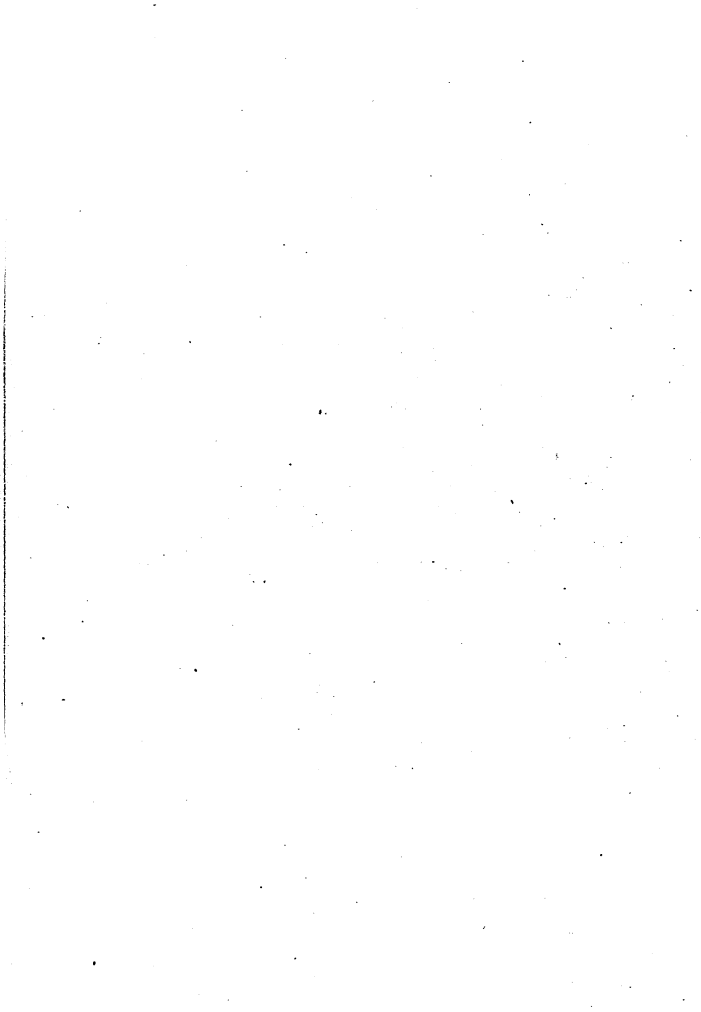

ANCIENT LAVA FLOWS

IN THE STRATA OF

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Aside from glacial boulders, the presence of eruptive rocks has not been known in Iowa until quite recently. During the past year (1892) a well was sunk by the town of Hull, in Sioux county, Iowa, in the hope of securing artesian waters. There was encountered at the depth of about seven hundred and fifty-five feet a very dark, compact, olive-green rock which was at first mistaken for "Sioux Quartzite." The rock was so unyielding to the drill that the contractors were exceedingly desirous of being released from further operations; firstly, on account of the extreme hardness of the rock; and secondly, because no artesian water had ever been known to be found beneath the above named formation. Upon casual examination, samples of the drillings appeared to be fragments of Sioux Quartzite or of a ferruginous chert. Closer inspection, however, disclosed the fact that the drill chips were typical quartz-porphyry, very similar to those described by Rosenbusch,* Zirkel† and Irving.‡

Macroscopically the ground-mass presents a deep olive-green appearance and contains small porphyritic

*Mikroskopische Physiographie der Massigen Gesteine.

†U. S. Surv. 40th Parallel, Vol. VI.

‡U. S. Geol. Sur., Monog. V.

crystals of flesh-colored orthoclase and larger quartz crystals which appear glossy black on account of the dark matrix. The ground-mass is aphanitic and generally shows a hackly fracture; but sometimes the fracture is almost conchoidal.

