. When so polished its appearance is very beantiful, for the whole internal structure of the coral is as well shown as it is in living specimens, and yet it is hard and compact as real marble." The stone would be valuable could it be obtained in blocks of large size. Unfortunately it occurs in pieces of but a few pounds' weight; $\dagger$ it is used therefore only for paper-weights, and small ornaments of various kinds.

Maryland.-The principal marble quarries of this State are located near Cockeysville and Texas, some 16 miles north of Baltimore, on the Northern Central Railroad. Here there oceurs a small and isolated area of Lower Silurian (?) dolomite of medium texture and pure white color that has been very extensively used for general building purposes in Baltimore and Washington and the neighboring towns, and to a less extent in Philadelphia. In the quarries the stone lies in large horizontai masses, and blocks 28 by 10 by 3 feet have been quarried entire. This stone was used in the construction of Christ Church in Baltimore, the Washington Monument, and the columns and heavy platforms of the Capitol extensions at Washington, D, C.

Near Union Bridge, in Frederick County, there occurs a fine-grained and compact white magnesian limestone, but which has not been quarried to any extent.

The only true conglomerate or breceia marble that has ever been utilized to any extent in the United States is found near Point of Rocks, Frederick County, in this State. The rock, which belongs geologically to the Triassic formations, is composed of rounded and angular fragments of all sizes, up to several inches in diameter, of quartz and magnesian limestone imbedded in a fine gray calcareous groundmass. This composition renders the proper dressing of the stone a matter of some difficulty, since the hard quartz pebble break away from the softer parts in which they lie, leaving numerons cavities to be filled with colored wax

[^4]or shellac. It should therefore never be worked with hammer and chisel, but only with saw and grinding material, and no attempt made at other than plain surfaces. The stone was used for the pillars in the old Hall of Representatives in the Capitol at Washington, and a polished slab, 34 inches long by 20 inches wide, may be seen in the National Museum. The pebbles forming the stone are of so varied shades that to state its exact color is a matter of difficulty. Red, white, and slate-gray are perhaps the prevailing tints. On account of its locality this stone has been popularly called "Potomac " marble, or sometimes "calico" marble, in reference to its structure and spotted appearance. The formation from whence it is derived is said to commence near the mouth of the Monocacy River and to extend along the Potomae to Point of Rocks, and along the valley on the eastern side of the Catoctin Mountain to within 2 miles of Frederick. The Curator is informed, moreover, that the same formation occurs in Virginia, near Leesburgh, and that here the quartzose pebbles are almost entirely lacking, thereby rendering the stone much less difficult to work.

Massachusetts.-Orystalline limestones and dolomites of such a character as to assume the name of marble are now or have been in times past quarried in various towns of Berkshire County, in this State. The stones are all white or some shade of gray color, medium fine-grained in texture, and are better adapted for general building than for any form of ornamental work.

The quarries at Lee were opened in 1852, and the stone has been used in the Capitol extension at Washington and the new city buildings in Philadelphia; but little of it has been used for monuments. In the quarries the stone lies very massive, and it is stated cubes 20 feet in diameter could be obtained if necessary. The Sheffield quarries were opened about 1838. The rock here is massive, with but little jeinting. Natural bloeks 40 feet square and 3 feet in thickness can be obtained. The Alford stone is used mostly for monnmental work and appears very durable. Much of the marble from these localities contains small crystals of white tremolite which weather out on expostre, leaving the rock with a rough pitted surface. This is very noticeable in the exterior walls of the Capitol building at Washington, already noted.

Missouri.-We have seen but few true marbles from this State, though colored marbles of fine quality equaling the variegated varieties of Tennessee are reported by Professor Broadhead as occurring in Iron, Madison, and Cape Girardean Counties. The Iron County stone is reported as light drab in color, with buff veins. The outerop oceupies an exposure of several hundred feet of a low bluff on Marble Creek near the east line adjoining Madison County. The Madison County marble occurs near Fredericktown, and is described as the best-appearing marble in the State both in regard to color and texture, the colors being red, peach-blossom, and greenish, beantifully blended. The stone is represented as very durable, but liable to tarnish on a polished surface
when exposed to the weather. The Cape Girardean stone is represented as of a variety of colors-purple, yellow, red, pink, gray, and greenish all being enumerated; the supply is unlimited. None of these marbles are at present systematically worked, owing to lack of capital and distance from market. Professor Broadhead further states that few of the marble beds of southeastern Missouri are thick enough to be economically worked, as there would be too large a portion of waste material.

No pure white crystalline marbles are as yet known to occur within the State limits. Other stones capable of receiving a polish and suitable for marble are stated to occur in the counties of Saint Lonis, Saint Charles, Warren, Montgomery, Ralls, Calloway, Lincoln, Cooper, Pettis, Cass, Jackson, Livingston, and Olay.

Montana Territory.-This Territory as yet quarries no marble or other stone of importance. There were exhibited, however, at the Centennial, in Philadelphia, 1876, and since then in the National Museum at Washington, two samples from Lewis and Clarke County that are worthy of note, since they form the nearest approach to the imported Italian black and gold marble from the Spezzia quarries of any at present found in America. The rock is very close and compact, of a dark blue-gray color, and traversed by irregular wavy bands of varying width of a dall chrome yellow color. So far as observed the stone is far inferior in point of beauty to its Italian prototype, and apparently would prove more difficult to work.

New York,-The belts of Archaean dolomite which lie to the north of New York City and eross the State in a northeasterly direction furnish a very fair quality of white and gray marbles that have at varions times been quite extensively utilized. At present the quarries at Tuckahoe and Pleasantville, in Westchester County, furnish marble of good quality but of rather coarse texture. That from Pleasantville is partieularly remarkable in this respect, being made up of large snow-white crystals, often an inch or more in length, whence it derives its popular name of snowflake marble. On account of its coarseness it is not well adapted for carved work or for use in long columns. The Tuckahoe stone is not quite so coarse in texture and has been more extensively employed for building purposes. St. Patrick's Cathedral, on Fifth avenue, New York City, is of this stone. At Sing Sing and Dover Plains are other quarries of rather coarse white dolomitic marble, but which are not extensively worked.

A very coarsely erystalline light-gray magnesian limestone of Archaean age occurs at Gouverneur, in Lewis County. Although too coarse for carved work it answers well for massive structures, and, as it acquires a good surface and polish, is used to some extent for ornamental work. It is believed to be durable, since gravestones in the vicinity which have been set upwards of seventy years still present clean and uniform surfaces, and are free from lichens and discolorations of any kind.

Two excellent varieties of colored marbles oceur at Plattsburgh and Chazy, in Clinton County, in this State, and which are commercially known as "Lepanto" * and French gray. The first consists of a close, fine-grained gray groundmass with pink and white fossil remains, which are evidently crinoidal. The second is more uniformly gray and bears larger fossils. It is an excellent stone and, with perhaps the exception of the Tennessee marbles, has been used more extensively for mantels, table tops, tiling, and general interior decorative work than any other of our marbles.
At Glens Falls, on the Hudson River, occurs an extensive deposit of dark blue-black magnesian limestone, certain strata of which furnish the finest varieties of black marble at present quarried in this country. The stone is very fine grained and compact, and, when polished, of a deep, lustrous black eolor, though the uniformity of the surface is sometimes broken by the presence of a small white fossil. A two-foot cube of this stone is in the Museum collections. The finest quality of this marble occurs in a single stratum some 12 feet in thickness. The poorer qualities are burned for lime, of which they furnish material of exceptional purity. Black marble is also quarried to some extent at Willsborough, in Essex County. At Port Henry, in this same county, there is quarried a green and white speekled marble, composed of an intimate mixture of serpentine, calcite, and dolomite that has been used for interior decorative work. This stone has been noticed more fully under the head of serpentine.

At Lockport there is extensively quarried a soft gray crinoidal limestone in which the fossils are frequently of a pink or bluish opalescent color.' It is used to some extent for mantels and other ornamental purposes.t

In the town of Warwick, in Orange County, there is found a beautiful, coarsely crystalline marble of a carmine-red color, sometimes slightly mottled or veined with white. But little of it has been used and the supply is reported as small.

North Carolina.-Alihough no quarries of marble are at the present time worked to any extent in this State, there occur within its limits numerons deposits of most excellent material that only require enterprise and capital to bring to a ready market. One of the most important of these is near Red Marble Gap, in Macon County. The rock is a beautiful bright flesh pink, sometimes blotched or striped with blue and yellow. The texture is fine and even, and it acquires an excellent surface and polish. The stone is stated by Professor Kerr to occur in the side of the mountain in cliffs 150 feet or more in height, and blocks of almost any size can be obtained. It is quite different from any-

[^5]thing now in the market, and would doubtless find a ready sale if once introduced. Other marbles of white or blne gray color oceur in Murphy, and Valley Town, Cherokee Connty; Warren Springs, Madison County, and near Marion, in McDowell County. Lack of transportation facilities at present is a serions drawback to the introduction of any of these into our principal markets. We have also seen small pieces of very compact deep blue-black crystalline limestone, taking a high polish and suitable for the finest grades of ornamental work, from near Nantehala, Swain County, in this State. Portions of the stoae are traversed by a coarse network of pure white calcite veins that greatly added to its beauty.

