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Iowa Mineralogical Notes

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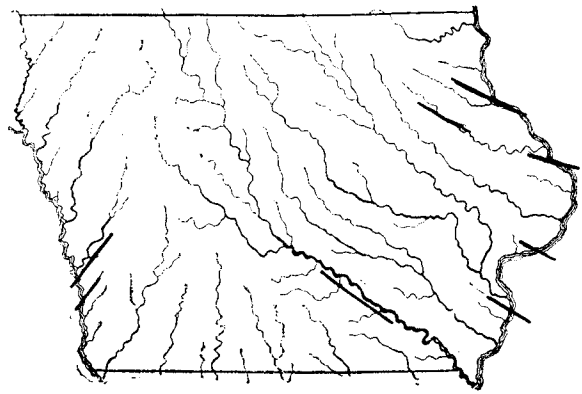
The pressure is sufficient, as is known from several sources.

There remains yet one necessary condition unsatisfied. That is geological structure.

It is well known that the strata in Iowa have a general dip to the southward—the total amount of fall being probably in the neighborhood of 3,500 feet. But the State of Iowa is covered everywhere with a thick mantle of glacial deposits hiding from view the stratified rocks almost entirely. Numerous streams, however, have corraded their channels completely through the drift debris even into the underlying indurated rocks, thus exposing in many places the arrangement of the different layers. It will be sometime before anything like accurate and detailed cross-sections can be made across the State in the direction of the common inclination of the rocks. Yet good progress in this work has already been made.

There is a widespread opinion that the Iowa strata have still their uninterrupted seaward tilt unaffected by deformations of any kind. Such, however is not the case. Although far removed from mountainous districts orographic movements have affected the beds to a slight extent, producing low folds. A number of these low anticlines and shallow synclines have long been known, though rather vaguely. According to McGee, who has indicated recently some of the chief axes in a sketch map of the State, the anticlinals of the eastern part of Iowa trend southwestward. Other folds have been recognized in the central and western portions



Sketch-Map of Iowa, showing Principal Lines of Deformation.

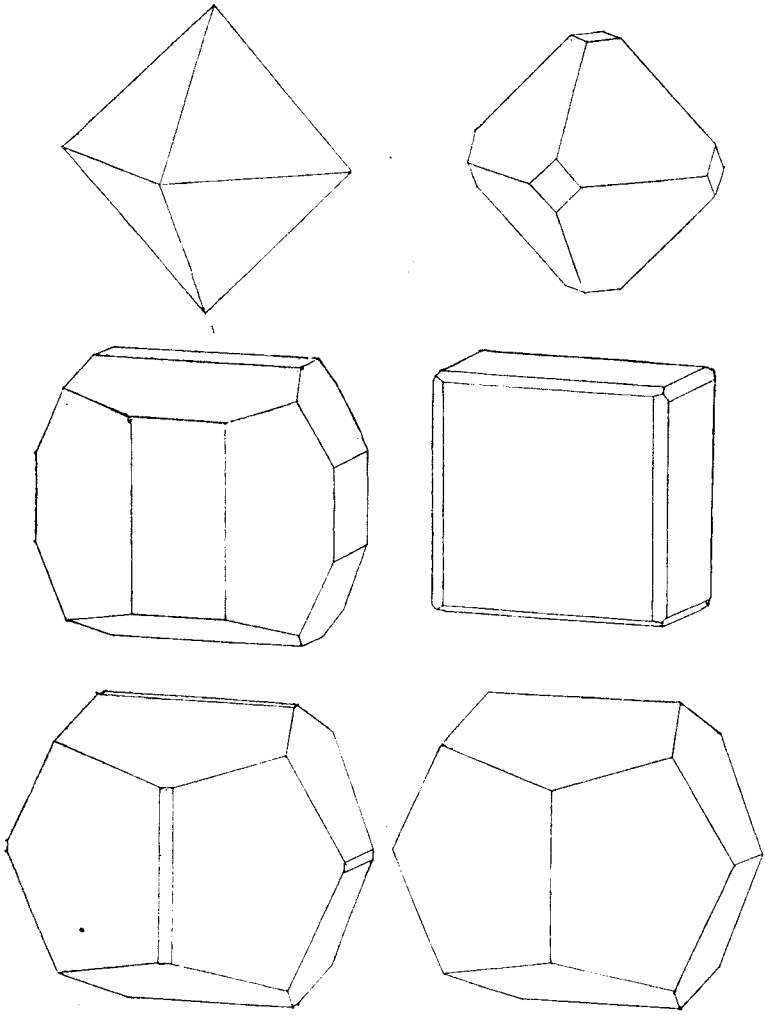
of the State. The extent of this folding is at present unknown, but in some cases it may prove to be very considerable; sufficient perhaps to satisfy the last requirement for a flowing well. It is not then beyond all hope that when, ere long the arching dome of some low anticline is pierced we may yet hear the mighty roar not soon forgotten, or listen to the gushing stream of liquid amber.

