# *TROPICAL SEAS to PRAIRIES*

## *A NATURAL HISTORY FIELD TRIP in BLACK HAWK and BREMER COUNTIES, IOWA*


Wayne Anderson

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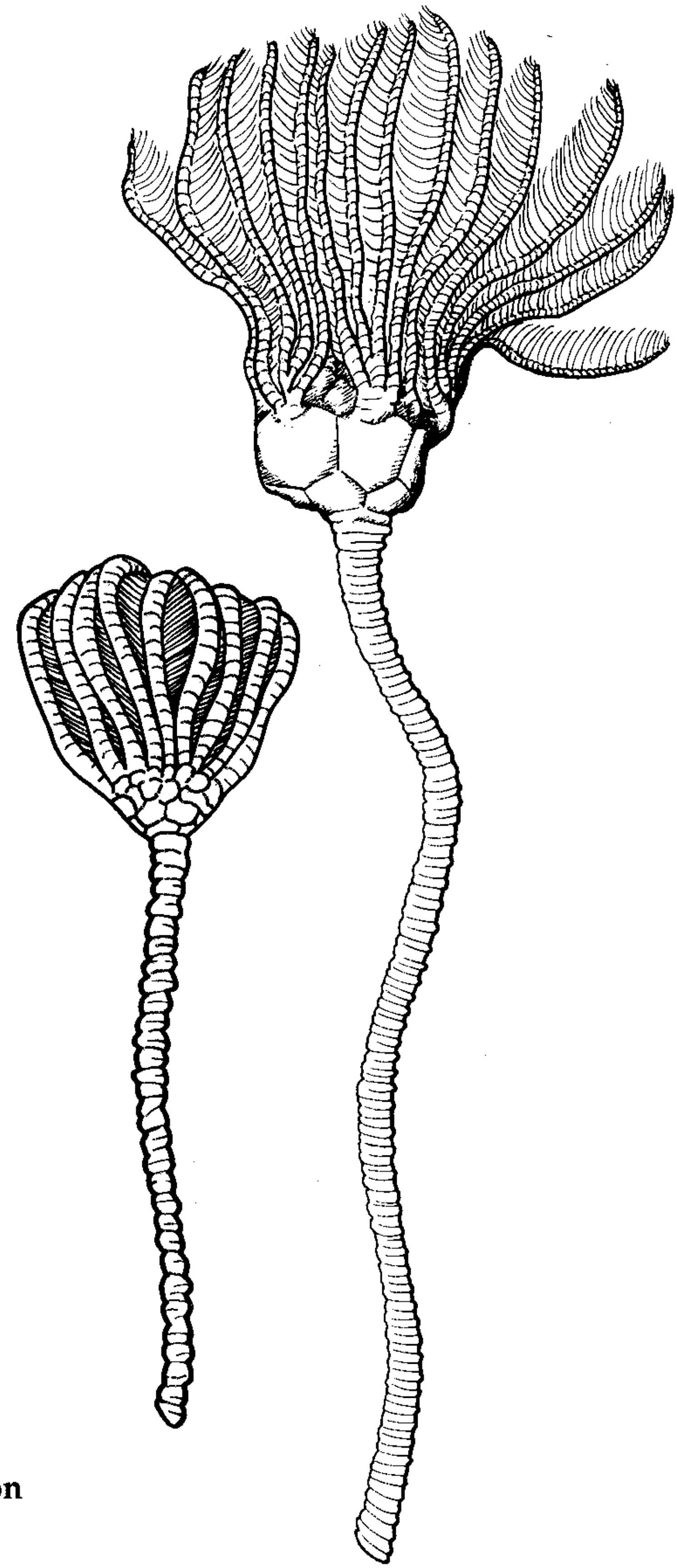

April 25, 1992


**Geological Society of Iowa**
**Guidebook 55**

**Iowa Natural History Association**
**Guidebook 8**

COVER: Though commonly referred to as "sea lilies," these crinoids represent a group of animals related to starfish. They lived attached to tropical sea floors, filtering ocean currents to gather food particles. Segments of their stems are among Iowa's most common fossils.

Drawings by Patricia J. Lohmann

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IOWA NATURAL HISTORY ASSOCIATION GUIDEBOOK 8

GEOLOGICAL SOCIETY OF IOWA GUIDEBOOK 55

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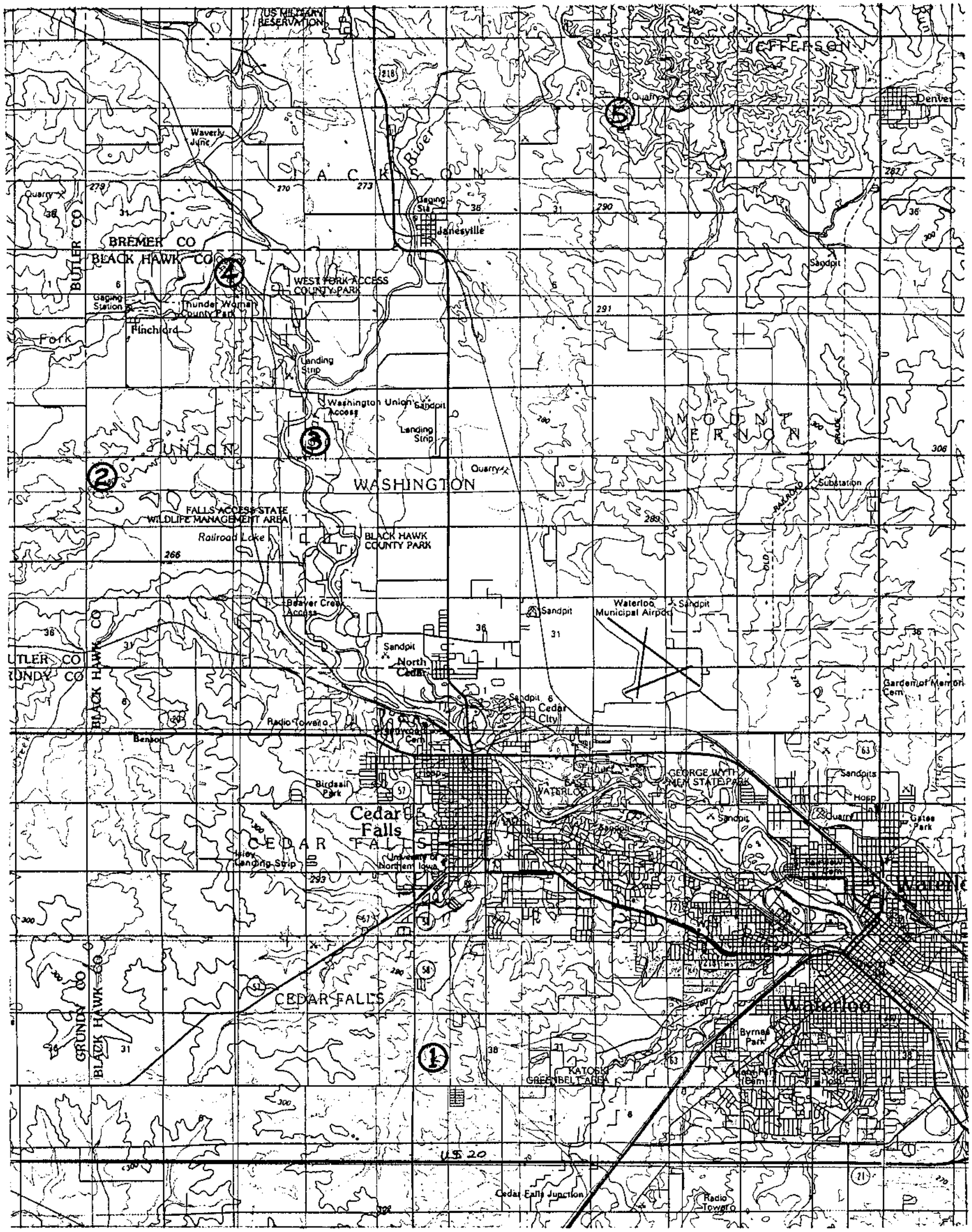
# C O N T E N T S

## GENERAL INFORMATION



## FIELD TRIP STOPS




LOCATIONS OF FIELD TRIP STOPS

SCALE

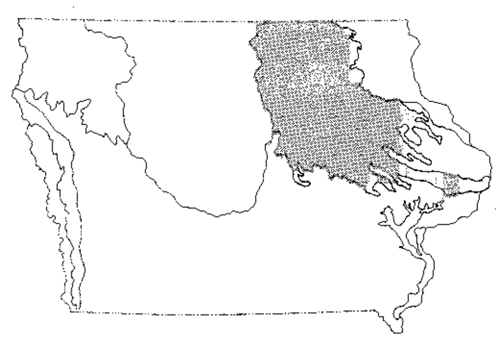
KILOMETERS 1 0 1 2 3 4 5 6 7 8 9 10 11 12 13

MILES 1 0 1 2 3 4 5 6 7 8

# INTRODUCTION

This year's meeting of the Iowa Academy of Science in Cedar Falls offers the Geological Society of Iowa, the Iowa Natural History Association, and other interested persons an opportunity to examine a variety of features in Black Hawk and Bremer counties. The Cedar and Wapsipinicon rivers and their uplands, along with the West Fork of the Cedar and the Shell Rock rivers, contain a variety of wetland, woodland, and prairie communities. The geological effects of glacial, stream, and wind processes are observable in the materials which underlie the landscape. The topography of the area is characteristic of one of our state's principal landform regions, the Iowa Erosion Surface. Jean Prior provided a geologic overview of the area in 1986 for Iowa Natural History Association Field Trip Guidebook No. 4. That overview is still current and is reproduced below with the author's permission.

## Iowan Surface



. . . a frozen sea, flecked with wakes of dark shadow behind each great boulder, fretted here and there with long, low rollers . . . and again broken by higher but shorter swells, gracefully curved as the bending backs of giant dolphins . . .

—W. J. McGee
"The Pleistocene History of Northeastern Iowa," 1891

(from Prior, 1991)

## GEOLOGIC OVERVIEW

The "Iowan" area of northeastern Iowa has long been a subject of controversy and investigation among geologists. This area was first described by W. J. McGee in 1891, and until the 1960's it was regarded as a distinct and separate glacial drift, younger than the Illinoian glacial deposits, but older than the late Wisconsinan deposits of the Des Moines Lobe. As will be seen on the field trip, the landscape of this region does not lend itself to providing many natural exposures. The resolution of the controversy over the age and origin of the "Iowan" thus lay with a detailed and systematic study of subsurface drill cores, three-dimensional reconstructions, and the application of radiocarbon dating, research techniques conducted by Robert V. Ruhe, then of Iowa State University. In 1968 Ruhe published the results of his extensive field work which proved that the "Iowan drift" did not exist, and that this region in no way represented a constructional surface of glacial deposition, but rather was a widespread erosion-surface complex. Since then, his basic conclusions and model have consistently explained the observed facts, and they continue to be verified and enhanced as geologists, geomorphologists, and soil scientists apply them in further studies. A good review of the past and present aspects of the Iowan Erosion Surface issue is found in the 42nd Annual Tri-State Geological Field Conference Guidebook on the Geology of East-Central Iowa (Hallberg, 1978).

Ruhe and his colleagues found that the "Iowan" plain, a distinct and mappable topographic region, is comprised of a series of discrete, multi-leveled erosion surfaces that step down the landscape from upland divides to an integrated drainage net. The well known paha are isolated, elliptical hills or ridges which stand along the drainage divides and above the multi-leveled plain. They are erosional remnants of a once higher and older land surface, and are composed of a full increment of preserved wind-deposited Wisconsinan loess, draped over well developed Yarmouth-Sangamon and Late Sangamon (inter-glacial) paleosols developed in Pre-Illinoian glacial till. The paha are topographic and stratigraphic remnants of the relatively uneroded loess-mantled Pre-Illinoian landscapes of the southern Iowa Drift Plain (Prior, 1976). The resolution of the "Iowan problem" began with unraveling the stratigraphy of paha, specifically Casey's Paha in northern Tama county, a part of which was recently dedicated into the State Preserves system. On the widespread, lower-lying landscape below the paha features, the tills and paleosols have been stripped leaving a residual lag deposit, a concentration of coarse pebbles (the conspicuous "stone line" or "Iowan pebble band") with a thin, discontinuous cover of loess or loam sediments.

The <u>Iowan Erosion Surface</u> developed through the removal of surficial materials by processes of stream action, slope wash, and wind deflation. Its clearest expression in the landscape is in this region of northeast Iowa and also in the Northwest Iowa Plains, west of the Des Moines Lobe. Radiocarbon dating and systematic thinning of the loess away from the divides indicates this surface evolved between about 29,000 and 14,000 RCYBP (Radiocarbon Years Before Present), during the period of Wisconsinan loess deposition. Particularly intense erosional development took place between 20,000 and

17,000 RCYBP. In the course of the field trip, we will be able to observe topographic features and geologic materials characteristic of this landform region. Paha are isolated topographic ridges, mantled with loess and/or eolian sand, and distinctly orientated in a northwest to southeast direction. They provide the principal relief on the Iowan surface which is otherwise a subtle landscape of gentle slopes and low relief. Glacial erratics, principally igneous or metamorphic boulders, were transported into Iowa by Pre-Illinoian glacial episodes (600,000 years ago or earlier) and can be seen strewn in undisturbed pastures or piled along fence rows by farmers clearing their fields for cultivation. They are particularly prominent on the Iowan Erosion Surface where stripping of older glacial tills has concentrated the large, ice-worn rocks. Exposures of the pebble band described earlier also may be seen in roadside outcrops. The glacial drift in the northern half of the Iowan Erosion Surface is thin, and the underlying Silurian and Devonian carbonate bedrock is often near enough to the surface to influence the character of the topography in places. The generally parallel courses of the West Fork, Shell Rock, Cedar, and Wapsipinicon also parallel the underlying strike trends of the subcropping bedrock units. Bremer County is also crisscrossed with pre-glacial bedrock valleys.

The rivers of this region are a special focus of the field trip, and excellent examples of the alluvial morphology of river valleys can be observed. In general, the Iowan Surface is well drained by rivers and streams, though seeps and wetlands are seen in scattered upland localities, fed either by vertical infiltration of surface water and lateral movement along an impermeable contact to an intersecting hillslope, or by upwelling artesian groundwater conditions. Many of the region's river valleys are not well defined; stream gradients are low and the valleys are broad sags in the landscape with poorly defined valley walls that generally merge in long, smooth slopes with the uplands. The Wapsipinicon through the field trip area displays these characteristics well. The alluvial sediments seen within its wide valley are composed dominantly of locally derived materials from within its drainage basin, which is confined to the Iowan Surface. The Cedar, West Fork, and Shell Rock Rivers on the other hand exhibit better defined valleys. The headwaters of these rivers carry all the way to the Des Moines Lobe. Thus, these valleys experienced greater flow volumes from glacial meltwaters during a portion of their history. Because these headwaters were marginal to the Wisconsinan ice lobe, they also received abundant ice-transported glacial debris into their systems.

The contrasts between the Cedar and Wapsipinicon were well described in 1906 by William Harmon Norton in the Geology of Bremer County:

> "In one respect the Wapsipinicon valley is in marked contrast with the valley of the Cedar. The latter river has cut its present channel a number of feet below the level of the old valley floor. Its ancient flood plain has been left moderately well drained and dry enough for the growth of forests. These have been cleared away for the cultivated fields and pastures of numerous farmsteads, whose dwellings may stand within a few rods of the river banks. On the other hand the aspect of the Wapsipinicon bottoms is that of a wide savanna whose marshy grass lands are suitable only for pasture. Forests have invaded the

area only along the natural levees or drained banks of the immediate vicinity of the stream. Farmsteads have gathered along the slopes of the bordering hills, but are almost wholly wanting over the valley. The roads which cross it are carried on well marked dikes ditched on either hand, and as the traveler looks out from them over the wide expanse of marshy grassland with occasional ponds bordered with sedge and pickerel weed and covered with yellow water lilies, he receives a vivid impression of the barrier which the "Wapsie bottoms" must have been to the pioneer before these causeways and their bridges had been built.

No village or town is located on the Wapsipinicon within the limits of the county, or indeed, from Bremer north to the state line, excepting the village of Frederika which has the vantage of the gentle slopes of low rocky hills which lift it out of the general wet."

Throughout the field trip we will observe good examples of floodplains, meandering river channels, alluvial terraces, alluvial sand and gravel deposits, eolian or wind-deposited sand, and sand dune topography.

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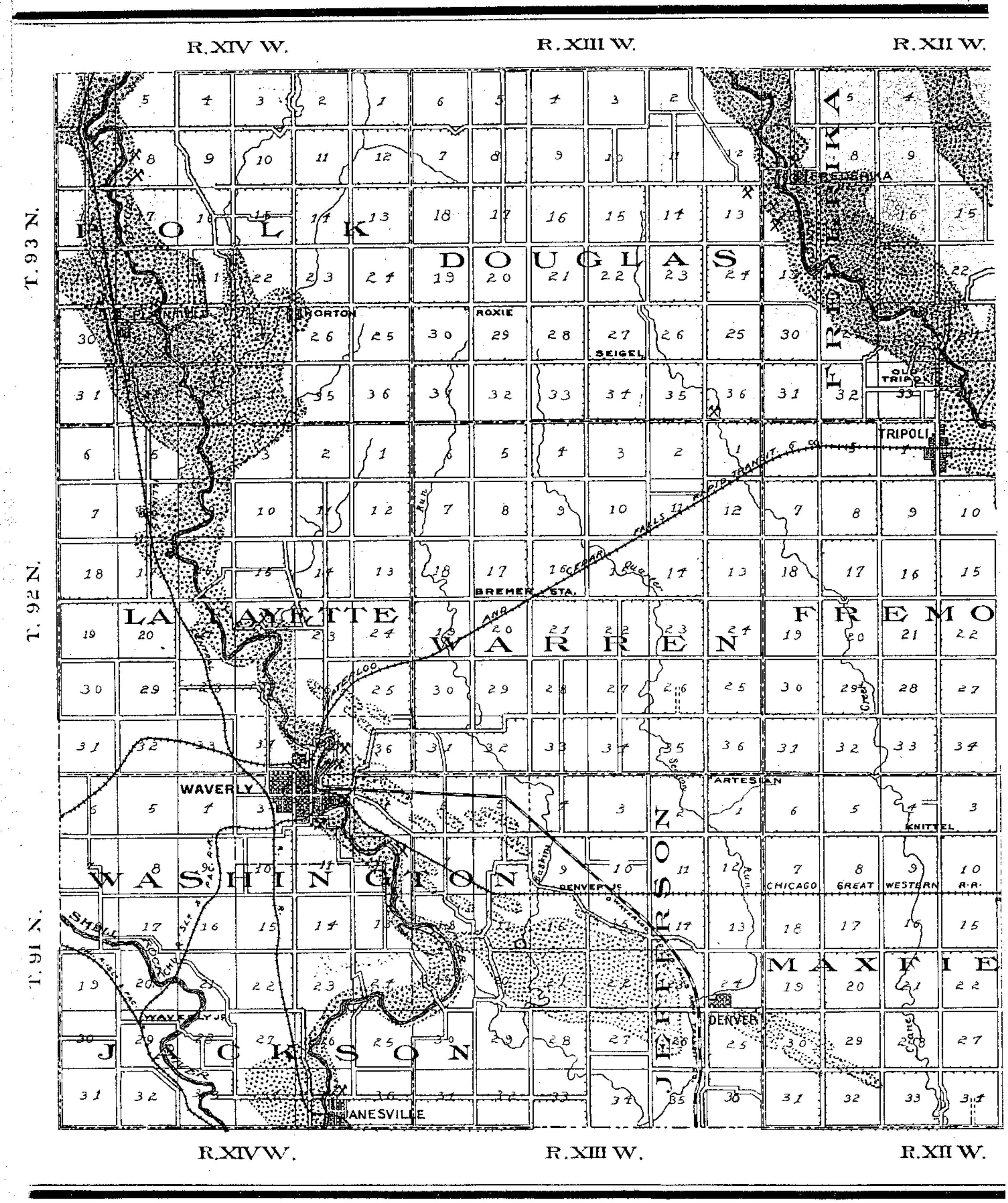
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WASHINGTON
JEFFERSON
MAXFIE
JACKSON
HORTON
ROXIE
SEIGEL
OLD TRIPOLI
TRIPOLI
BREMER STA.
WAVERLY
ARTESIAN
KNITTEL
DENVER JC
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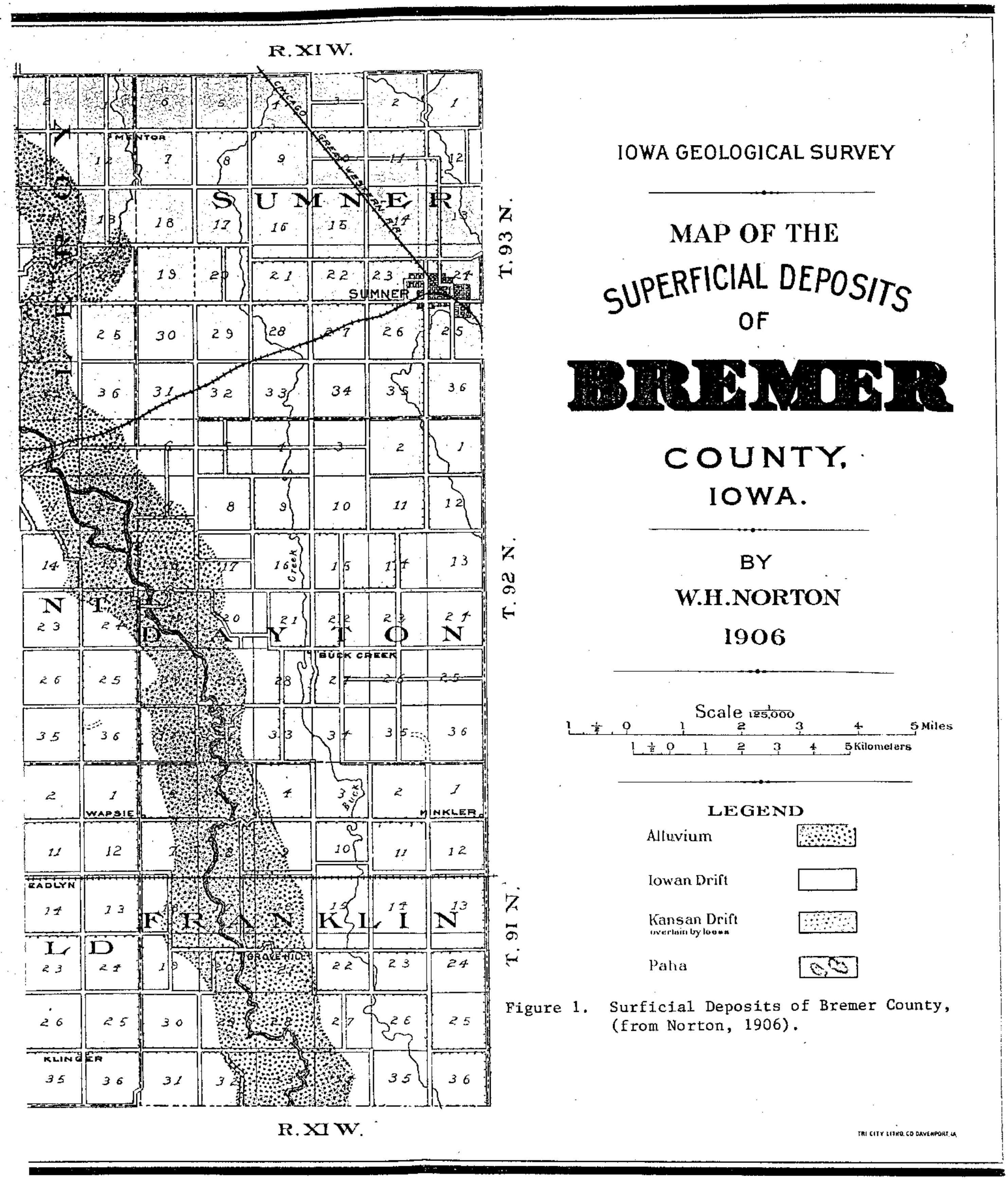


Figure 1. Surficial Deposits of Bremer County, (from Norton, 1906).

