GEOLOGICAL SOCIETY OF IOWA

Field Trip Guidebooks Twenty-nine through Thirty

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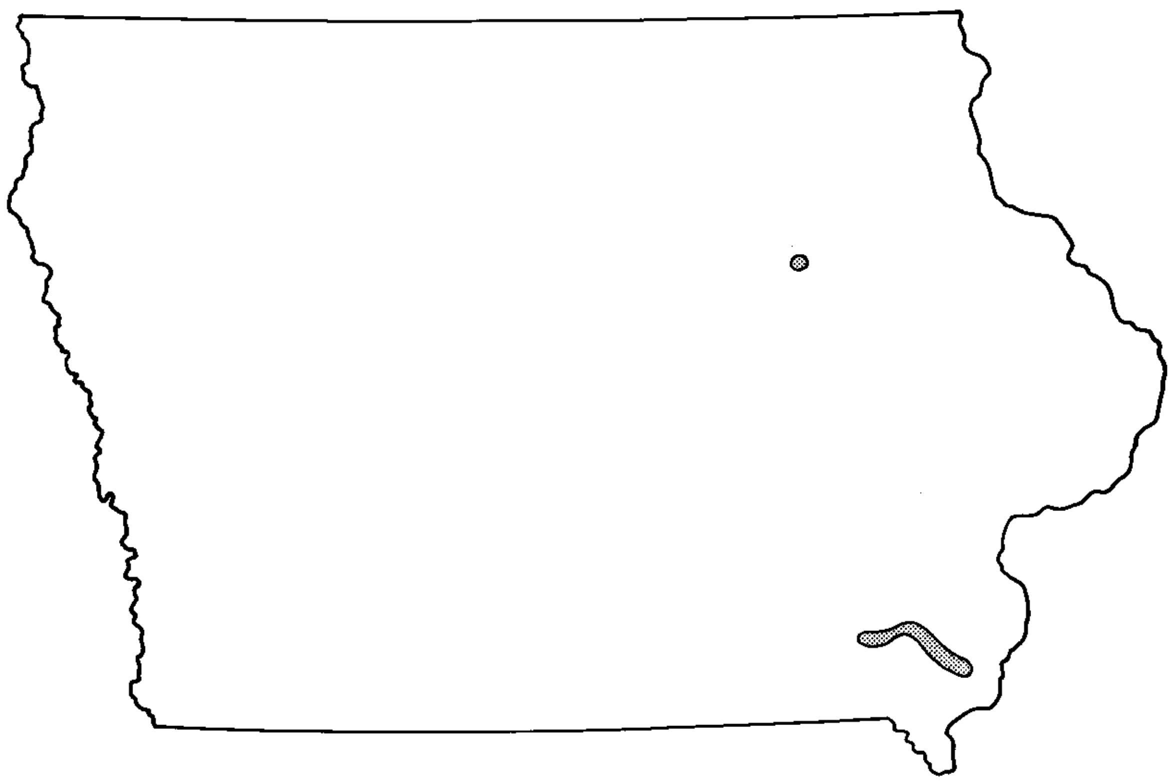

compiled and reprinted

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GUIDEBOOK 29

FIELD TRIP ANNOUNCEMENT

Sponsored by

The Iowa Geological Survey

The Geological Society of Iowa

A professional-interest field trip for the purpose of examination and discussion of the stratigraphy and lithofacies of the Spergen formation (Mississippian-Meramec) of southeast Iowa is planned for Saturday, October 29, 1977. The trip will be led by Bonnie Milne, graduate student in Geology at the University of Iowa. Departure is scheduled for 9:00 a.m. from the east edge of Fairfield, Iowa, along U.S. Rt. 34. Hardhats are required and participants are responsible for their own brown-bag lunch.

Stratigraphy and lithofacies of the Spergen Formation

Southeast Iowa

Leaders: Bonnie Milne
Fred Dorheim

IGS-sponsored field trip

STATE OF IOWA
IOWA GEOLOGICAL SURVEY
123 NORTH CAPITOL STREET
IOWA CITY, IOWA 52242
Phone: (319) 338-1173

Iowa
a place to grow

Stanley C. Grant
Director and State Geologist

Orville J Van Eck
Associate State Geologist

Donald L. Koch
Assistant State Geologist

October 29, 1977

Schedule of Stops

Stop #1 Cedar Creek Quarry, Jefferson County

Section consists of Pennsylvanian coal, shale and sandstones overlying questionable St. Louis and the Spergen Formation. The extremes of lithologic variation within the Spergen are well represented at this location.

Stop #2 Oakland Mills Roadcut

Section consists of St. Genevieve Formation, St. Louis Limestone, Spergen Formation and the Warsaw Shale.