Microscopically the ground-mass appears, in thin sections, to be more or less colored with minute particles of iron oxide. These particles are larger and more numerous in certain wavy bands, the line of flow, and sometimes outline lenticular areas which may be the remains of devitrified sphaerulites. The fluidal structure is very pronounced. In some cases the ferrites present an appearance of crowding in the vicinity of the porphyritic crystals; while in other cases the phenocrysts seem to have exerted a repulsive influence, or else no influence at all, on the iron particles. The substance which composes the ground-mass is felsitic, it being wholly devitrified, and yet the presence of certain scale-like isotrophic bodies bear evidence of its former glassy condition.

Of the porphyritic constituents the quartzes are most prominent. Nearly all of the quartz crystals show effects of magmatic corrosion in their rounded angles and embayments. Some of the crystals are irregularly fractured and the fragments are differently oriented, as shown between crossed nicols. From this may be inferred that the magma was semi-viscous and under great pressure when the flow took place.

In ordinary light the porphyritic feldspars show but poorly defined outlines and present a reddish, turbid appearance, due to decomposition. Between crossed nicols, the crystallographic outlines and cleavage cracks of the phenocrysts are readily made out.

Figure 18 represents a thin slice of the quartz-porphyry magnified fifteen diameters. It was taken from a depth of seven hundred and eighty-six feet. The section shows the fluxion structure. The plain areas rep-

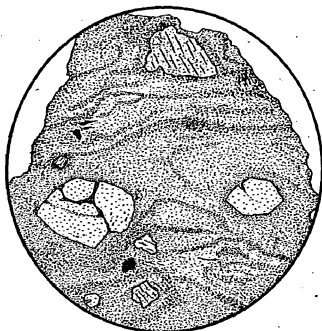


Figure 18. Thin Section of Quartz-Porphyry. $\times 15$.

resent quartz crystals and the irregular bodies showing cleavage lines are the feldspars.

After drilling about forty-five feet in quartz-porphyry, a stratum, about two feet in thickness, of soft, fine-grained, sandy material was struck. This was immediately followed by another stratum of quartz-porphyry and these in turn gave place to sand-rock. These alternations of quartz-porphyries and sandstones continued to the end of the drilling, a depth of over 1,200 feet. The whole series of quartz-porphyries seem to be identical in structure and composition.

The following is an approximation of the record,* below 755 feet:

	FEET.
18. Compact, olive-green quartz-porphry.....	755—800
17. Fine-grained sandrock	800—802
16. Quartz-porphry	802—
15. Coarse-grained sandstone.....	825—
14. Quartz-porphry	832—840
13. Fine-grained sandstone	840—860
12. Conglomerate	866—
11. Fine-grained sandstone.....	880—900
10. Quartz-porphry—the drillings also contain angular fragments of quartz.....	900—930
9. Fine-grained sandstones.....	930—
8. Water-worn pebbles with fine sand adhering.....	930—935
7. Decomposing quartz-porphry.....	935—940
6. Perfectly fresh quartz-porphry.....	944—
5. Decomposing quartz-porphry.....	949—
4. Quartz-porphry	975—990
3. Sandstone	990—
2. Quartz-porphry	1194—1220
1. Fine-grained sandstone.....	1228—

Numbers 5, 6 and 7 comprised a continuous deposit; but being included between very pervious strata their iron constituents (of 5 and 7) have been almost entirely withdrawn.

At the present time it is quite generally accepted by geologists that quartz-porphries are of igneous origin. In order to account for the flows in the present case two explanations may be put forward: (1) that the flows probably took place during Paleozoic times, perhaps in the Carboniferous, the lava being secularly poured out over the old sea-bottom; (2) that the whole series of flows were contemporaneous, and in point of time Post-Carboniferous. In this case the intercalations may be re-

*For the record and samples of the drillings I am indebted to Dr. N. G. O. Coad, Hull, Iowa.

garded as the result of a subterranean lava flow, or intrusive sheets from a Post-Carboniferous volcano, the lava following lines of least resistance and forcing itself between the strata. The data at hand is not at all conclusive regarding either view, but the facts seem to point to the latter as being the most probable. That the flow took place under pressure is evidenced by the shattered quartz crystals, whose fragments are differently oriented, and the homogeneity of the flows may be taken as evidence that they were probably not separated by any considerable lapse of time, and finally, the containing strata show evidence of metamorphism.