## BEDROCK GEOLOGY OF BLACK HAWK AND BREMER COUNTIES

Exposed bedrock in Black Hawk and Bremer counties consists of rocks of Silurian and Devonian ages. A generalized cross section (Figure 1) from Witzke et al. (1988) shows the interpreted stratigraphic relationships of Devonian strata from north-central to east-central Iowa.

Devonian rocks in Black Hawk and Bremer counties are assigned to the Cedar Valley and Wapsipinicon groups. Witzke et al. (1988) include four formations within the Cedar Valley Group. In ascending order, the formations are Little Cedar, Coralville, Lithograph City, and Shell Rock. All except the Shell Rock Formation are well exposed in quarries in the fieldtrip area. Each formation corresponds to a major transgressive-regressive cycle of deposition, and each formation is separated from adjacent formations by an erosional surface (Witzke et al. 1988). The Cedar Valley Group lies unconformably on the Wapsipinicon Group. The Wapsipinicon Group is represented by the Otis (lower) and Pinicon Ridge (upper) formations. Rocks of the Cedar Valley and Wapsipinicon formations reflect deposition under extensive shallow-marine, restricted marine, tidal-flat, and evaporative settings (Plocher and Bunker, 1989).

The Geologic Map of Iowa (1969) shows Ordovician, Silurian, and Devonian bedrock in Black Hawk and Bremer counties (Figure 2). A pattern of older rocks (Ordovician or Silurian) surrounded by younger Devonian strata suggests the presence of anticlinal structures in the area. As noted by Prior (1986), Bremer County is crisscrossed with pre-glacial bedrock valleys. This also affords an explanation for the appearance of older bedrock on the geologic map.

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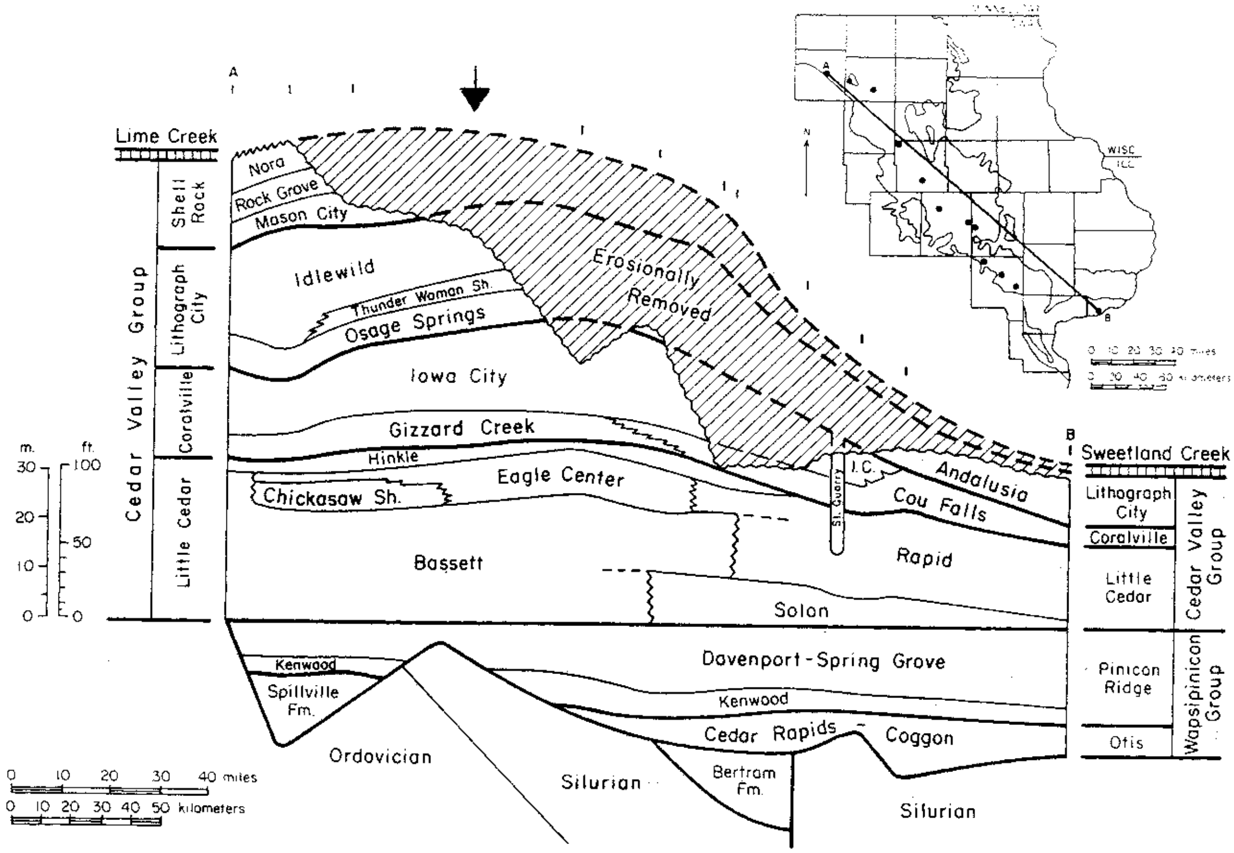


Figure 1. Generalized stratigraphic cross-section from north-central to extreme east-central Iowa, showing interpreted stratigraphic relationships of the various units of the Wapsipinicon and Cedar Valley groups. Arrow points to location of border between Black Hawk and Bremer counties. (from Witzke et al., 1988).

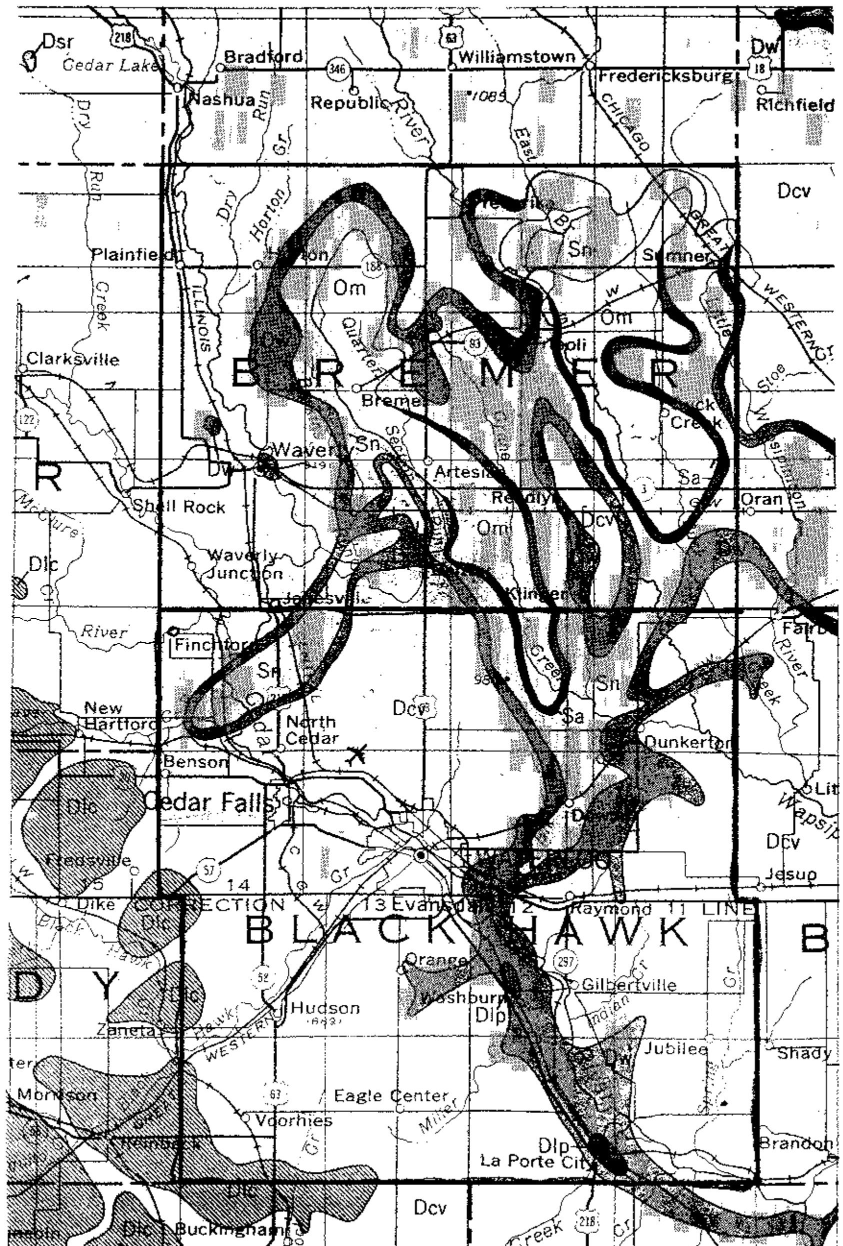


Figure 2. Bedrock Map of Black Hawk and Bremer counties. Note southwest to northeast trending pattern of Silurian strata (Niagaran, Sn.) in northwest Black Hawk County and southwest Bremer County (from Geologic Map of Iowa, 1969).

The Silurian-Devonian rocks comprise one of the major bedrock aquifers of our state. Approximately 512,000 people (17.5 percent of the state's population) rely on the Silurian-Devonian aquifer for their water needs. The communities of Cedar Falls, Charles City, Waterloo, and Waverly pump substantial quantities of water from the aquifer. Cool water from the aquifer is used to air-condition buildings on the UNI campus. Yields of more than 500 - 1,000 gallons per minute can be obtained in the outcrop area where wells intersect highly-fractured and cavernous carbonate rocks. In the outcrop area, the chemical quality of the water from the Silurian-Devonian aquifer is generally suitable for public supply. In areas of karst or where surficial materials are less than 50 feet thick, excess nitrate and surface contaminants may be present in the water. Figure 1 shows a generalized cross section and flow system for the Silurian-Devonian Aquifer in eastern Iowa (Horick, 1984).

## References

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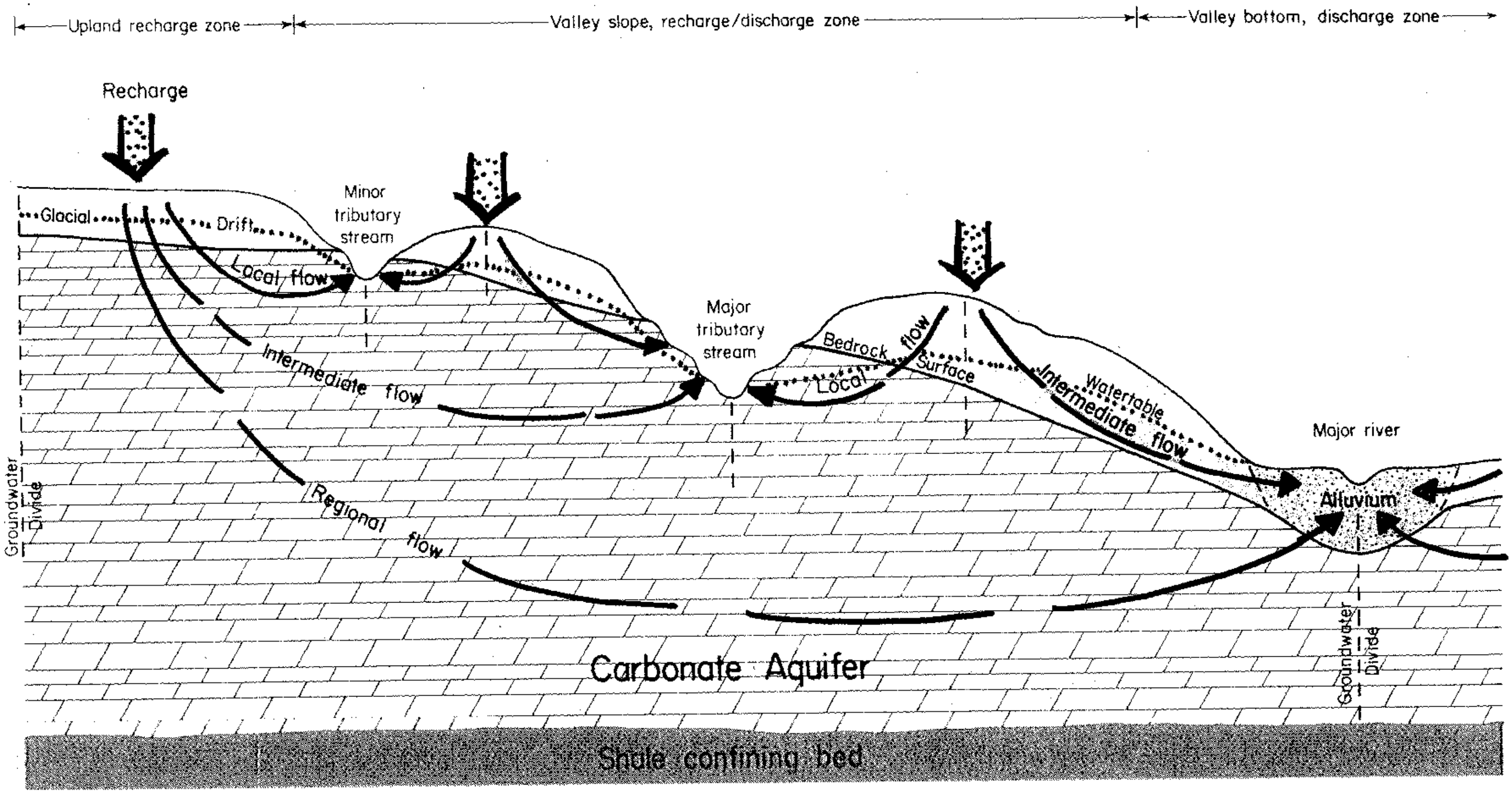
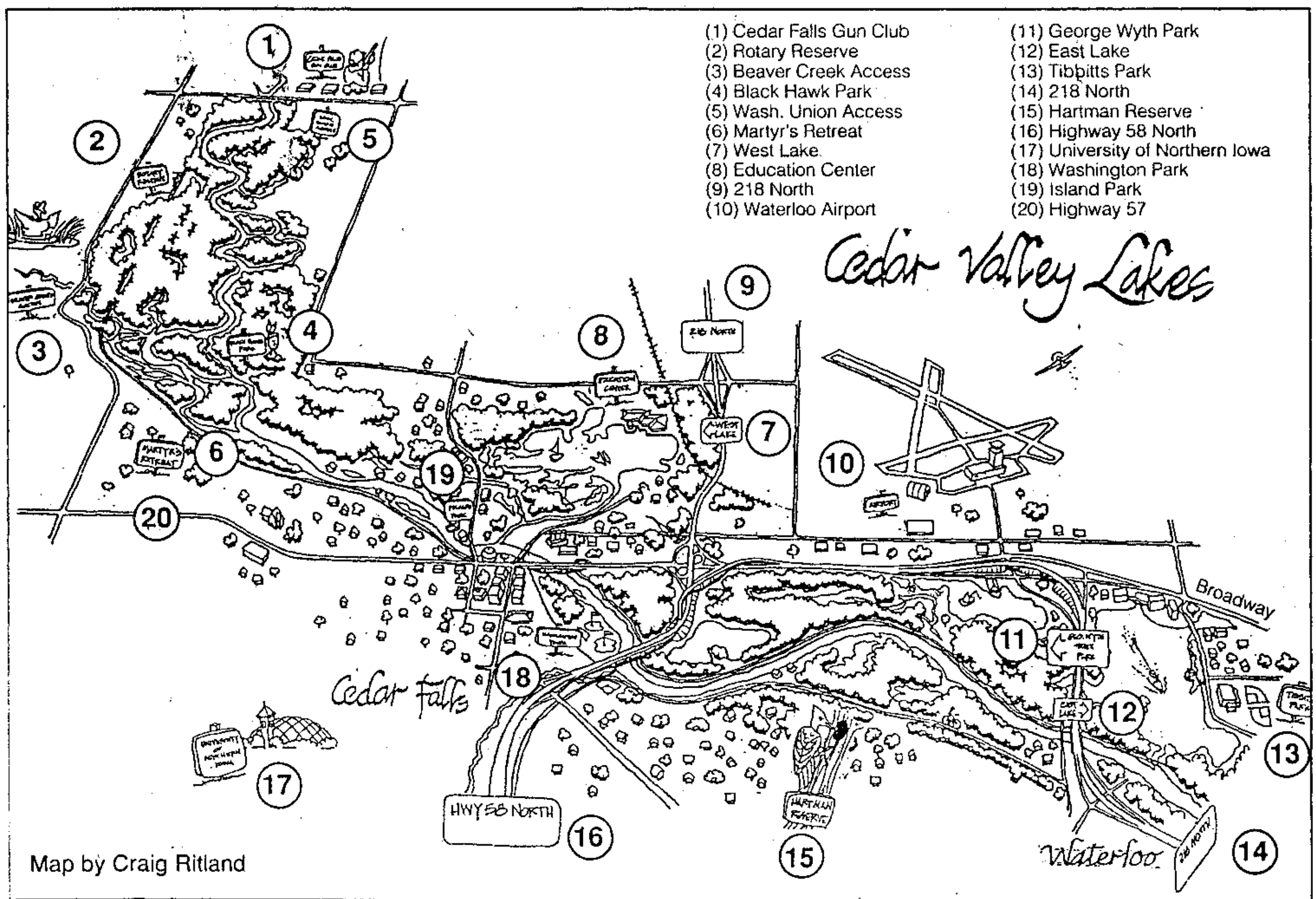



Figure 1. Schematic two-dimensional diagram of hypothetical groundwater flow system in the Silurian-Devonian Aquifer and glacial-drift overburden in eastern Iowa. (From Horick, 1984.)

THE INTERSTATE SUBSTITUTION PROGRAM

The Waterloo-Cedar Falls area has experienced considerable highway construction in recent years, and evidence of ongoing construction is evident in many areas. Highway 58 North is being constructed through Cedar Falls and will serve to link U.S. Highway 20 to U.S. Highway 218. Highway 218 is nearing completion through Waterloo and will connect with Highway 58 near George Wyth State Park in northern Cedar Falls. Excavations to provide fill for the highway projects have produced an enlarged lake in George Wyth State Park and "East Lake" in Waterloo. These lakes, along with the proposed "West Lake" in Cedar Falls, constitute the Chain of Lakes project. When completed, this project will greatly enhance recreational opportunities in the area. See Craig Ritland's map (reproduced from the Waterloo Courier, 16 February 1992) for details.



# CEDAR FALLS PRAIRIE LAKES EXCAVATION SITE

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## Site Location

The Cedar Falls Prairie Lakes excavation site is located on the south side of Cedar Falls, immediately east of old Highway 58 (Hudson Road) and approximately 1.5 km north of U.S. Highway 20.

Excavations at this site were made in early 1990 as a part of the expansion of the Cedar Falls industrial park, road construction associated with it, and the development of a city recreational area. Additional excavations since then have modified the exposures, but no major trenching has been done for over two years. Over this period of time, 12 individual vertical to near-vertical sediment-filled wedges were exposed and remained visible long enough to be studied in detail. Other wedges were seen and subsequently destroyed during periodic excavations, but they were unable to be examined because of continuing trenching activities. A brief description of the sediment-filled wedges studied at this site, their possible origin, and their paleoclimatic interpretation is presented here.

## The Iowan Surface

The features exposed at this location provide some clues to the development of the Iowan Surface of northeast Iowa. This landform region has received considerable attention over the years, but it was not until Ruhe and others (1968) carried out a systematic drilling program across the region that its true nature was understood. A good summary of the controversy surrounding this region and its resolution can be found in Hallberg and others (1978). It is now recognized that the key to the origin of the Iowan Surface is large-scale erosion (Prior, 1991), apparently in a former periglacial environment. Examination of the sediment-filled wedges at this site suggests they are ice-wedge casts and supports the idea of cold-climate weathering and erosion to form the Iowan Surface.

## Description of the Sediment-Filled Wedges

The features described here are found on the north-facing side of an east-west trench approximately 0.6 km long. When the trench was being dug, sediment-filled wedges were seen on both sides of the 7 m wide excavation. The south side (north-facing side) of the trench was left vertical, but the north side (south-facing side) was widened and graded to a smooth gentle slope, thereby removing any possibility of examining wedges on that side.

When first exposed in the cut in 1990, the sediment-filled wedges were quite distinct. In the two years since then, weathering and erosion have modified the face of the scarp considerably. Because the sandy sediment of the wedges is less resistant than the enclosing clayey till, erosion has preferentially carved the wedges into V-shaped notches along the scarp. This may be all that we get to see at this site, but at least we will get an idea of the dimensions of the features. The description that follows will provide information on former wedge characteristics and perhaps allow us to make some reconstructions. Figure 1 shows cross sections of the wedges investigated, and Figures 2 and 3 show specific characteristics of two wedges.

The wedges at this site occur in pre-Illinoian till, except for one wedge on the lower, far west end of the trench (VR-1) which is in stratified sands and small gravels (Fig. 2). Loamy sediment about 1 m thick with a stone line at its base overlies the wedges. The stone line usually dips slightly into the upper parts of the wedges, but in some cases it runs across their tops without modification. Ventifacts appear at several places in the stone line. In a study of the stone line at this location, Kane (1991) noted the presence of well-developed ventifacts and pitted stones. She attributed the pitting to wind action. The wedges vary in dimension (Fig. 1), but maximum width at the top of the wedges is about 2 m, with an average width of approximately 130 cm. Maximum depth is about 3 m, with an average of 190 cm. The infilling material is mostly sand, with pockets of silt, silty sand, and gravelly sand (Figs. 2 and 3). Some of the infilling sand is clean and loose, and some is iron stained and moderately indurated. Inclined to nearly-horizontal stratification of the infilling sands was noted in only a few cases (Fig. 3). Stratification of infilling sands is much more common at other wedge sites in Black Hawk County (Walters, 1989). Upturned or downturned host material was not seen in association with any of the wedges penetrating till, but both types of disturbance were observed in the wedge occurring in stratified sands (Fig. 2). Slump and subsidence features were also noted in some wedges.

All of the wedges have lateral continuity as noted by observations during the excavation process. As has been seen at other sites in northeast Iowa, they appear to form a polygonal pattern in plan view (Ruhe and others, 1965; Ruhe, 1969; Walters, 1989,1990).