Pennsylvania.-The belt of Lower Silurian limestone that extends from Sadsbury and Bart Townships, in Lancaster County, in a general easterly direction throngh Chester Connty, and through the western half of Montgomery County, includes within its area the only quarries of merchantable marble at present worked within the State limits. According to Professor Rogers* this belt forms the bed of a narrow valley some 58 miles in total length, extending from near Abington, in Montgomery County, to the source of Big Beaver Creek, in Lancaster County. The prevailing colors of the stone throughout the larger portion of this area are yellowish or bluish, aud it is, as a consequence, suitable only for making quieklime or for ordinary rough building purposes. On the southern side of the valley, however, between Brandywine and Wissahickon Oreeks, the stone has become highly metamorphosed and converted into a crystalline granular marble, white or some shade of blue in color, though often variously veined or mottled. All the quarries as yet opened are situated in Montgomery County, on the steeply upturned or overturned edges of the outcrops within half a mile of the southern edge of the formation between Marble Hall and the Chester Oounty line.

It is stated that quarries were first opened here about the time of the Revolutionary war, and that up to 1840 this stone was the favorite and almost only material used in the better class of stone buildings in and about Philadelphia. At about the latter date increased facilities for transportation brought the better varieties of eastern marbles and other stones into competition with it and its use has as a consequence considerably diminished. Among the important buildings constructed of the stone during its popularity were the United States custom-house and mint, the Naval Asylum, and Girard College, while the seemingly endless rows of red brick houses with the white marble steps, door and window trimmings are even now as characteristic of Philadelphia as are the brown-stone fronts of New York City.

The sarcophagi for General and Martha Washington, at Mount Vernon, are also of this material. While the Montgomery County stone

[^6]has shown itself to be very durable, in point of beanty it falls far short of the marbles from the more Eastern States, and hence its use for any form of ornamental work has almost entirely ceased. There were, however, on exhibition at the Philadelphia Exposition of 1876 (and since then transferred to the National Museum) samples of this limestone from along the Lebanon Branch of the Philadelphia and Reading Railroad, some of which gave promise of great utility. I would mention especially two samples from Myerstown and Mill Lane. These are very fine-grained and compact, of a drab or bluish color on a polished surface, and traversed by wavy and very irregularly anastomosing, nearly black lines. They seem in every way admirably adapted for decorative work, though I am not aware that they have as yet been at all used for this purpose. Newberry states* that a fine variety of black marble occurs in or near Williamsport, Lycoming County. I have never seen the stone and know nothing further regarding it. A black limestone that takes a fine polish and appears well suited for interior work is stated also to occur near the east end of Mosquito Valley, in the same county. For exterior work it is stated to be unsuited, as it splinters up badly on exposure.

Tennessee.-The valley of East Tennessee is underlaid by limestone of Lower Silurian age that furnishes some of the finest and most beantiful grades of colored marbles at present quarried in the United States.

The history of the quarrying industry in this part of the State, as given by Dr. Safford, $t$ is substantially as follows: In April, 1838, the Rogersville Marble Company was formed by gentlemen in and near Rogersville, Hawkins County, for the purpose of sawing marble and establishing a marble factory in the vicinity. The company operated to a limited extent for several years, erecting a mill and selling several thousand dollars' worth of material annually, most of which was used within the State limits. In 1844 the company sold out to a Mr. Rice, who shortly after sent a block of the light mottled, strawberry variety to the Washington Monument; another block was subsequently sent, in accordance with an act of the State legislature. These blocks attracted the attention of the building committee of the National Capitol, who finally decided on the adoption of the material for the interior decorative work in the extensions of that building. As a consequence, what was known as the Government quarry was opened, at a point about 9 miles southwest of Rogersville, where the Holston River intersects the marble range. The rock here was in large part massive and the bed several hundred feet in width. Many thousand feet were taken out, being shipped by river and rail to Charleston or Savannah, and thence by water to Washington. Public attention having thus been drawn to the beauty of these stones, there has arisen a constantly increasing demand for them, to supply which other quarries have been opened, and

[^7]now "Tennessee marble" is one of the widest known and most generally used of our ornamental stones.

At the present time the most extensive quarries are situated in Knox and Hawkins Counties. The prevailing colors found here are chocolate red and white, often coarsely variegated and fossiliferous; though finely and evenly crystalline varieties of a beautiful pink or "strawberry" color, with scarcely a trace of fossil remains, also occur. All of them cut to a sharp edge and acquire a beautiful and lasting polish not excelled and rarely equaled by any foreign or domestic marbles. Of foreign marbles, so far as the writer is aware, they have no exact counter. part, but perhaps resemble the "Rosso de Levanto" from Spezia, or the Persian "fiorto," more closely than any other that can be mentioned.

Besides the localities above mentioned, colored marbles oceur in the following counties in this part of the State: Hancock, Grainger, Jefferson, Roane, Blount, Monroe, McMinn, and Bradley ; some also oceur in Meigs, Anderson, Union, and Campbell Counties. The Hawkins County marble is part of a comparatively short belt of Trenton and Nashville rocks lying west of Rogersville. It is some 16 or 17 miles long, and from 50 to 300 feet in thickness. The supply is therefore practically unlimited and inexhaustible. The best variety of the stone is used only for ornamental work, owing to its high price, being valued at from $\$ 2$ to $\$ 3$ per cubie foot delivered at the nearest railway station.

The Knox County quarries are mostly situated within a few miles of the city of Knoxville. According to Dr. Safford* the entire thickness of the marble bed here is some 300 feet, the different layers of which vary from chocolate red and white variegated varieties through grayish white, pinkish, and more rarely greenish colors. The most esteemed variety has when polished a brownish red color, with white spots and clonds, due to fossil corals and crinoids. The grayish white variety, which is the nearest approach to a truly white marble of any now found in the State, is greatly esteemed for tombstones, monuments, tiling, ete., and is said to be very durable, tombstones which have been exposed for upward of thirty years showing no signs of disintegration or wear. Both the Hawkins County and Knox County stones are very strong and heavy, weighing about 180 pounds per cubic foot, which is some 14 pounds heavier than granite. Quite similar variegated marbles are said to occur in many of the counties of the Cumberland table-land, as in Franklin County, on the Elk River; at the Oil Springs, on Leipor's Creek, in Maury County. Some of the marbles of this latter place have a grayish groundmass, with fleecy clouds of red and green. $\dagger$

A beautiful olive-green fossiliferous marble is also found in the eleventh district of Davidson Connty, though the extent of the deposit is not known by the writer. Near Calhoun, in McMinn County, just south

[^8]
of the Chilhowee Mountain, occur breccia marbles of exceptional beauty, of pink and olive-green colors. One quite unique stone from this locality is composed of a grayish.ground mass, with large rounded and angular fragments of a lemon-yellow color. These same marbles also oceur in Greene, Cocke, Sevier, and all the counties of the Unaka range, but they are not much worked, on account of the hardness of the included fragments.*

Dove-colored marbles are stated by the same authority to oceur a few miles south of Manchester, Coffee County, and in Wilson and Davidson Counties. Dark limestones, almost black when polished, and often traversed by veins of calcite, forming a good black marble, are not uncommon, occurring in the vicinity of Jonesborongh, Washington County, Greeneville and Newport, Cocke County, on the Pigeons, in Sevier County, and also in McMinn and Polk Counties. They are at present but little used.
Colored marbles are also said to occurt in the Western Tennessee Valley, which, though somewhat inferior in point of beauty to those of the East Valley, are still valuable stones. Perry, Decatur, Wayne, and Hardin Counties are mentioned as offering the best facilities. On Shoal Creek, in Lawrence County, are said to be beds of fawn-colored or brownish-red marbles, some 40 feet in thickness and extending on both sides of the creek for a distance of 15 miles. The stone is often variegated by fleecy clouds of green or red-green and white colors. Owing to lack of transportation facilities it is not now in the market. In Wilson and Davidson Counties other beds of bluish or dove-colored marble ocenr, and in Rutherford County is a bed of pale-yellow marble with serpentine veins of red and black dots. The extent of the deposit is not known, and at present the stone is seeu ouly in the form of small objects for paper-weights and curiosities.

