to the making of a thin section and a subsequent microscopic examination that revealed a total lack of the crystalline structure characteristic of basalt, but instead showed a dark color, a semi-opacity and a subcrystalline featureless texture for the most part, the only exceptions being a few grains of metallic iron and a small number of very small quartz particles.

The megascopic characteristics need not be entered into here inasmuch as Pratt* and Wrather† have quite fully considered that phase in their articles. This and other examples show, however, quite plainly how comparatively easy it is to generate a so-called igneous rock from a sedimentary by dynamic metamorphism alone.

Summary

The above paper calls further attention to the danger of confusing some "fused cores" or "drillites" with igneous rocks where a rotary core drill is used, contributes a complete chemical analysis of a supposed "drillite," describes the petrographic features of a thin section of this "drillite" and points out the ease with which sedimentary rocks could be transformed into so-called igneous or crystalline rocks.

XXI. NOTES ON THE BLACK MESA BASALT

A. C. Shead

From the Oklahoma Geological Survey.

The basaltic cap of Black Mesa in the extreme northwestern part of the Oklahoma Panhandle is the eastermost occurrence of that Tertiary lava flow which is so conspicuous and picturesque a landscape feature in what is known as the Mesa De Maya or Raton Meesa region of northeastern New Mexico, southeastern Colorado and western Oklahoma.

The abrupt, almost vertical ascent to the level tops of these mesas, the straight edge of their skyline, their marked precipitous relief from the extensive, level surface of the surrounding high plains country lends particular aptness to the designation of "tables" applied to this peculiar topography by the early Spanish or Mexican settlers of this region.

That portion of this flow that concerns this report, enters the Oklahoma Panhandle at the western border of Cimarron county in NW.¼sec. 6, T.5N., R.1E., continues east for about one-half mile and thence turns northeast to the center of the north line of sec.

*Pratt Wallace E. A note on supposed evidence of the volcanic orgin of Gulf Coast domes: Bulletin, American Association of Petroleum Geologists, vol. 5 No. 1, p. 91 Jan. and Feb. 1921.

†Wrather, W. E. Supposed igreous rock from Wichita County, Texas wells, Bulletin, American Association of Petroleum Geologists, vol. 5. no. 4, p. 512, July and Aug. 1921.

33, T.6N., R.1E., a total distance of about three miles within this state. Since the average width is about one-half mile, according to E. P. Rothrock,* the area covered by the flow is about 1.5 square miles in Oklahoma. The author just cited gives the average thickness of the flow within this area (Cimarron county) as about 58 feet, varying from 50 feet thick two miles north of Kenton, Oklahoma, to 66 feet at Nigger Spring. From the figures given the tonnage of this rock within the Oklahoma borders can be easily computed.

To give a more general idea of the nature of the associated formations it is thought fit to include the following section by Charles N. Gould† before passing on to the more specific minor physical and chemical peculiarities of the rock.

Section of Black Mesa, two miles north of Kenton, Oklahoma.

	"Malpais" basaltic lava	100 feet
Tertiary	Tertiary pebbles	20 feet
Dakota	Heavy massive sandstone, crossbedded	45 feet
	Clay shale	40 feet
	Massive crossbedded sandstone, small rounded concretions	60 feet
	Shale, yellow and black, talus slope	100 feet
	Sandstone, gray and reddish	70 feet
	Red Beds Red Clay	100 feet

This section gives some idea of (1) the thickness of the rocks, (2) the general nature of the underlying sedimentaries of the region and (3) the amount of erosion that has taken place in this part of the country since the Tertiary in which the basalt was extruded.

Probably the most prominent structural feature of the rock en-masse is the vesicularity. This feature is strictly subordinate in the lower half of the rock where the basalt is quite dense but the porosity increases progressively from about the middle of the flow, to the surface where the vesicles are at a maximum in number, and size, while the density is at a minimum here. It is thus possible to locate a given specimen from the mass quite definitely.

The jointing in the rock is not marked which is a feature to be expected by reason of the conchoidal fracture that is developed. The other major physical features are those common to most basalts, namely, the color is grayish black, the surface scoriaceous and the structure porous.