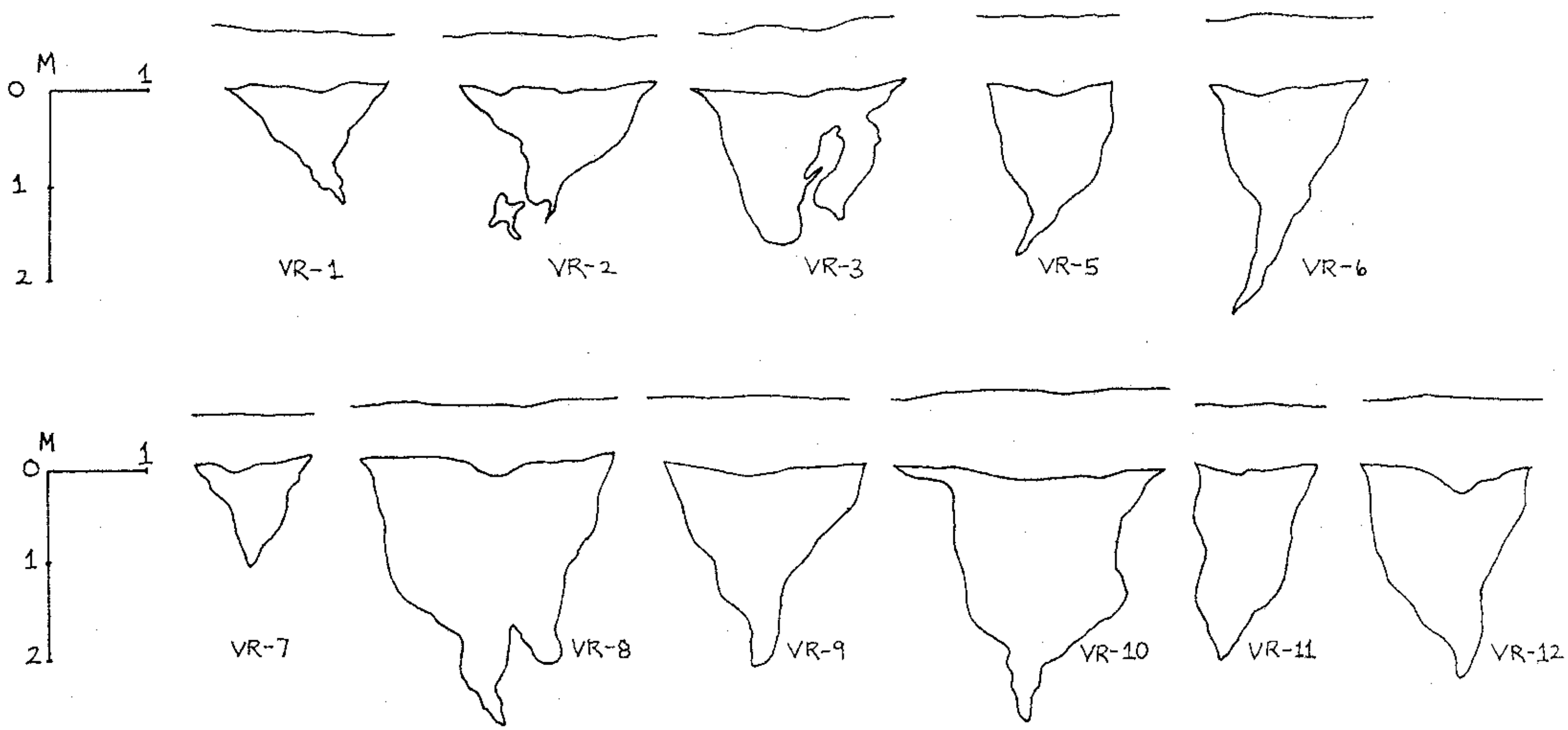


Figure 1. Cross sections of the sediment-filled wedges studied at the Cedar Falls Prairie Lakes site. Drawings were made from photographs and field sketches.

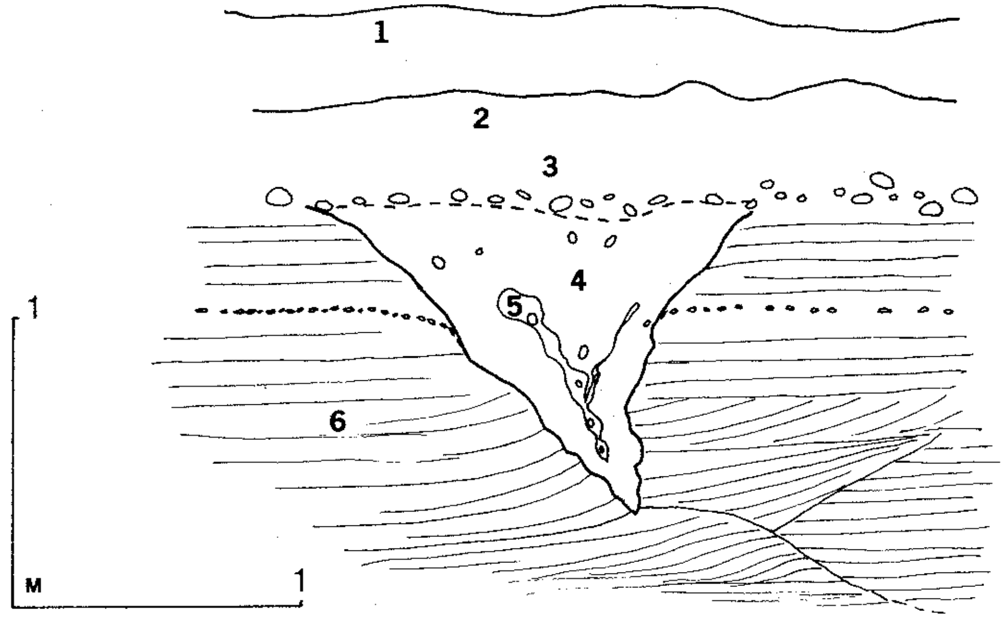


Figure 2. Sketch of wedge VR-1. 1 = disturbed, 2 = brownish-black loam, 3 = brown sandy loam, 4 = brown sand, 5 = reddish-brown sand, 6 = stratified yellowish-brown sand.

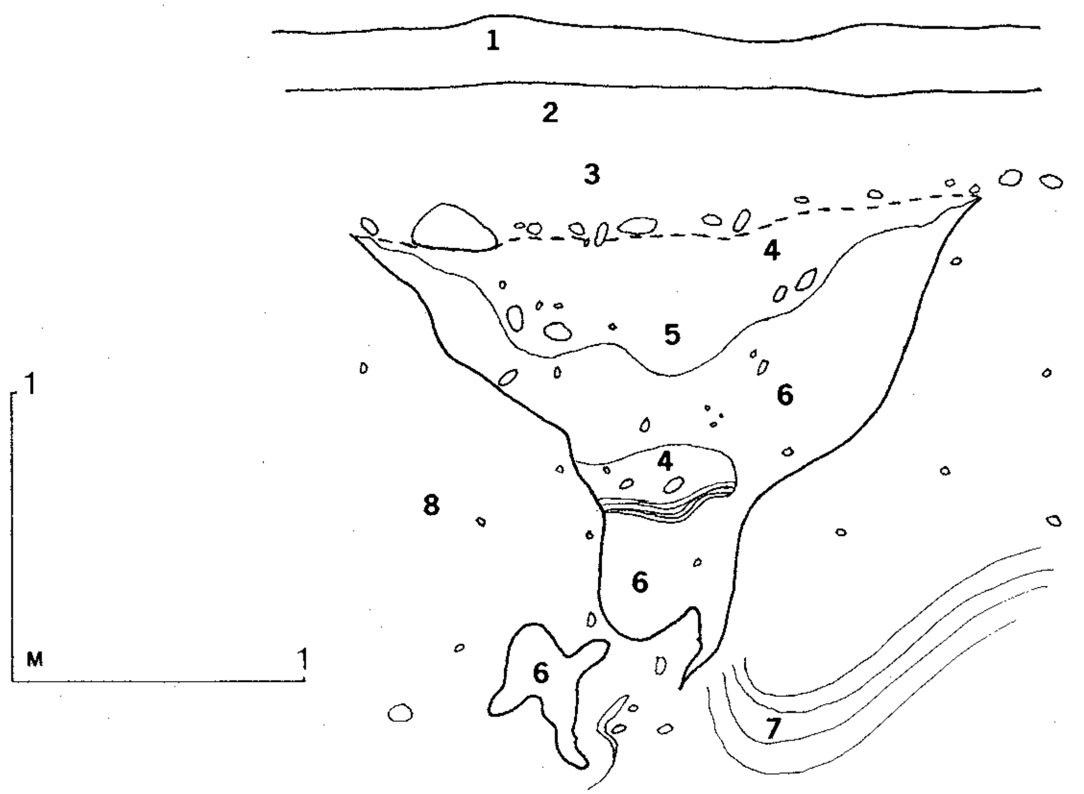


Figure 3. Sketch of wedge VR-2. 1 = disturbed, 2 = brownish-black loam, 3 = brown sandy loam, 4 = brown coarse sand, 5 = brown gravelly sand, 6 = yellowish-brown sand, 7 = silt/clay bands alternating with sand layers, 8 = clayey till.

## Origin of the Sediment-Filled Wedges

Several types of wedges can form in sediment (Black, 1976), but because the wedges investigated here show a polygonal pattern, we need consider only those processes which would produce such a pattern. Another important consideration is that the infilling material in the wedges displays a variety of features indicative of secondary infilling. The presence of horizontal to near-horizontal stratification, slump features, and blocks of host material included in the wedge filling all suggest that these wedges formed as sediment replaced a melting ice wedge. Sediment was probably both washed into and blown into the degrading ice wedge. A study of quartz grain surface textures from sediment-filled wedges at a site less than 3 km from here shows that the infilling material is dominantly of glacial origin with mixed episodes of fluvial and eolian infilling (Lewis, 1990). Wedge filling preceded development of the stone line and overlying loamy sediment, but remnants of ice must have remained in the lower portions of many wedges as indicated by the penetration of the stone line into the upper part of most wedges at this location.

## Paleoclimatic Implications

The sediment-filled wedges have characteristics which suggest they are ice-wedge casts. Since ice-wedge polygons form only in permafrost, this indicates that the periglacial environment in this region must have been severe. Studies of fossil plants, insects, small mammals, and snails in Pleistocene deposits in Iowa show that tundra conditions existed in places between 21,000 and 16,500 years ago, the coldest part of late Wisconsinan time (Baker and others, 1991). The ice-wedge polygons in northeast Iowa probably formed at this time. At least discontinuous permafrost must have been present with extreme freeze-thaw activity, sheetwash of slopes, and strong winds characterizing the periglacial environment of this region.

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**CEDAR HILLS SAND PRAIRIE**

Daryl D. Smith

Cedar Hills Sand Prairie is located within the Iowa Erosion Surface Region. The prairie is near the eastern terminus of a narrow upland divide between the broad valleys of the West Fork Cedar River to the north, and Beaver Creek to the south. Both streams join the Cedar River which flows from north to south about three miles east of the prairie.

The property is owned by The Nature Conservancy and consists of a 36-acre native vegetation State Preserve and a 54-acre old field addition that is undergoing secondary succession to prairie.

Most of the area consists of eolian sand deposits, although there are also some alluvial deposits. The deposition undoubtedly coincided with the Wisconsin glacial period when the West Fork Cedar River was being affected by meltwater from the Des Moines Lobe. The presence of glacial erratics and Palms muck in the north swale indicate that the overlying deposits were probably eroded away.

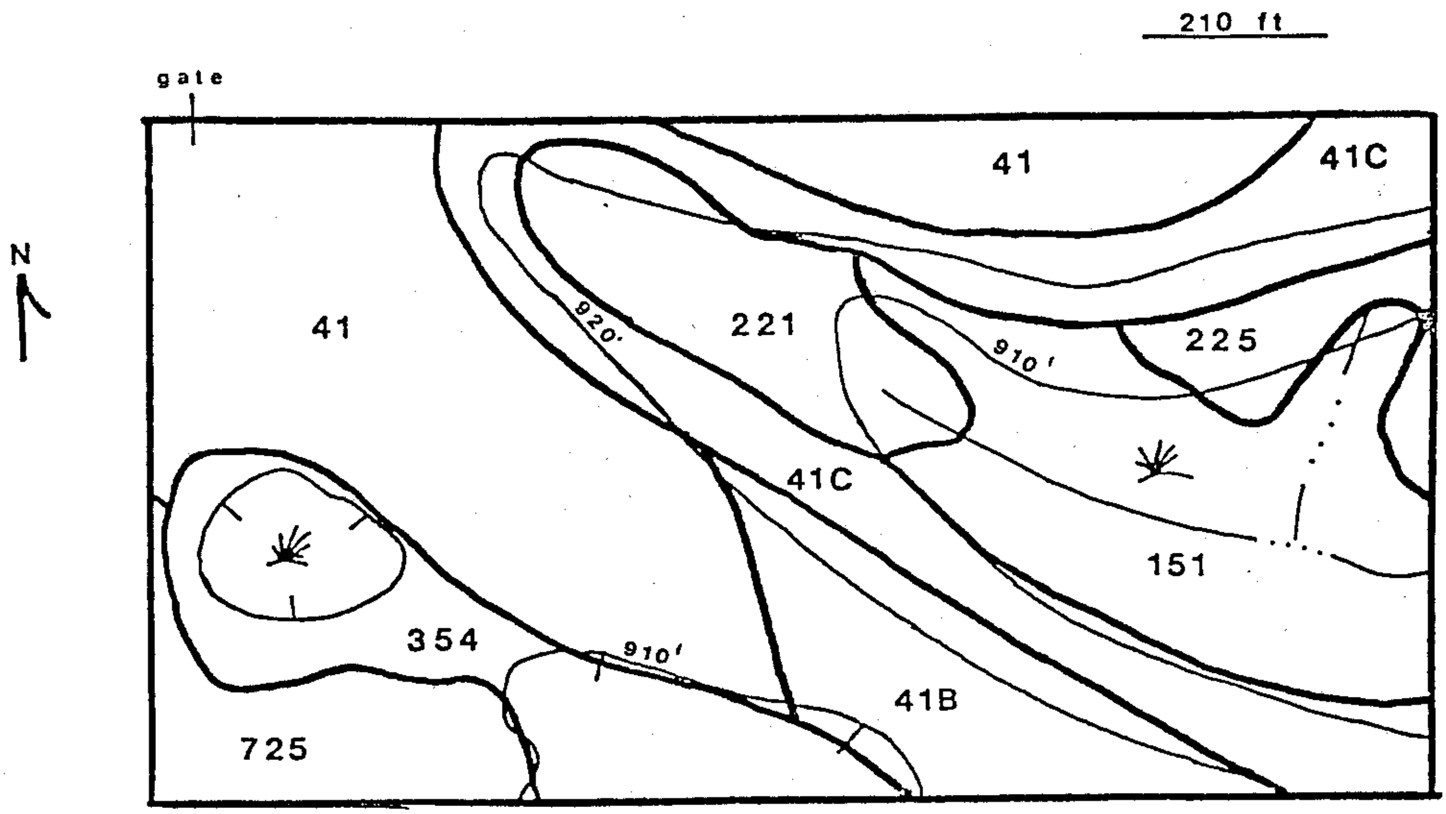
The source of the eolian sand is the floodplain of the West Fork Cedar River. The depth of the sand varies, a depth of 25 feet was recorded from a drill sample taken near the preserve in the SW corner of the old field portion. As is typical of upland sand deposits, the area has an undulating topography with dunes, ridges, pockets and depressions. Undoubtedly the surface has been reworked periodically since the original deposition, erosional features such as blowouts are present.

The presence of alluvial deposits within the preserve as well as the topography of the area has led to the conjecture that this area is a part of a breach of the upland divide by the West Fork Cedar River into the Beaver Creek Valley during the height of the glacial meltwater outflow (Prior 1990). Much of the eolian sand deposition occurred subsequent to the return of the overflow to the current valley.

The eolian sands were probably reworked whenever there was not sufficient vegetation cover to stabilize the surface. Wind erosion was likely heightened 4,000 to 8,000 years ago during the arid Hypsithermal time. A stabilized dune field is located in the north old-field portion and two blowouts occur along the NW to SE sand ridge of the preserve. Wetlands developed as dunes traversed and blocked drainages (Knapp 1983). A marsh complex is located on the south edge of the preserve. Several other wet prairie sites occur within the preserve and the old field.

The soils of the Cedar Hills Sand Prairie are a part of the Sparta-Olin-Dickinson Association. This association is characterized by nearly level to moderately steep, excessively-

Soil map of the Cedar Hills Sand Prairie



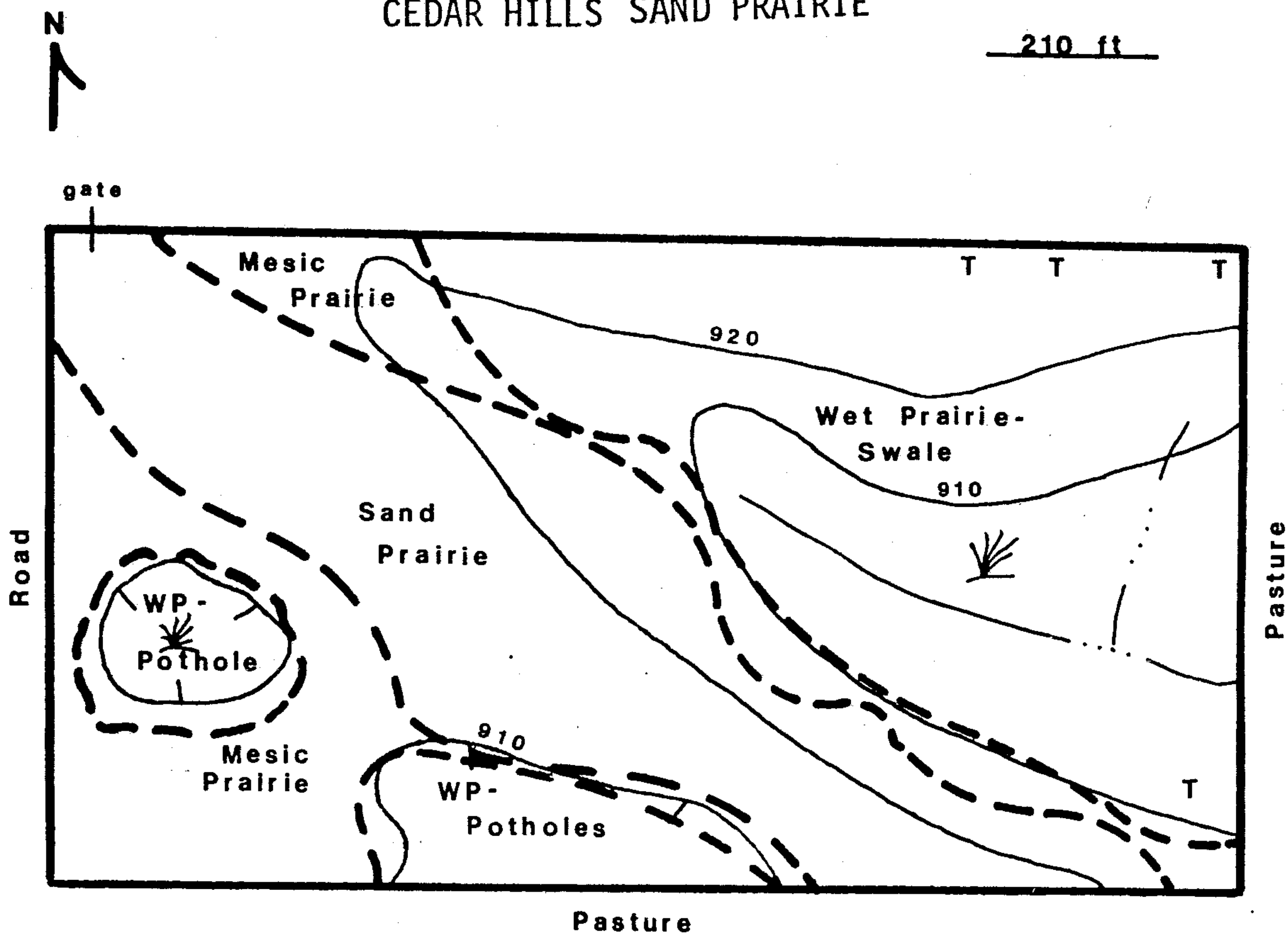

| Soil No. | Name |
|---|---|
| 41 | Sparta loamy fine sand, 0-2% slope |
| 41B | Sparta loamy fine sand, 2-5% slope |
| 41C | Sparta loamy fine sand, 5-9% slope |
| 151 | Marshan clay loam |
| 221 | Palms muck |
| 225 | Lawler loam |
| 354 | Marsh |
| 725 | Hayfield loam |

drained to well-drained sandy and loamy soils formed in eolian sands or eolian sands and the underlying glacial till on upland and terraces. The soil types occurring on the prairie are as follows: **Sparta loamy fine sand**- Moderately dark colored, excessively-drained, coarse textured soils formed in eolian sand under native prairie vegetation. They are usually found in river valleys on stream terraces and associated uplands; **Marshan clay loam**- Dark-colored, poorly drained loams with coarse sand and gravel at about 0.6m (2ft.). They were formed in alluvium and glacial sediment under native prairie vegetation. They are found on stream terraces and on upland glacial outwashes; **Palms muck**- Black, very poorly-drained organic soil formed in glacial sediment under native marsh vegetation; **Lawler loam**- Black, somewhat poorly-drained loamy soils overlaying sandy substrates, developed under native prairie vegetation. They are found on stream benches and outwash plains; **Marsh**- A catch-all term for highly organic soils found in marshes and wetlands; **Hayfield loam**- Moderately dark colored, somewhat poorly-drained soils formed in alluvium and leached sand gravel under both native prairie and forest vegetation (Fouts and Highland 1978).

The vegetation communities are closely aligned with the soil types and topography. They range from a xeric sand community similar to those of the Sandhills of Nebraska through a mesic tallgrass prairie community to a marsh complex on the south side and a fen in the deep moist swale. Carex stricta is the dominant species of the swale and forms dense hummocks. Other species associated with the swale are marsh marigold (Caltha palustris), marsh cinquefoil (Potentilla palustris) and Sphagnum sp. The marsh areas contain Carex lacustris and the hardstem bulrush (Scripus acutus). Sensitive fern (Onoclea sensibilis), marsh fern (Thelypleris palustris), northern dewberry (Rubus flagellaris), and bluejoint grass (Calamagrostis canandensis) are abundant in both the swale and around the marshes. The mesic tallgrass prairie is represented by such species as big bluestem (Andropogon gerardii) little bluestem (Andropogon scoparius), switchgrass (Panicum virgatum), Indian grass (Sorghastrum nutans), gentians (Gentiana andrewsii and Gentiana suberula), bird's foot violet (Viola pedata), mountain mint (Pycnanthemum virginianum), and hoary puccoon (Lithospermum canescens). The xeric sand prairie community is dominated by little bluestem (Andropogon scoparius) and Canada bluegrass (Poa compressa) with white sage (Artemisia ludoviciana) as an important forb. Characteristic sand species include sand dropseed (Sporobolus cryptandrus), hairy grama (Bouteloua hirsuta), purple love grass (Eragrostis spectabilis), bead grass (Paspalum ciliatifolium) and (Cyperus filenlmis). Other common species include June grass (Koeleria cristata), porcupine grass (Stipa spartea), perennial ragweed (Ambrosia psilostachya), rough blazing star (Liatris aspera), and Missouri goldenrod, (Solidago missouriensis).