Texus.-The resources of this State are as yet but little known. There have been received at the National Museum several samples of compact, light-colored cretaceous limestones, from the vicinity ot Austin, Travis County, though few of them are of such quality as to be used as marbles. There was on exhibition at the New Orleans Exposition in 1884-85 a marble fire-place and mantel of Austin marble that was worthy of more than passing notice. The stone was compact, very light drab in color, and interspersed with large fossil shells and transparent calcite crystal. This composition would render some care necessary in cutting, but the final result would seem to jnstify the outlay. The marbles received from Burnet and vicinity present a variety of colors, some of which are very pleasing. They range from blue-gray and distinetly erystalline to very fine and compact forms, designated as "mahogany-red," "red and white," " purple variegated," ete. The " mahogany-red" is dull in color, and traversed by a net-work of lighter lines. It is too hard and brittle to work economically. The most promising variety is the purple

[^9]varcegated. This presents an extremely compact base of a grayish, or light lavender-tint, which is traversed by fine, irregular lines of a red and purple color. The stone acquires an excellent surface and polish, but is so hard as to work with great difficulty.

Utah.-A yellowish white crystalline limestone, that can scarcely be called a marble, was received at the Museum from Payson, in this Territory, and a compact nearly black stone, interspersed with numerons white fossil shells, from the San Pete Valley. Neither stone can lay any claim to beanty, though possibly the last mentioned might be mule to do as marble under certain circumstances.

Vermont.-Since this is the leading marble-producing State of the Union a brief deseription of the chief geological features of the marble formations may not be out of place here. According to Professor Brainard* this formation extends along the western borders of the States of Connecticut, Massachusetts, and Vermont, between the Green Mountain elevation, which extends from the Canada line nearly to Long Island Sound, and the intermittent Taconic Mountains, which extend south of Lake Champlain, and in places admit the marble veins within the border of New York. Of these immense formations, which are from 1,000 to 2,000 feet in thickness, the lower portion, known to geologists as the calciferous ( 300 to 400 feet in thickness), is for the most part siliceons, partaking of the nature of the sandrock that underlies it. The upper portion, known as the Trenton ( 500 to 600 feet in thickness), is impure from the presence of clayey matter, partaking of the nature of the slate formation that overlies it. Only certain layers of the middle portions seem to have been fitted by their original constitution for the production of marble.

These strata in Rutland and Addison Counties appear in two parallel lises about 2 miles apart, stretching from the north line of Middlebury to the south line of Rutland, and are from 100 to 200 feet in thickness. The limits of the formation may be best understood by reference to the accompanying map (Plate VII), redrawn from Professor Brainard's report. $\dagger$

Professor Hitchcock $\ddagger$ conveniently divides the marbles of this State into four groups or classes: (1) the common white and bluish or Eolian marble (so called from its occurring extensively on Mount Eolns) ; ( 2 ) the Winooski ; (3) the variegated of Plymouth, and (4) the dark, almost black, of Isle La Motte. Of these the Eolian is most abundant by far, and is most extensively quarried. In textnre the stone is fine-grained and often saccharoidal, though less so than the Italian marbles. In color it varies from pure snowy white through all shades of bluish, and sometimes greenish, often beautifully mottled and veined, to nearly black, the bluish and black varieties being as a rule the finest and most durable.

[^10]The stone occurs in beds usually but a few feet in thickness, which vary considerably in color, so that several grades, from pure white through greenish, bluish, and almost black, may be taken from the same quarry.* As a rule the best marbles in the State occur where the beds or strata stand at high angles, as at West Rutland. The quarries themselves at this village lie along the western base of a low range of hills, which, to the ordinary observer, give no sign of the vast wealth of material concealed beneath their gray and uninteresting exterior. In quarrying, the best beds are selected, and upon their upturned edges excavation is commenced, first by blasting, to remove the weathered and worthless material, and afterward by channeling, drilling, and wedg. ing; no powder being used lest the fine massive blocks become shattered and unfit for use. The quarry thus descends in the form of a rectangular pit, with almost perpendicular, often overhanging, walls, to a depth of sometimes more than 200 feet, when the beds are found to curve to the eastward and pass under the hill, becoming thus more nearly horizontal; in following these the quarry assumes the appearance of a vast cavern from whose smoke-blackened, gaping mouths one would little suppose could be drawn the hage blocks of snow-white material lying in gigantic piles in the near vicinity (sce Plate 1). Some of the quarries have been partially roofed over to protect them from snow and rain, and seem like mines rather than quarries. The scant daylight at the bottom is scarce sufficient to guide the quarryman in his work. As one peers cantionsly over the edge into the black and seemingly bottomless abyss, naught but darkness and ascending smoke and steam are visible, while his astonished ears are filled with such ant unearthly clamor of quarrying machines, the puffing of engines, and the shouts of laborers, as is comparable with nothing within the range of our limited experience.

The stone taken from the quarries is worked up in the companies? shops in the immediate vicinity or shipped in the rough as occasion demands. The supply is used for monumental, decorative, or statuary work and general building.

Other quarries in which the stone so closely resembles that of Rutland as to need no special description, are situated at East Dorset and Dorset, Wallingford, Pittsford, Sutherland Falls, Brandon, and Middlebury. At Sutherland Falls the stone is very massive, and large

[^11]blocks are taken out for building purposes. Some of the most valuable, according to Professor Seely, ${ }^{*}$ are known as the dark and light mourning vein varieties. The dark mourning vein has a ground of deep blue, while lines, nearly black, run through it in a zigzag course, presenting a beautiful appearance. The light mourning vein has similar veins, but the ground is lighter. The quarries at this place are described by Professor Seely as being in the form of a hollow cube cat into a hill with perpendicular walls on the north and west rising to a height of nearly 100 feet, open to the sky, and with an acre of rock forming its horizontal marble floor. Over this floor are running chatsneling machines, cutting out long parallel blocks which are afterwards cut up into convenient size, lifted from their beds, and taken to the mills to be sawn. Some sixty gangs of saws are kept running here day and night during the busy season, and not less than five hundred persons, all told, are employed in and about the quarries. The workmen are of many nationalities, including English, Scotch, Welsh, Irish, Canadian, and Italian.

As stated by Professor Hitchcock, t the beds of the Eolian variety of marble are not restricted to one locality but extend over a large portion of western Vermont, the formation in which it occurs extending the entire length of the State, usually interstratified with siliceous and magnesian limestones. The strata vary in thickness from a few inches to 6 or 8 feet, the thickest beds being usually found where the marble is coarsegrained and friable. From Dorset the beds thin out toward the north, the more northerly beds, thongh thinner, usually furnishing the finer grained and more compact stone. It is stated $\ddagger$ that Pittsford has the honor of having one of the earliest quarries in the State, if not the earliest, Jeremiah Sheldon having worked marble here as early as 1795 . There are three beds or veins of marble running through the town, north and south. The most easterly has a breadth of some 200 feet, and the stone is of the same character as that at Sutherland Falls or Proctor, as the town is now called. The middle bed is separated from the first by about 200 feet of lime rock. The bed itself is some 400 feet wide, and the stone varies in color from pure white to dark blue. The third or west bed which is thought to correspond to that of West Rutland is about half a mile west of the central and is aboat 400 feet wide. The stone is dark-blue and often beautifully mottled. Some of the beds here, as at West Iutland, furnish a beantiful snow-white saceharoidal stone suitable for statuary purposes, for which it has been used to a slight extent. The Vermont statuary marble, however, differs from its Italian prototype, in being of a dead white color and lacking the mellow, waxy luster so characteristic of the Italian stone.

[^12]Several outerops of marble oceur in Middlebury, and which have been worked for many years past; but in consequence of the thinness of the beds, their badly-pointed structure, and the interstratification of a magnesian state that produces numerous "rising seams," it is quite difficult to obtain perfeetly sound blocks of large size.*
The quarries in Dorset are sitnated mostly upon the sides of Mount Eolus, or Dorset Mountain, as it is also called, a section of which (after Hitehcoek) is here given.
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The thickness of the slaty cap rock is estimated by Hitchcock at 498 feet, and the varions beds of limestone below at 1,970 feet. Althongh but a small portion of this is suitable for quarrying, still the supply is readily seen to be inexhanstible. The prevailing colors of the stone, as at Rutland, are white and bluish, varionsly mottled and reined. According to Professor Seely $t$ the first quarry opened in Dorset was by Isaac Underhill, in 1785; the stone being used chiefly for fire-jambs, chimney-backs, etc. The first marble grave-stones ever furnished here were the work of Jonas Stewart, in 1790.
The bed of primordial rock known to geologists as the "red sandrock," which occur in the northwestern part of the State, bordering on Lake Ohamplain, is, as a rule, a hard, dark-red sandstone, containing some 8 or 9 per cent. of potash, with about the same amounts of iron and lime. The entire formation, which is some 2,000 feet in thickness, is, however, by no means uniform in composition, but includes considerable beds of limestone, dolomite, slate, and shale. It is the dolomitic layer which furnishes the peculiar red-and-white mottled stone popnlarly known as Winooski marble. According to a writer in the American Naturalist, $\ddagger$ the beds of this marble appear first one or two miles north of Burlington and extend in a somewhat interrupted series north throngh Saint Albans, and end between that place and Swanton. More than thirty years ago a quarry was opened in this rock abont 6 miles from Burlington, but owing to the hardness of the stone the enterprise proved a failure and the quarries were abendoned. Later quarries were opened at Saint $A$ lbans, and still more recently were re-opened at Burlington, the stone being used largely for flooring-tiles, wainscot. ings, and general interior decorative work. As a rule the stone is crystalline and very hard, much harder than ordinary marble. Its color is

[^13]quite variable, though some shade of red mottled with white usually predominates. Some varieties are beautifully light pink aud white, or pink and deep-blue gray or greenish. The very common chocolate-red and white variety is put upon the market as Lyonaise marble, and is used largely for tiling, its natural color being often rendered darker by oiling.