Stop #3 Henry County Quarry, Mt. Pleasant, Iowa

St. Genevieve Formation, St. Louis Limestone and Spergen Formation

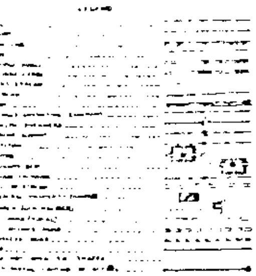
Stop #4 Warsaw Shale - Spergen Formation Roadcut

Roadcut showing contact between the Warsaw Shale and the Spergen Formation. In the past fine specimens of the fenestellid bryozoa Archimedes sp. have been collected at this cut.

Stop #5 Heinold Quarry

St. Louis Limestone and Spergen Formation

Rest Stops and a lunch stop will be scheduled.



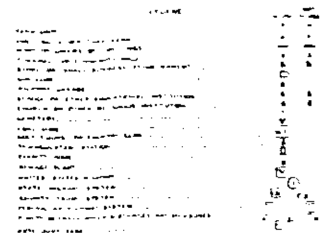
GENERAL HIGHWAY AND TRANSPORTATION MAP
JEFFERSON COUNTY
IOWA

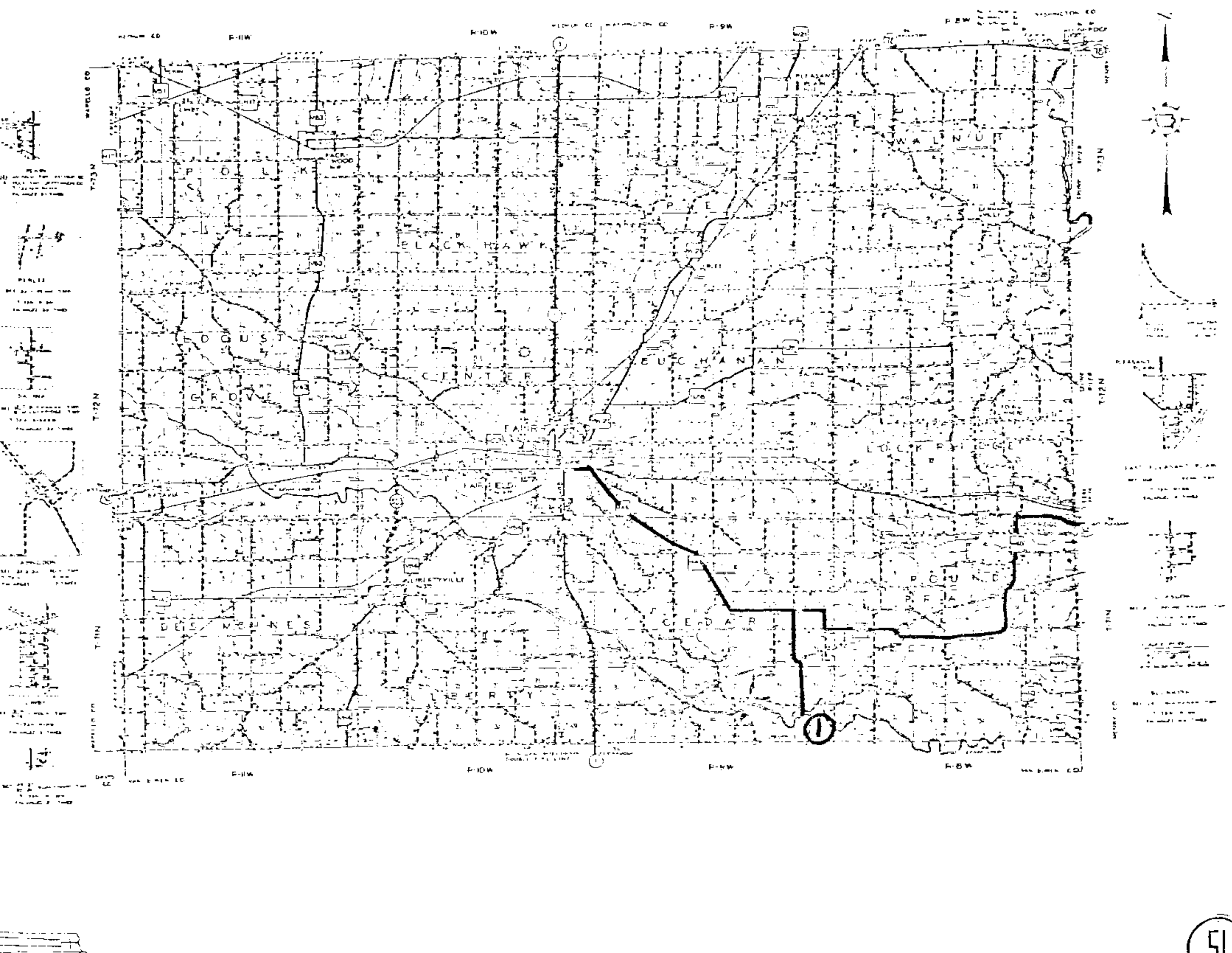
IOWA STATE HIGHWAY COMMISSION

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

HIGHWAY PLANNING SURVEYS DEPARTMENT

1970





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GENERAL HIGHWAY AND TRANSPORTATION MAP

