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LIVERWORTS OF THE SO-CALLED UNGLACIATED AREA OF IOWA

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For ten years it has been well known to geologists that *all* of the State of Iowa was at one time or another covered by Pleistocene ice. The northeastern corner of the State is usually mapped as unglaciated — a part of "the unglaciated area" which includes adjacent corners of Illinois, Wisconsin and Minnesota. At no time was this area an island in a sea of ice as the maps suggest. It was once swept on the west by a glacier that extended far to the south. At another time the area was swept by ice on the east. The drifts of these two glaciations overlap south of the area, leaving a triangular patch that never was glaciated. Along the western border of the unglaciated land, that is, along the eastern border of the Nebraskan Glacier, a drainage stream flowed. This stream is now the Mississippi River. Thus west of the River there is no unglaciated land, according to Iowa geologists (Kay & Apfel 1929).[1]

That portion of northeastern Iowa which is usually mapped as unglaciated I am here calling the once-glaciated area of Iowa.

So far as concerns relics of pre-Kansan or pre-Wisconsin vegetation, the once-glaciated region of Iowa is as good a hunting ground as if it had never been ice-scratched at all. It is a rugged country, with deep narrow valleys and vertical cliffs of rock. These cliffs include the very porous and soft Jordan Sandstone of Cambrian age, covered successively by the Ordovician Oneota dolomite, New Richmond sandstone, Shakopee dolomite, the porous St. Peter Sandstone, and Galena-Platteville limestone. Moist shaded north-facing vertical sandstone surfaces furnish our best hunting grounds for bryophytes.

On such a face of St. Peter Sandstone at Giard School, Clayton Co., have been found

[2] Bazzania trilobata — the only record for Iowa.
Harpanthus scutatus — the only station in Iowa.
Blepharostoma trichophyllum — the only station in Iowa.
Tritomaria exsecta — known from two other stations, on St. Peter Sandstone.
T. exsectiformis — known from one other station, on St. Peter Sandstone.

1 Steere (1937) is not supported by Iowa geologists when he states that parts of four northeastern counties "are in whole or in part unglaciated," p. 356.
2 Nomenclature follows Buch, Evans & Verdoorn 1938.

Lepidozia reptans — known from several boreal communities.
Jamesoniella autumnalis — widespread in eastern half of State.
Scapania nemorosa — widespread in eastern half of State.
Plectocolea hyalina — widespread in eastern half of State.
Plagiochila asplenioides — common in eastern half of State.
Lophocolea heterophylla — common in eastern half of State.

The rock is mostly covered by *Tetraphis (Georgia) pellucida*, growing luxuriantly and fruiting abundantly.

At Pictured Rock near McGregor, Clayton Co., also on St. Peter Sandstone, occur

Scapania nemorosa	Lepidozia reptans
Jamesoniella autumnalis	Tritomaria exsecta
Plectocolea hyalina	T. exsectiformis

Jungermannia lanceolata, the only collection in the State.

So much for what may be called relic communities, or social disjunctions. Following are three species which occur more or less alone.

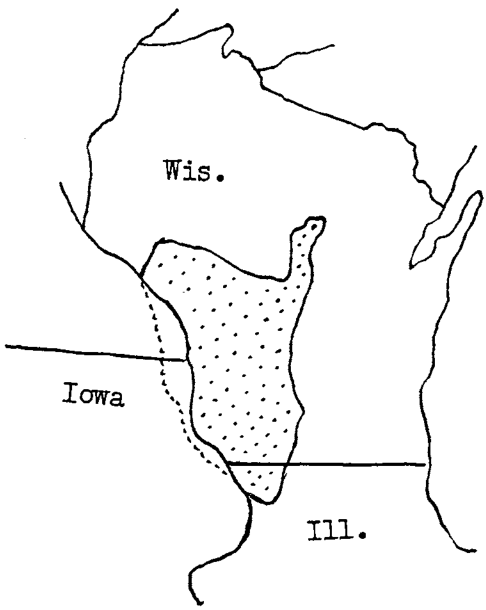

Fig. 1. Driftless area (stippled) amended from Voss (1934) according to Kay & Apfel, (1929).

Occasionally in the once-glaciated and adjacent areas of Iowa occurs *Cololejeunea Biddlecomiae*. It is especially fond of the stems of *Taxus canadensis*, in moist shady places, where also *Radula complanata* is found. This tiny papillose lejeune is reported from New England to Florida and Alabama. It is in no sense boreal.

Mannia (Grimaldia, or better *Neesiella) pilosa* and *M. rupestris* are distinctly boreal. I have the latter species from three stations, two on Jordan Sandstone and one on St. Peter, all in Winneshiek County (second county west of the Mississippi River in the northern tier). *M. pilosa* was found at one of the Jordan stations, and was collected for *M. rupestris*. The two look very much alike. Near them were beds of *Preissia quadrata*. Each station is on a shaded moist north-facing vertical surface of crumbling sandstone.

