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6. The action was probably not simultaneous over the entire area, the fine material removed from the most barren parts being deposited in places already prepared for its retention.

THE FLORA OF THE SIOUX QUARTZITE IN IOWA.

BY B. SHIMEK.

The Sioux quartzite is exposed in this state only in the extreme northwestern corner of Lyon county. Other and greater exposures however are found in the adjacent parts of South Dakota.

The chief exposure on the Iowa side is located only a few rods south of the state line and about one and three-quarters miles east of the Big Sioux river.

It occupies a depression in the rolling prairie, which is bordered by hills on the north, east and south, and slopes gradually to the Big Sioux bottoms to the west. It is best seen at and near the junction of two streamlets, one coming from the east and the other from the south, the course of the resulting stream being westward.

At the time that the observations herein recorded were made (August 4 and 6, 1896), these streamlets were almost dry, there being only a few disconnected pools of water.

The greater portion of the exposure is horizontal, vertical ledges not exceeding six feet in thickness being found only along the streamlets for a few rods above their juncture.

The exposure is in part barely disguised by a scant surface soil upon which, and upon the bare rock, flourishes a flora in some respects unique, and strikingly different from that of the surrounding prairie, a fact already noted by Prof. J. C. Arthur, who in the "Contributions to the Flora of Iowa," No. VI,* says: "The extreme northwestern corner (of Iowa) is geologically and botanically very unlike the rest of the state."

The list of plants herein given is undoubtedly far from complete, being the result of a rather hasty survey. It shows a flora which is sufficiently unique, however, to be of interest to the student of plant distribution.

* Proc. Davenport Acad. Sci., vol. IV., p. 73.

The plants in the first list seemed to be restricted to the exposure and have not been collected anywhere else in the northwestern part of the state by the author, nor have they been reported from that section excepting from the immediate locality under consideration. They are:*

Talinum teretifolium Pursh. Abundant. Also reported from Woodbury county.

Hosackia purshiana Benth. Abundant. In fruit. Also reported from Henry and Woodbury counties.

Opuntia fragilis Nutt. Common. A few fruits were found.

Aphyllon ludovicianum Gray. Not common. Not heretofore reported from the state.

Isanthus cœruleus Mx. Not common. A stunted unbranched form. The species occurs in Henry, Muscatine and Johnson counties, in the eastern part of the state.

Polygonum tenue Mx. Common. Also reported from Linn and Muscatine counties.

Buchloe dactyloides Eng. Staminate plants were not rare.

Woodsia scopulina Eaton. Rather common. Found in crevices of the rock. This has not been reported from the state. The specimens, which were collected with fruit in all stages of development, are typical.

Selaginella rupestris Spring. Common. The species is also reported from Muscatine, Winneshiek and Benton counties.

Asterella hemisphærica Beauv. Not common. Abundant in the eastern part of the state. With the exception of the liverwort *Asterella* all of the species in the list are distinctly dry and barren ground plants, and even the exception commonly occurs in places which are wet only during a short period each year. It will be noticed also that the species belong largely to the flora of the dry western and northwestern plains.

The second list includes plants which occur on this exposure, but are also found upon dry, sandy, or gravelly hillsides on the prairies throughout the northwestern part of the state, and also in isolated localities in other parts of the state upon sandy, barren tracts. These also belong to the western flora. They are:

Astragalus lotiflorus Hook. Not common. Found also on the barren hills near Granite. Heretofore reported only from Fremont county.

*The nomenclature here employed, excepting that of the lichens, is, like that of most of the Iowa lists heretofore published, that of Gray's Manual. Without regard to the merits of the nomenclature controversy, this will make the notes more convenient for comparisons.

- Liatris punctata* Hook. Not rare.
- Chrysopsis villosa* Nutt. Rather common. Not reported from Iowa.
- Aster oblongifolius* Nutt. Not rare.
- Aster ptarmicoides* T. and G. Not common.
- Artemisia canadensis* Mx. Not common.
- Artemisia frigida* Willd. Not common. Not reported from any other part of the state.
- Lygodesmia juncea* Don. Not common.
- Cuscuta arvensis* Beyr. Common, chiefly on the two species of *Artemisia* mentioned.
- Pentstemon gracilis* Nutt. In fruit. Not common. This is the first report of its occurrence in the state.
- Pentstemon grandiflorus* Nutt. Rare on the exposure, but very common on the barren hills west of Granite.
- Verbena angustifolia* Mx. Not common.
- Plantago patagonica* Jacq., var. *gnaphaloides* Gray. Common. Reported from several counties in the western and southwestern part of the state.
- Oxybaphus hirsutus* Sweet. Not common.
- Salsola kali* L., var. *tragus* (L.) Moq. A dwarf form not exceeding eight inches in height, with mostly simple stems, was quite common.
- Bouteloua oligostachya* Torr. Common.
- Bouteloua hirsuta* Lag. Not rare. Both of these species are quite common near Granite, and also near Rock Rapids, in Lyon county.
- Carex stenophylla* Wahl.* Not uncommon. A rare species, heretofore found in this state only in Emmet county.
- Placodium vitellinum* (Ehrh.) Naeg. and Hepp.† Not uncommon.
- Placodium vitellinum* var. *aurellum* Ach. Rather rare.
- Placodium elegans* (Link) D. C. Rare.
- Placodium cerinum* (Hedw.) Naeg. and Hepp. (?) Not common.
- Lecanora cinerea* (L.) Sommerf. Not common.
- Lecanora rubina* (Vill.) Ach. Quite common.
- Lecanora muralis* (Schreb.) Schær., var. *saxicola* Schær. Quite common.
- Rinodina oreina* (Ach.) Mass. Very common.