HENRY COUNTY

IOWA

IOWA STATE HIGHWAY COMMISSION

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

HIGHWAY PLANNING SURVEYS DEPARTMENT

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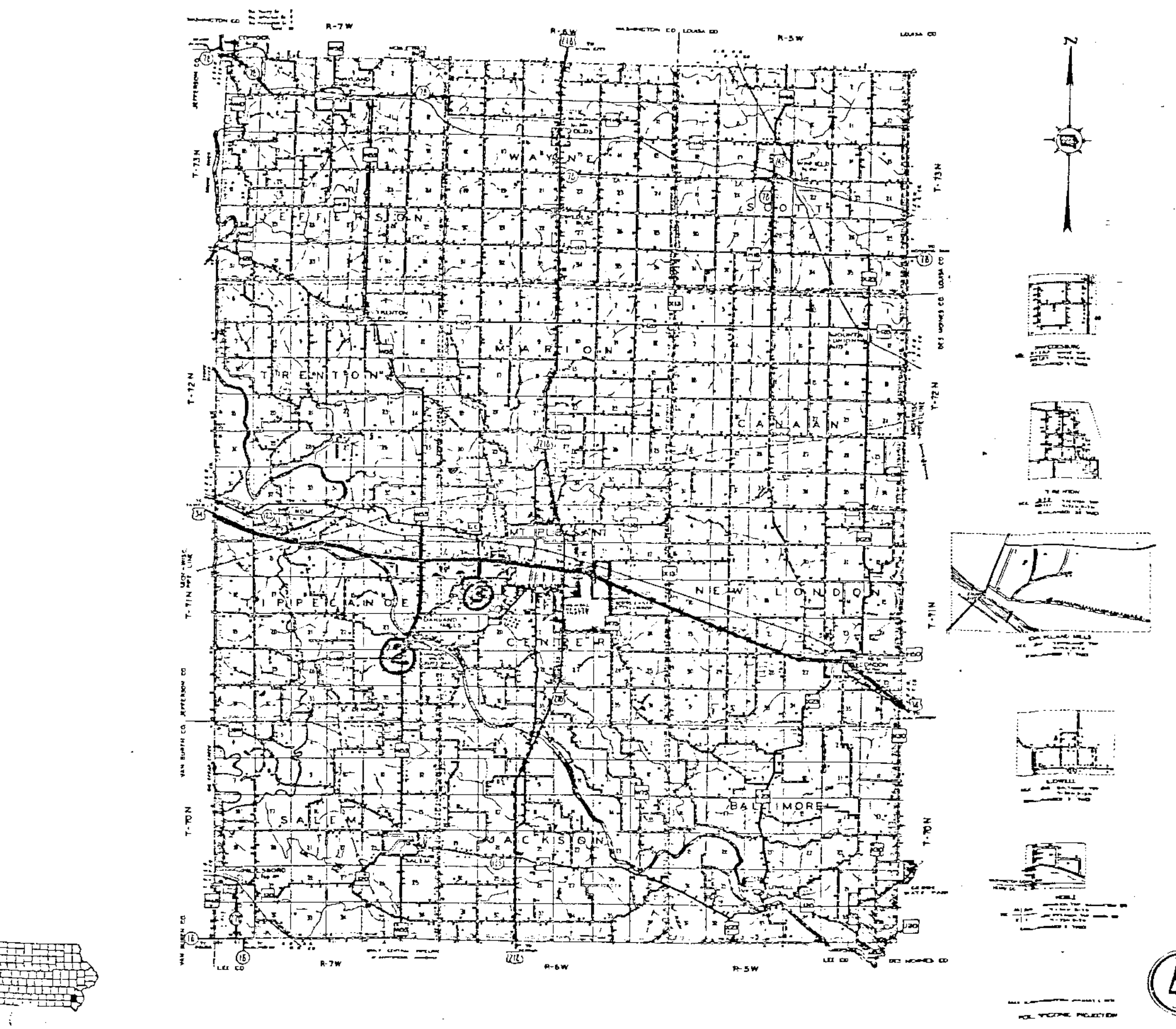
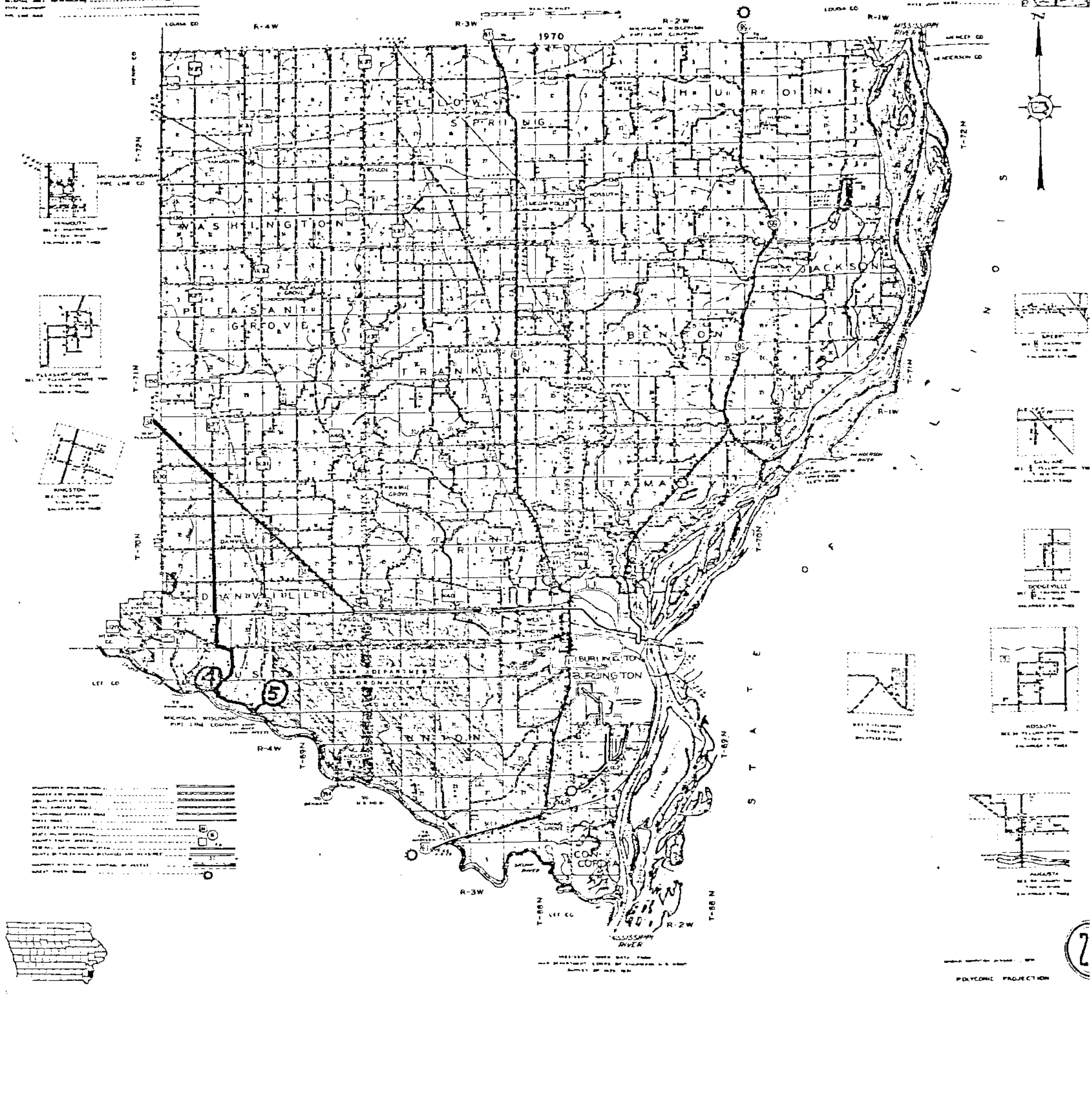