IOWA MINERALOGICAL NOTES.

BY CHARLES ROLLIN KEYES.

Pyrite.—Quite recently there have been obtained from limestone cavities in Lee county some small but very perfect pyrite crystals. The faces are brightly reflect-

ing and meet in sharply defined edges. The more common crystallographic forms are the pentagonal dodecahedron, or pyritohedron, and the cube, with all gradations between the two. Though small they are perhaps the most perfect crystals of this mineral found in the state up to the present time.



PYRITE.—Upper two from Dubuque; lower four from Ft. Madison.

From the Kinderhook clays of Burlington were obtained a number of bright-faced specimens showing the cube with the corners very slightly truncated by the octohedron. These occur sometimes singly, sometimes in aggregates of considerable size.

In the black bituminous shales of the Lower Coal Measures at Des Moines occur some rather remarkable specimens of pyrite. The form is the octohedron modified

very slightly by the cubic faces. In the direction of the crystallographic axes the octohedral corners have become greatly extended from the center forming long, series of octohedrons partly inclosed in one another, the terminal one in each of the six sets being almost perfect except on the end of attachment. With one series pointing directly in front and the opposite one directly behind the remaining arms forms a slender Swiss cross, whose dimensions are sometimes from four to six inches. These may be regarded as a large number of sub-individuals forming parallel growths, each individual represented by a thin plate between each pair of reentering angles. The terminal octohedrons are often an inch along the edges. But if the skeleton were completely filled out the octohedral edges would measure five inches or more.

Calcite.—Among the "geodes" from the Keokuk limestone of southeastern Iowa, calcite is found in many different forms; a large variety of rhombohedrons and scalenohedrons and their combinations being represented. A particularly interesting occurrence is that of very perfect fundamental or cleavage rhombohedrons (R), with the planes of no other forms present. This is one of the rarer forms of the mineral under consideration and the known occurrences are very limited.

Gypsum.—Crystallized gypsum is a rather common occurrence in many of the coal measure shales of central Iowa. Some specimens discovered a short time ago seem worthy of special note since they are unusually perfect and are found in large numbers. The edges are sharply cut and faces brilliant. The crystallographic forms are $\infty P \breve{\infty}$, $P \breve{\infty}$, and ∞P. They assume the well known diamond shapes, with beveled edges. Not unfrequently individuals contain very distinct "shadow" crystals.

In some localities the crystals form swallow-tailed twins and become greatly elongated in the direction of the vertical axis. Examples of this kind sometimes attain a length of six to eight inches.

Millerite.—For a number of years past there has been noted occasionally in "geode collections" examined from different parts of Lee county in southeastern Iowa, certain specimens containing clear calcite crystals, traversed in different directions by minute yellowish filaments after the manner of the familiar *fleches d'amour* —the rutile needles in quartz. Recently in opening a large quarry near the city of Keokuk, in the compact Keokuk limestone some feet below the regular "geode bed" numerous cavities were encountered varying from three to twenty inches in size. These hollows have large, thickly set rhombohedrons of calcite jutting out towards the center. The faces are brightly polished and the edges are sharply cut. On some of the calcites have been found beautiful tufts of closely arranged, brass-yellow needles of millerite pointing from the center of attachment, in all directions to a distance of one-half to two and one-half inches. In some of the examples the tufts are made up of hundreds of filaments, often so close together that the needles of the different branches are interwoven, forming a dense matted mass. Often a large, perfectly transparent calcite has a tuft of long millerites completely inclosed in it; or a part of the tuft may be embedded in the lime crystal, the extremities of the needles left projecting outside.

The Keokuk occurrences are believed to be the most beautiful ever found in this country, if not in the world.

Mr. C. A. Flannery, of Keokuk, has very lately found another "nest" of similar geodes containing millerite. One specimen of calcite covered thickly with needles of the nickel sulphide weighed over fifty pounds. Still more recently equally fine specimens of millerite have been reported from Ft. Madison.

Eruptive Rocks in Iowa.—During the past few years a number of deep wells have been made in different parts of the State. The depths reached are from twelve hundred to two thousand feet. Several of these deep borings are of particular interest as they pass through all the sedimentary rocks into the crystalline basement below, penetrating the latter in some cases to the extent of several hundred feet. A typical gray granite has been recognized in some instances; in others different types of eruptive rocks.