*Rothrock, E. P. The Geology of Cimarron County (Unpublished thesis).

†Gould Charles Newton. Geology and water resources of Oklahoma: U. S. G. S. Water-Supply Paper 148 p. 82, 1905.

Microscopically, the Black Mesa basalt shows as follows: (1) about 45 per cent of lath shaped, euhedral or idiomorphic plagioclase feldspars with large extinction angles. The composition of these lie as well as could be ascertained, from chemical analysis, between ab_1an_2-ab_1an_3 hence probably a transition between labradorite and bytownite. (2) About 45 per cent of a light greenish pyroxene,*

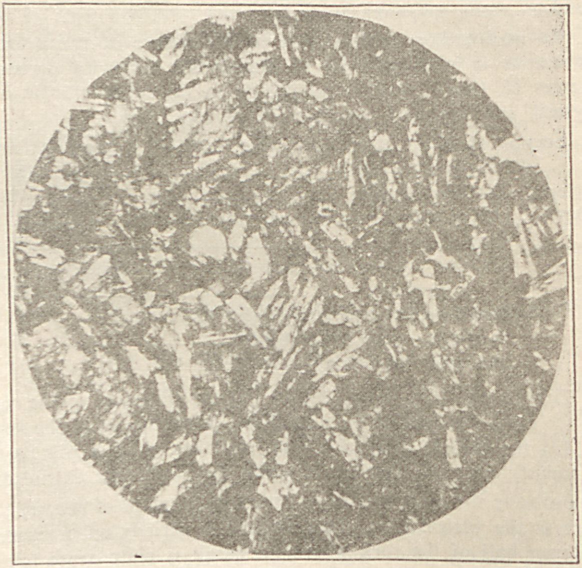

Fig. 5. Photomicrograph of Black mesa basalt, ordinary light X 70. C. W. Honess.

allotriomorphic, very small in size and granular, fills the interstices between all the other minerals. This shows that the pyroxenes crystallized last, out of their usual order, and together with the peculiar lath shaped feldspars, marks the Black Mesa basalt as diabasic. (3) There is about 9 to 9.5 per cent of Fe_3O_4, magnetite shown chemically to be titaniferous, together with hematite and limonite as decomposition products of other minerals. (4) About .3 per

*The pyroxene could not be distinguished because of strain and consequent distortion of crystals and the development of wavy extinction in all slides examined.

cent of olivine phenocrysts, which were the largest in the rock, showed the most perfect outlines. They were as much as 1.3 mm. long and about .75mm. wide although most of the crystals were much smaller. They were also the only minerals showing marked decomposition to iron ores, hematites, etc. This decomposition was only initial however, as very little serpentine was noted. The olivine had magnetite inclusions. The microscopic examination was not particularly satisfactory in identifying closely either the pyroxene or the plagioclase, owing to the extremely fine texture but it did definitely place the rock as an olivine diabase.

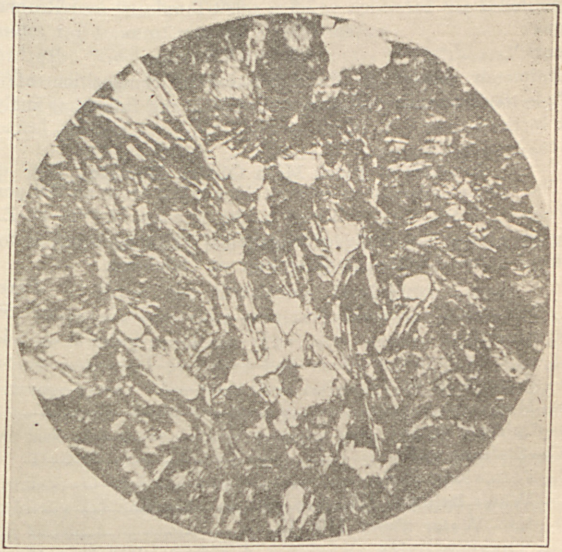

Fig. 6. Photomicrograph of Black mesa basalt. Ordinary light X 80. C. W. Honess.