GENERAL HIGHWAY AND TRANSPORTATION MAP
DES MOINES COUNTY
IOWA

IOWA STATE HIGHWAY COMMISSION

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

HIGHWAY PLANNING SURVEYS DEPARTMENT



April 22, 1978
GEOLOGICAL SOCIETY OF IOWA
GUIDEBOOK 30

PINT'S QUARRY

The following discussion is adapted from Kettenbrink, E. C., 1972, The Cedar Valley Formation at Pint's Quarry in General Geology in the Vicinity of Northern Iowa; Guidebook for the 36th Annual Tri-State Geological Field Conference; Dept. of Earth Science, University of Northern Iowa.

INTRODUCTION: Welp and McCarten, Inc. operate "Pint's Quarry," just north of U. S. Highway 20, Raymond, Iowa in the SE¼, Sec. 36, T.89N., R.12W., Black Hawk County. All three members of the Devonian age Cedar Valley Formation are exposed here. The Cedar Valley Formation is the most widespread Devonian formation in the Upper Mississippi Valley. It crops out in a NW-SE trending belt from southern Minnesota through eastern Iowa into western Illinois. The outcrop belt varies in width from 75 miles in the north to 20 miles in the south. The Cedar Valley is recognized in the subsurface throughout Iowa and studies indicate that the Cedar Valley exceeds 500 feet in thickness in the deepest part of its depositional basin. The Cedar Valley was deposited in a broad, ill-defined shallow sea termed the Central Iowa basin (Collinson et al., 1967).