Chemically the stone is a dolomite, thongh varging widely in composition in samples from different loealities. Some samples show a very decided brecciated structure, while in others this entirely disappears. It is as a rule very hard to work, and, as exhibited in the capitol at Albany, the surface is often disfigured by irregular cavities and flaws which are rather unsightly. The color is said to fade on exposure to the weather, and hence the stone is used mostly for interior work.

An excellent outcrop of this marble occurs on the shore of Mallet's Bay, in the town of Colchester. The strata at this point are nearly horizontal, and in many places form the banks of the lake. One of the best quarries is so situated that a vessel can be brought up alougside and loaded with blocks with as much ease as they are usually loaded upon earts or cars at inland quarries. The stone oceurs in beds varying in thicknes from 1 to 6 feet, and blocks of almost any size can be obtained. It is hard to work, but as a consequence is very durable when once finished, being not easily scratched or scarred.

The best developments of the roek for marble quarrying are at Colchester, as already mentioned, Milton, Georgia, Saint Albans, and Swanton. At the last-named place there also occurs a beautiful gray marble, with angular fossil fragments of a white and pink color, identical with the "Lepanto " marble of New York. There is also a fine and compact dove-colored marble here, admirably adapted for decorative work, but the quarries are now abandoned.

The Plymouth marble, so called, is a quite pure dolomite, an analysis by Dr. Hunt resulting as follows:

The stone oceurs in the talcose-schist formation near the center of the town of Plymouth, at an elevation of 250 feet above the Plymonth pond. Quarries were opened here about 1835 , but were soon abandoned, as the demand at that time was almost altogether for white marble. The beds dip $60^{\circ}$ to the east, and the quarry walls, which have been exposed to the weather for twenty years, seem unaffected. In color the stone is blue or blnish-brown, diversified with long stripes and figures of various shapes in white. It is fine grained and compact, splitting with equal facility in every direction.*

[^14]The Isle La Motte marble derives its name from Isle La Motte, in Lake Champlain, where it oceurs in considerable abundance. It also occurs on several other islands in this lake and upon its banks in many places. Aecording to Professor Hitcheock* this was the first marble worked in the State, quarries having been opened prior to the Revolntionary war. The stone, which is largely used for flooring-tiles, is very dark, almost black in color, and highly fossiliferous, having undergone less metamorphism than the marble in the interior of the State. So far as the author has observed its color and texture are such as to preclude its obtaining a high rank for purely decorative purposes, but for floortiling is much esteemed and very durable. Fossil shells of great beauty are not uncommon, and, being snowy white in color, show up in strong contrast to the dark paste in which they are embedded.

Virginia.-The extensive area comprehended under the title of the Valley of Virginia embraces "all the portion of the State laving for its eastern boundary the western slope of the Blae Ridge and its inflected continuation, the Poplar Camp and Iron Mountains, and for its western, the Little North and a portion of the Big North Mountain, with the sonthern prolongation of the former, Caldwell and Brushy Mountains; and near its southwestern termination the line of knobs forming the extension of Walker's Monntain." $\dagger$

The central portion of the valley as thus ontlined is underlaid largely by limestones of Silurio-Cambrian age, which are in several places, according to the authority above quoted, capable of yielding good marbles. The special varieties mentioned are: (1) a dun-colored marble met with near New Market and Woodstock, and on the opposite side of the Massanattep Mountain in Page County ; (2) a mottled blaish marble to the west of New Market; (3) a gray marble occurring some threefourths of a mile in a southeasterly direction from Buchanan, in Botetourt County; (4) a white marble of exquisite color and fine grain about 5 miles from Lexington, in Roekbridge County ; (5) a red marble occurring only in the Cambrian formations lying among the mountains in the more sonthwestern counties; and (G) a shaded marble found in Rockingham County. This last is said to be compact, susceptible of a beantiful polish, and of a yellowish gray and slate color. None of the above have as yet received more than a local appiication.

At Craigsville, in Augusta County, there occurs a gray, sometimes pink-spotted encrinal limestone which acquires a good polish, and though in no way remarkable for its beanty is capable of extensive ap. plication for furniture and interiordecoration. The Archaan area to the eastward of the Valley of Virginia also includes sundry areas of workable marble. It is stated by Rogers $\ddagger$ that "near the month of the Tye River (in Nelson County) and the Rockfish, a true marble is

[^15]found, of a beantifnt whiteness and of a texture which renders it susceptible of a fine polish as well as being readily wrought with the chisel. A fow miles from Lynchburgh, in Campbell County, a good marble is likewise found." "The Tye River marble and one or more analogous veins" are further stated to "have all the characters of a statuary marble of fine quality, and should not some peculiarity, as yet unperceived, prevent their application to the purposes of the sculptor, they will no doubt be looked upon as very valuable possessions." The writer has seen none of the material from this locality. White and pink marbles of excellent quality also occur in the vicinity of Goose Creek, in Loudoun County. We have seen samples of the white, which for purity of color, fineness of grain, and general excellence, are not excelled by any marble now quarried in the United States, but the extent of the deposit is as yet unknown.

The stalagmitic deposits upon the floors of the caverns at Luray, in Page County, furnish, when ent, oceasional fine pieces of the so-called onyx marble, but the stone is too easily fractured and too uneven in texture to be worked economically, even were the deposits of sufficient extent to warrant the opening of quarries. I am informed by Prof. G. B. Goode that it is a common thing to find mantels of stalagmitio marble in the dwellings of Virginia. These are, however, always made from blocks found loose in the field or in caves near at hand.

## (4) LIMESTONES AND DOLOMITES OTHER THAN MARBLES.

Alabama.-A dark compaet limestone has been received at the Museum from Calera, Shelby County, and a light-colored, finely fossiliferous one from Dickson, in Colbert County. The last mentioned closely resembles in general appearance the celebrated limestone from Bedford, Ind., to be noticed later. It appears of good quality, and works readily.
Arkansas.-Oolitic limestone suitable for building, and baving the reputation of being very durable, is stated by Mr. Owen * to occur near Batesville, in Independence County.

Colorado. The collections show from this State a coarse, reddish limestone from Jefferson County, and also a very compact, finely crystalline black stone, traversed by a coarse net-work of very fine white lines, from Pitkin in Gunnison County. This last stone takes a polish, and might almost be classed as a marble. Neither stone is now quarried to any extent.

Florida.-This State at present furnishes scarcely anything in the line of building stone, nor is there much demand for any other form of building material than wood. On Anastasia Island, abont 2 miles from Saint Augustine, there was formerly quarried to a considerable extent a very coarse and porous shell limestone which was used in the construetion of the old city of Saint Augustine and of Fort Marion, which was

[^16]built about the middle of the eighteenth centrury. The rock is composed simply of shells of a bivalve mollusk more or less broken and comented together by the same material in a more finely divided state. Fragments of shells an inch or more in diameter occur. The rock is loosely compacted and very porous, but in a mild climate like that of Florida is nevertheless very durable. The quarries were opened upwards of two hundred years ago, but the stone is not now extensively used, owing in part to the dampness of houses constructed of it, and in part to the cheapness of wood. The rock, which is popularly known as Coquina (the Spanish word for shell), is of Upper Eocene age. In the quarries the stone lies within a few feet of the surface, and can be cut out with an ax, in sizes and shapes to suit.

The oolitic limestone occurring at Key West has been quarried and used in the construction of numerous private and public buildings in that vicinity.

Kansas.-The limestones and dolomites of this State are, as a rule, of a light color, soft and porous and incapable of receiving a polish such as will fit them for any form of ornamental work. Many of them are cellular and loosely compacted, being made up in large part of a small fossil rhizopod about the size of a grain of wheat and known under the name of fusulina. Such stones are obviously unfitted for exposed work in localities subject to great extremes of temperature, although they may be very durable in mild or dry climates. Those at present quarried are almost withont exception of Carboniferous or Permian age, and oceur only in thin beds, varying from a few inches to 8 or 10 feet in thickness.

Near Irving there occurs a light-colored, soft, thin-bedded atone, which, though not quarried during the census year, has in times past been used for building purposes in Atchison and Kansas City. It is soft and easily quarried and for ordinary construction requires but little dressing. At Frankfort a similar stone occurs which has been used to some extent for buildings, though principally for foundations. Some of the stone from these localities are of very poor quality, being soft and quite cellular through the breaking away of the small fossils above referred to. Atchison, in the same county, has quarries of a darker, more compact stone, which are worked for local use.