A variety of rare plants are found on the preserve. Included on the state endangered list are a rush (Juncus greenei), a sedge (Carex leptalea), least grape fern, Botrychium simplex, milkwort

CEDAR HILLS SAND PRAIRIE



(Polygala incarnata) and northern panic grass (Panicum boreale). Ophioglassum vulgatum is on the state threatened list while the sage-leaved willow (Salix candida) and tall cotton grass (Eriophorum angustifolium) are considered to be plants of special concern in Iowa. (Veronica scutellaria) and (Juncus vaseyi) are rare in Iowa and the populations on the preserve are considered to be disjunct.

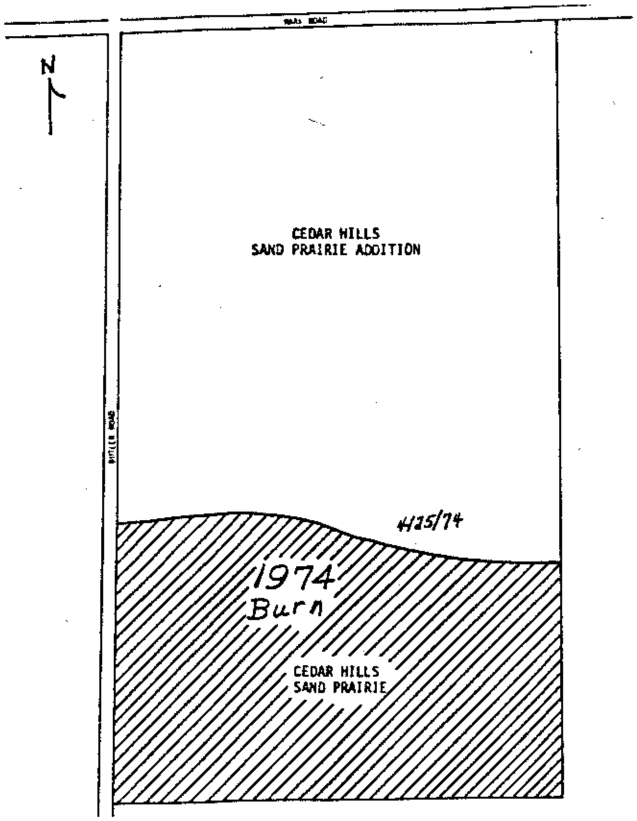
A complete inventory of the animal species is lacking. The eastern gartersnake (Thamnophis sirtalis) and bullsnake (Pituophis melanoleucus) are common as are the plains pocket gopher (Geomys bursarius) and white tailed deer (Odocoileus virginianus). Twenty-five species of mammals have been observed including the short-tailed shrew (Blarina brevicauda), masked shrew (Sorex cinereus), meadow vole (Microtus pennsylvanicus), meadow jumping mouse (Zapus hudsonius), gray fox (Urocyon cinereoargenteus), ermine (Mustela erminea), long-tailed weasel (Mustela frenata) and white-tailed jack rabbit (Lespus townsendii). Birds known from the prairie include the killdeer (Charadrius vociferus), upland sandpiper (Bartramia longicauda), common yellowthroat (Geothlypis trichas), bobolink (Oolichonyx oryzivorus), yellow-headed blackbird (Xanthocephalus xanthocephalus) and song sparrow (Melospiza melodia). Prairie chickens (Tympanuchus cupido) were last reported present in the early 1940s (Polder 1986). Long-eared and short-eared owls (Asio otus and A. flammeus) have over-wintered in a small cedar grove on the north of the preserve. Thirty-eight butterfly species have been recorded on the Cedar Hills Sand Prairie which has often been a migration site for large numbers of monarch butterflies (Danaus plexippus).

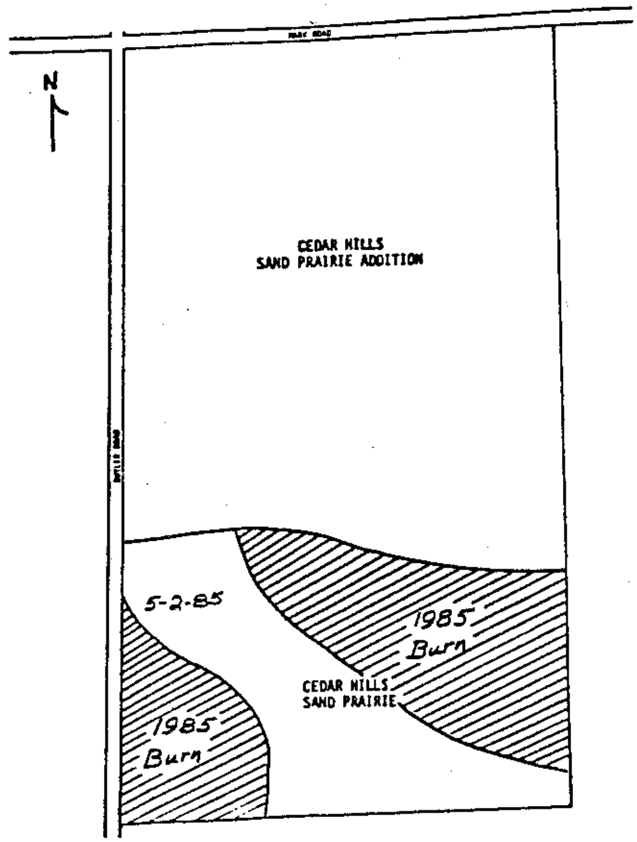
Primary management concerns of the preserve are expansion of Siberian elm (Ulmus pumila) from the windbreak across the road, continued encroachment of smooth brome (Bromus inermis) and increased woody growth in the southwest and northeast corners. The old field portion to the north is being managed to enhance secondary succession to prairie.

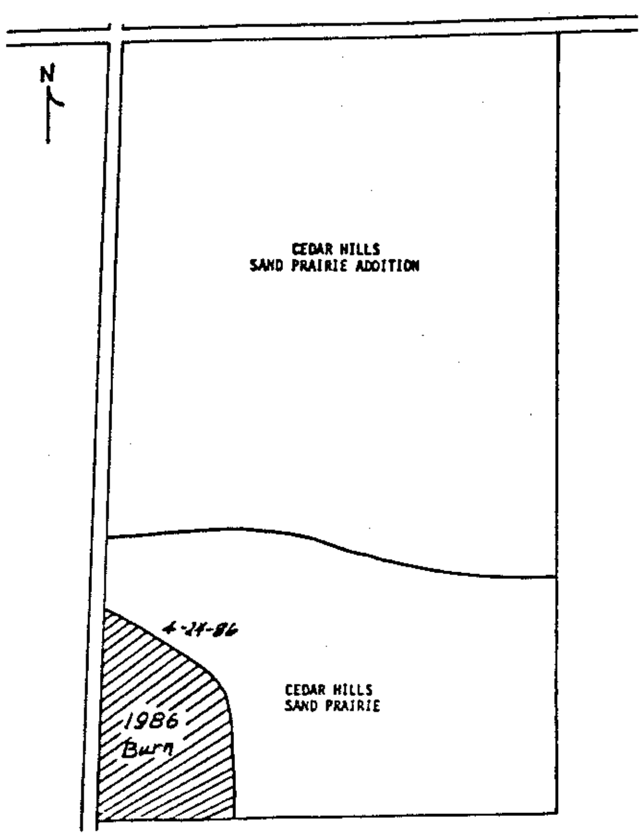
The preserve was burned in 1973 to initiate control of eastern red cedar (Juniperus virginiana). The use of fire and selective cutting have reduced the eastern red cedar expansion.

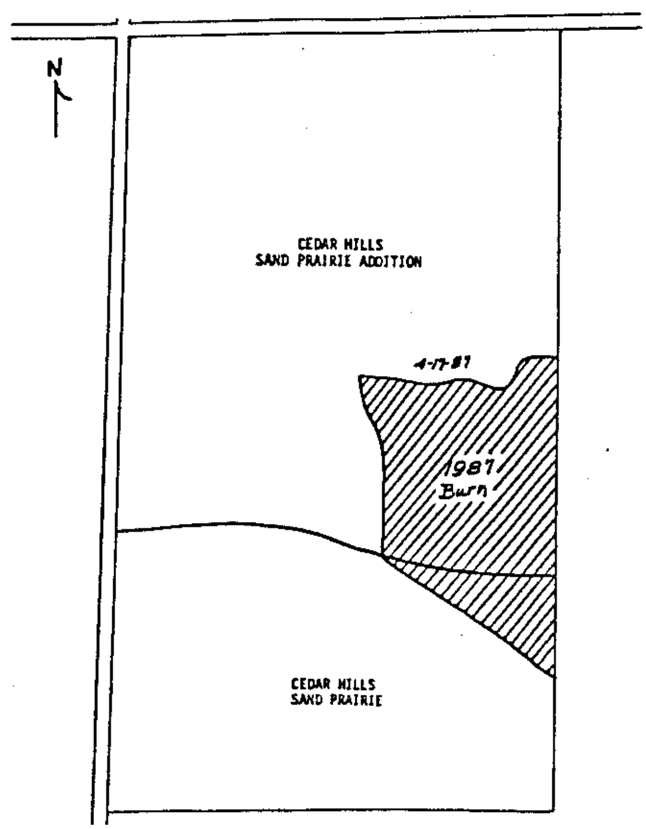
A prescribed burn program was initiated in 1985. Portions of the preserve have been burned annually, with the exception of 1991, since that time. Fire management has not been sufficient to control the Siberian elm expansion so girdling and cutting management activities have been initiated.

CEDAR HILLS SAND PRAIRIE BURNS
1974, 85-87



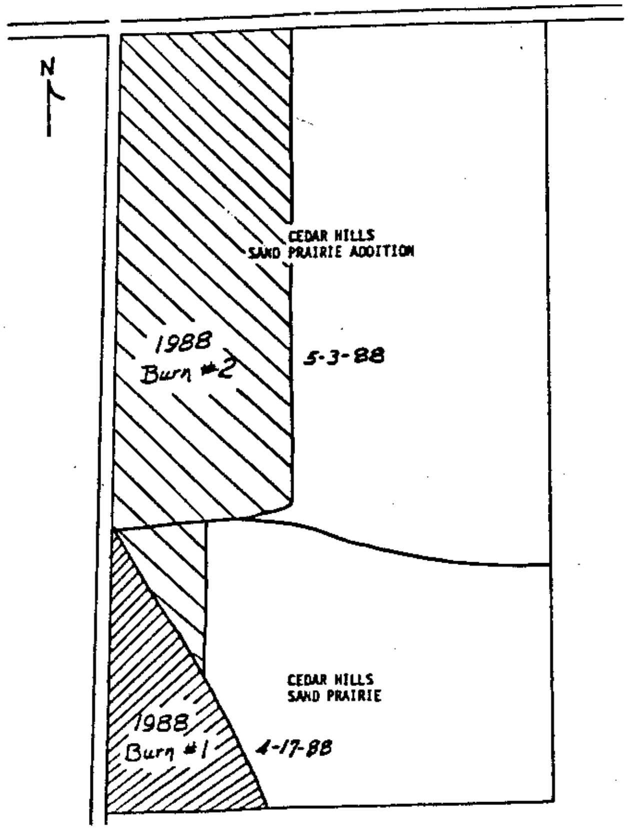



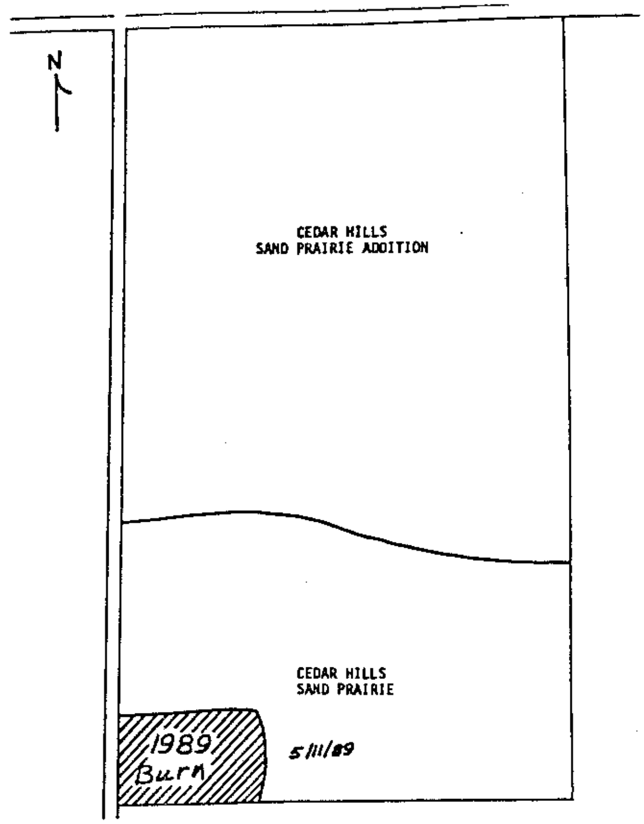



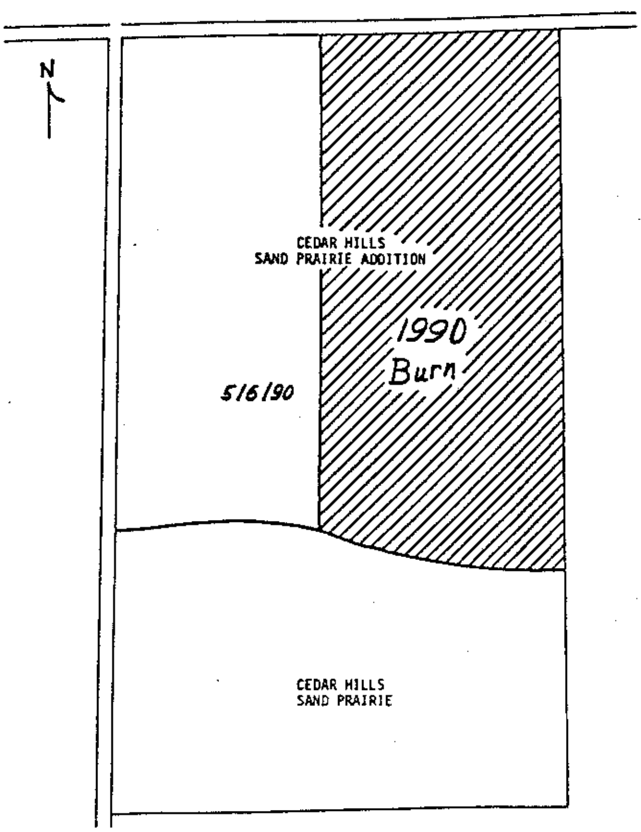



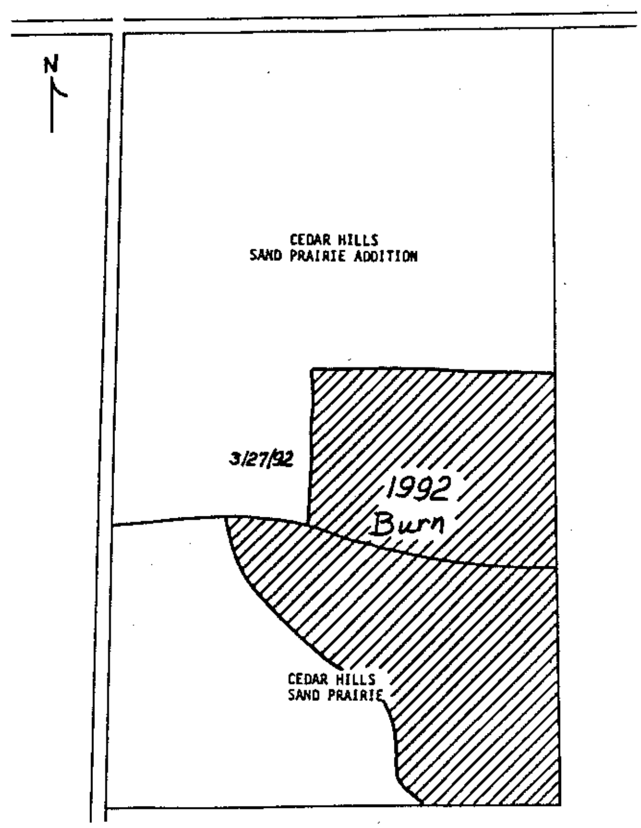

Daryl Smith

CEDAR HILLS SAND PRAIRIE BURNS
1988-90, 92




Daryl Smith

## CEDAR BEND SAVANNA

Daryl D. Smith

The Cedar Bend Savanna is located on the Iowa Erosional Surface on an alluvial terrace east of the Cedar River near an old channel.

The savanna was acquired recently by the Black Hawk County Conservation Board as a part of its Cedar River Greenbelt. Little is known about this natural area and to date no study of it has been undertaken. However, the paucity of surviving savannas in Iowa coupled with the relict species that are present indicate a need for further study.

The soils of floodplain of the Cedar River comprise the Loamy alluvial land, channeled-Saude-Flagler Association. The Cedar Bend Savanna is located on the Finchford Series portion of that association. The Finchford Series consists of nearly level to moderately sloping, excessively drained loamy sand soils on high alluvial terraces and adjacent escarpments. These soils formed in coarse textured water-deposited material under the influence of drought-tolerant grass vegetation. Adjacent to the Finchford loamy sand is the Loamy Alluvial Land, Channeled type which consists of highly stratified, recently deposited alluvial sediments that have not been in place long enough for soil to develop. The native vegetation was mainly mixed grass, brush and timber (Fouts and Highland 1978).

The savanna is dominated by black oak (Quercus velutina) with scattered bur oaks (Quercus macrocarpa). Black oak appears to be a locally dominant species on relatively undisturbed sandy loam soils associated with the Cedar River Valley. In addition, a considerable number of eastern red cedar (Juniperus virginiana) are present, they appear to be younger than the oaks. Mesic woody species are more common on the adjacent soils of the Loamy Alluvium, channeled type. Within most of the prairie openings side-oats grama (Bouteloua curtipendula) is the dominant grass, occasional clumps of big bluestem (Andropogon gerardi) and little bluestem (Andropogon scoparius) are scattered throughout as are a couple of clumps of prairie dropseed (Sporobolus heterolepis). The uncommon Astragalus distortus is locally quite abundant and in early spring the abundance of pasque flower (Anemone patens) is readily apparent. Hoary puccoon (Lithospermum canescens), thimbleweed (Anemone cylindrica), prairie bush clover (Lespedeza capitata), prairie larkspur (Delphinium virescens), tall cinquefoil (Potentilla arguta), evening primrose (Oenothera biennis), three-awn (Aristida sp) and draba (Drala caroliniana) are present. In addition, Carolina anemone (Anemone caroliniana) has been reported within the site (Witt and Golz 1991).

Prior to acquisition by the Black Hawk County Conservation Board the area was grazed for an extended period of time. Very likely the expansion of the eastern red cedars coincided with grazing. Apparently the grazing assisted in maintaining the prairie openings. Following acquisition in August 1985 the area was allowed to undergo natural succession. Consequently woody tree species, especially black oak, expanded rapidly into the prairie openings. In 1990, the Cedar Prairie Group of the Iowa Sierra Club volunteered to assist in managing the area and initiated a plan to remove trees within the prairie openings and to expand the openings by removing trees on the margins of the openings. When sufficient fuel is available a burn management program will be instituted.

# Flora of a Sand Prairie in Black Hawk County, Iowa[1]

GLENN H. CRUM[2]

## Annotated List of Vascular Plants Collected on the Sand Prairie

### Pteridophyta

*Equisetaceae (Horsetail Family)*

*Equisetum arvense* L. Common Horsetail. Moist to dry prairie; common; May.
*Equisetum laevigatum* A. Br. Prairie Scouring-rush. Dry prairie; infrequent; June.
*Equisetum sylvaticum* L. Swale; rare; June.

*Polypodiaceae (Polypody Family)*

*Onoclea sensibilis* L. Sensitive Fern. Marsh edges and swale; common; June.
*Thelypteris palustris* Schott. Marsh Fern. Marsh edges and swale; common; June.

### Spermatophyta

#### Gymnospermae

*Cupressaceae (Cypress Family)*

*Juniperus virginiana* L. Red Cedar. Moist prairie; infrequent.

#### Angiospermae

#### Monocotyledoneae

*Alismataceae (Water-plaintain Family)*

*Alisma subcordatum* Raf. Water-plantain. Shallow water in swale; rare; July.
*Sagittaria cuneata* Sheldon Arrowhead. Shallow water in swale; rare; July.
*Sagittaria latifolia* Willd. Arrowhead. Marsh; infrequent; Aug.
*Sagittaria rigida* Pursh Arrowhead. Marsh; infrequent; July.

*Amaryllidaceae (Amaryllis Family)*

*Hypoxis hirsuta* (L.) Coville Yellow Star-grass. Moist prairie; frequent; June.

*Commelinaceae (Spiderwort Family)*

*Tradescantia bracteata* Small Spiderwort. Mesic prairie; infrequent; June.
*Tradescantia ohiensis* Raf. Spiderwort. Mesic prairie; infrequent; June.

*Cyperaceae (Sedge Family)*

*Carex annectens* (Bickn.) Bickn. Marsh edges; common; June.
*Carex atherodes* Spreng. Marshes; common; June.
*Carex bicknellii* Britt. Dry prairie; infrequent; June.
*Carex buxbaumii* Wahl. Marsh edges and swale; frequent; May.
*Carex conjuncta* Boott Swale; infrequent; June.
*Carex conoidea* Schk. Moist prairie; common; May.
*Carex gravida* Bailey Dry prairie; infrequent; June.
*Carex haydenii* Dew. Marsh edges; infrequent; June.
*Carex interior* Bailey Swale; frequent; June.
*Carex lacustris* Willd. Marshes; locally abundant; May.
*Carex lasiocarpa* Ehrh. Marsh edges and swale; frequent; May.
*Carex leptalea* Wahl. Swale; rare, new Iowa record; June.
*Carex meadii* Dew. mesic prairie; infrequent; June.
*Carex muhlenbergii* Schk. Dry prairie; infrequent; June.
*Carex sartwellii* Dew. Marsh edges; infrequent; June.
*Carex scoparia* Schk. Marsh edges and swale; frequent; June.
*Carex stricta* Lam. Swale; abundant; May.
*Carex vesicaria* L. Marshes; abundant; May.
*Carex vulpinoidea* Michx. Swale; frequent; June.
*Cyperus esculentus* L. Yellow Nut-grass. Marsh edges; infrequent; Aug.

*Plants not indigenous to North America.

*Cyperus schweinitzii* Torr. Dry prairie; infrequent; July.
*Cyperus strigosus* L. Swale; infrequent; July.
*Dulichium arundinaceum* (L.) Britt. Three-way Sedge. South marsh; rare; June.
*Eleocharis calva* Torr. Spike Rush. Spring; rare; June.
*Eleocharis compressa* Sulliv. Spike Rush. Swale; infrequent; June.
*Eleocharis palustris* (L.) R. & S. Spike Rush. Marsh edges; frequent; June.
*Eriophorum angustifolium* Honckeny Cotton Grass. Swale; infrequent; May.
*Scirpus acutus* Muhl. Hard-stem Bulrush. Marshes; locally abundant; June.
*Scirpus cyperinus* (L.) Kunth Wool Grass. Marsh edges and swale; infrequent to locally abundant; July.
*Scleria triglomerata* Michx. Nut Rush. Moist prairie; rare; June.