The evolution of Cedar Valley stratigraphic nomenclature is complicated. Current practice divides the formation into three members (Stainbrook, 1941). In ascending order they are Solon, Rapid, and Coralville, all named for localities near Iowa City in Johnson County, Iowa. These divisions were originally based on faunal zones (mainly brachiopods) worked out by M. A. Stainbrook, and published over a period of 30 years (1922-1943). Lithostratigraphic studies substantiate this three-fold subdivision.

In the type area most of the formation is limestone, with minor shaly and dolomitic horizons. Calcilutite with varying fossil and clay content is the dominant lithology. Local concentrations of calcarenites are abundant. Corals and stromatoporoids are major rock formers. Biostromes built by these two groups are locally conspicious in all three members.

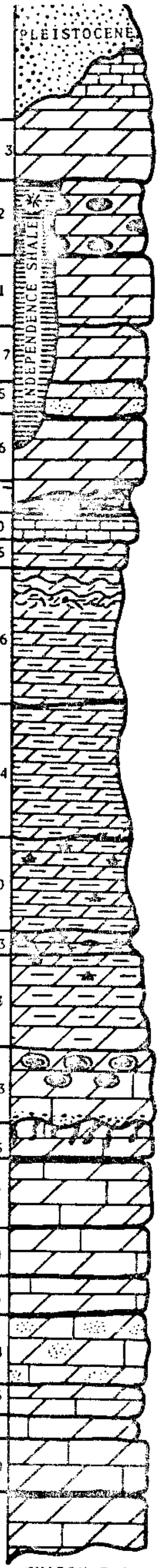
The Solon and Rapid Members represent a marine transgressive sequence, with the Solon being the more "normal" marine. Northward and eastward the Rapid is less fossiliferous and more dolomitic than in the type area, and it may represent a slightly restricted environment. The Coralville Member is lithologically the most variable and represents very shallow water sedimentation. Although minor transgressions did occur, generally the Coralville represents a regressive sequence back into the basin in which the Rapid and Solon were deposited.

The stratigraphic section at Pint's Quarry: Approximately 102 feet of the Cedar Valley Formation is exposed at Pint's Quarry. This includes all of the Rapid Member (41 feet), a portion of the Solon Member (28 feet), and part of the Coralville Member (33 feet). The upper part of the Coralville Member has been removed by erosion and is overlain by Pleistocene till. A core log from the Iowa State Highway Commission indicates that another 42 feet of Solon is present below the quarry floor so the total thickness of the Solon Member at this site is approximately 70 feet.

dolоutite = very fine-grained dolomite
calcilutite = very fine-grained limestone
*Independence Shale is no longer exposed in the quarry.