In the vicinity of Topeka there are quarried light-colored, compact, finely fossiliferons dolomites and limestones which work very readily, and which have been used in the construction of about thirty-five common buildings in that city, besides a chnrch, school, and opera houses in Emporia. They have also been used in Parsons, in Labette County, and neighboring towns in Missouri.

Near Lane, in Franklin County, gray and buff limestones are quarried and used quite extensively in Ottawa and Garnett, in the same State, though some have been shipped to Chicago. The buff variety is sometimes oolitic, resembling to some extent the Bedford (Indiana) stone.

The texture is firm and compact, and it acquires a good surface and polish. The gray variety is coarser, and often somewhat cellular, owing to the imperfect filling of the spaces between the fossil particles of which it is composed. A section of the quarry shows the gray stone to occur in a bed about 4 feet in thickness, and the buff oollitic about 6 feet in thickness, the layers of which vary from 18 to 24 inches each.

Near Marion Center, in Marion County, there is quarried a light-drab cellular magnesian limestone of Permian age, that has been used in the construction of the asylum for the blind and insane at Wyandotte and Topeka, in this State. Similar stones are quarried at Cottonwood, in Chase County. The stratum of quarry rock here is some 6 feet in thickness and blocks of any desired size and of thickness not exceeding $2 \frac{2}{2}$ feet ean be obtained. The principal markets for these stones are Kansas City, Mo.; Lincoln and Omaha, Nebr. ; Pueblo and Denver, Colo., and Atchison, Topeka, and Leavenworth, Kans.

In the vicinity of Fort Scott are some half a dozen irregularly worked quarries which furnish stone for building foundations and pavements in the near vicinity. The stone is dark colored, fine grained, and semierystalline, and is said to stand the wear of from ten to fifteen years' exposure very well. It turns to a brownish color on long exposure and is strong enough for ordinary structures. The stone quarried at Winfield is a light-colored, fine-grained cellular rock and so soft as to be quarried by means of plug and feathers only, the holes being first bored by means of a common anger without point. It is a handsome stone and has a good reputation for durability. It is used mostly in this State, though some is shipped to Kansas City, Mo.*

Many of the towns in Butler County produce fine-grained, light-colored limestones suitable for rough bnilding in the immediate vicinity, but not at all suitable for ornamental work.

Illinois.-No siliceous erystalline rocks of any kind are to be formd within the State limits, almost the entire product being limestone or dolomites, with a few quarries of sandstone, which are noticed on p. 448.

The most notable of the limestones of this State is the flne grained, very light-colored Niagara stone, quarried in the vicinity of Lemont and Joliet, in Will Connty. According to Professor Conover, $t$ the Lemont quarries lie on both sides of the Illinois and Lake Michigan Canal, and the beds of stone are quarried to their lower limits through a variable thickness of from 12 to 40 feet. The stone here is uniformly a finegrained, homogeneons, light-drab limestone, occurring in beds from 6 to 24 , and sometimes 30 inches in thickness. The beds are divided vertically by seams occurring at intervals of from 12 to 50 feet, and continuing with smooth faces for long distances, and also by a second set running nearly at right angles with the first, but only continuous between massive joints and at irregular intervals. This structure renders

[^17]the rock very easily quarried and obtainable in blocks of almost any required dimensions. The stone is soft and easily worked, taking readily a smooth surface, but no polish. It can be turned on a lathe, and is made into balustrades and other forms of ornamental work. It can be carved in bas relief, but is not sufficiently tough for high reliefs that are to be exposed to the weather. To produce smooth surfaces for flagging, ete., the stone is planed by machines somewhat similar to those used in planing iron. The stone from the immediate vicinity of Lemont is said to contain less iron and to tarnish less readily than that a few miles distant at Joliet.

The stone in the quarry contains much moisture, and daring cold weather care has to be taken to avoid injury by freezing until the quarry water has evaporated. This causes a considerable annual expense in making earth protections, except in those few quarries that are so sitnated that they can be flooded with water during the winter months.

The quarries extend for nearly 4 miles below Lemont, where a gap oecurs, to just below Lockport, from which point a line of closely-adjoining quarries extend to below Jolict. The finer varieties of the stone do not seem well fitted for heavy masonry in damp situations. Fine clay seams abound, which are invisible when the stone is first quarried, and which under favorable circumstances do not develop at all, but when exposed to heavy pressure or to alternate moisture and dryness, accompanied by frost, they are soon developed, and often render the stone worthless. Even the best varieties of the stone tarnish after a short exposure, especially in cities where soft coal is burned.

The Joliet quarries extend from a point about a mile below Loekport to the same distance below Joliet. Two distinct varieties of stone occur. That quarried from the lower beds on the right bank of the river is as a rule rougher, more coarsely textured, and tarnishes more readily than that from the higher levels. It is now but little used, except for heavy masonry. In the quarries back from the river, on the higher levels, the stone is fine grained, more homogeneous, and in this respect fully equal to the Lemont stones. The beds now worked are from 3 to 4 feet in thickness, and large blocks are obtainable. Most of it seems to weather-stain rather more than that from Lemont. The value of the stone quarried at these two places is probably fully equal to that of all the other stone quarried in the State."

Three large quarries are worked in these same formations at Batavia, but as a rule the stone is coarser and more difficult to work than those just described. Other quarries occur at Thornton and Blue Island, Cook County, and other parts of the State, as noticed in the catalogue

[^18]of the Mnseum collection. Within the city limits of Chieago there is quarried from this same formation a coarser somewhat cellular stone, that from its unique character perhaps merits a special description. According to Hunt* this stone when pure is a nearly white granular crystalline dolomite, containing 54.6 per cent. earbonate of lime. It, however, contains so large a portion of bituminous matter, that blocks sometimes become quite black on exposure. The color fades somewhat in time, but the petroleum odor is often perceptible for long distances. The stone has been used to some extent for building purposes, as notably in the First Presbyterian Church in Chicago. The gammy bituminons matter causes the dust from the streets to adhere to exposed surfaces, thus giving the buildings a peculiar antique appearance. We are informed by Mr. Batchen that this pseudo-antique appearance is greatly admired by some. The presence of the bitumen is beneficial in at least one respect, in that it renders the stone less pervions to moisture, and hence less liable to disintegration by freezing. This stone is represented by an 18 -inch cube in the Museum collections.

Lower Silurian (Trenton) limestones and dolomities are quite extensively quarried in Jo Daviess County, and make a handsome and very durable building material. Calhoun, Alexandria, and Ogle Counties also furnish good material, but which, for lack of space, can not be described here. At various points in Whiteside and Hopkins Counties there are outcrops of limestones belonging to the Cincinnati group, a part of which will furnish durable building material. The stone needs, however, to be selected with the greatest care, since all the beds are not of equal quality.

At Jonesborongh, in Union County, there occurs a fine, even-grained, compact, beantifully oolitic stone that cuts to a sharp even edge, and seems admirably adapted for carved work and general building purposes as well. Specimens in the National Museum are of a lighter color than the Bedford, Ind., oolotic stone and take a better polish. We have had no means of ascertaining its lasting qualites, but it is stated $\dagger$ to be liable to injury from frost when exposed in damp places. The stone is of the Carboniferous age. Other oolitic stones occur at Roseelair, in Hardin County. They are of a dark bluish-gray color and take a good polish.

There are many other localities in the State which furnish excellent varieties of building stone. These can not be mentioned here for lack of space. Interested parties are therefore referred to the catalogue of the Musenm collections and to the report of the Tenth Census.

Indiana.-Few of the limestones at present quarried in the United States exceed in reputation and beanty the fine-grained oolitic stone of sub-Carboniferous age from the vicinity of Bedford, in this State, and popularly known as "Bedford limestones." The rock is of fine and

[^19]even texture, and is composed of small rounded concretionary grains of about the size of a grain of mustard seed compactly cemented together by crystalline lime or calcite. The stone is soft, but tenacious (specimens having borne a pressure of 12,000 pounds per square inch), and works readily in every direction. It is therefore a great favorite for carved work, and is used more extensively for this purpose than any other of our limestones. No better example of the adaptability of the stone for this purpose can be given than the elegant mansion of Mr. O. J. Vanderbilt, on Fifth avenue, in New York City. Uufortunately, as is usually the case with light limestones, this stains badly in cities where there is a great amount of manufacturing, as is only too well illustrated in the case referred to.

Although the quarries have been worked systematically for but a few years, the stone is already widely known, and is coming into very general use in nearly every city of importance in the country. At the principal quarries, which are situated near Bedford, Lawrence County, the stone oceurs in a solid bed, that has been worked to a depth of 40 feet without reaching the bottom.