*Gramineae (Grass Family)*

**Agrostis alba* L. Redtop. Marsh edges and moist prairie; frequent; June.
*Agrostis hiemalis* (Walt.) B.S.P. Tickle Grass. Swale; frequent; June.
*Alopecurus aequalis* Sobol. Short-awn Foxtail. Edges of spring; rare; June.
*Andropogon gerardii* Vitman Big Bluestem. Moist to mesic prairie; common; Aug.
*Andropogon scoparius* Michx. Little Bluestem. Moist to dry prairie; common; Aug.
*Aristida basiramea* Engelm. ex Vasey var. *basiramea*. Needle Grass. Dry prairie; infrequent; Sept.
*Bouteloua hirsuta* Lag. Hairy Grama. Dry prairie; infrequent; Aug.
**Bromus inermis* Leyss. Smooth Brome. Moist prairie; common in southwestern corner, rare elsewhere; June.
*Calamagrostis canadensis* (Michx.) Beauv. Bluejoint. Marsh edges and moist prairie; locally abundant; June.
*Cenchrus longispinus* (Hack.) Fern. Sandbur. Dry prairie; rare; Aug.
**Dactylis glomerata* L. Orchard Grass. Moist prairie; rare; June.
*Echinochloa muricata* (Beauv.) Fern. Barnyard Grass. Desiccated bottom of marsh; rare; Sept.
*Elymus canadensis* L. Canada Wild-rye. Mesic prairie; infrequent; July.
*Eragrostis spectabilis* (Pursh) Steud. Purple Love Grass. Dry prairie; infrequent; Aug.
*Glyceria grandis* S. Wats. Reed Meadow Grass. Marshes and swale; frequent; June.
*Glyceria septentrionalis* Hitchc. Floating Manna Grass. Marsh on south boundary; infrequent; June.
*Glyceria striata* (Lam.) Hitchc. Fowl Meadow Grass. Swale; infrequent; June.
*Hierchloë odorata* (L.) Beauv. Holy Grass. Moist prairie; locally abundant in northeastern corner, rare or absent elsewhere; June.
*Hordeum jubatum* L. Squirrel-tail Barley. Moist prairie; infrequent; June.
*Koeleria cristata* (L.) Pers. June Grass. Dry prairie; common; June.
*Leersia oryzoides* (L.) Sw. Rice Cut-grass. Swale; infrequent; Aug.
*Muhlenbergia glomerata* (Willd.) Trin. Muhly Grass. Spring; rare; Aug.
*Muhlenbergia mexicana* (L.) Trin. Muhly Grass. Marsh edge, rare; Aug.
*Panicum implicatum* Scribn. Moist prairie; infrequent; June.
*Panicum scribnerianum* Nash Mesic to dry prairie; common; May, Oct.

*Panicum virgatum* L. Switch Grass. Moist to mesic prairie; common; Aug.
*Paspalum ciliatifolium* Michx. Dry prairie; infrequent; July.
**Phleum pratense* L. Timothy. Moist prairie; infrequent; June.
**Poa compressa* L. Canada Bluegrass. Dry prairie; common; June.
*Poa palustris* L. Fowl Meadow Grass. Swale; infrequent; June.
**Poa pratensis* L. Kentucky Bluegrass. Moist to dry prairie and swale; locally abundant in southwestern corner and near fences, infrequent to common elsewhere; May.
**Setaria lutescens* (Weigel) F. T. Hubb. Yellow Foxtail. Disturbed areas near southwestern corner; infrequent; July.
*Sorghastrum nutans* (L.) Nash Indian Grass. Moist to dry prairie; frequent; Aug.
*Spartina pectinata* Link Slough Grass. Swale; locally abundant in three clones; July.
*Sphenopholis obtusata* var. *major* (Torr.) Erdman Wedge Grass. Swale; infrequent; June.
*Sporobolus cryptandrus* (Torr.) A. Gray Sand Dropseed. Dry prairie; infrequent; Sept.
*Sporobolus heterolepis* (A. Gray) A. Gray Prairie Dropseed. Mesic to dry prairie; frequent; Aug.
*Stipa spartea* Trin. Porcupine Grass. Moist to dry prairie; common; May.

*Iridaceae (Iris Family)*

*Iris virginica* L. var. *schrevei* (Small) E. Andres. Blue Flag. Marsh edges; infrequent; May.
*Sisyrinchium campestre* Bickn. Blue-eyed-grass. Moist to dry prairie; common; May.

*Juncaceae (Rush Family)*

*Juncus canadensis* J. Gay Spring and marsh in the blowout; rare; Aug.
*Juncus greenei* Oakes & Tuckerm. Moist to mesic prairie; common; July.
*Juncus tenuis* Willd. Path Rush. Moist prairie; infrequent; June.
*Juncus vaseyi* Engelm. Moist to mesic prairie; infrequent; July.

*Lemnaceae (Duckweed Family)*

*Lemna minor* L. Duckweed. Marshes and spring; common.
*Spirodela polyrhiza* (L.) Schleiden Giant Duckweed. Marsh; rare.

*Liliaceae (Lily Family)*

*Smilacina stellata* (L.) Desf. False Solomon's Seal. Moist prairie; locally abundant along the southern rim of the swale, infrequent elsewhere; May.

*Orchidaceae (Orchid Family)*

*Liparis loeselii* (L.) Rich. Twayblade. Moist prairie near the northeastern corner; rare; June.
*Spiranthes cernua* (L.) Rich. Ladies' Tresses. Moist prairie; rare; Aug.

*Sparganiaceae (Bur-reed Family)*

*Sparganium americanum* Nutt. Bur-reed. South marsh; locally common; June.

*Typhaceae (Cat-tail Family)*

*Typha latifolia* L. Cat-tail. South marsh; infrequent clones; June.

DICOTYLEDONEAE

*Aceraceae (Maple Family)*

*Acer negundo* L. Boxelder. Swale; rare; May.
*Acer saccharinum* L. Silver Maple. Swale; infrequent; April.

*Amaranthaceae (Amaranth Family)*

*Froelichia floridana* (Nutt.) Moq. Cottonweed. Driest prairie; infrequent; Aug.

*Anacardiaceae (Cashew Family)*

*Rhus radicans* L. Poison Ivy. Moist prairie, on fence-line; rare; May.

*Apocynaceae (Dogbane Family)*

*Apocynum sibiricum* Jacq. Indian Hemp. Marsh edge; one small population, rare; June.

*Asclepiadaceae (Milkweed Family)*

*Asclepias amplexicaulis* J. E. Smith. Dry prairie; infrequent; June.
*Asclepias incarnata* L. Swamp Milkweed. Marsh edges and swale; infrequent; July.
*Asclepias syriaca* L. Common Milkweed. Mesic prairie in disturbed areas; infrequent; June.
*Asclepias verticillata* L. Whorled Milkweed. Dry prairie; infrequent; June.
*Asclepias viridiflora* Raf. Green Milkweed. Dry prairie; infrequent; June.

*Betulaceae (Birch Family)*

*Corylus americana* Walt. Hazel Nut. Swale; rare; April.

*Boraginaceae (Borage Family)*

*Lithospermum canescens* (Michx.) Lehm. Hoary Puccoon. Mesic to dry prairie; common; May.
*Lithospermum caroliniense* (Walt.) MacM. Puccoon. Mesic to dry prairie; frequent; May.

*Campanulaceae (Bluebell Family)*

*Campanula aparinoides* Pursh Marsh Bellflower. Marsh edges and swale; common; June.
*Lobelia siphilitica* L. Great Blue Lobelia. Marsh edges and swale; infrequent; Aug.
*Lobelia spicata* Lam. Pale-spike Lobelia. Moist prairie; frequent; June.

*Cannabinaceae (Hemp Family)*

**Cannabis sativa* L. Marijuana. Disturbed area near the southwestern boundary; infrequent; July.

*Caprifoliaceae (Honeysuckle Family)*

**Lonicera tatarica* L. Tartarian Honeysuckle. Moist prairie; only one plant was seen; May.
*Sambucus canadensis* L. Elderberry. Swale near northern boundary; rare; June.
*Viburnum lentago* L. Nannyberry. Swale near northern boundary; only one plant was seen; May.

*Caryophyllaceae (Pink Family)*

**Cerastium vulgatum* L. Mouse-ear Chickweed. Swale; infrequent; June.
*Stellaria longifolia* Muhl. Chickweed. Swale; frequent; June.

*Chenopodiaceae (Goosefoot Family)*

*Chenopodium album* L. Lamb's-quarters. Disturbed areas near road and southwestern boundary; infrequent weed; July.

*Cistaceae (Rockrose Family)*

*Helianthemum bicknellii* Fern. Frostweed. Mesic to dry prairie; frequent; June.
*Lechea stricta* Leggett Pinweed. Dry prairie; frequent; Aug.

*Compositae (Sunflower Family)*

*Achillea millefolium* L. Yarrow. Mesic to dry prairie; frequent; June.
*Ambrosia artemisiifolia* L. Common Ragweed. Disturbed areas along fence-lines; infrequent; Aug.
*Ambrosia psilostachya* DC. Perennial Ragweed. Dry prairie; abundant; Aug.
*Ambrosia trifida* L. Giant Ragweed. Disturbed area near the entrance on northwestern corner; rare; Aug.
*Antennaria neglecta* Greene Pussy-toes. Dry prairie; common; May.
*Artemisia ludoviciana* Nutt. White Sage. Mesic to dry prairie; frequent to locally abundant; Sept.
*Aster azureus* Lindl. Bright Blue Aster. Moist prairie; infrequent; Aug.
*Aster ericoides* L. Heath Aster. Moist to mesic prairie and swale; common; Aug.
*Aster novae-angliae* L. New England Aster. Moist prairie and swale; frequent; Aug.
*Aster puniceus* L. Red-stem Aster. Moist prairie and swale; frequent; Aug.
*Aster simplex* Willd. Moist prairie and swale; infrequent; Aug.
*Aster umbellatus* Mill. Flat-topped White Aster. Swale; common; Aug.

*Bidens cernua* L. Stick-tight. Marsh edges and swale; infrequent; Aug.
*Bidens coronata* (L.) Britt. Swamp Beggar-ticks. Marsh edges and swale; infrequent; Aug.
•*Circium arvense* (L.) Scop. Canada Thistle. One clone near the northeastern corner, apparently absent elsewhere; July.
*Circium discolor* (Muhl.) Spreng. Field Thistle. Moist to mesic prairie; infrequent; July.
*Conyza canadensis* (L.) Cronq. Horseweed. Disturbed areas on mesic to dry prairie; infrequent; July.
*Coreopsis palmata* Nutt. Tickseed. Moist to dry prairie; frequent to locally abundant; June.
*Erechtites hieracifolia* (L.) Raf. Fireweed. Marsh edges; infrequent; Aug.
*Erigeron strigosus* Muhl. Daisy-fleabane. Moist to dry prairie; common; June.
*Eupatorium maculatum* L. Joe-Pye Weed. Swale; frequent; July.
*Eupatorium perfoliatum* L. Boneset. Marsh edges and swale; common; July.
*Helianthus grosseserratus* Martens Sunflower. Swale; frequent; Aug.
*Helianthus laetiflorus* Pers. Sunflower. Mesic to dry prairie; infrequent; Aug.
*Krigia biflora* (Walt.) Blake Dwarf Dandelion. Moist prairie; frequent; June.
*Kuhnia eupatorioides* L. False boneset. Mesic to dry prairie; frequent; Aug.
*Lactuca canadensis* L. Wild Lettuce. Moist to mesic prairie; frequent; Aug.
*Liatris aspera* Michx. Blazing Star. Mesic to dry prairie; abundant; late July, with peak in mid-Aug.
*Liatris pycnostachya* Michx. Blazing Star. Moist prairie; infrequent; July.
*Prenanthes racemosa* Michx. Rattlesnake-root. Moist prairie; rare; Aug.
*Rudbeckia hirta* L. Black-eyed Susan. Moist to mesic prairie; common; June.
*Rudbeckia subtomentosa* Pursh Sweet Coneflower. Swale; infrequent; Aug.
*Senecio pauperculus* Michx. Groundsel. Mesic to dry prairie; locally abundant to frequent; June.
*Solidago canadensis* L. Pasture Goldenrod. Moist to mesic prairie; frequent; Aug.
*Solidago gigantea* Ait. Large Goldenrod. Moist to mesic prairie; infrequent; Aug.
*Solidago graminifolia* (L.) Salisb. Bushy Goldenrod. Swale; frequent; Aug.
*Solidago missouriensis* Nutt. Mesic to dry prairie; abundant; late July, with peak in mid-Aug.
*Solidago nemoralis* Ait. Field Goldenrod. Mesic to dry prairie; frequent; Aug.
*Solidago rigida* L. Stiff Goldenrod. Mesic to dry prairie; infrequent; Aug.
*Solidago speciosa* Nutt. Slender Showy Goldenrod. Mesic to dry prairie; Aug.
•*Taraxacum officinale* Weber Dandelion. Weed of mesic to dry prairie; infrequent, except, common along the southern boundary; May.
•*Taraxacum laevigatum* (Willd.) DC. Red-seeded Dandelion. Mesic to dry prairie; infrequent; May.
•*Tragopogon dubius* Scop. Goat's Beard. Mesic to dry prairie; frequent; June.
*Vernonia fasciculata* Michx. Ironweed. Marsh edges and moist prairie; infrequent; Aug.

*Convolvulaceae (Morning-glory Family)*

*Convolvulus sepium* L. Hedge Bindweed. Mesic prairie, along the northern boundary; infrequent; June.

*Cornaceae (Dogwood Family)*

*Cornus racemosa* Lam. Panicled Dogwood. Moist prairie and swale; frequent; June.

*Cruciferae (Mustard Family)*

•*Lepidium densiflorum* Schrad. Pepper Grass. Dry prairie; infrequent; June.
*Rorippa islandica* (Oeder) Borbas Yellow Cress. Spring; rare; June.

*Euphorbiaceae (Spurge Family)*

*Euphorbia corollata* L. Flowering Spurge. Mesic to dry prairie; abundant; June.
*Euphorbia geyeri* Engelm. Prostrate Spurge. Dry prairie; infrequent; Aug.
*Euphorbia glyptosperma* Engelm. Prostrate Spurge. Dry prairie; infrequent; Aug.

*Gentianaceae (Gentian Family)*

*Gentiana andrewsii* Griseb. Closed Gentian. Moist prairie; infrequent; Sept.
*Gentiana puberula* Michx. Prairie Gentian. Dry prairie; rare; Sept.

*Hypericaceae (St. John's-wort Family)*

*Hypericum majus* (A. Gray) Britt. St. John's-wort. Marsh edges and swale; common; July.
*Hypericum mutilum* L. St. John's-wort. Swale; common; July.
*Triadenum fraseri* (Spach) Gl. Marsh St. John's-wort. Swale; common; July.

*Labiatae (Mint Family)*

*Hedeoma hispida* Pursh Mock-pennyroyal. Dry prairie, infrequent; June.
*Lycopus americanus* Muhl. Bugleweed. Moist prairie; frequent; July.
*Monarda fistulosa* L. Horsemint. Moist to mesic prairie; infrequent; July.
*Prunella vulgaris* L. Self-heal. Moist to mesic prairie; common; July.
*Pycnanthemum flexuosum* (Walt.) BSP. Mountain Mint. Moist prairie and swale; common, July.
*Scutellaria galericulata* L. Skullcap. Swale; rare; June.
*Scutellaria lateriflora* L. Mad-dog. Swale; infrequent; Aug.
*Scutellaria parvula* Michx. Skullcap. Moist to dry prairie; frequent; May.
*Stachys palustris* L. Hedge Nettle. Marsh edges and swale; frequent; May.

*Leguminosae (Legume Family)*

*Amorpha canescens* Pursh Lead-plant. Mesic to dry prairie; frequent; July.
*Baptisia leucophaea* Nutt. Wild Indigo. Moist to mesic prairie; infrequent; June.
*Desmodium canadense* (L.) DC. Tick Trefoil. Moist prairie and swale; infrequent; July.
*Gleditsia triacanthos* L. Honey Locust. One tree, about 4 m, which did not flower was near the northern boundary.
*Lespedeza capitata* Michx. Bush-clover. Mesic to dry prairie; common; Aug.
*Petalostemon candidum* (Willd.) Michx. White Prairie-clover. Mesic to dry prairie; frequent; July.
*Petalostemon purpureum* (Vent.) Rydb. Purple Prairie-clover. Mesic to dry prairie; frequent; July.
•*Trifolium pratense* L. Red Clover. Disturbed roadway, near northwestern corner; rare; June.
•*Trifolium repens* L. White Clover. Disturbed roadway, near northwestern corner; rare; June.

*Lentibulariaceae (Bladderwort Family)*

*Utricularia vulgaris* L. Bladderwort. Marsh on southern boundary; frequent; June.

*Linaceae (Flax Family)*

*Linum sulcatum* Riddell Grooved Yellow Flax. Dry prairie; infrequent; July.

*Lythraceae (Loosestrife Family)*

*Lythrum alatum* Pursh Loosestrife. Swale; frequent; June.

*Oleaceae (Olive Family)*

*Fraxinus pennsylvanica* Marsh. Green Ash. One small tree was found by the abandoned roadway near the northwestern corner.

*Bidens cernua* L. Stick-tight. Marsh edges and swale; infrequent; Aug.
*Bidens coronata* (L.) Britt. Swamp Beggar-ticks. Marsh edges and swale; infrequent; Aug.
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*Oleaceae (Olive Family)*

*Fraxinus pennsylvanica* Marsh. Green Ash. One small tree was found by the abandoned roadway near the northwestern corner.

*Onagraceae (Evening-primrose Family)*

*Epilobium coloratum* Biehler Willow Herb. Swale; infrequent; Aug.

*Ludwigia polycarpa* Short & Peter Swale; infrequent; July.

*Oenothera biennis* L. Evening-primrose. Moist to dry prairie; frequent; July.

*Oenothera rhombipetala* Nutt. Dry prairie; infrequent; July.

*Oxalidaceae (Wood-sorrel Family)*

*Oxalis stricta* L. Yellow Wood-sorrel. Mesic to dry prairie; infrequent; May.

*Oxalis violacea* L. Violet Wood-sorrel. Moist to dry prairie; frequent; May.

*Plantaginaceae (Plantain Family)*

*Plantago aristata* Michx. Buckhorn. Driest prairie; infrequent; July.

*Plantago purshii* R. & S. Woolly Plantain. Driest prairie; infrequent; July.

*Plantago rugelii* Dcne. Common Plantain. Moist to dry prairie; infrequent; June.

*Polemoniaceae (Phlox Family)*

*Phlox maculata* L. Wild Sweet William. Moist prairie and swale; infrequent; June.

*Phlox pilosa* L. Prairie Phlox. Swale; infrequent; June.

*Polygalaceae (Milkwort Family)*

*Polygala sanguinea* L. Milkwort. Moist to mesic prairie; infrequent; July.

*Polygonaceae (Smartweed Family)*

*Polygonum coccineum* Muhl. Water Smartweed. Marshes; infrequent; July.

*Polygonum convolvulus* L. Wild Buckwheat. Moist prairie; twining on other plants; rare; June.

•*Polygonum hydropiper* L. Water Pepper. Marsh edges; infrequent; July.

*Polygonum pennsylvanicum* L. Pinkweed. Marsh edges; infrequent; July.

*Polygonum punctatum* Ell. Water Smartweed. Marsh edges and swale; infrequent; July.

*Polygonum sagittatum* L. Tear-thumb. Abundant in swale, infrequent in marshes; July.

•*Rumex acetosella* L. Red Sorrel. Mesic to dry prairie; frequent to locally abundant; May.

•*Rumex crispus* L. Sour Dock. Marsh edges and swale; infrequent; June.

*Rumex orbiculatus* A. Gray Great Water Dock. Swale; infrequent; July.

*Primulaceae (Primrose Family)*

*Dodecatheon meadia* L. Shooting Star. Moist to mesic prairie; infrequent; May.

*Lysimachia hybrida* Michx. Loosestrife. Marsh edges and swale; infrequent; June.

*Lysimachia terrestris* (L.) BSP. Swamp Candles. Swale; rare; June.

*Ranunculaceae (Buttercup Family)*

*Anemone canadensis* L. Anemone. Swale; locally abundant near western end, apparently absent elsewhere; May.

*Anemone cylindrica* A. Gray Windflower. Mesic to dry prairie; frequent; June.

*Caltha palustris* L. Marsh Marigold. Swale; locally abundant; April.

*Delphinium virescens* Nutt. Larkspur. Mesic to dry prairie; frequent; June.

*Ranunculus fascicularis* Muhl. Buttercup. Moist to mesic prairie; infrequent; May.

*Thalictrum dasycarpum* Fisch. & Avé-Lall Moist prairie and swale; infrequent; June.

*Rhamnaceae (Buckthorn Family)*

*Ceanothus americanus* L. New Jersy Tea. Mesic prairie; rare, only one robust shrub was found; July.

*Rosaceae (Rose Family)*

*Agrimonia parviflora* Ait. Agrimony. Moist prairie; rare; July.

*Crataegus mollis* (T. & G.) Scheele Hawthorne. Moist prairie; rare, a small clump of trees was near the northern boundary, which apparently failed to flower.

*Fragaria virginiana* Duchesne Strawberry. Moist to dry prairie; locally abundant; May.

*Potentilla arguta* Pursh Tall Cinquefoil. Mesic to dry prairie; frequent; June.

*Potentilla norvegica* L. Cinquefoil. Spring; rare; June.

•*Potentilla recta* L. Five-finger. Mesic to dry prairie; infrequent; June.

*Potentilla simplex* Michx. Old-field Cinquefoil. Moist to dry prairie; common; May.

*Prunus americana* Marsh. Wild Plum. Mesic prairie; locally abundant in two small thickets; May.

*Prunus serotina* Ehrh. Black Cherry. Moist to mesic prairie; rare; May.

*Rosa carolina* L. Wild Rose. Mesic to dry prairie; infrequent; June.

*Rosa suffulta* Greene Wild Rose. Mesic prairie; infrequent; June.

*Rubus allegheniensis* Porter Common Blackberry. Swale, above the spring; locally common; May.

*Rubus flagellaris* L. Northern Dewberry. Swale; locally abundant; May.

*Spiraea alba* DuRoi Meadow Sweet. Marsh edges and swale; locally abundant, forming small thickets; June.

*Rubiaceae (Madder Family)*

*Galium obtusum* Bigel. Bedstraw. Swale; frequent; June.

*Galium trifidum* L. Bedstraw. Swale; frequent; June.

*Rutaceae (Rue Family)*

*Xanthoxylum americanum* Mill. Prickly Ash, Toothache-tree. Moist prairie; a small thicket was present near the northern boundary; May.

*Salicaceae (Willow Family)*

*Populus tremuloides* Michx. Quaking Aspen. Swale; infrequent; May.

*Salix bebbiana* Sarg. Beaked Willow. Swale; infrequent; May.

*Salix candida* Fluegge Sage-leaved Willow. Swale; rare, only two shrubs were found; May.

*Salix discolor* Muhl. Pussy Willow. Marshes and swale; frequent; April.

*Salix petiolaris* Sm. Willow. Marshes and swale; April.

*Salix rigida* Muhl. Heart-leaved Willow. Swale; infrequent; April.