In the accompanying photomicrographs of the Black Mesa basalt by C. W. Honess, Chief Geologist for the Oklahoma Geological Survey, the long slender white minerals are the laboradorite, the rounded white areas are the vesicles, the light shaded areas are the pyroxenes. The other minerals are almost indistinguishable.

The above results of the microscopic examination in thin sections are compared with those of E. P. Rothrock in the following table:

Tabulation of Minerals in the Black Mesa Basalt

Species	Amount in Rock in Percent	Size in Millimeters	Observer
Laboradorite	45.0	n. d.	Shead
Laboradorite	45.0	0.2	Rothrock
Pyroxene	45.0	n. d.	Shead
Augite	45.0	0.1 to 0.2 mm	Rothrock
Magnetite	9.0 to 9.5	n. d.	Shead
Magnetite	7.0	.099 mm.	Rothrock
Olivene	0.3	1.3 mm. max.	Shead
Olivene	1.0	0.425 mm.	Rothrock

Intimately related to the mineralogical composition of the basalt is the chemical composition shown by the following analysis made by the writer:

Analysis of Black Mesa Olivine Diabase

The sample consisted of several chips taken from an 800 pound specimen of Black Mesa collected in the summer of 1919 by E. P. Rothrock of the University of Oklahoma. This specimen is to be exhibited at the Oklahoma State Fair at Oklahoma.

	Percent
SiO_2—Silica	50.96
Al_2O_3—Alumina	17.54
Fe_2O_3—Ferric oxide	3.10
FeO—Ferrous oxide	7.46
Mgo—Magnesia	5.17
CaO—Calcium oxide	9.18
Na_2O—Sodium oxide	2.78
K_2O—Potassium oxide	.54
H_2O—Water beloww 110° C.	.48
H_2O plus—Water above 110° C.	.38
TiO_2—Titanium oxide	1.31
ZrO_2—Zirconia (Probably absent)	n. d.
CO_2—Carbon dioxide	Faint Trace
P_2O_5—Phosphorous pentoxide	.54
SO_3—Sulphur trioxide	.00
(Cl. F)	n. d.
S—Sulphur	.08
Cr_2O_3—Chromium oxide	.04
V_2O_3	n. d.
NiO—Oxide of nickel	.00

MnO—Oxide of manganese	.15
BaO—Barium oxide	Not detected
SrO—Strontium oxide	Not detected
Li_2O--Lithia	.00
Total	99.71

From the microscopic and chemical examinations it is to be concluded that the Black Mesa rock is an clivine diabasic basalt.

The foregoing paper discusses the relationships, topographic features, microscopic characteristics, and chemical composition of Black Mesa basalt. To this is to be appended the following references for some of the above information:

(1) "Geology and Water Resources of Oklahoma," U. S. G. S. Water Supply Paper No. 148 by C. N. Gould.

(2) "The Raton Mesas of New Mexico and Colorado," Geological Review for July, 1921, by Willis T. Lee.

(3) The Geology of Cimarron County (unpublished) by E. P. Rothrock.

XXII. BUILDING MATERIALS OF OKLAHOMA

M. C. Oakes

From the Oklahoma Geological Survey.

There is a very close relation between the geology of a region and its housing problems. The early settlers made their dugouts where geological processes had made the digging easy and the drainage good. They biult their cabins where tree growing formations outcrop. Good limestone gave a community stone houses while the lack of a more suitable material gave rise to the sod house.

Timber being a light-weight material, it has been shipped great distances so that the tree bearing formations have extended their influence far and wide, causing extreme uniformity among American houses.

Now that the timber is rapidly nearing exhaustion, the local formations will exert their latent influence. Since stone, cement, gypsum, etc. are all relatively heavy the result will be that each community will have its own type of house, and individuality will be the rule where uniformity now prevails.

To bring up to date the Survey's information on the present development of the state's resources in building materials, David Hedley and the writer made an extended inspection trip during the past field season. In the course of this trip we visited in the order named the following places: Pauls Valley, Davis, Sulphur,