Stones very similar in general appearance, but not always so distinetly oolitic and often coutaining a considerable percentage of bituminous matter, also oceur and are extensively quarried at Ellettsville, in Monroe County. Other localities not so extensively worked occur in Owen, Washington, Crawford, and Harrison Counties. Samples received at the Maseum from near Corydon in the last-named county are of a beautifully fine and even oolitie structure, very light color, firm and compact. They resemble the oolitic stone from Princeton, Ky., more closely than any other, but are much more compact. The stone is stated to occur in inexhaustible quantities.

The Washington County deposit at Salem is said to be a very fine one, there being a solid bed of the oolite 30 feet in thickness, with only about 5 feet of cap rock.

Other limestones or dolomites of excellent quality, but lacking the oolitic structure, oceur in many parts of the State. A compact, finegrained drab stone, taking a very good polish and also of subCarboniferous age, oceurs at Greencastle, Putnamville, and Okalla, in Putnam County, and is quarried for lime and for building purposes in the various cities and towns in the vicinity. There is quarried at Bedford also a fine grained semi-crystalline, dark-gray stone, which is capable of a variety of uses.

Near Silverville, in Lawrence County, there occurs a very fine-grained compact stone of a drab color, that acquires readily a smooth and even surface. An attempt has been made to utilize this for lithographic purposes, but, it is stated, with indifferent success. It bears a close resemblance to the darker variety of the well-known Bavarian lithographic stone, but is somewhat harder.
$\Delta s$ will be noticed, nearly all the quarries mentioned lie in that por-
tion of the State south of Indianapolis. But few quarries of importance lie to the north of this point, and when worked the stone is used principally in the manufacture of quicklime. At Anderson, in Madison County, a light-colored, fine-grained stone occurs in beds of from 4 to 12 inches in thickness, which is used locally for flagging and general trimming purposes.

Ioza.-Although this State abounds in limestones and dolomites to the exelusion of almost all other varicties of building stone, but little of the material now quarried is of such a nature as ever to acquire more than a local reputation. Though having altogether more than three times the number of quarries found in Illinois, these are mostly small affairs, and the value of the total product is but little more than onehalf that of the latter State. At the time of the taking of the Tenth Census the whole number of quarries in the State was 131, of which 128 were of limestones and dolomites, and the remaining 3 of sandstone, which are mentioned on p. 449.

At the present time the most important quarries are situated in the Niagara division of the Upper Silurian formations, in the vicinity of Stone City, Jones County; Farley, Dubuque County, and in various portions of Jackson, Cedar, Clinton, and Scott Counties. The Jones County stone is a very light-colored, fine-grained and compact bituminous dolomite. That from Farley is very similar in general appearance, but contains less bituminous matter. In the small blocks received at the Museum the stones appear of good quality, but we have had no opportunity of learning their weathering qualities.

A finely crystalline light colored limestone of sub-Carboniferous age is quite extensively quarried near Burlington, in Des Moines County. According to Professor McGee * this stone, which is practically identical with that of Keokuk, in Lee County, is used chietly for common masoury, and only occasionally for dressed work. The upper beds are "nearly white in color, fine, compact, homogeneous, and hard, with a choncoidal or splintery fracture, like the so called lithographic limestone of nearly the same geological age. This stone has been used to some extent for ornamental purposes, but contains too many incipient fractures, and is too liable to unexpected disruption to be of special value."

Near Le Grand and Montour, in Tama County, there occurs a magnesian limestone of the same age as that just described, which is fine grained, compact, and generally buff or whitish in color. The coarser portions are extensively used for heavy masonry, while the finer grades, which are often beautifully veined with iron oxides, are used for ornamental work under the name of "Iowa marbles." Some of the stone from this locality is oolitic. Similar stones are extensively quarried at lowa Falls and at Humboldt and Dakota, in Hamboldt County. Lime-

* Ieport of Tenth Census, D. 261.
stones and dolomites belonging to the Saint Louis epoch of the Sabcarboniferous age are quite extensively quarried in various parts of Lee, Des Moines, Henry, Washington, Van Buren, Jefferson, Keokuk, Wapello, Manhaska, Marion, Story, Hamiltor, and Webster Counties. Tlat from near Farmington, Van Buren County, varies from light buff to nearly white in color, is fine grained, and has been quarried for lithographic purposes. It is, however, no longer used, having been found to contain too many dry seams often cemented by crystalline carbonate of lime. At Chequest the limestone takes a fair polish and is known as "Chequest marble."

In the Devonian limestones near Iowa Oity and Roberts Ferry there frequently occur masses of fossil coral (Acorvularia davidsoni) which, when cnt and polished, form beautiful ornaments and paper-weights, though of small size. They are known popularly as bird's-eye and fishegis marbles.
One of the most unique marbles in this country is found in the Devonian beds near Charles City. The stone, which is known commercially as "Madrepore marble," consists of a fine grained and compact non-crystalline groundmass of a yellowish-brown or drab color, in which are embedded a great variety of fossil forms and shapes, including large strometophera sometimes a foot or fifteen inches in diameter. The stone polishes well and the fossil forms show up in a manner peculiarly beautiful and unique. This marble is represented in the Museum collections by a large polished slab (catalogue No. 38465) as well as by the smaller specimens in the systematic series.

Kentucky.-Although the building stones of this State are entirely unknown in our principal markets and but few of them have more than a strictly local reputation it by no means follows that there is any lack of material or that it is at all inferior in quality. While it is true that no marbles or granites of importance are found, yet there abound limestoues of the finest quality and in inexhaustible quantities. The oolitic limestones of this State are without superiors, if indeed they have equals. Through the energy of Prof. J. R. Proctor the Museum has received a full series of these stones, and we are able to speak of their qualities from personal observation. In Todd, Grayson, Meade, Simpson, Christian, and Caldwell Counties oolitic stones occur of very light, almost white, color and excellent quality. The varieties from Litchfield and Princeton are especially worthy of meution. The oolitic character is very pronounced in these stones, and while in some eases the production of a perfect surface is impossible, owing to the breaking away of these minute ronnded grains, still in the better qualities the sharp edges and smooth surfaces are as readily acquired as on the celebrated Bedford (Ind.) or other stones of this character. These are superior to the Bedford stone, moreover, in their clear and uniform colors, never being blotehed with oil, as is the Bedford stone. Professor Proctor informs us that the stone is quarried with ease, is easily wronght, stands
ure well, and is considered one of the most reliable stones in the state.

Compact fine-grained limestones of a dark drab color, taking a smooth surface, but not suited for marble, are found in the towns of Franklin, Simpson County ; Lebanon, Marion County ; Russellville, Logan County, and others. A part of the Franklin County stone is fine grained and suitable for lithographic purposes, though inferior to the imported Bavarian stone. Very light colored compact limestones are found also in Simpson, Logan, and Franklin Counties, but we have no information regarding their availability or the extent to which they are quarried.

Maine.-Limestone is an abundant and common rock in this State, especially in the southeastern part, in the counties of Knox and Lincoln, where it is very extensively burnt into quicklime. So far as I am aware none of the stone is utilized for building, as its colors-blue and blue-black, veined with white-are poorly adapted for such purposes. No stone suitable for marble is yet known to occur in the State, though Hitcheock* expresses the opinion that such may yet be found in "the belt of Helderberg limestone, running from Matagamon (east branch Penobscot) River northeasterly."

Many samples of so-called white marbles have been taken from the limestone formations about Rockland, in Knox County, but, so far as observed by the present writer, they are all too coarsely erystalline or too distinetly granular in structure to be of value.

Michigan.-Limestone or dolomites of a character suitable for building purposes are at present but little quarried in this State, the entire value of the output during the census year being but about $\$ 26,000$. A fine-grained fossiliferous dolomite of a drab color is worked at Sibley's Station, in Wayne County, and a very light-colored granular rock, of similar composition, near Raisinville, in Monroe County. Near Alpena light-colored limestones are quarried which are hard, compact, and said to be durable. They are not obtainable anywhere in large quantities nor in blocks of large size, but there are numerous small openings sufficient to supply the local demand. Other localities where stone can be obtained are at Trenton, near Detroit, and upon Macon Creek, both in Monroe County. The stone is apt to contain dry seams and requires care in selecting. These are all of Devonian age.

Minnesota.-The Lower Silurian limestones and dolomites of this State, which are at present the only ones quarried, are, as shown by the Museum collection, nearly all of a light buff, drab, or blue color, fine-grained and compact, though in some cases cellular and semicrystalline, according to Professor Winchell. $\dagger$

The stone appears in the bluffs of the Mississippi River and St. Croix Valley, and is quarried at all points where (except Lake City) there is any demand between Stillwater and Winona, along the Mississippi Val-

[^20]ley on the Minnesota side, and also at several places farther west, as at Caledonia, in Houston County, Lanesborough and Rushford, in Fillmore County, and at points in Winona County.

At Stillwater the rock is a silicious dolomite of a light buff color. In the ledge, which is about 45 feet thick, it occurs in altornate bands of compact and cellular rock varying from 3 to 6 feet in thickness. The coarser variety is most durable and is used in heavy masonry, as bridges and foundations. The finer variety is used for house trimming, ashlar work, and tombstones.