* The species of *Carex*, mentioned in this paper, were partly identified or verified by Prof. R. I. Cratty.

† The lichens were identified or verified by Prof. Bruce Flink.

Parmelia conspersa (Ehrh.) Ach. The most common lichen on the exposure, covering large areas of rock.

Physia cæsia (Hoffm.) Myl. Not common.

Omphalaria ————. An undescribed species found in Iowa, Minnesota and Nebraska. Not common.

Pertusaria ———— sp. (?) Not common.

Endocarpon miniatum (L.) Schær. Rare. Probably a variety.

The lichen flora of the exposure, very conspicuous by its abundance and variety, is an exceedingly interesting one. The rock in many places is fairly covered with these persistent forms, and the species are, for the most part, identical with those which occur on surface granite boulders in the northern or northeastern part of the state.

In addition to the species given in the preceding list, there are several which may be found almost anywhere on the prairies, and which readily adapt themselves to new surroundings, yet are properly dry ground species. They are:

Delphinium azureum Mx. Not common.

Psoralea argophylla Pursh. Not rare.

Psoralea esculenta Pursh. Rather rare.

Castilleia sessiliflora Pursh. Rare.

Hedeoma pulegioides Pers. Very common.

Juncus tenuis Willd. Common.

Carex cephalophora Muhl. Not common.

Carex straminea Willd., var. *brevior* Dewey. Quite common.

Carex straminea Willd., var. Not common.

Andropogon scoparius Mx.* Common.

Stipa spartea Trin. Common.

Muhlenbergia glomerata Trin. Not common.

Sporobolus cuspidatus Torr. Common.

Calamagrostis canadensis Beauv. Common.

Calamagrostis longifolia Hook. Common.

This report would be incomplete without a list of the species which were found along the edges of the pools left by the streamlets. They do not properly belong to the flora of the rock-exposure, but their presence is of interest, especially as some of them were observed nowhere else in Lyon county. They are:

Rotala ramosior Koehne. Not common. Known heretofore only from Benton and Henry counties.

*For the identification of some of these grasses thanks are due to Prof. L. H. Pammel.

Ammannia coccinea Rottb. Not common. Reported only from Story county.

Veronica anagallis L. Not common.

Juncus nodosus L., var. *megacephalus* Torr. Not rare.

Beckmannia erucaeformis Host., var. *uniflora* Scrib. Quite common near two of the pools, but not found by the author at any other point. It is also reported from Story (introduced) and Plymouth counties.

As has been noted, the plants which constitute this flora are for the most part inhabitants of dry and more or less barren regions. The flora may be duplicated in part in several barren isolated spots in other portions of the state. One of these is found in Muscatine county, and many of its interesting forms have already been reported by Mr. Fred Reppert; another is in Dubuque county; and still others are mentioned by Prof. L. H. Pammel.*

It is probably the remnant of a flora which once covered the greater part of the north half of the state. It is closer in its relation to the western than to the eastern flora, and its evolution probably took place to the west and southwest beyond the limits of the glacial sheet.

The recession of the glaciers left a barren surface, for the most part covered with sand and boulders, and seamed and scarred by the vast sea of ice. The depressions were occupied by water, and upon the bleak hills this flora slowly established itself. But its own presence gradually caused an accumulation of finer surface soil, and other plants, more vigorous and rapid growers, took possession of the now fertile spots. The fertile area thus increased until only a remnant of the original flora was left in the few spots which presented conditions most nearly like those which prevailed soon after the disappearance of the ice sheet.

The distribution of the lichen flora probably differed from that of the higher plants. The wonderful vitality of the lichens, especially as illustrated by their habits far to the north, admits of the belief that they were able to exist even through the glacial period. It is probable that the ledges of the Sioux quartzite, then much more prominent, were covered with lichens even before the glacial epoch, and that the same force which ground out the boulders from the solid rock carried fragments of lichens out over the state eastward and southward. It is

*Proc. Iowa Acad. Sci., vol. III, p. 106.

probable that the glaciers advanced and receded with the changes of seasons, and with each recession of the ice the lichens were given a new lease of life. Thus while the higher plants from the east and the west met on the barren prairies of Iowa, those from the west at first predominating, and while their advance was probably respectively from the southeast and southwest, the lichens of the rocky ledges and boulders came to us from the north and represent the oldest flora in the state.

NOTES ON AQUATIC PLANTS FROM NORTHERN IOWA.

BY B. SHIMEK.

The aquatic flora of northern and northwestern Iowa is of great interest, and it deserves especial attention because the occupancy of that part of the state by agricultural man is rapidly transforming the "Thousand Lake Region of Iowa," as the early settlers called it, into thousands of pastures, flax fields and wheat fields.

The lakes and ponds are being drained either artificially or by the changes in surface conditions, and while it is probable that the aquatic flora will persist in the larger lakes for a long time, it will certainly be restricted; it is, in fact, already restricted, and if these large lakes change as rapidly as Clear lake, Spirit lake and Lake Okoboji (to say nothing of smaller ones) have in the past few years, Iowa will soon know no lakes. It is important, therefore, that the history of the aquatic plants of the northern part of the state be as complete as possible, and that specimens of these plants be preserved for future reference.

Various scattered notes on this flora have been published, but thus far only one paper specially devoted to it has appeared. Early in the year Mr. R. I. Cratty published* an admirable paper on the aquatic flowering plants of Iowa, and these notes are practically merely supplementary to that paper. A part of the field work at Spirit lake and Lake Okoboji, the results of which are here given, was made in company with Mr. Cratty, and his experience and enthusiasm added much to the interest and the value of the work.

* Bulletin Lab. of Nat. His., State Univ. of Iowa, vol. III, No. 4.