Mannia pilosa is attributed by Evans (1923) and by Frye & Clark (1937) to "rocks in arctic and alpine regions"; Greenland, Que., Vt., Wis., Minn., Alta., B.C., Alaska, Asia, Eur. One of the Minnesota stations is at Winona, in the once-glaciated area; the other is north of Lake Superior, in a region notable for relic species. Conklin (1929) reports *M. pilosa* from two stations in Grant Co., Wis., in the truly unglaciated area, and one far north of this (Polk Co.). Gams (1938) considers that this species originated in eastern Siberia and spread, probably during the next-to-last glacial epoch, to northwestern Norway where he cites 23 stations, the Carpathians (4 stations) and Alps (10 stations, rarely below 1600 m.). This species, therefore, meets all the requirements of a "glacial relic."

Mannia rupestris is attributed by Evans (1923) to "rocks, largely or wholly calcareous." Frye & Clark (1937) pronounce it calciphile. Nichols & Steere (1937) found it "on moist base of dia-

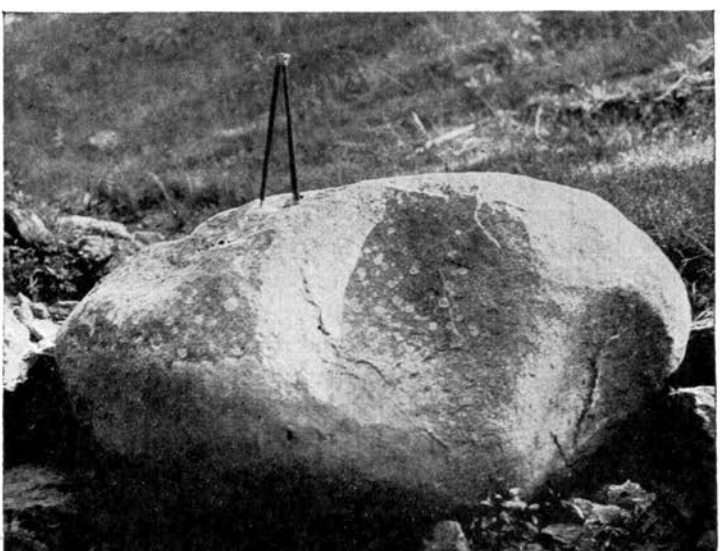

Fig. 2. Granite glacial boulder in Allamakee Co., Iowa, near Waterville (Nebraskan drift). Photo by Mr. Ellison Orr.

base cliffs." Gams (1938) considers it decidedly neutrophile or feebly calciphile, suggesting that it especially likes calcium nitrate in the substratum. Our Jordan and St. Peter sandstones are soaked with water rich in the ions of calcium, magnesium, sulphate and carbonate. These rocks are the most important water horizons for deep wells in Iowa, supplying very "hard" water. The distribution of *M. rupestris* includes Europe, south to Germany, Japan, Alaska, Que., Ont., Vt., N. Y., Wis., Minn., Mo. We now have it from Iowa. Gams (1938) gives over 40 stations in central Europe, nearly all in the Alps, from the foothills up to 2600 m. Husnot (1922) gives Italy, France, Switzerland, Germany and Austria. The plant is a short-lived annual. The sporophytes mature in April and May in the Alps, May and June in our "unglaciated" area, and then the whole plant dies. Gams considers it to have been derived quite recently from *M. pilosa*, by reduction, and thinks it may have originated in the last or next-to-last interglacial period. With so late an origin how could it spread so far around the globe? May it not go back to the *first* interglacial period, the Aftonian? The argument for rapid dissemination faces two ways.

There is, it seems to me, still room to question the doctrine of boreal relics. Are these disjuncts relics or immigrants? The social groups, often including mosses, ferns, seed plants and animals, furnish strong evidence for the survival of whole plant communities *in situ*. The isolated disjuncts may well be immigrants — especially when the plant is a feeble annual, growing on fast crumbling faces of sand. At each spot, and each year, it *is* an immigrant. From whence? Even the social groups may be aggregations of immigrants. There are certainly at least two possible explanations for all of our disjuncts. Perhaps the decision depends upon our previous opinion as to whether the last glacial episode is still receding, or a new one is advancing.

If the plants we are discussing are the direct descendants, at the same station, of those that lived there in the cold periods of half a million years ago, or even of 30,000 years ago, how marvellously persistent the tiny creatures are! And if it is just a matter of their finding these small, rare and scattered spots which are safe for little liverworts, how minutely inquisitive their search must be, and how many must be the disseminules that miss the strait and narrow way! Which is it?

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