CEDAR VALLEY FORMATION

Member	Bed Number	Cumulative Thickness	Thickness	Description
CORALVILLE	24	102.0	10.3	dololutite/calcilutite, lower part similar to bed 23, but without calcite, abrupt change in middle to thinly laminated dololutite, top few feet which is poorly exposed is a laminated/thin-bedded calcilutite with scattered intraclasts and fossils.
	23	91.7	4.2	dololutite, dark brown, soft to "earthy" with cavities up to several inches filled with single crystals of dark brown calcite. Top of bed forms third prominent bench.
	22	87.5	4.1	dololutite, similar to beds 20 and 21, but darker and with more iron staining, possible dessication (?) features near top.
	21	83.4	3.7	dololutite, similar to bed 20, but with fewer recognizable fossils.
	20	79.7	1.5	dololutite, similar to bed 19, recrystallized corals produce "blotchy" mottling, concentration of recrystallized brachiopods and crinoid fragments near middle of bed.
	19	78.2	4.6	dololutite, buff, massive, no bedding features, calcite lined vugs present, this ledge forms the second prominent bench in quarry.
	18	73.6	1.2-3.4	dololutite, argillaceous with intraclasts of underlying bed, calcite void filling, much variation in composition, texture.
	17	70.2	1.0	calcilutite, laminated/thin bedded, light color, hard, dense, composed of 90% micritic pellets, no dolomite present.
RAPID	16	69.2	1.5	dololutite, argillaceous, calcitic, light brown, weathered, undeformed.
	15	67.7	10.6	dololutite, argillaceous, similar to bed 14, but finer laminations and more pyrite upper 3 feet contain deformed bedding, some of which closely resemble ripplemarks.
	14	57.1	10.4	dololutite, argillaceous, thinly laminated, scattered horizontal and vertical burrows, small "cut and fill" structures, prominent iron stained zone at top.
	13	46.7	6.0	dololutite, argillaceous, similar to bed 11, no distinct laminations, discontinous layer of chert nodules near top in a prominent iron stained horizon.
	12	40.7	0.3	dololutite, very argillaceous, less resistant unit, contains flat calcite nodules and chert.
	11	40.4	7.3	dololutite, argillaceous, fine pyrite laminations-but not very distinct, more crystal lined vugs in lower half of bed, a few scattered chert nodules near top.
	10	33.1	4.3	dololutite, calcitic, light gray, transitional Rapid lithology, coarser grained than overlying dololutites, lag concentration of phosphatic (fish) fossils and glauconite pellets on disconformity, abundant silicified corals, crystal lined vugs, and silicified "oncolites", top of bed is lowest bench in quarry.
SOLON	9	28.8	1.5	dololutite, calcitic, light brown, fewer vugs and fossils, top of bed is burrowed disconformity with 6 to 8 inches relief and marks the Solon-Rapid contact, distinct color change at contact.
	8	27.3	4.7	dololutite, calcitic, similar to units 5, 6 & 7, but with fewer crystal lined vugs, shaley parting at top of bed.
	7	22.6	4.0	dololutite, calcitic, similar to beds 5 and 6, but with fewer crystal lined vugs, shaley partings at top of bed.
	6	18.6	2.0	dololutite, calcitic, similar to bed 5, fluorite in vugs first noted here.
	5	16.6	5.4	dololutite, calcitic, similar to beds below, abundant scattered vugs in lower part, more abundant solitary corals in upper part, recrystallized corals produce "blotchy" mottling.
	4	11.2	1.5	dololutite, calcitic, similar to beds 2 and 3, but lighter in color.
	3	9.7	0.8	dololutite, calcitic, similar to bed 2.
	2	8.9	4.0	dololutite, calcitic, similar to unit 1, but with fewer bituminous partings, and more vugs, abundant horizontal burrows.
	1	4.9	4.9	dololutite, calcitic, thick-bedded to massive, dark brown, numerous discontinous bituminous partings particularly near the top, abundant crystal lined vugs, a few discontinous calcite veins parallel to bedding, a few scattered fossil fragments and solitary corals.



QUARRY FLOOR

Figure 1. Stratigraphic section of the Cedar Valley Formation at Pint's Quarry (provided by E. C. Kettenbrink).

Diagenesis is a striking feature of the rocks at Pint's Quarry. Recrystallization of calcite and dolomitization is extensive. Few beds in the quarry have escaped extensive dolomitization. Silicification, although less abundant, is pervasive. Vugs, ranging from ½ inch to 6 inches in diameter and lined with calcite crystals are conspicuous features throughout the formation. Additional mineralization of these vugs with pyrite, marcasite, sphalerite, barite, fluorite, and other minor minerals have made this quarry a favorite with mineral collectors. Fluorite is perhaps the most unusual and noteworthy for the size of individual crystals (up to 1 inch in diameter). A study of the various minerals and their crystal forms has recently been carried out (Lin, F.-C., in press).

<u>Solon</u> -- The Solon rocks are dark brown, with bedding thick to massive. Irregularly spaced, discontinuous bituminous partings are common. Concentration of more closely spaced partings (forming "shaly" seams up to 1 inch thick) mark the top of most beds in the Solon Member. Horizontal, unbranched, sinuous burrows are particularly common in the lower part of the quarry exposure. The burrows, averaging 3/8 to 1/2 inch in diameter, have been traced up to 12 inches, and are particularly well displayed on bituminous partings. In cross-section, these burrows appear as an ellipse with the major axis parallel to bedding and with a slightly different texture and color than the surrounding matrix. The most distinct feature of the burrow cross-sections is their peculair "swirled" texture.

The Solon Member contains 10 to 25 percent recognizable fossils and is not as fossiliferous at Pint's Quarry as at some other Solon sections in the area. Rugose corals are the most abundant fossils in the Solon at this locality. Favositid corals are also common. Stromatoporoids, brachiopods, bryozoans, and crinoid fragments are also found, but are definitely scarcer at Pint's Quarry than at most Solon localities. A notable exception to the general scarcity of fossils at Pint's Quarry is the abundant fish fauna.

Of the many crystal-lined vugs in the Solon, most give no indication as to their origin. However, when silicification was included in the mineralization of these structures, the origin is apparent. Silicification around the outer margin of these vugs has preserved the skeletal structure of various corals. Silicification of the outer part of these corals was followed by solution of the remaining carbonate skeletons of the corals leaving voids. Following calcite emplacement in the voids, selective mineralization of individual vugs produced the mineral suites now found.

