Oklahoma Building Stones

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Introduction.

The subject of Oklahoma building stones is too large to be treated fully in a thesis of this kind. In this paper the barest outline has been made of the stones of Oklahoma, a chemical analysis made of 10 representative rock, and a brief discussion given of the various physical properties of 25 or 30 specimens from different parts of the Territory. With respect to those constituents usually found in rock of this nature, the analysis may be considered complete. No effort has been made to weigh those substances present in very small quantities. The specific gravity has been determined at the balance after extracting the air from the rock in a vacuum. To determine the amount of water absorbed the rock was immersed in distilled water for 24 hours and then weighed, the rock having been previously dried and weighed.

The specimensexamined have been collected from various sources. A number of fine samples were contributed by the department of Geology of the University of Oklahoma. Special thanks are due Prof. Woodruff of this department and Mr. Schramm, an advanced student of the University, for information given and courtesies extended. Prof. Balcomb, of the Southwestern Normal, and Prin. Robinson, of Tecumseh, submitted some valuable

material with information concerning the location of the same. Architect Layton,of ElReno,has been kind in furnishing specimens and information regarding location of quarries. Where the writer has desired data concerning geological formations, and extent of the various rock ledges,he has drawn freely from Dr.VanVleet's biennial report and Prof.Gould's"Geology and Water Resources of Oklahoma". A great deal of the material, however,the writer has collected himself and his own observations,supplemented by information gathered from some of his students,have been utilized in the preparation of this paper.

Limestones.

Limestones are found in several places in Oklahoma,but particularly in the northeast corner of the Territory and in the line of counties bordering Texas on the west. The very finest grades of limestone appear as ledges in the Osage Nation and in Kay county west of the Arkansas river. An oolitic limestone sent in from ElReno as an Oklahoma limestone has been analyzed. Since the analysis Mr.Layton,of that city,has furnished the information that it comes from a quarry in the Chickasaw Nation. Its proximity to Oklahoma suggests the fact that similar rock may be found in the Territory across the line. For this reason and for the reason that an analysis has already been made, its description has been included in this paper.

One of the best grades of limestone in Oklahoma is taken from a quarry near Newkirk in Kay county. The new building of the Central State Normal School located at Edmond is trimmed with this stone. It contains about 5% insoluble matter and from 1 to 2% each of iron and aluminum oxides,and magnes-

ium carbonate,the remaining portion being calcium carbonate with but a small trace of water. Its specific gravity is 2.656 and it absorbs 3.07% of water. Its hardness is about 2½,it is compact in structure with but slight evidence to the naked eye of the shelly texture which is quite common to this class of rock. It shows no distinct line of cleavage but fractures irregularly. Its creamy white color adds beauty to its appearance either as a building stone or as a trimming stone. Buildings constructed from Newkirk limestone which have stood for ten or twelve years do not show any great evidence of discoloration. Large quantities of this stone are quarried and used for local purposes or shipped to distant points in Oklahoma and the states for building purposes.

The Newkirk stone is a representative limestone of northeastern Oklahoma in composition and structure. A form that differs from it in texture and hardness is a rock from Uncas in the same county. Its hardness is about 3 and its structure is almost oolitic,-the shell of which it is formed being very prominent. These two limestones will take a very good polish, suggesting the fact that they might be used on the interior of buildings where a polished stone is desirable. A limestone from Chilocco in northern Kay county is much like these two described. It is,however,finer in texture,about as hard as the Newkirk stone and has an almost imperceptible dark moss-like growth scattered through it. A form of limestone,less desirable,is found in Pawnee county. It is evidently from the formation in eastern Oklahoma that grades from the true limestone of the north into the sandstone of the south. It is shaly or flinty in appearance with a hardness of about 3. While iys color,-a dark lead gray- would detract from its value as a building stone,it gives evidence of

possessing enduring qualities,and for this reason it should be placed in the class of good limestones.