At Saint Paul the rock is a fine light-bluish semi-crystalline magnesian limestone. It is usually quite regularly stratified, and oceurs in beds from 3 to 24 inches in thickness, with joints from 10 to 30 feet apart. Blocks 10 by 5 by 2 feet ean be obtained if desired. It is used only locally. At Minneapolis the rock is quite similar, though sometimes slightly fossiliferous or mottled with argillaceous spots. It was formerly used almost exelusively in Minneapolis, but is now being gradually replaced by stone from the neighboring States.

In speaking of these stones Professor Winchell says :*
"In the use of the Trenton limestone quarried at Saint Paul and Minneapolis regard should be had constantly to its laminated structure. The beds quarried now are as they were originally deposited, and as ent for use embrace in every block many layers of from one-half to two inches in thickness. These consist of alternating clayey and calcareous portions, the latter constituting the hard and enduring part of the stone. These layers are not always distinet and continuous over large surfaces, but they blend or shade into each other every few inches. Yet in process of time, under natural weathering, they get separated so as to fall apart, the clayey matter disintegrating first and eausing the calcareous strueture which sustains the whole to break up into small sheets or fragments. Hence this stone should never be placed on edge, but in the same position it occupied in the quarry. It should never be allowed to oceupy projecting or exposed parts of a building. More especially if it be on elge and in a projecting cornice or capital it is the source of weakness to the structure, as well as of danger to all passers, from the dropping of sheets or fragments as the weather, by wet or frost, separates them from each other. Its color is also against its being put in the exposed and ornamental parts of a strueture. * * * The color of the Trenton makes it very suitable for foundations and for the ranges below the water-table, but even there it should be well bedded in mortar and protected by the water-table in order to keep out the water."

At Red Wing, in Goodhue County, the stone is quarried only for local building and for burning into quicklime. Blocks as large as can conveniently be handled can be obtained. At Frontenac, in the same county, the stone is of a buff or gray color, medium fine, and quite

[^21]H. Mis. 170, pt. 2-26
cellular. This rock is considered one of the best in the State, and is used for all varieties of building purposes, as well as for bases and tombstones. Blocks 11 by 7 by $5 \frac{1}{2}$ feet and weighing 18 tons have been taken out, which is about as large as the quarries will furnish. It is said to work with comparative ease, and to withstand the weather well. Although having been in use longer than any other stone in the State, it has not as yet shown any change whatever from atmospheric influences. Its powers of resistance to pressure vary from 5,000 to 7,000 pounds per square inch.

At Kasota and Mendota, in Le Seuer Coanty, the dolomite is of a buff or rusty pink color, of homogeneous texture, and very strong and durable. It withstands a pressure of 10,000 pounds per square inch without crushing. Blocks 10 by 11 feet by 1 foot in thickness can be obtained. It is quite generally used throughout the State, the pink variety being most admired and bringing the highest price.

At Mankato, in Blue Earth County, the rock is also a dolomite, buff in color, fine, compact, and semi-crystalline, sometimes cellular. Blocks 20 by 10 by 6 feet can be obtained from the quarries.

At Winona the dolomite is quarried for general building purposes, flagging, and burning into lime. It is of a buff color, usually fine and uniform in testure, thongh sometimes containing cherty lumps, and porous. Blocks of any size that can be handled may be taken from the quarries.

Missouri.-Limestones and dolomites of a nature unfitted for marbles, but of good quality for general building purposes, oceur in great abundance in Saint Louis, Cole, Cooper, Pettis, and Jackson Counties in this State. At present, owing to the ready accessibility of a good market, the Saint Louis stone is the most extensively quarried of any of these mentioned. The stone, which is of Carboniferons age, is fine-grained and compact, and of a drab color. It is represented as strong and durable and well adapted for the manufacture of lime. At present it is used largely for foundations. A very fine-grained and compact limestone of a dark drab color occurs near Saverton, in Ralls County, which has been used to some extent for lithographic purposes. Stones from other localities are mostly eompact, and of light or dull red. A very light encrinital stone is quarried in the vicinity of Hamilton and Bear Oreek, in Marion County.

Nebraska.-Fine-grained, light-colored, compact, or sometimes fluely fossiliferous and oolitic limestones, apparently of good quality, have been received at the Museum from near Roca, in this State. Also a light-colored fusulina-bearing stone, closely resembling that of Augusta, Kans., from Glen Rock, Nemaha County, and a fine-grained, soft, lightcolored fossiliferons stone from La Platte, in Sarpy County. The writer possesses no information regarding the extent to which they have been worked, if at all.

New York:-With but few exceptions the limestones of this State con-
tain a sufficient percentage of magnesia to merit the name magnesian limestone, though scarcely enough to constitate a true dolomite. Many of the rocks belonging to this group are marbles, and have already been described.

At Greenport, Columbia County, a stratum of Lower Silurian limestone upward of 60 or 70 feet in thickness is extensively worked for ornamental and building purposes. The quarry proper is said to cover an area of 40 acres, and a face 30 feet high and half a mile in length has been opened. The stone is of medium texture, semi-crystalline, of a water-blne or gray color. The quarries at Glens Falls, on both sides of the Hudson River, furnish beside the black marble already referred to a great amount of dark-colored limestone which is used for tiling, ete., as well as burning into lime. At Willsborough and Crown Point, in Essex County, there are also extensive quarries of blue black limestone of good quality. In various towns in Montgomery County a gray or bluegray semi-crystalline limestone is worked for building material. The stone is said to be strong and durable, though care need to be used in its selection. At the Indian reservation in Onondaga County a gray, compact, semi crystalline limestone, said to possess great streugth and durability, was formerly extensively quarried, but the work has of late fallen off somewhat, owing to lack of transportation facilities. A gray, crinoidal stone that takes a fair polish is also found at Onondaga, in the same county.

At Lockport, in Niagara County, a fossil-bearing calcareous dolomite has been quarried for many years for general purposes of construction in New York and Rochester. The stone does not take a good surface and consequently does not polish readily, but some portions make quite slowy mantels, owing to the presence of red crinoidal remains. According to Professor Julien * this stone as used in New York City has not proved durable. The fault, however, he regards in part to the manner in which the stone is used, about 40 per cent. of the blocks being set on edge.

North Carolina.-Limestones and dolomites of good quality for building purposes occur in abundance in this State, but are not extensively quarried for lack of a market or transportation facilities. Near New Berne, Craven County, there occurs a very coarse cellular shell stone of Eocene age that has been used for underpinnings and fences, but it is said not to weather well. Material of the same nature, but much finer in texture and more compact, occurs at Rocky Point, in Pender Cotinty, and which has been used in the construction of breakwaters and other harbor improvements at Wilmington, in this State. A coarse, dull red dolomiteoceurs at Warm Springs, in Madison County, andalso light bluegray varieties, but neither are worked, as there is little demand for the material.

[^22]Ohio.-The limestones and dolomites of this State are almost altogether of a dull, uninteresting color, and though in many cases durable and strong are entirely unfit for any sort of fine building and ornamental work. They are therefore used chiefly for the rough work of foundations, street paving, and flagging, and to a very large extent for making quicklime. In many instances they have been used locally for building purposes, but their qualities are not such as to cause them to be sought from a distance.

At Point Marblehead, in the northern part of the State, dull, lightcolored compact dolomites of Carboniferous age have been quarried for making lime and for building purposes for the past lifty years. Many buildngs in the vicinity have been constructed from it, and it has also been largely used by the Government for light-houses and other struetures along the lake front. Of late years its use for building has very considerably diminished. Near Sandusky, in Erie County, the same formations have been extensivly worked, not less than 12 acres in the vieinity having been quarried over to a depth of $S$ feet. The stone is of a dull, bluish-gray color, and is used for building, flagging, and making lime; about one hundred and eighty houses in the eity have been constructed from it. Near Columbus, in Franklin County, the Devonian limestones are extensively quarried, and the product has in a few instances been used for building purposes. By far the greater part of the product is, however, used as a flux for iron and for making quicklime. A dolomite from the same formations is quarried for rough building and lime burning at and near Marion, in Marion Uounty.

In Allen, Miami, Clarke, Greene, Montgomery, Preble, and several other counties the dolomites and limestones of Upper Silurian age are extensively worked, but so far as the author can learn but a small part of the quarry product is utilized for building. At Springfield the stone is buff in color and somewhat porous, though it is said to be strong and durable.

Near Greenfield, Ross County, and Lexington, Highland County, there are extensive quarries of a bituminous dolomite, which is largely used in Cincinnati for flagging, steps, and in the manufacture of lime. Specimens received at the National Museum from the places show the stone to vary from dark grayish distinetly laminated to fine, compact, and homogencous of a yellowish or buff color. The buff stone can be cut to a sharp edge, and acquires a good surface, but takes only a dull polish. So far as the author has observed this is one of the finest appearing and best working stones in the State.