*Santalaceae (Sandalwood Family)*

*Comandra umbellata* (L.) Nutt. Bastard Toad-flax. Mesic to dry prairie; frequent; May.

*Saxifragaceae (Saxifrage Family)*

*Heuchera richardsonii* R. Br. Prairie Alumroot. Moist to mesic prairie; infrequent; June.

*Penthorum sedoides* L. Ditch Stonecrop. Swale; infrequent; July.

*Saxifraga pennsylvanica* L. Swamp Saxifrage. Swale; frequent; May.

*Scrophulariaceae (Figwort Family)*

*Mimulus ringens* L. Monkey Flower. Swale; infrequent; July.

*Gerardia purpurea* L. Gerardia. Marsh edges; rare; Aug.

*Pedicularis lanceolata* Michx. Lousewort. Moist prairie; infrequent; Aug.

*Veronica scutellata* L. Speedwell. Swale; rare; June.

*Veronicastrum virginicum* (L.) Farw. Culver's Root. Marsh edges and swale; frequent; July.

*Solanaceae (Nightshade Family)*

*Physalis heterophylla* Nees Ground Cherry. Mesic prairie; infrequent; June.

*Physalis virginiana* Mill. Moist to dry prairie; frequent; June.

*Solanum carolinense* L. Horse Nettle. Mesic prairie; rare; apparently restricted to a small disturbed area near the southeastern boundary; July.
*Solanum nigrum* L. Black Nightshade. Marsh edge; apparently rare; Aug.

*Ulmaceae (Elm Family)*

*Ulmus americana* L. American Elm. Swale; infrequent, a number of small trees, mostly under 3 m, were growing on drier parts of the swale; April.
•*Ulmus pumila* L. Siberian Elm. Moist to dry prairie; infrequent, apparently the seed source was a wind break across the road, west of the prairie. Most of the trees are under 2 m.

*Umbelliferae (Parsley Family)*

*Cicuta maculata* L. Water Hemlock. Marshes and swale; infrequent; June.
*Eryngium yuccifolium* Michx. Rattlesnake-master. Moist prairie; rare, only one plant was found, near the western boundary; Aug.
*Oxypolis rigidior* (L.) Raf. Cowbane. Marshes and swale; infrequent; Aug.
*Sium suave* Walt. Water Parsnip. Swale; rare; Aug.

*Verbenaceae (Vervain Family)*

*Verbena hastata* L. Blue Vervain. Marsh edges and moist prairie; frequent; July.
*Verbena X rydbergii* Moldenke (*V. hastata* X *V. stricta*). Mesic prairie; infrequent; June.
*Verbena stricta* Vent. Hoary Vervain. Moist to dry prairie; frequent; June.

*Violaceae (Violet Family)*

*Viola papilionacea* Pursh Meadow Violet. Swale; infrequent; May.
*Viola pedata* L. Bird-foot Violet. Mesic prairie; locally abundant, with obvious variation between clones; May.
*Viola pedatifida* G. Don Prairie Violet. Mesic prairie; infrequent; May.

*Viola sagittata* Ait. Arrow-leaved Violet. Moist to mesic prairie; frequent; May.
*Viola sororia* Willd. Woolly Blue Violet. Swale; infrequent; May.

*Vitaceae (Grape Family)*

*Parthenocissus vitacea* (Knerr) Hitch. Virginia Creeper. Moist to mesic prairie; infrequent along boundary fence-lines; May.
*Vitis riparia* Michx. Wild Grape. Mesic prairie; rare.

## SUMMARY

| | *Families* | *Genera* | *Species* Native | Naturalized |
|---|---|---|---|---|
| Pteridophyta | 2 | 3 | 5 | 0 |
| Spermatophyta | | | | |
| Gymnospermae | 1 | 1 | 1 | 0 |
| Angiospermae | | | | |
| Monocotyledoneae | 12 | 49 | 81 | 7 |
| Dicotyledoneae | 48 | 118 | 171 | 15 |
| Subtotal | | | 258 | 22 |
| Total | 63 | 171 | 280 | |

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Mammal species known or expected from the Cedar Hills Sand Prairie (Schwartz from Cuthrell and Perkins 1989)

| Scientific name | Common name |
|---|---|
| Didelphis virginiana | Virginia opossum |
| Sorex cinereus | masked shrew |
| Blarina brevicauda | short-tailed shrew |
| Scalopus aquaticus | eastern mole |
| Sylvilagus floridanus | eastern cottontail |
| Lepus townsendii | white-tailed jack rabbit |
| Marmota monax | woodchuck |
| Spermophilus franklinii * | Franklin's ground squirrel |
| S. tridecemlineatus | 13-lined ground squirrel |
| Geomys bursarius | plains pocket gopher |
| Perognathus flavescens * | plains pocket mouse |
| Reithrodontomys megalotis | western harvest mouse |
| Peromyscus leucopus | white-footed mouse |
| P. maniculatus | deer mouse |
| Microtus ochrogaster * | paririe vole |
| M. pennsylvanicus | meadow vole |
| Mus musculus | house mouse |
| Zapus hudsonius | meadow jumping mouse |
| Canis latrans | coyote |
| Vulpes vulpes | red fox |
| Urocyon cinereoargenteus | gray fox |
| Procyon lotor | raccoon |
| Mustela erminea | ermine |
| M. frenata | long-tailed weasel |
| M. nivalis | least weasel |
| Taxidea taxus | badger |
| Spilogale putorius * | spotted skunk |
| Mephitis mephitis | striped skunk |
| Odocoileus virginianus | white tailed deer |

* = expected to occur at the prairie but not verified

Bird species known from the Cedar Hills Sand Prairie (Cuthrell and Perkins 1989)

| Scientific name | Common name |
|---|---|
| Anas platyrhynchos | Mallard |
| A. discors | Blue-winged teal |
| Phasianus colchicus | Ring-necked pheasant |
| Charadrius vociferus | Killdeer |
| Bartramia longicauda | Upland sandpiper |
| Zenaida macroura | Mourning dove |
| Geothlypis trichas | Common yellowthroat |
| Agelaius phoeniceus | Red-winged blackbird |
| Carduelis tristis | American goldfinch |
| Colinus virginianus | Bobwhite |
| Oolichonyx oryzivorus | Bobolink |
| Xanthocephalus xanthocephalus | Yellow-headed blackbird |
| Melospiza melodia | Song sparrow |
| Tyrannus tyrannus | Eastern kingbird |

Butterfly species recorded at the Cedar Hills Sand Prairie (Cuthrell 1988-89 and Schlicht 1989 from Cuthrell and Perkins 1989)

| Scientific name | Common name |
|---|---|
| Pholisora catullus | Common sootywing |
| Polites coras | Yellowpatch skipper |
| P. themistocles | Tawny-edged skipper |
| P. origenes | Crossline skipper |
| P. mystic | Long dash |
| Atrytone delaware | Delaware skipper |
| Poanes hobomok | Hobomok skipper |
| Poanes viator | Broad-winged skipper |
| Euphyes dion | Sedge skipper |
| E. conspicua | Black dash |
| E. bimacula | Two-spotted skipper |
| Pontia protodice | Checkered white |
| Artogeia rapae | Cabbage white |
| Colias philodice | Common sulphur |
| C. eurythem | Orange sulphur |
| Lycaena phlaeas | American copper |
| Gaeides xanthoides | Great grey copper |
| Hyllolycaena hyllus | Bronze copper |
| Epidemia helloides | Purplish copper |
| Harkenclenus titus | Coral hairstreak |
| Strymon melinus | Gray hairstreak |
| Everes comyntas | Eastern tailed blue |
| Celastrina ladon | Spring azure |
| Euptoieta claudia | Variegated fritillary |
| Speyeria cybele | Great spangled fritillary |
| S. aphrodite | Aphrodite |
| S. idalia | Regal fritillary |
| Clossiana selene | Silver bordered fritillary |
| C. bellona | Meadow fritillary |
| Charidryas gorgone | Gorgone crescentspot |
| C. nycteis | Silvery crescentspot |
| Phyciodes tharos | Pearly crescentspot |
| Vanessa virginiensis | American painted lady |
| V. cardui | Painted lady |
| V. atalanta | Red admiral |
| Satyrodes eurydice fumosa | Eyed brown |
| Cercyonis pegala | Wood nymph |
| Danaus plexippus | Monarch |

512 2nd Ave., SE
Dyersville, IA 52040
Sept. 11, 1986

Dr. Daryl Smith
Head-Dept. of Biology
UNI
Cedar Falls, IA

Dear Dr. Smith:

Sorry I couldn't get to the Prairie Heritage meeting this week. I am interested in the Cedar Hills Prairie since I once lived a mile north of this place and spent a few years of my youth hunting and trapping over this prairie and the marshes to the east. Later as a student at Iowa State Teachers Dr. Roy Abbot and I collected small mammals on this prairie.

I recall crossing the sand prairie in April and early May in 1932 and finding the wooly precocious young of the white-tail jackrabbit crouched in barren sand depressions where they were born. The lark sparrow and the little red squirrel were two unusual animals that I found in a black oak savannah to the northeast of the prairie site. The red squirrel is probably endangered in Iowa now. The only other place where I have seen the lark sparrow was in the Rockville Cedar Glade four miles south of Dyersville. One specimen of red squirrel was caught in a trap by George Pashby a mile north of the sand prairie and I placed the skin in the Iowa State University mammal collection in 1938.

In 1932 a few prairie chickens used the sand prairie for their mournful, moaning mating rites. They nested and raised their chicks in the spartina and blue stem swales and I saw as many as 30 in a winter flock that foraged in our corn and bean fields. These birds were still around in 1940, the last time I visited the area.

Dr. Abbot and I collected small mammals on the prairie and on farms in the next section north of the prairie. The dusky pocket mouse and Dykes harvest mouse lived in sand burrows and were quite abundant. (the harvest mouse could be easily mistaken for a house mouse except for the grooves in the upper incisors.) The prairie whitefooted mouse, Pennsylvania vole, the prairie vole, large shortailed shrew, pocket gopher, 13 lined ground squirrel, Franklins ground squirrel, and the common mole were common in the area. Predators were the long-tailed weasel which used gopher and Franklin squirrel burrows for dens, the least weasel which used mole runs for den sites, and the spotted skunk which also lived in the burrows of gophers and Franklin squirrels. The large striped skunk and the opossum used the dens of badgers and woodchucks. Two varieties of muskrat were found in the prairie marshes. About 3/4 of the population was the dark eastern form and 1/4 were the rusty red western plains form. The Beaver Creek and west fork of the Cedar River are in the intergradation zone. The mink commonly used muskrat dens, woodchuck and Franklin squirrel burrows for their den sites.

Both the red fox and racoon ranged over the prairie and bedded down in the spartina grass swales. Gray foxes and fox squirrels lived in the black oak savannahs and chipmunks, flying squirrels and the deer mouse also were found there. Both the red bat and hoary bat roosted in the wild grape and hazle brush of the savannah during the summer months.

In the winter barred owls and great horned owls hid in the brown leaves that remained on the black oaks. I often saw ten to twenty short eared owls flying over the tallgrass swales on winter days and they sometimes roosted in the black oaks and in white pines on a farmstead north of the prairie.

Three species of rails reared their black chicks in the wet swales of the prairie. In the spring the "bump-wump" of the American bittern drowned out the raucus call of the yellow headed blackbird. I also found a least bittern hiding in the tall grass in the prairie swale.

Meadow larks, horned larks, field sparrows and vesper sparrows nested on the prairie and I often saw the killdeer there but never found a nest. The upland plovers reared young on the prairie each summer and bob-o-links nested in the tall grass bordering the swales.

These are recollections of nearly 50 years ago and many changes since then have no doubt changed the picture. I took the Iowa ornithologists to this prairie in 1936 or 1937 during their spring meeting and found a large number of northern phalaropes, greater yellowlegs, and lesser yellowlegs on one of the seepage ponds. I called this prairie to the attention of Martin Grant in 1950 and am surprised that no interest was taken in this place till 1969.

Best wishes for your preservation efforts.

Sincerely,

Emmett Polder

P.S. May 21, 1990

I just uncovered this letter and will add that spring peepers, chorus frogs, leopard frogs, toads, and spotted salamanders lived in and about the marshes of the sand prairie. The leopard frogs & toads were preyed on by red banded garter snakes, yellow striped ribbon snakes and hog nosed snakes. Both the bull snake and the fox snake were abundant there. The red shouldered hawks that nested in the Bensen woods on Beaver Creek preyed on the garter and ribbon snakes of the sand prairie.

Insects and spiders of the sand prairie were quite different from those on the black soils south and west of the prairie. I particularly remember the ants with red abdomens, red winged grasshoppers and the big black wolf spiders that made deep burrows in the sand.

This list may give you some idea of changes that occurred in the 50 years since I last visited this place.

By the way could you check with the curator of the UNI museum to see if there is a pleistocene bison skull in the collection? I unearthed this skull near Union bridge about 6 or 7 miles north of Cedar Falls and left it with Dr. Cable to put in the museum. My full name then was Polderboer. I have since shortened the name.

If the skull is still there I may come to C.F. and have another look at it.

Sincerely,

E. Polder

P.S. again--

There was a small marsh in the middle of the section north of the sand prairie. As I recall there was a fen-like growth of moss on the south bank of the marsh. It may still be there and be of interest to you. I often thought I should have trapped it to see if there were red-backed mice and short-tailed weasels living there.

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## YOKUM QUARRY, FINCHFORD

Yokum Quarry has been visited on previous field trips, including the 1972 Tri-State Field Conference, the 1972 Geological Society of Iowa field trip, and the 1986 Geological Society of Iowa field trip (Anderson, 1972a, Anderson 1972b, and Bunker, Witzke, and Day, 1986). The stratigraphic section (Figure 1) and description for Yokum Quarry are taken from a section by B. J. Witzke, B. J. Bunker, and J. Day, 1985 (p. 30-33, Geological Society of Iowa Guidebook No. 44).

Erik Spande (1987) conducted a petrographic study of the Idlewild Member of the Lithograph City Formation from exposures at the Yokum Quarry, near Finchford, Iowa. His study confirmed the interpretations of Bunker, Witzke, and Day (1986) that the upper Lithograph City Formation represented deposition under regressive conditions. Spande interpreted the lower beds (19 and 20) of the Idlewild to indicate deposition under low-energy conditions based on the presence of articulated ostracods, unabraded bioclasts of stromatoporoids, and an abundance of micritic limestone. Units 22-26 display predominantly intraclastic and bioclastic textures, indicating a greater degree of agitation. Well-rounded quartz grains are moderately abundant in units 25-26, and suggest derivation of quartz sand from a terrigenous source (perhaps from Lower Paleozoic quartz sandstones). Unit 27 displays complete ostracods and micrite with some desiccation features.

Bunker, Witzke, and Day (1986) suggest that the upper beds at this location may represent a tidal channel facies. Overall the Lithograph City Formation represents deposition in a shallow marine setting (about 370 million years ago) at a time of worldwide lowering of sea level (Bunker, 1991).

Stromatoporoids are the most abundant fossils in the quarry but brachiopods, gastropods, crinoid stems, and nautiloids, are also known. Jaw parts of marine worms (scolecodonts) have been recovered from the shales of the Thunder Woman Member. Figure 2 illustrates two common varieties of stromatoporoids found at this site.

What are stromatoporoids?

Stromatoporoids (or stromatoporates as they are sometimes called) were assigned to the hydrozoan cnidarians in the Treatise on Invertebrate Paleontology (Le Compte, 1956). Many paleontologists still consider this to be a valid placement. Stearn (1975) suggested that stromatoporoids are closely related to modern sclerosponges, and he presented a reconstruction of the proposed soft-part anatomy of the stromatoporate animal modeled after sclerosponges. Kazmierczak and Kempe (1990) argue that coccoid cyanobacteria are modern analogs of Paleozoic stromatoporoids, and they document mat structures produced by modern coccoid cyanobacteria in alkaline lakes that are linked to the sea. These modern mats resemble certain Paleozoic stromatoporoids.

What ever their origin, stromatoporoids are abundant in the Yokum Quarry. Both hemispherical and branching stromatoporoids are common and sufficiently abundant to constitute laterally extensive beds of fossils (biostromes) at several levels in the section. See stratigraphic section (Figure 1 ).

The beds in the Yokum Quarry are not horizontal; they dip to the west-southwest. As noted by Bunker, Witzke, and Day (1986), the exposures at Yokum Quarry are approximately 200 feet higher in the stratigraphic section than beds exposed at Janesville, 2.7 miles to the east. Silurian bedrock is exposed at Loomis Quarry, three miles northeast of Janesville. The Bedrock Map of Iowa shows an elliptical pattern of Silurian rocks in northwest Black Hawk and southwest Bremer counties surrounded by younger Devonian strata. Such a relationship suggests the presence of an anticlinal structure in the area.

The Yokum Quarry is located adjacent to the West Fork of the Cedar River. Pumping is necessary to keep the water level down in that the water table is essentially at the level of the local flood plain. We will not be able to see the lower portion of the stratigraphic section unless the quarry is being pumped at the time of our visit.

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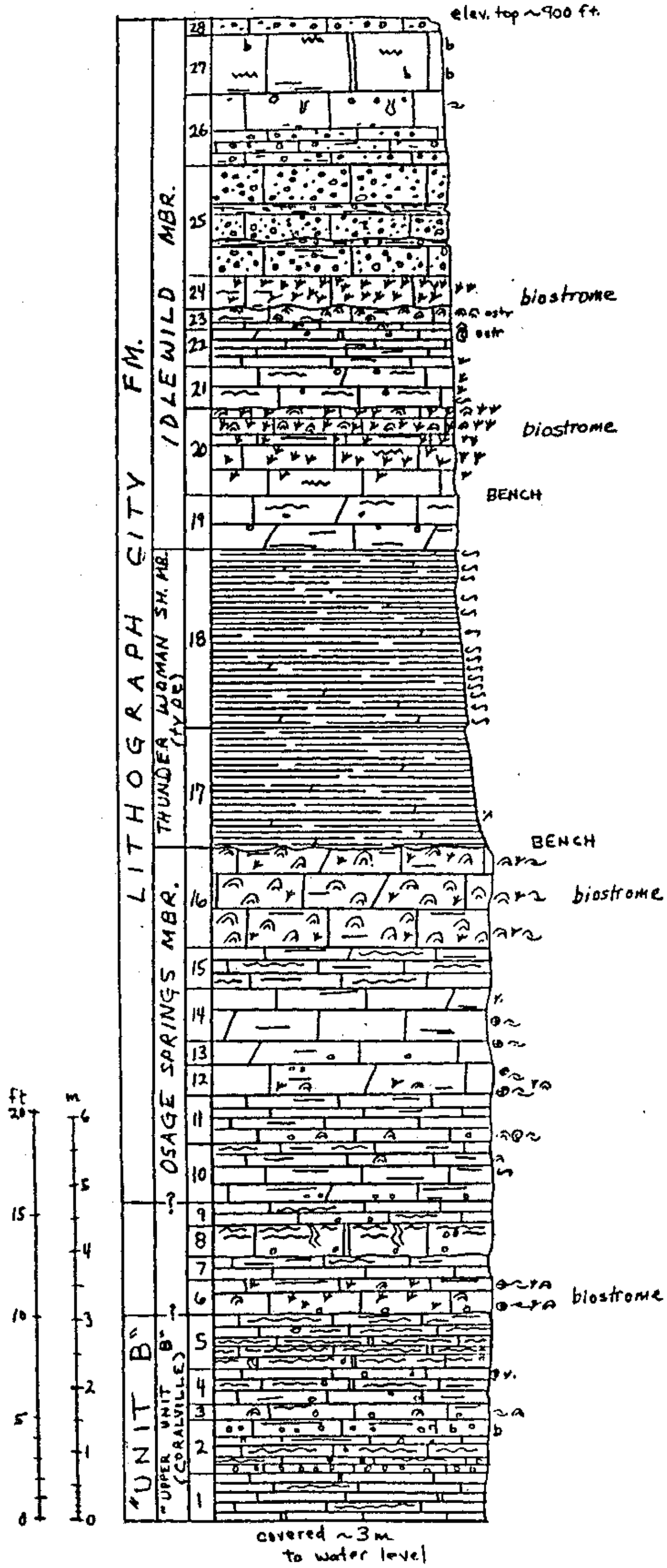



Figure 1. Yokum Quarry, composite section, near Finchford - NW SW section 4, T90N, R14W; Black Hawk County (from Bunker, Witzke, and Day, 1986).

YOKUM QUARRY SECTION

Owned by Basic Materials Corporation (section measured by B. J. Witzke, B. J. Bunker, and J. Day, Iowa Geological survey, 1985).

LOCATION - NW SW Section 4, T90N, R14W; Black Hawk County; elevation of the top of quarry section is approximately 900' (sea level datum)

MIDDLE and UPPER DEVONIAN
CEDAR VALLEY GROUP
LITHOGRAPH CITY FORMATION

IDLEWILD MEMBER

Unit 28 - Limestone, small intraclastic unit, with scattered to rare sand; s0 cm.

Unit 27 - Limestone, very fine to sublithographic, argillaceous, shaley near base, stylolitic, birdseye and stromatactis structures (1-2 mm) throughout; 90 cm.

Unit 26 - Limestone, very fine to extremely fine, slightly argillaceous, dense; thin argillaceous partings in lower half, with small scattered intraclasts (< 1 mm), scattered to abundant fine to medium quartz sand; upper part includes scattered sand, calcite-replaced brachiopods (spiriferids?), stromatactis structures near top; 1.1m.

Unit 25 - Limestone, prominent intraclastic unit, part slightly argillaceous, scattered to abundant intraclasts (< 1 mm to 5 cm in size), scattered to abundant fine to medium quartz sand; approximately 45 cm above base occurs a prominent 7-13 cm shale, calcareous, chunky, laterally includes intraclastic lenses, pebbles, slightly sandy; approximately 98 cm above base another prominent shale (18 cm), calcareous, chunky, with scattered intraclasts, sandy; a 3-5 cm shale at top of unit; 1.76 m.

Unit 24 - Limestone, biostrome, slightly dolomitic; abundant branching stromatoporoids (< 1-3 mm diameter), massive stromatoporoids in lower part; upper 10 cm laterally loses stromatoporoids to become replaced by dense limestone, very faintly laminated; 49 cm.

Unit 23 - Limestone, biostrome, abundant ostracods in lower half, in part finely laminated, scattered to abundant stromatoporoids in upper part (to 4 cm diameter), part shaley; 22 cm.

Unit 22 - Limestone, very fine to sublithographic, dolomitic, small scattered intraclasts; scattered small branching stromatoporoids, small irregular stromatoporoids to 3 cm, ostracods, and gastropods; 67 cm.

Unit 21 - Limestone, very fine to extremely fine, burrowed at base, small intraclasts scattered, very faintly laminated in uppermost part; scattered small branching stromatoporoids; 56 cm.

Unit 20 - Limestone, very fine to extremely fine, biostrome, stylolitic, dense, part argillaceous; scattered to abundant branching stromatoporoids (1-2 mm diameter), common small hemispherical stromatoporoids (2-10 cm) in upper 40 cm; uppermost part massive stromatoporoids; 1.29 m.

Unit 19 - Dolomite to calcareous dolomite, very fine to extremely fine, slightly argillaceous; upper part dense, faintly laminated; 85 cm.