The oolitic rock mentioned above is the purest form of any of the limestones analyzed,containing almost 98% of calcium carbonate. This limestone is composed of globular masses of strikingly uniform diameter,these small oolites are about one-sixteenth of an inch in diameter and are cemented together by a matrix of calcite crystals. The rock is white ,has a specific gravity of 2.684 and a hardness of from 3½ to 4. It is susceptible of a very high polish;this fact in connection with that of its hardness and structure makes of it a very beautiful and lasting building stone. There are good reasons to believe that this same rock will be found in Oklahoma upon further investigation.

Dolomites.

A building stone of considerable importance in western Oklahoma is secured from the ledges of dolomite. These ledges, being very resistant,cap many of the hills extending through Woodward,Dewey,Blaine, and Caddo counties and even as far south and west as Greer county. While the beds are not continuous,they are sufficiently plentiful to furnish a good building stone where other kinds are either not so desirable or else wanting. The beds vary from a few inches to several feet in thickness.

Two specimens of dolomite have been examined and analyzed, and a so-called limestone has,after analysis,been classified as a dolomite. One of these samples is from Caddo county. An analysis shows it to contain about the theoretical quantities of calcium and magnesium carbonates,with but small quantities of insoluble portion,iron and aluminum oxides and water.

A fresh fracture is light flesh-colored,weathering to darker on exposure. It is from compact to crystalline in structure, showing a distinct lamination. Scattered through it are small mossy flecks and here and there are to be seen narrow bands of calcite crystals. It is somewhat harder than calcite,has a specific gravity of 2.76 andabsorbs 1.41% of water. Considering its hardness and the small amount of water it absorbs, it is evident that it would make a desirable building stone. It is soft enough to trim easilyyet hard enough to resist rapid weathering. Its color,too,adds to its value; the small amount of impurities contained in it would not stain it to any considerable extent.

An examination shows a dolomite from Blaine county to be very similar to the one just described, It differs,however, in that it contains a greater amount of calcium carbonate and a smaller per cent of magnesium carbonate. It is more pinkish on a fresh surfacethan the other but weathers to about the same color. The dark mossy spots are more pronounced and the calcite crystals show a more evident banding. This dolomite is fractured in planes perpendicular to the planes of lamination,the fracture planes are filled with calcite crystals and are stained a dark color. Its specific gravity is 2.734,hardness,3½ to 4,and it absorbs 1.76% of water. The specimen examined would not indicate that it would be as desirable a stone as the first,but from appearances it was taken from near the surface while the other was probably secured from a place lower down.The difference mentioned may be due to this fact.

The dolomite-limestone,examined,has a high percent of insoluble matter but otherwise corresponds very closely to

a typical dolomite. It has a specific gravity of 2.723,a hardness of about 2,and absorbs 15.30% of water. It is creamy-white in color and compact to earthy in structure. It is very much like chalk although somewhat harder. The fact that it is so soft and absorbs so much water would seem to indicate that its enduring qualities would not be great. However,its massiveness,its color,and the ease with which it can be quarried place it in the class of practical building stones.

Sandstones.

Sandstone rock is quite generally scattered over Oklahoma, with the exception of the level plain region of the north central part where little rock of any kind is found. These sandstones grade from a fine-textured material that can be rubbed apart with the hand,to the coarse flint-like structure that cannot be scratched with the knife. The sandstones of Oklahoma occur in a variety of colors;the prevailing one,however,in many parts,being red. Four or five representative rock,from different parts of the Territory,have been subjected to a chemical analysis,while a dozen or more have been examined for their physical properties alone. Since the region south of the Arkansas river and east of the Santa Fe track is rich in sandstone,a discussion of this section will be taken up first.

The region about Edmond furnishes a good grade of red sandstone. The old building of the Central State Normal School was constructed from this rock. It contains about 93% of silicon dioxide,5% of iron and aluminum oxides,and from 1 to 2% each of calcium carbonate and water. It has a specific gravity of 2.584,a hardness of three after drying,and absorbs

5.31% of water. It occurs in great ledges in the hills immediately east of Edmond and is easily quarried. When taken from the quarry,it is moist and very soft,in fact some of it is so soft that it can readily be crumbled with the fingers and carved with the knife,but upon being built into the wall and permitted to dry,it quickly hardens. The fact that it is so soft when quarried and hardens to such an extent upon drying makes it a very desirable building stone. Its rich red color adds to its value. In addition to the Normal building,the two bank buildings and other business blocks as well as the foundations of Edmond and vicinity are constructed from this same stone.