<u>Rapid</u>--The Solon-Rapid contact can be placed at a prominent burrowed disconformity. This contact is several feet below the lowest bench in the quarry. A lag concentration of phosphatic fossils and glauconite pellets occurs on this contact and it is accompanied by a slight, but distinct change in lithology between members. A distinct color change from medium yellowish brown (10 YR 5/2) in the Solon Member to medium grennish gray (5 GY 5/1) in the Rapid Member exists at this contact. The basal several feet of the Rapid Member is more dolomitic than the underlying Solon. The basal Rapid is also coarser grained and more fossiliferous than the rest of the overlying Rapid and it represents a transitional lithology between the two members. This basal transitional lithology of the Rapid has one of the largest concentrations of mineralized vugs of any bed in the quarry. Large silicified corals are also abundant in this transitional lithology. Of particular interest, is the occurrence of possible silicified oncolites. These "oncolites" range from ½ inch to 7 inches in diameter. Larger specimens are due to the coalescence of smaller "oncolites"

forming larger compound structures. The strongest evidence of an algal origin of the "oncolites" is the overlapping festoon laminae that all of the specimens exhibit. In thin section there is a definite textural and mineralogical difference between these festoon laminae and surrounding portions of the "oncolites". Some laminae show possible borings or burrows. The "oncolites" may or may not show a distinct nucleus. The orientation of skeletal material within the "oncolite" structures is a problem. One would expect to see more of a tangential alignment of elongated fragments in true oncolites that have rolled on the sea floor than is seen in the Pint's Quarry material. Some "oncolites" are found with brachiopod shells or other fossil remains within them. The concentric laminae or bands appear to cut through the shells, meaning that they may not be true growth lines but rather a secondary feature associated with silification of the structures (Anderson and Wiig, 1974). The loss of much structural detail due to the combined effects of recrystallization, dolomitization, and silicification present serious problems in the interpretation of these structures.

Contorted and deformed bedding of laminated dololutites occur within the top few feet of the Rapid Member. In areas of less pronounced deformation, the bedding superficially resembles current ripples in both plan and cross section views. The wavelengths of "ripples" vary from ½ to 12 inches, with the majority of the wavelengths measuring approximately 2 inches. Preservation of equally spaced pyrite laminations and lack of cross bedding preclude a ripple (primary) origin for these structures. The "ripples" are interpreted as being caused by the deformation of soft sediment, possible due to intrastratal folding of weakly consolidated carbonate mud. These contorted and deformed beds were cut by still later micronormal faults with displacements up to 1 cm. This deformation may have resulted from gravitational slippage of mud layers.

Coralville-- The bulk of the Coralville Member consists of thick-bedded to massive, light to dark brown dololutites, with varying amounts of sparry calcite as recrystallized fossils, void filling, and cement. Again recrystallization and dolomitization has been intense, destroying much original fabric. Ghost fossils, mainly favositid corals almost completely obliterated by diagenesis, produce a "blotchy" mottling pattern similar to that found in the upper Solon beds.

A very soft to "earthy" dark brown dololutites mottled with large single crystals of dark brown calcite occurs in the upper third of the Coralville. Single crystals of calcite, up to several inches in diameter, occur in the dololutites beds. The large calcite crystals break along cleavages, and are very prominent because of their reflection of sunlight. It appears that the crystals started as void filling and proceeded to replace the dololutite as indicated by a transition zone along the margin of crystals.

Several beds contain numerous irregular spar-filled fissures which may represent dessication cracks (?). Unequivocal dessication polygons have been found at about the same stratigraphic position at other localities in the area. In the top six feet of the section there is an abrupt change from thick-bedded dololutites, to laminated/thin-bedded calcilutites. These limestones are very fine-grained and contain scattered intraclasts and a very few fossil fragments.

References cited:

Anderson, W. I. and Wigg, S. V., 1974, Environment of deposition of the Cedar Valley Formation in the vicinity of Black Hawk County, Iowa: Proc. Iowa Acad. Sci., v. 81, p. 135-142.

Collinson, C. *et al.*, 1967, The north-central region, United States: in Oswald, D.H. International Symposium on the Devonian System, Calgary, v. 1, 933-971.

Lin, Feng-Chih (in press) Minerals in vugs at Pint's Quarry: Proc. Iowa Acad. Sci.

Stainbrook, M. A., 1941, Biotic analysis of Owen's Cedar Valley limestones: Pan Amer. Geologist, v. 75, p. 321-327.