The latest drilling in the northwestern part of the State is the well in Hull, in Sioux county. At a very considerable depth—between seven hundred and fifty and twelve hundred feet—several thick beds of flint-like rock were passed through. The different beds of the rock were separated by gravels or sands several feet in thickness, if the samples and records are to be relied upon. Some of the flint-like fragments were sliced by Mr. S. W. Beyer, of the Agricultural College, and upon petrographical examination proved to be typical quartz-porphyry—a truly igneous rock, very acid in character, essentially identical with granite, but cooling under somewhat different physical conditions. Under the microscope the ground mass appears microgranitic with large clear crystals of quartz and feldspar scattered through it. Both kinds of phenocrysts have the crystallographic angles rounded through magmatic corrosion. Characteristic embayments are also apparent. Now the interest in these eruptive rocks *in situ*, true lava flows of perhaps paleozoic date, so far beneath the surface, centers around their nearness to the great mass of metamorphosed sandstone known as the Sioux Quartzite. This quartzite outcrops along the Big Sioux river in the northwestern corner of the State, extending northward from Minnehaha county, South Dakota, to Pipestone and Rock counties, Minnesota. Its geographical extent is much greater than was formerly supposed; and it has lately been found well exposed in Iowa twenty miles to the southeastward of the outcrops heretofore noted. There are large exposures in Lyon county in the vicinity of Rock Rapids, where the stone is quarried, and borings indicate a much farther eastern extension. It has been usually believed that no other crystalline rocks appear in the neighborhood of the Sioux Quartzite outcrop. It is of considerable interest then to know that G. E. Culver* has very lately discovered in the midst of the quartzite of southeastern Dakota, in Minnehaha county, within less than half a dozen miles of the Iowa boundary, or more accurately in Sections 15 and 22, R. 49 west, Twp. 101 north, a large mass of diabase. It is exposed for fully a mile along one of the tributaries of the Big Sioux.

Hobbs,† who has examined the intrusive rock microscopically, finds it to be a well pronounced coarse-grained olivine diabase, with hornblende, biotite, ilmenite, and apatite present, in addition to the plagioclase, augite and olivine.

The presence of this massive basic rock of undoubted eruptive origin is very suggestive of the agencies that may have been involved, to some extent at least, in metamorphosing the old Sioux sandstone. Further investigations will doubtless disclose other similar types of eruptives in the quartzites of the neighborhood in all three of the states already mentioned.

The quartzite still has its planes of sedimentation clearly defined. It lies in low folds which are quite noticeable in many places.

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*Culver and Hobbs: On a new occurrence of Olivine Diabase in Minnehaha county South Dakota. (Trans. Wisconsin Acad. Science, Arts and Letters, Vol. VIII, pp. 208-210. Madison, 1892.)

†Loc. cit.

Concerning the geological age of the Sicux Quartzite a number of different opinions have been expressed.

From the first mention of this formation by Catlin, in 1837, in connection with the celebrated pipestone quarry, until 1866, when Hall entered the reigion, no suggestion was made regarding the age of the flint-like mass. Nicholet visited the quarry in 1838, and gave a very complete description of the rock; but for nearly thirty years no special notice appears to have been taken of the place. Hall, though not seeing all the exposures, concluded that the quartzite beds must be Huronian in age. Hayden, who examined the rocks about the same time, thought he had ample reason for regarding them as Triassic or Cretaceous. In connection with his work in Iowa, White was led to adopt Hall's opinion; while Winchell approaching the region from the Minnesota side referred the hardened sand-bed to the Potsdam—Upper Cambrian. Still later Irving expressed his view to the effect that the Sioux Quartzite was Huronian.

Though very little information bearing directly upon the geological age of the indurated sandstones of the Big Sioux region is yet available, the recent observations on the geology of northwestern Iowa are not without interest.

The presence *in situ* of the undoubted eruptive rocks mentioned and at no very great distance below the surface of the ground in the northwestern part of the State; the existence of diabasic masses in the midst of the quartzite mass itself; the folded and disturbed condition of the strata, all point to the great antiquity of the Sioux formation as compared with other rocks exposed within the limits of the State. The inference is, then, that the rocks under consideration must be very much older than any others exposed in Iowa.

SURFACE DISINTEGRATION OF GRANITIC MASSES.

BY CHARLES ROLLIN KEYES.

Throughout the drift mantled surface of Iowa, glaciated boulders of crystalline rocks are of common occurrence. They vary in size from a foot to more than fifty feet across. These boulders are rounded more or less, globular in form, though often slightly flattened on one side, sometimes on two. When closely examined, the outside is commonly found to be more or less affected by meteoric agencies, but the interior is fresh and unaltered as a rule. Most of the Iowa boulders are known to be of northern origin, coming from near or beyond the present northern boundary of the United States. In this region the granite, diabase and gabbro areas are usually firm, and but slightly decayed at the surface, the rocks having been planed and scored by glacial action. Passing beyond the limits of the glaciated region an entirely different set of phenomena is presented, and in an area of crystallines, the rocks are decayed for many, often one hundred or more feet below the surface, the bi-products remaining *in situ* until removed by running water.

It is to a granite area outside of the glacial boundary that attention is directed —an area in central Maryland some twenty miles west of Baltimore, near the villages of Woodstock and Sykesville.

The Woodstock granite forms a small isolated patch midway between the two largest granitic masses of the region. Though having a superficial area of scarcely