As one rides north from Oklahoma City on the Santa Fe he sees great ledges of this red sandstone out-cropping from the from the sides of the hills.All the villages and cities on this line as far north as Perry have substantial business blocks constructed from this rock. In Perry many two-and three-story buildings facing the square are built of red sandstone. One of the prettiest buildings in Oklahoma is the High School building of Perry which is built to the second story with red sandstone,the second story being finished in brick.

Passing east from the Santa Fe,one observes that many of the ledges change from a red to a gray color. Practically all the sandstone along the eastern border of the Territory is colored reddish brown to light gray. The compositiom of these sandstones varies with the location Some of them contain so much of the carbonates of calcium and magnesium that they effervesce freely with hydrochloric acid while others seem to be fairly pure varieties of sandstone.

Out of a half-dozen specimens examinedfrom Pottawatomie

county,one,appearing to be the best for general building purposes,was selected for analysis. It was taken from a quarry near Tecumseh and contains about 63% silicon dioxide,from 1% to 2% each of iron and aluminum oxides,and water,and from 15 to 16% each of calcium and magnesium carbonates. In addition to these,it contains some manganese oxide. It has a specific gravity of 2.678,a hardness of 3½ and absorbs 3.73% of water. It is made up of very fine grains of sand,firmly cemented together by the carbonates. It is homogeneous in structure and light-gray in color. It is fairly plentiful and is used for both buildings and foundations. It should be classed as a good building stone.

Other sandstones in Pottawatomie county vary from the same texture to a coarser and less uniform structure.The color varies from a gray to a pink,a flesh color,or a mottled. One takes the form of a conglomerate sandstone with a large quantity of iron,a high specific gravity and a high degree of hardness. Some of these would make a fairly good building stone for general use while others are suitable only for foundations.

The specimens of sandstone examined from Lincoln county and Pawnee countyfarther north,are very similar in structure. they are usually fine grained,of a medium hardness,and of a light gray color. Many of the buildings in the towns of eastern Oklahoma are constructed of these stones. One of the new buildings of the Agricultural and Mechanical College at Stillwater is built of this rock.

The sandstones of western and southwestern Oklahoma can hardly be considered as valuable for building purposes as those just described,since the beds are not so extensive,the quality does not seem to be so good in general and other stones

are to be found that can be used in their place. Examination, however,proves that there are many places where a good quality of sandstone can be secured of such a quality that a brief description of two or three of them is necessary in this connection.

A chemical analysis of a sandstone from Caddo county reveals the fact that its composition is very much like that of the gray sandstone from Pottawatomie county. However,it differs from the other in thay it contains a smaller percent of silicon dioxide and a larger percent of calcium carbonate. Its specific gravity is 2.690,its hardness is about 3,and it absorbs 2.69% of water. It is very much like the red sandstone of eastern Oklahoma but is finer in texture. It is certainly a good building stone. A rock very much like it from Blaine county exhibits a laminated structure. Another specimen from the same region,very similar to these two in structure,appears to be rotten,suggesting the fact that it would not be nearly so durable a stone as the other two,consequently not so valuable for building purposes.

An extremely hard sandstone from Woodward county contains over 85% of silicon dioxide,3% iron and aluminum oxides,8% of calcium carbonate and less than 2% each of magnesium carbonate and water.It has a specific gravity of 2.449,its hardness is about 6½ and it absorbs 2.49% of water. It is compact to crystalline,irregular in fracture,and is flesh colored. It would make a good building stone if it were not for its extremely high degree of hardness. It would certainly be difficult to quarry. However,it ought to weather well after being placed in position. In the absence of other kinds of building stone it should be considered valuable.

Granites, Gabbros.