THUNDER WOMAN SHALE MEMBER (type section)

Unit 18 - Shale, slightly dolomitic, light - light medium gray, chunky, scattered to numerous horizontal to subvertical burrows; 2.7 m.

Unit 17 - Shale, slightly dolomitic, light - light medium gray, chunky, slightly flakier and softer in top 69 cm, crumbly; 1.78 m.

OSAGE SPRINGS MEMBER

Unit 16 - Limestone, dolomitic, biostrome, matrix of biostrome very argillaceous to shaley, becoming shalier upwards through unit; hemispherical and laminar stromatoporoids (5 - 20 cm) common, branching stromatoporoids, atrypids, spiriferids, and other brachiopods; top of biostrome exhibits a hummocky surface which is displayed at the top of the first bench on the west side of the quarry; 1.20-1.62 m.

Unit 15 - Limestone, extremely fine, dolomitic, dense, thin to flaggy bedded, slightly argillaceous to argillaceous, shaley in upper part, finely laminated (1-5 mm); cliff former; 61 cm.

Unit 14 - Limestone, very fine to extremely fine, dolomitic, dense, slightly argillaceous, slightly nodular in upper half; some skeletal lenses scattered which includes: crinoid debris, spiriferids, and other brachiopods; 78 cm.

Unit 13 - Limestone, very fine to extremely fine, dense, some intraclastic lenses, shaley at top,; spiriferids, and crinoid debris noted near top; 35 cm.

Unit 12 - Limestone, skeletal packstone, crinoid debris, hemispherical stromatoporoids (to 4 cm diameter), digitate stromatoporoids, gastropods, spiriferids, and other small brachiopods; 48 cm.

Unit 11 - Limestone, fine to extremely fine, skeletal wackestone to packstone in lower 1/3, small hemispherical stromatoporoids (to 5 cm diameter) common, small gastropods, spiriferids; flat pebble intraclasts (to 3 cm) scattered throughout; upper 1/3's, Limestone, very fine to extremely fine, slightly argillaceous to shaley, forms recessive unit; 71 cm.

Unit 10 - Limestone, extremely fine to sublithographic, dolomitic in part, dense to massive, argillaceous, thinly bedded, shaley; intraclastic at base (clasts 1 - 8 mm); burrowed in upper half; middle part contains large hemispherical stromatoporoids (to 9 cm in diameter); isolated thin shale part at top; 87 cm.

MIDDLE DEVONIAN
CEDAR VALLEY GROUP
"UPPER UNIT B"
(CORAVILLE)

Unit 9 - Limestone, fine to extremely fine, dense, intraclastic (0.5-15 mm), faintly laminated; 35 cm.

Unit 8 - Limestone, very fine to sublithographic, massive, in part fractured (some shale filled), intraclastic at base (1 mm - 1 cm) with indeterminate elongate molds to 5 mm; becomes faintly laminated with small intraclast (small - medium sand size) molds (skeletal?) in middle part; upper half dense, faintly laminated, with a few small intraclasts; 48 cm.

Unit 7 - Limestone, very fine, dense, very shaley to platy in top half, laminated; irregular surface at top (3 cm relief) with prominent irregular shale (0-6 cm) at contact; 34 cm.

Unit 6 - Limestone, biostrome, massive, highly fractured; intraclastic at base (to 3 cm); scattered skeletal material including: crinoid debris, brachiopods (including spiriferids and Athyris), laminar stromatoporoids Amphipora, and gastropods; 54 cm.

Unit 5 - Limestone, extremely fine to sublithographic, dense throughout, faintly laminated, in part intraclastic 9to 2 cm); scattered lenses of microbreccia in lower part; scattered shale partings throughout; upper part laminated interval which shows local thickening with amplitudes of 2 cm (stromalites?); shaley at top; 79 cm.

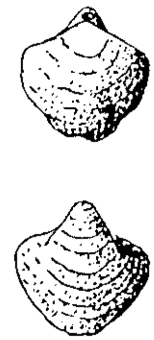
Unit 4 - Limestone, very fine to sublithographic dense; lower 13 cm shaley in part and irregularly bedded; faintly laminated in middle portion of unit, small intraclasts scattered throughout; small gastropods and other indeterminate skeletal debris near top; laterally discontinuous shale part at top; 55 cm.

Unit 3 - Limestone, fine to extremely fine, massive, scattered intraclasts (1-10 mm), upper 6-10 cm dense and faintly laminated, shaley at top; scattered indeterminate brachiopods, few scattered rounded stromatoporoids (to 4 cm in diameter); shale part at top; 27 cm.

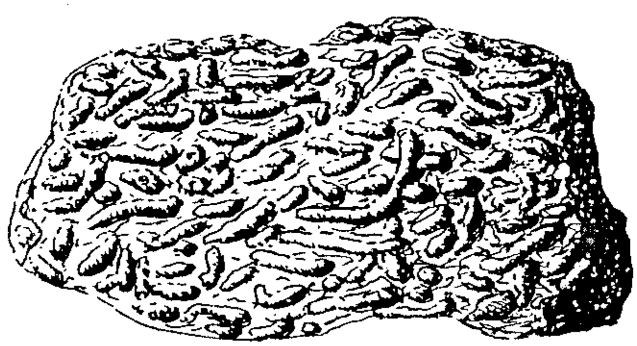
Unit 2 - Limestone, extremely fine to sublithographic at top, fine to extremely fine below, dense throughout; near top scattered calcite spar resembling birdseye grading to intraclastic faintly laminated beds below, clasts medium to coarse sand size with larger clasts to 5 cm; 4 cm shale at top; 83 cm.

Unit 1 - Limestone, extremely fine to sublithographic dense, very faintly laminated in part; 68 cm.

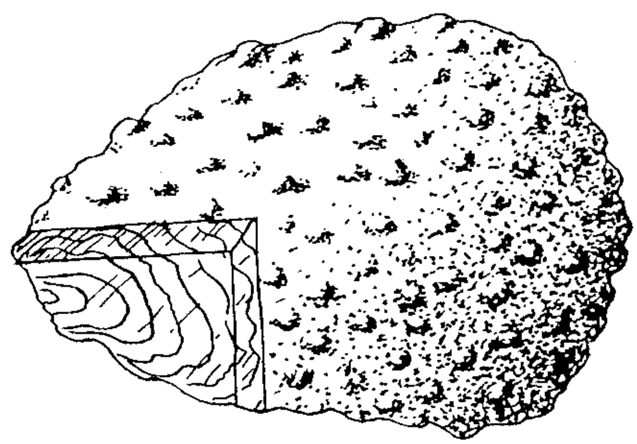
*Staparollus* sp.



*Cranaena* sp.
X 2



*Amphipora* sp.



*Actinostroma* sp.
X 0.75

Figure 2. Representative fossils from the Yokum Quarry. The drawings are actual size unless indicated otherwise. Drawings by Tom Wagner (from 1972 Tri-State Guidebook).

## SILURIAN-DEVONIAN UNCONFORMITY
## LOOMIS QUARRY, DENVER, IOWA

Loomis Quarry (Figure 1) is operated by the Paul Niemann Construction Company, Sumner, Iowa. Dorheim and Koch (1962) described an unusual exposure of the Silurian-Devonian unconformity at this site. The quarry was visited in 1972 on the 36th Annual Tri-State Geological Field Conference (Anderson, 1972). Since then, the quarry operation has advanced to the south and portions of the north end of the quarry have been filled with spoil. Gaylen Hiesterman (UNI geology major) is currently studying the unconformity and the beds adjacent to the unconformity as part of an undergraduate research project.

The stratigraphic section described by Anderson (1972) in the north end of the quarry is still representative of the stratigraphic units currently revealed in the south part of the quarry, although there is considerable variation in composition of beds immediately above the unconformity. A stratigraphic section modified from Anderson (1972), with some revision of stratigraphic nomenclature, is shown in Figure 2.

<u>Discussion</u>: In the north end of the quarry, beds of the Wapsipinicon Group rest directly on the Silurian Blanding Formation. The Silurian Hopkinton Formation is absent in the north end of the quarry, but in some parts of the quarry, the Wapsipinicon rests on the Hopkinton Formation. The upper surface of the Hopkinton Formation (Niagaran Series of Dorheim and Koch, 1962) is an erosional surface and is quite irregular. On the west wall of the quarry the Hopkinton dolomites form a large hummock. Beds of the Wapsipinicon Group were deposited on the eroded surface of the Hopkinton adjacent to this hummock (see Figure 3). The hummocky top of the Silurian is also displayed elsewhere in the quarry (see Figure 4). This surface represents an ancient (post-Silurian--pre-Devonian) landscape. Exposures in the Loomis Quarry provide an excellent opportunity to study this ancient surface and the Devonian units that were deposited unconformably on the surface.

Beds 1 and 2 of the section (Little Cedar Formation) contain fossil brachiopods and suggest deposition in a normal marine setting. Bed 2 has been affected by post-depositional processes (perhaps solution and collapse). Unit 2 shows the effects of brecciation with large blocks of dolomite in a matrix of shale.

Bed 3 is a fine-grained limestone (micrite) with appearance and composition characteristic of the Davenport Member of the Pinicon Ridge Formation. This unit is brecciated in places, probably by processes involving solution, collapse, and recementation. Evaporites may have been present in the section initially, with their solution initiating the collapse process.

Bed 4 is structureless and friable, weathering to a yellowish-orange clay and silt. It contains no fossils.

Bed 5 is variable in composition and thickness. Typically, angular clasts of chert are present and are cemented by fine-grained calcium carbonate. Blocks of this chert breccia can be observed at several places in the quarry. In places, a poorly-sorted chert-quartz sandstone occurs at this level (see Figure 5). Gaylen Hiesterman is conducting size-grade analyses and roundness studies of the sandstones and will report on the results.

In places, a chert rubble is observable, resting on the eroded Silurian surface. The chert rubble is in a clay matrix and is found in low areas and "pockets" on the Silurian dolomites (either on the Blanding Formation or on the Hopkinton Formation). This unconsolidated material apparently represents a residium from weathering and solution of cherty dolomites exposed on the post-Silurian--pre-Devonian landscape (see Figure 6).

The Hopkinton and Blanding formations have been dolomitized, but fossils are still recognizable. Pentamerid brachiopods, tabulate corals, horn corals, and stromatoporoids are present. Fossils are better preserved where they have been silicified. Both the Hopkinton and the Blanding contain chert, but the Blanding contains more chert, overall.

Core information from the Iowa State Highway Commission indicates that the Ordovician Maquoketa Shale is encountered 55 feet below the main floor of the quarry. The Bedrock Map of Iowa indicates that Ordovician constitutes the bedrock nearby. The map shows Ordovician rocks surrounded by younger Silurian and Devonian strata, a pattern that is suggestive of an anticlinal structure. Approximately ten miles to the north-northeast, steeply-dipping and structurally-complex Silurian beds are present in a quarry west of Tripoli.

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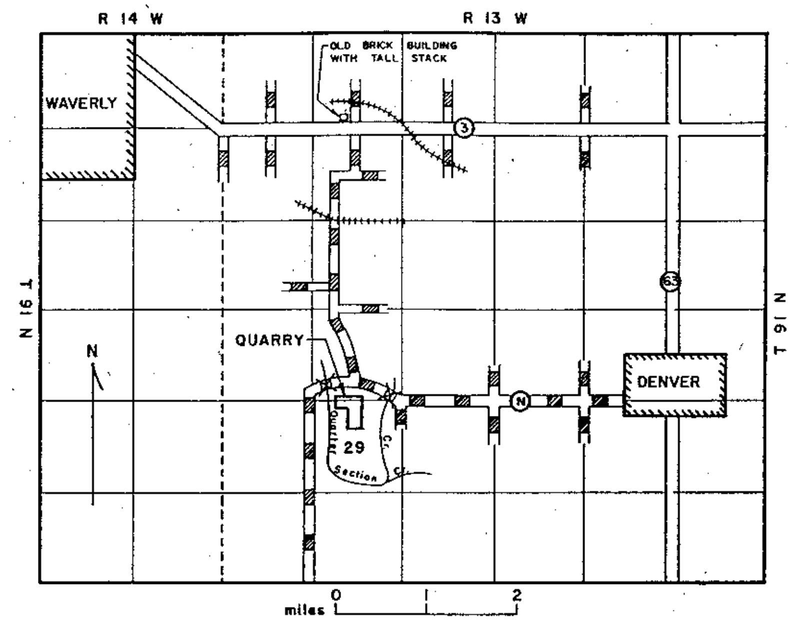



Figure 1. Location Map of Niemann's Loomis Quarry, west of Denver, Iowa (from Dorheim and Koch, 1962, p. 342).

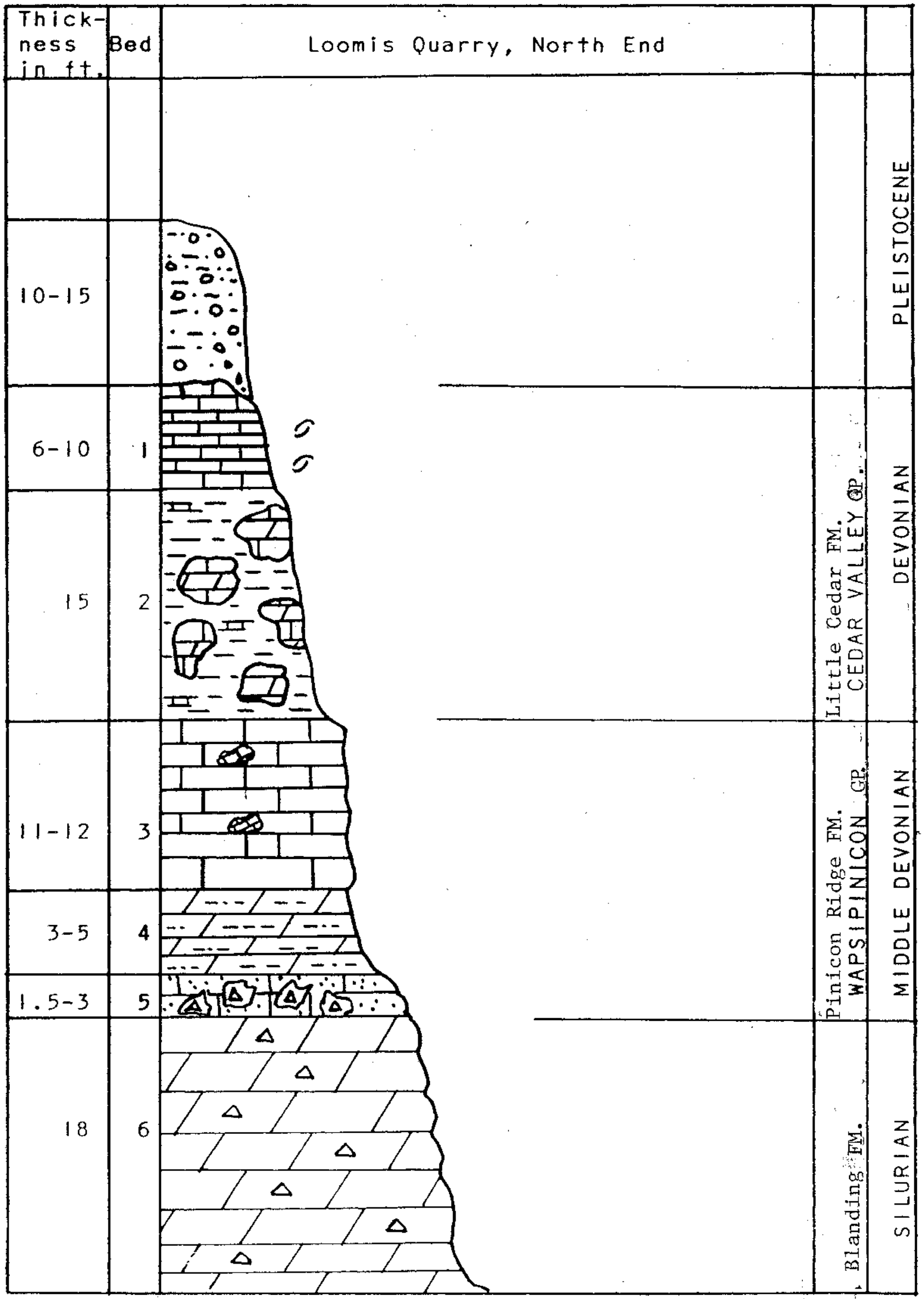



Figure 2. Stratigraphic section, north end, Niemann's Loomis Quarry (modified from Anderson, 1992).

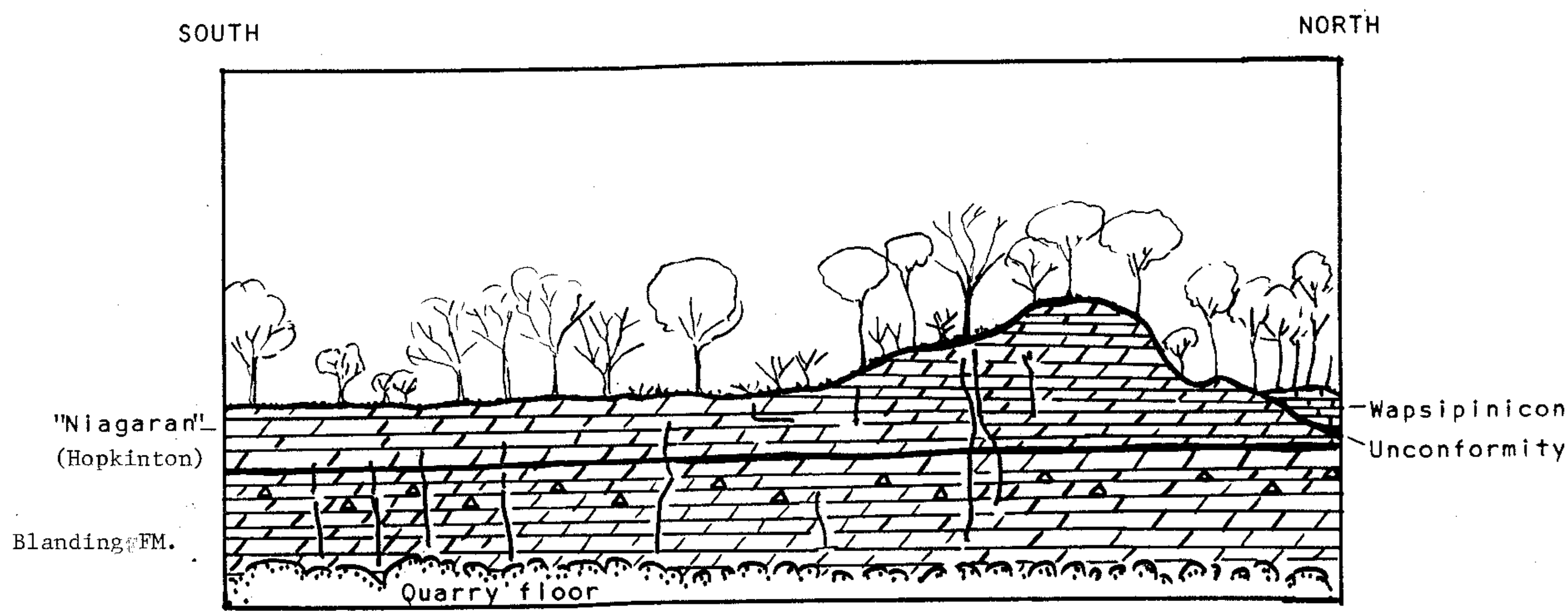



Figure 3. Hummock of Hopkinton Formation ("Niagaran" of Dorheim and Koch, 1962) on west face of quarry. Limestone of the Wapsipinicon Group is exposed on the north side of the hummock. Scale: 1 inch = approximately 20 feet (from Anderson, 1972).

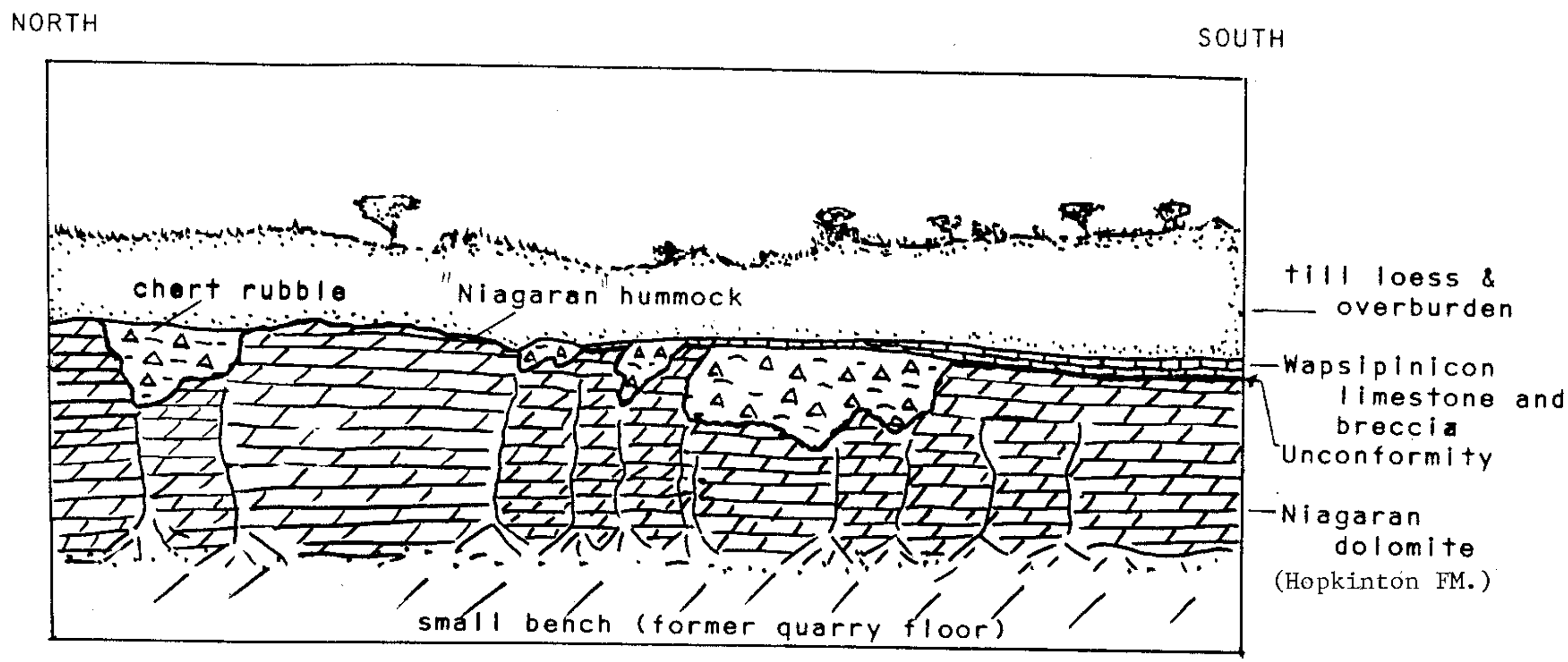



Figure 4. "Niagaran" (Hopkinton Formation) hummocks on east wall of quarry showing pockets of chert rubble. Note that beds of the Wapsipinicon Group overlie chert rubble on the right side of the figure. Figure drawn from a photograph taken October, 1970. The quarry has been deepened since the photograph was taken. Scale: 1 inch = approximately 20 feet (from Anderson, 1972).