The Montgomery County stone is a magnesian limestone, and it is said to have obtained a good reputation. It is not now used as much as formerly, however. The stone quarried in the other localities mentioned present so little diversity of character as to need no special description.

Pennsylvania.-The Lower Silurian formations in Montgomery, Lancaster, and Ohester Countics, which furnish the supply of marble already referred to,* furnish also large quantities of gray or bluish-gray stone of the same composition, but, owing to its color and texture, unsuited for any form of ornamental work. It is, however, extensively quarried for general building, for foundations and bridge abntments. Besides, in Montgomery County, limestone is quarried for local use in Easton, Tuckerton, and Reading, Berks Connty, and in Annville, Lebanon County; also near Marrisburg, Dauphin County ; Leaman Place, Laneaster County; York, Xork County; Bridgeport, Shiremanstown, and Carlisle, Cumberland County. The stone from the Laneaster quarries breaks with an irregular fracture; is "plucky," as the stone cutters say, and is hence hard to work. It is, however, very durable, exposare for many years having no other apparent effect than that of a slight fading of the color.

The York stone is very fine grained, compact, and of a deep blne.black color. It takes a high polish, and but for its uneven texture might mako a fine marble. In Wrightsville, in this same connty, a white or bluish erystalline granular stone is quarried, which takes a fair polis $h_{\text {, }}$ and which might perhaps be used for marble.

At Chambersburg, and in other parts of Franklin County the stone is a calcareous dolomite, dark in color, fine grained, and very durable; buildings which have stood for a century showing only a slight fading. It is used locally for rough building, lime burning, and fertilizers.

At varions localities near South Mountain, a limestone breceia similar to that of Frederick, Md., occurs, and which perhaps can be made to yield good stone for ornamental work.

Tennessec.-A compact, finely fossiliferons, light pink spotted limestone occurs in the vicinity of Nashville, in this State, and which is quite extensively quarried for use in the near vicinity. The stone is said to be of rather poor quality, but is used on account of its accessibility. Near Chattanooga, in Hamilton County, a magnesian limestone of blaish-black color is quarried for local use. The quarry is said to be very favorably located, and the stone cheap and very durable.

Light pink, finely fossiliferous, semicrystalline limestones occur at Columbia, Maury County; light-colored, similar-textured stones at Carter's Oreek; light, almost white, at Morristown ; red, compact fossilfferous at Springville; and compact drab and almost black dolomites near Chariotte Pike. A fine grained, compact, and light-colored oolitie stone oceurs at Sherwood Station, which euts to a sharp, smooth edge and scems a most excellent stone. So far as the anthor is aware-none of these are quarried for anything more than local use.

Texas.-Compact, fine.grained Cretaccous (?) limestones of excellent quality ocenr near San Saba in this State. A portion of these are

[^23]entirely erystalline and acquire an excellent surface and polish, such as fits them for interior decorative work.

Light-colored, fine-grained limestones also oceur in the vicinity of Austin, in Travis Connty; and dark mottled varieties near Burnet, in Burnet County.

Wisconsin.-The more thickly settled portions of this State are, according to Professor Conover,* underlain by Silurian rocks so disposed that there are but few regions where roek fit for ordinary purposes of construction can not be obtained in quantities sufficient to supply the local demand. Previous to 1880 , however, with a single exception, no quarries had been worked for export beyond the State, and but few that had been worked for other than local markets. As a whole the stone belonging to this class in the State are characterized by their light colors, compact textures, and hardness. Many of them will take a good polish and might be used for ornamental work, but that the colors are dull and uninteresting. Such occur and are quarried to a considerable extent at Byron, Foud du Lac, and Eden, ir: Fond du Lac County, but although the stone seems very durable, its hardness is such that it has not been used for facings or any kind of ornamental work. Coarse drab dolomites are quarried for general building at Ledyard and Kaukanna, in Ontagamie County ; at Neenah and Oshkosh, Winnebago County, and at Duek Creek Station, in Brown County. In various parts of Wankesha Connty there occurs a light drab, sometimes almost white, dolomite, which, though a hard stone to cut, hasbeen quite extensively usel and with very good effect for general building. At Eden, Oak Centre, and Sylvester, Green County, a similar stone occurs, which also crops out in Calumet County. Here it is of a white mottled color, takes a good polish, and is locally called marble.

Near Racine there occur beds of dolomite, carying from coarse, porons, and irregularly bedded to a fine, compact, and homogeneous rock, eminently adapted for fine building material, though not well suited for ornamental work. The quarries are very extensively worked. Other quarries in the same formation oceur at Milwankee, Cedarburgi, Grafton, Sheboygan, and Manitowoc. The Milwaukee quarries furnish several grades of bnilding material, and of almost any necessary size. These are said to be remarkable for the great depth of excellent building stone which their working has developed.

Numeroas other quarries ocear in Rnck, Dane, anil La Crosse Counties, but which can not be mentioned here for lack of space.

[^24]
[^0]:    *Hall, Building and Ornamental Stones, pp. 279, 281.

[^1]:    *So called after the Frenoh geologist, Dolomien.
    t Geol. of Alabama, Fisst Bien. Rep., 1849, p. 45 ,

[^2]:    * Geol. of Arkansas, First Annual Reporf.
    $\dagger$ Rep. Tenth Census, p. 279.
    $\ddagger$ Rep. State Mineralogist of Cal., 1884, p, 73.

[^3]:    ${ }^{*}$ Bien. Rep. State Geol. of Colo., 1880, p. 33.

[^4]:    *Geol. of Iowa, vol. 2, p. 313.

    + White, op. cit., p. 316.

[^5]:    *The Lepanto marble is figured on Pl. xxxil of the census report, where it is wrongly set down as from Isle La Motte, Vermont.
    $\dagger$ J. S. Newberry in report on building and ornamental stones, Vol. III Inter. Ex. Reports, p. 158.

[^6]:    *Rep. of First Geol, Surv, of Penna., Vol, I, p. 211.

[^7]:    *Rep. of Judges, p. 138, 139.

    + Geology of Tennessee.

[^8]:    *Op. cit., pages 236, 237.
    $\dagger$ Tennessee and its Agricultural and Mineral Wealth, by J. B. Killebrew, page 149,

[^9]:    *Geology of Tennenses, p, 222.

    + Min. Resources of Tennessee.
    II. Mis. 170, pt. $2-25$

[^10]:    *The Marivo Border of Western Now England, p. 38
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[^11]:    *Professor Hitchcoek (Geology of Vermont, Vol. 11, p. 764) gives the following figures relative to the marble-beds at one of the West Ratland quarries, beginniog at the castern side or top layer:

    1. Upper blue layer, 4 feet thick.
    2. Upper white layer, 3 feet 6 inches thick.
    3. Gray limestone layer, 5 feet thick.
    4. White statuary layer, 3 feet thick.
    5. Striped layer, 1 foot 8 inches thick.
    (6. New white layer, 4 feet thiok,
    6. Wedged white layer, from 8 inches to 2 feet 6 inches thiok.
    7. Muddy lnyer, 4 feet thick.
    8. Striped green layer, 4 feet thiek.
    9. Camphor-gum layer, 3 feet thiok.
    10. White layer, 9 feet thick.
    11. Blue layer, 3 feet 6 inches,
[^12]:    - Op. cit., p. 41.
    + Geology of Vermont, Vol. 11, p. 772.
    \#The Marble Border of Western Now England, 1, 46.

[^13]:    - Geology of Vermont, Vol. 11, p. 769.
    top, cit., p. 36 .
    †Georgo H. Perkins, American Naturalist, Feb., 1881.

[^14]:    *Geology of Vermont, Vol. 11, p. 776.

[^15]:    -Op, cit., p. 776.

    + Rogers, Geol. of the Virginias, pp. 203, 204.
    \$Op, cit., Pp. $81-83$.

[^16]:    *Geol. of Ark., Vol. 1, p. 220.

[^17]:    *Professor Brolhead in Reprort of Tenth Censas, pp. 275-277.
    $\dagger$ Report of Tenth Census, p. 221.

[^18]:    *These beds were formerly described as composed of light buff stone, while the deeper portions of the quarries now furnish "blnestone" The difference results from the difforence in amonnt of oxidation of the small amount of iron disseminated through the whole mass, the change having resulted from atmospheric inflnences, The same change mast ultimately take place in all the blnestone which is brought to the aurface. (Geology of Illinois, Vol. iv, p. 220.)

[^19]:    *Chemical and Geological Essays, p. 172.

    + Report of Tenth Census, p. 225.

[^20]:    *Second Annual Rep, Geol, of Maine, 1869, p. 428.
    $\dagger$ Rop. Tonth Census, p. 219, and Geol. of Minu, vol.

[^21]:    * Preliminary Rep, on Building Stone, ete, 1859, p. 33.

[^22]:    *Report of Tenth Censns, Vol. x, p. 369.

[^23]:    *See p. 382.

[^24]:    *Report of Tenth Census, Vol. X.