Geology in the Vicinity of Cedar Falls, Iowa

The campus of the University of Northern Iowa is located on gently rolling plain of "glacial drift." These materials were deposited by continental ice sheets which advanced across Canada and the Northern states and into the Midwest during the Pleistocene period of geologic time, beginning approximately two million years ago. These glacial deposits contain a mixture of clay, silt, sand and gravel and form the parent material from which the area's fertile soils developed. Large boulders, or "glacial erratics", are quite common in this part of Iowa, and are frequently seen scattered in fields or concentrated along fence rows, moved there by farmers who found them a hinderance during spring cultivation. Most of these erratics are igneous rock types which, in a state dominated by sedimentary rock units, betray their northerly origins. The glacial drift here is from one of the older advances of glacial ice, known as the "Kansan." Landforms which resulted from the presence of the ice during Kansan time have long since been modified by stream erosion. In fact, this part of northeastern Iowa is referred to as the "Iowan Erosion Surface", owing to a history of particularly intense erosion which has reduced the relief of the land surface substantially beyond that found in the highly dissected terrain characteristic of the loess-mantled, Kansan-age drift in the southern half of Iowa. Remnants of this older and higher plain remain as conspicuous, loess-capped, northwest-southeast trending hills and ridges known as "paha". Hickory Hill County Park north of Dysart in Tama County and Cornell College at Mt. Vernon are good examples of these paha.

As mentioned, stream erosion has been the most active geological process at work on the landscape here since glaciation. The valley of the Cedar River north of Cedar Falls-Waterloo offers exceptionally good views of landforms associated with alluvial or stream processes. A complex history of river meandering within the valley is clear from the number of sloughs, oxbow lakes and meander scars on the floodplain. Numerous sandpits testify to the quantities and economic importance of the sand and gravel resources that underlie the valley. George Wyth State Park, just north of Waterloo, is located within the maze of meander channels characteristic of the Cedar River Valley in this area.

Just as some aspects of geologic history may be inferred from features of the landscape, other important information comes from subsurface materials encountered during the drilling of wells. For example, well records are on file at the Iowa Geological Survey in Iowa City for two recent water wells drilled on the University of Northern Iowa campus, one at the Commons and the other for the New Science Building. These two wells reveal the glacial drift is between 80 and 90 feet thick beneath the campus, oxidized and leached of carbonate minerals in the upper portion, but unoxidized and unleached as greater depths are penetrated. Beneath this unconsolidated glacial drift, bedrock is encountered -- the Cedar Valley formation of Middle Devonian age. These wells were drilled to depths of 195 and 200 feet respectively and penetrated each of the members which compose the Cedar Valley -- the Coralville, a very fine-grained limestone; the Rapid, a dolomite with some chert; and the Solon, another limestone member. Taken together this sequence of carbonate rocks with its internal patterns of fractures and crevices yields the ground water which is pumped to the surface and utilized within these buildings.

These rock units are also fossiliferous, holding within them the remains of marine life forms that inhabited the warm shallow seas which covered this portion of Iowa during the Devonian Period of geologic time, over 300 million years ago. The Cedar Valley and each of its members are well exposed in Pint's Quarry a few miles east of campus. Fossil and mineral collecting will be available here during a special field trip sponsored by the Geological Society of Iowa on Saturday afternoon, April 22nd.

Throughout most of Iowa, these sedimentary bedrock units remain hidden beneath a mantle of glacial drift. However, in a number of areas in northeastern Iowa, the glacial drift is quite thin. Solution and collapse characteristic of the underlying limestone is reflected on the land surface in the form of sinkholes. Active sinkhole development is especially well displayed in the fields adjacent to Hwy. 218, two miles north of Floyd, in Floyd County. The potential for pollution of the important ground water resources contained within these rock units is especially high in these areas of "karst topography." Sinkholes provide a direct conduit for the introduction of harmful chemicals and waste material into subsurface water supplies.

There are a variety of features of geologic interest to be observed within the general vicinity of Cedar Falls and along the route traveled by people attending the 1978 Iowa Academy of Science meetings. For further information, the following publications are recommended: 1) General Geology in the Vicinity of Northern Iowa: Guidebook for the 36th Annual Tri-State Geological Field Conference, Oct. 7-8, 1972. (Eds. Dept. of Earth Science, Univ. of Northern Iowa, Cedar Falls, IA.) 2) Cedar Falls 7½" Topographic Quadrangle: U.S. Geological Survey 1963. 3) Geology of Black Hawk County by Melvin Arey: Iowa Geological Survey Annual Report for 1905, v. 16, p. 410-452. 4) Fossils and Rocks of Eastern Iowa: Iowa Geol. Survey Educ. Series 1 by J.N. Rose, 1967. 5) The Minerals of Iowa: Iowa Geol. Survey Educ. Series 2, by Paul J. Horick, 1974. 6) A Regional Guide to Iowa Landforms: Iowa Geol. Survey Educ. Series 3 by Jean C. Prior, 1976.

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The Geological Society of Iowa