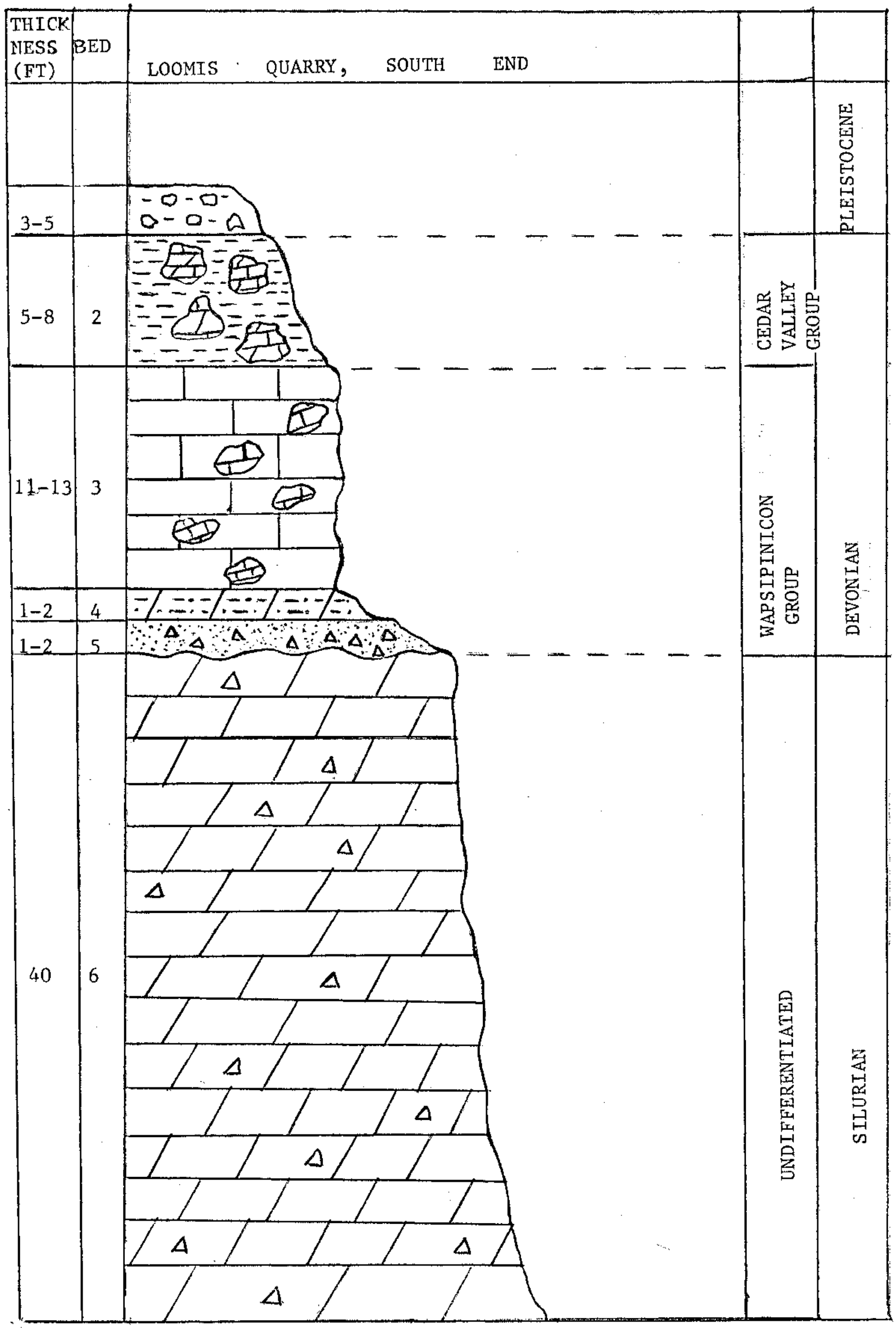



Figure 5. Stratigraphic section in southeast end of Loomis Quarry. Note chert-quartz sandstone resting unconformably or Silurian dolomite. (Section by Gaylen Hiesterman, fall 1991.)

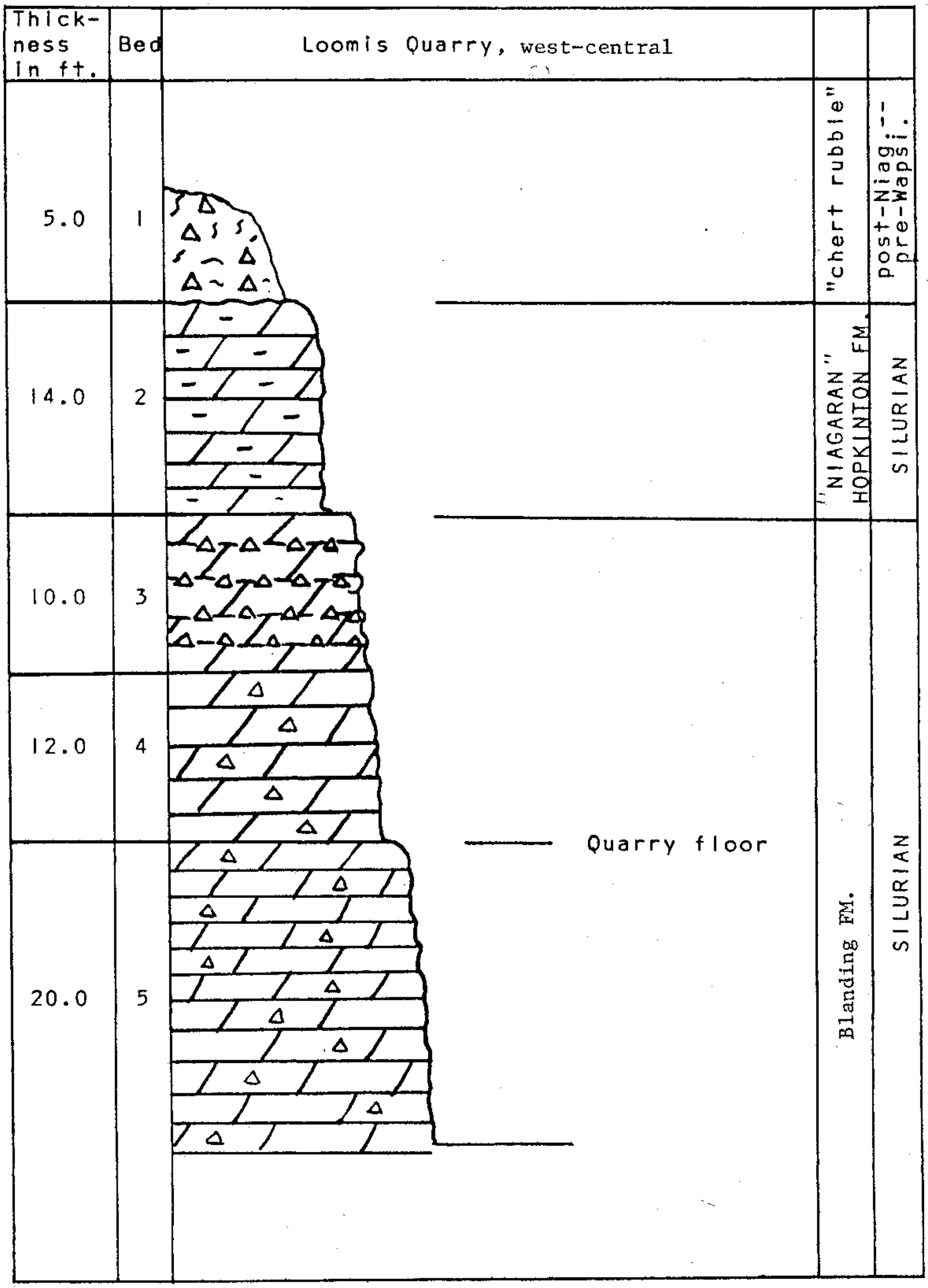



Figure 6. Stratigraphic section, west-central face of Loomis Quarry (from Anderson, 1972).

## PAHA AREA, WEST OF DENVER

Although no formal stop is planned, we will journey east from the Loomis Quarry to view the landscape and land usage of the paha area, west of Denver Iowa (Figures 1 and 2). This wooded hilly terrain has been developed for housing. Figure 3 provides a generalized diagram of a typical paha.

The name "paha" comes from the Dakota Sioux and means "hill" or "ridge". W. J. McGee first applied the name to special streamlined hills in northeastern Iowa. The hills have a distinct orientation of northwest-to-southeast and are capped with silt and fine sand. According to Prior (1992), the distribution and alignment of paha suggest that they formed as wind-aligned dunes in response to strong, prevailing northwest winds that scoured the Iowan Surface during times of glacial cold, between 16,500 and 21,000 years ago.

### References

McGee, W. J., 1891. The Pleistocene History of Northeastern Iowa. Eleventh Annual Report of the Director of the U.S. Geological Survey, Pt. 1: Geology. Washington, D. C.

Prior, Jean C., 1991, Landforms of Iowa, University of Iowa Press, Iowa City, 153 p.

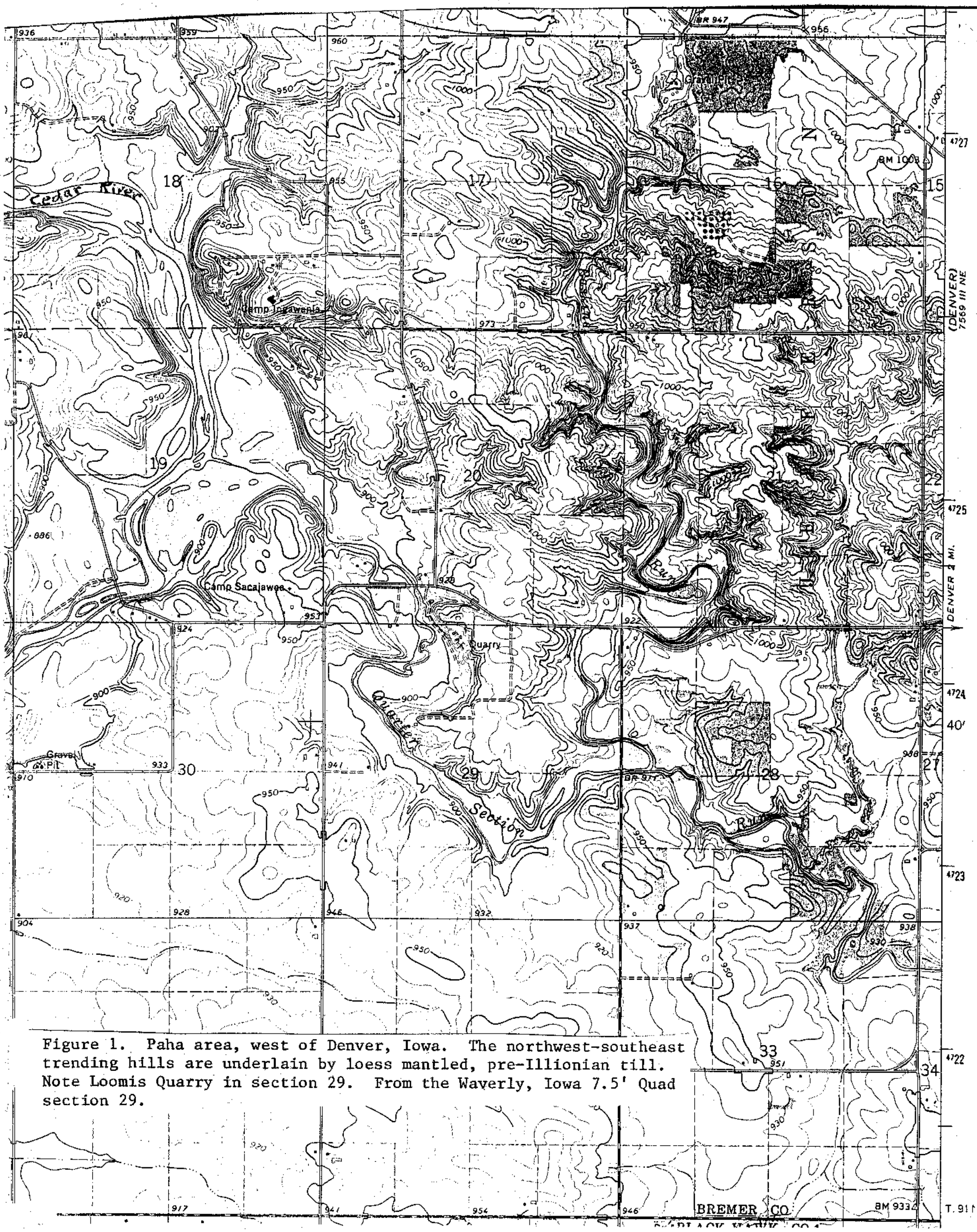



Figure 1. Paha area, west of Denver, Iowa. The northwest-southeast trending hills are underlain by loess mantled, pre-Illionian till. Note Loomis Quarry in section 29. From the Waverly, Iowa 7.5' Quad section 29.

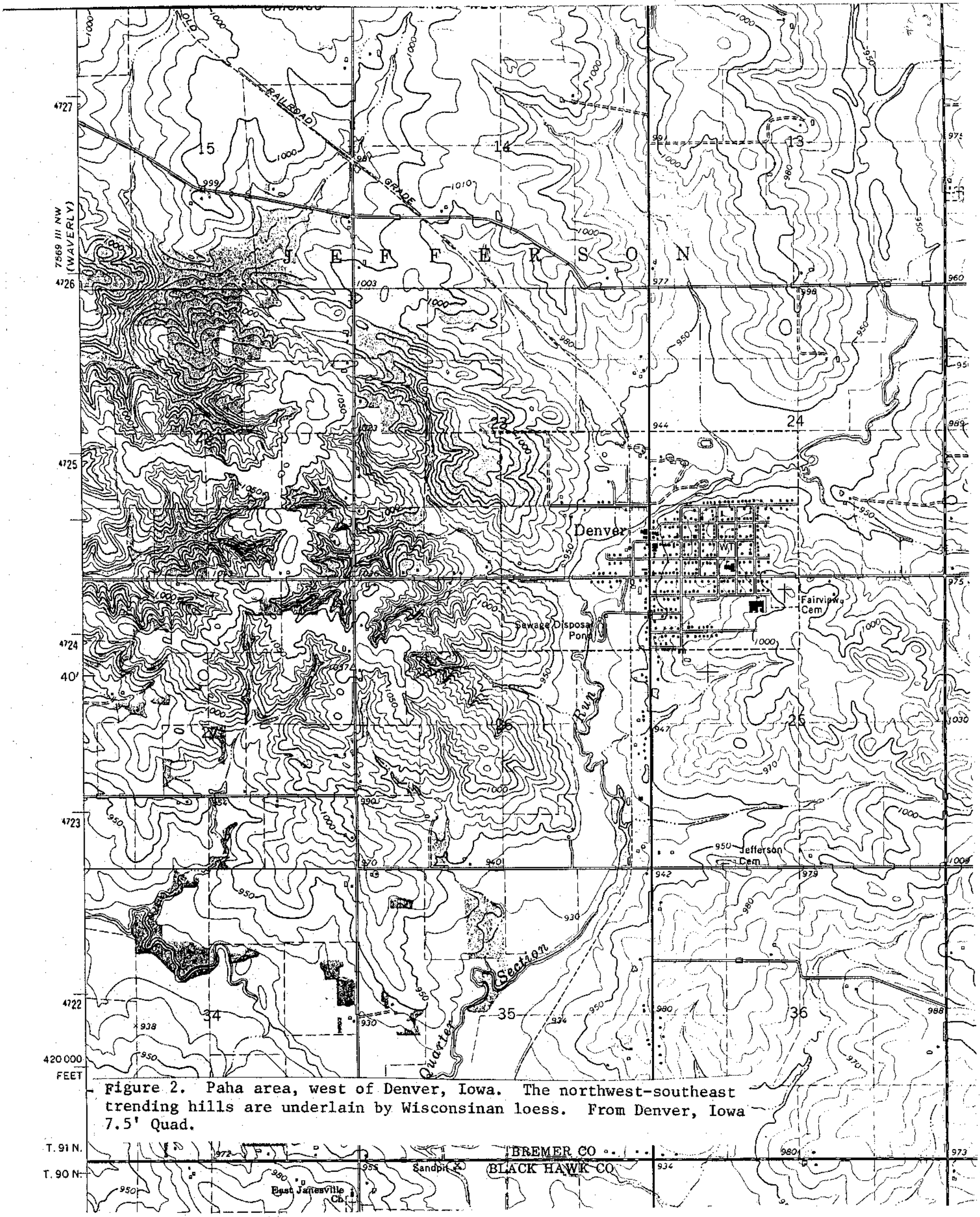



Figure 2. Paha area, west of Denver, Iowa. The northwest-southeast trending hills are underlain by Wisconsinan loess. From Denver, Iowa 7.5' Quad.

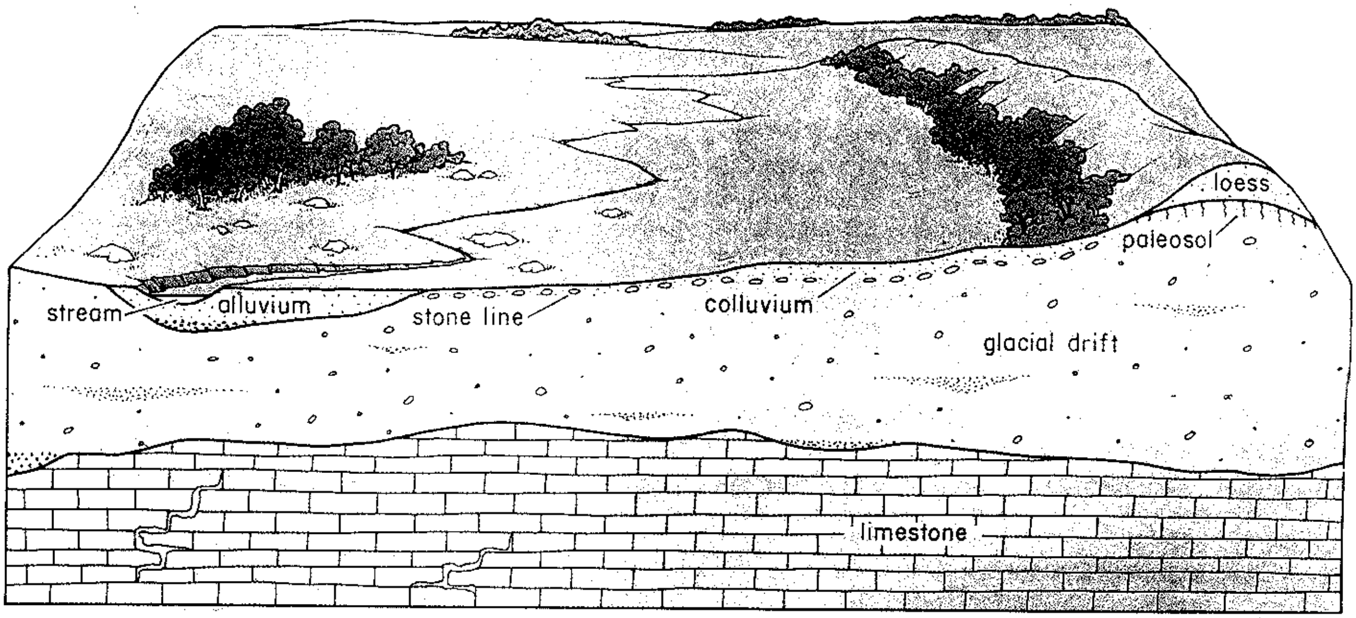
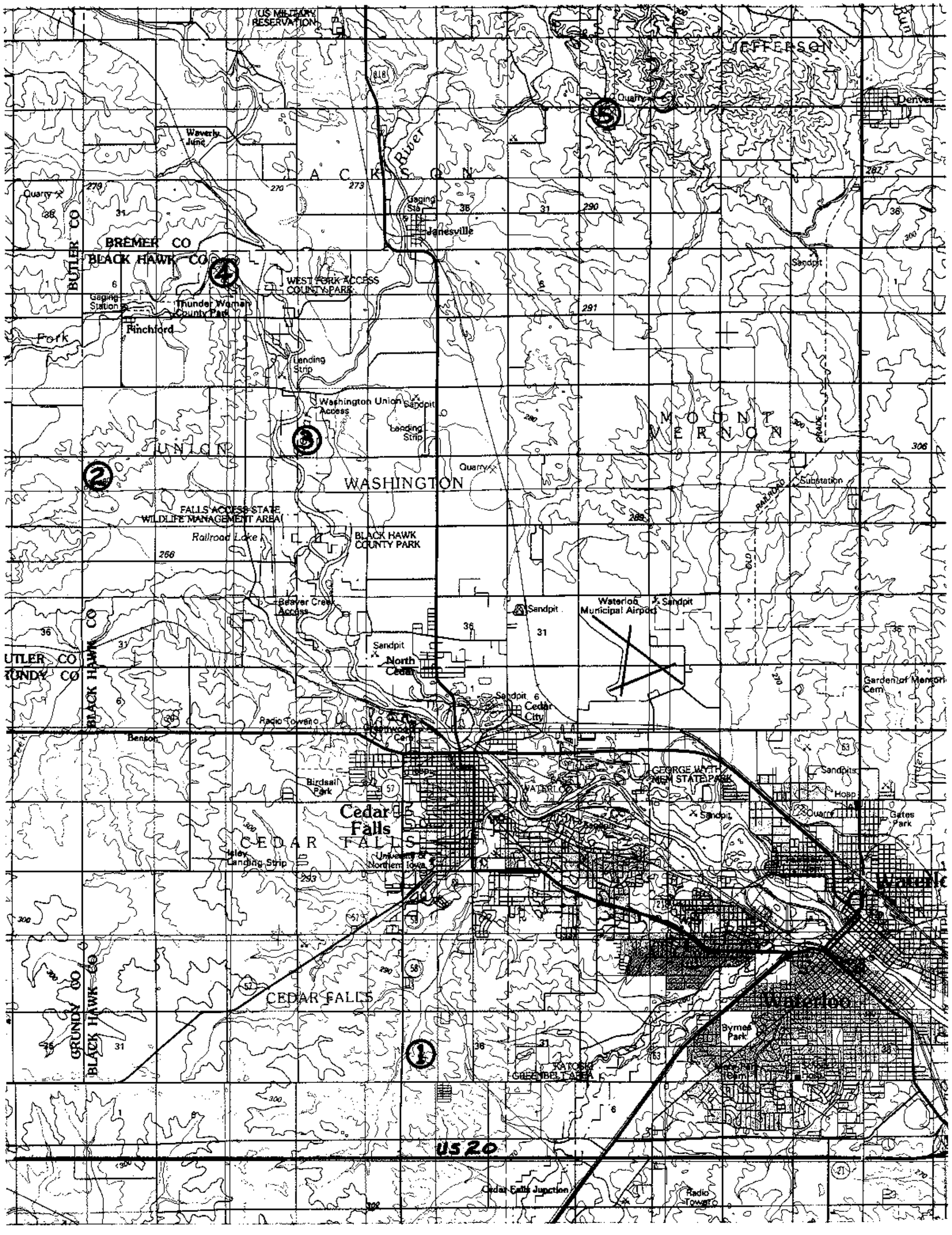



Figure 3. Diagram showing topography and generalized stratigraphy associated with a paha (From Prior, 1992).




LOCATIONS OF FIELD TRIP STOPS

SCALE