While confined to a limited portion of the Territory, granite is one of the most valuable products of Oklahoma. It is found only in the region of the Wichita mountains, which occupy parts of Caddo, Comanche, Kiowa, and Greer counties. Some of the best grades are found at Granite, Greer county, although fine qualities of granite occur at other places in the Wichita mountains.

An analysis of a fragment from a quarry in Granite shows About 71% of silicon dioxide, 17% aluminum and iron oxides, between 4 and 5% each of sodium and potassium oxides and a small quantity of the oxides of calcium and magnesium, and water. It has a specific density of 2.648, a hardness of 6½, and absorbs .42% of water. It is made up of large, reddish-flesh colored masses of feldspar and crystals of semi-transparent quartz. A sample of granite from the Ruggles Granite Quarry, of Granite, which was prepared for advertising purposes, and which is evidently the same rock as the one analyzed, shows that this granite is susceptible of a very high polish. It would make a beautiful stone for interior decorations and its massive and compact structure, its relative imperviousness to water, its susceptibility to a high polish, and its beautiful color, all combine to make this granite extremely valuable as a building stone.

A sample from near Granite, made up of smaller masses of feldspar and quartz crystals, but very much like the one just described in other respects, will probably prove to be just as valuable as it. A fragment of black granite from the same locality is undoubtedly a good product but will hardly compare with the red granite on account of its color.

As a building stone,the gabbros of the Wichitas are evidently valuable,but they can hardly be placed in the same class with the granites. The deposits are large and the color of the rock is varied,in structure the gabbros are similar to the granites. The gabbros will probably be used a great deal locally,but it remains for the future to determine how largely they will be utilized for general building purposes.

Conclusion.

In the study of Oklahoma building stones enough has been learned to indicate that the Territory has an unlimited supply of limestones,dolomites,sandstones,and granites,-all of which can be used for practical or decorative building purposes. Up to the present time,but few quarries have been fully developed,but as the country grows older and the demand increases others will be opened up and a high grade of cheap building material will be at the command of city,village,and country. Moreover,the fame of Oklahoma's limestone and granite quarries will reach beyond her borders and a demand for her rock will be created in distant states and cities. One of Oklahoma's most valuable assets is her building stones.

	Limestones.		Dolomites.		
	Newkirk.	Colitic.	Bridgeport.	Geary.	Greer.
Insoluble Si O_2	5.15	.22	.67	.81	7.85
Al_2O_3, Fe_2O_3	1.07	.46	.30	.45	.70
$CaCO_3$	92.42	97.30	54.96	68.19	51.10
$MgCO_3$	1.47	.82	41.37	30.45	41.16
K_2O					
Na_2O					
CaO					
MgO					
H_2O	Trace.	Trace.	.35	.13	.27
	100.11	98.80	97.66	100.03	101.08
Spec.Grav.	2.656	2.684	2.760	2.734	2.723
H_2O Absorb.	3.07 %	2.16 %	1.41%	1.76 %	15.30 %
Hardness	2½	4.	3½.	3½.	2.
Color.	CreamWhite	White.	Flesh.	Flesh.	White.

Table Of
Examination and Analysis
of
LIMESTONES and DOLOMITES.

	Sandstones.				Granite.
	Edmond.	Tecumseh.	Caddo Co.	Woodward.	Granite.
SiO_2	93.25	62.63	55.10	85.41	71.35
Al_2O_3, Fe_2O_3	4.75	1.91	3.87	3.32	16.71
$CaCO_3$	1.28	15.27	22.96.	8.53	
$MgCO_3$		15.82	16.34	1.57	
K_2C					4.86
Na_2C					4.09
CaC					1.69
MgC					.64
H_2C	1.25	1.48	2.35	1.82	.60
MnC		1.75			
	100.53	98.86	100.62	100.65	99.94
Spec.Grav.	2.584	2.678	2.690	2.449	2.648
H_2C Absorb.	5.31 %	3.73 %	2.69 %	2.49 %	.43 %
Hardness.	3	3½	3	6½	6½
Color.	Red.	Light-gray.	Red.	Flesh.	Reddish-mottled.

Table of
Examination and Analysis
of
Sandstones and Granite.