GEOLOGICAL SOCIETY OF IOWA

Field Trip Guidebooks Sixteen through Twenty-four

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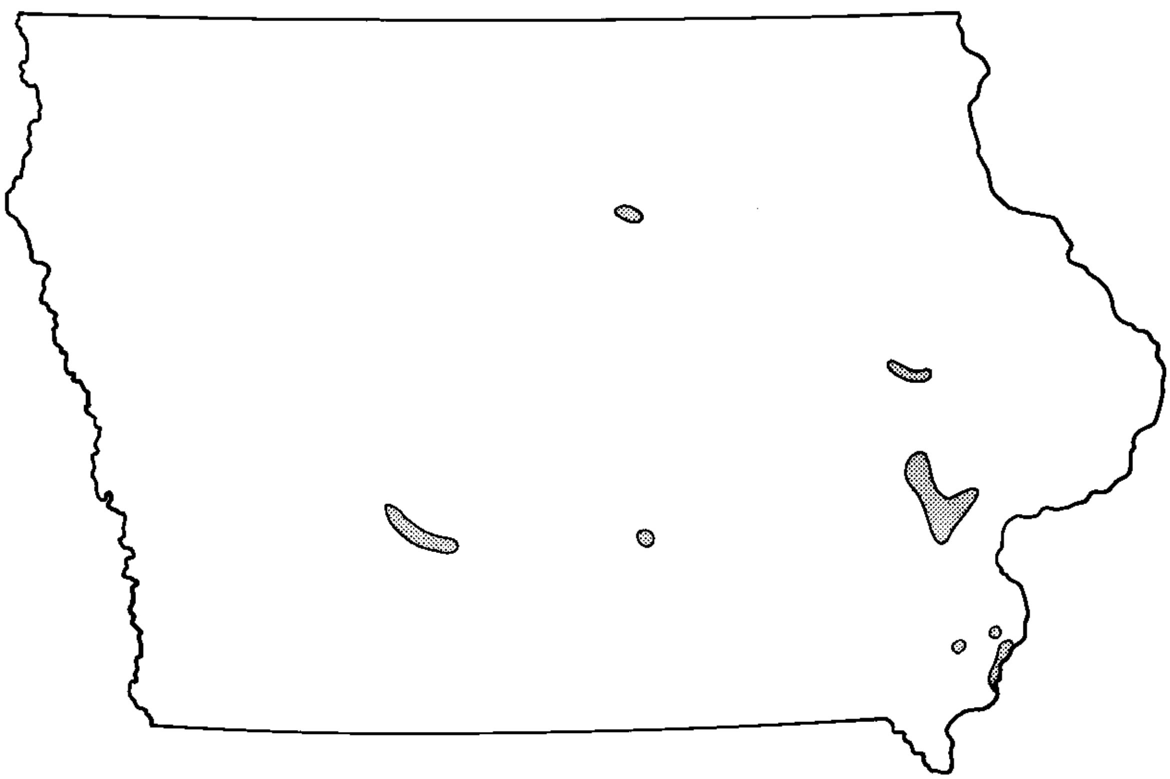

Volume Two

compiled and reprinted

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GEOLOGICAL SOCIETY OF IOWA FIELD TRIP -- U.S. GYPSUM COMPANY -- SPERRY, IOWA
GUIDEBOOK 16

Friday afternoon, June 2, 1967

Trip Leader: Lyle V.A. Sendlein - Iowa State University

INTRODUCTION

The gypsum occurs 610 feet below the surface in the Spring Grove Member of the Wapsipinicon Formation of Middle Devonian age.

The regional dip is six feet per mile to the southwest with local structures trending northwest-southeast. These smaller structures are doubly plunging anticlines with approximately 100 feet closure. The mine is located near the crest of one of these anticlinal structures.

The gypsum occurs in a dolomite member and ranges in thickness from stringers less than a centimeter to a bed approximately 4.5 meters. The gypsum bed is separated into two horizontal units (upper and lower gypsum) by a thin, less than a centimeter, carbonate lamina. The upper gypsum is massive to thick bedded, and contains lenses of black dolomite, satinspar and anhydrite, whereas the lower gypsum is thinly bedded and contains anhydrite lenses. The bedded effect, commonly referred to as banding, is caused by thin irregular laminations of brown dolomite. Megascopic observations, thin section evidence, and thermodynamic considerations indicate that anhydrite has been replaced by gypsum.

Internal structures observed in the bed are pseudo-folds, irregular dolomite bodies, and quartz nodules. Pseudo-folds in the gypsum measuring approximately one meter in horizontal extent, are features undescribed in the literature. Inter-relationships between the carbonate lamina, anhydrite lenses and the pseudo-folds indicate that a portion of the fold form has been produced without mechanically deforming the carbonate lamina or the lenses of anhydrite. Tabular dolomite bodies inclined approximately 60 degrees from the horizontal occur closely associated with the pseudo-folds.

The origin of the sulfate is questionable because the chemical nature of the primary deposit cannot be determined. The gypsum has formed by hydration of a pre-existing anhydrite bed. A mechanism of formation of the pseudo-folds is proposed and includes folding by a flexural mechanism and replacement of anhydrite by gypsum along arched planes assumed to be trajectories of maximum stress. The fold form produced by replacement is later deformed by flexural slip or flexural flow folding.

GENERAL GEOLOGY

Since Keyes described the general geology in 1893, very little has been published on this area. A guide book compiled by the Kansas Geological Society in 1935 covers this area and includes stratigraphic descriptions, isopach maps and structure contour maps for the major formations present.

Surface Geology

Pleistocene till and alluvium comprise the major units exposed at the surface. Rocks which crop out in the area are Pennsylvanian in the northern portion of the county and Mississippian in the southern half. Several known outcrops of Devonian (?) Maple Mill shale are also present. Outcrops of Mississippian strata occur along the bluffs of the Mississippi River, which borders the county on the east.

Subsurface Geology

Stratigraphy

Approximate stratigraphic thicknesses in the local area to the top of the Maquoketa shale are as follows:

Pleistocene till	100-300 feet
Mississippian	45 feet
Devonian (?) Maple Mill	300 feet
Devonian Lime Creek	10 feet
Devonian Cedar Valley	120 feet
Devonian Wapsipinicon	75 feet

The buried bedrock surface is dissected by deep steep-walled valleys of probably pre-Pleistocene age. The bedrock on the buried upland surface is Mississippian; the Devonian (?) Maple Mill shale and occasionally the Devonian Cedar Valley limestone constitute the bedrock surface in the deep buried valleys.

The thickness of the glacial till varies from a few feet to approximately 100 feet on the upland surfaces and up to 300 feet in the buried valleys.

The Mississippian limestones are part of the Kinderhook series. In places they have been removed by erosion during the formation of the buried valleys, and also thinned on the upland surface to an average thickness of 45 feet.

The Devonian (?) Maple Mill shale has a thickness of 300 feet where overlain by Mississippian limestone. The shale is absent in isolated areas located beneath the bottom of deep valleys.

The Devonian Lime Creek dolomite and Cedar Valley limestone are generally present in full thickness.

The Wapsipinicon formation is composed of five members, of which only the upper three are present in this area. They are from youngest to oldest: Davenport limestone, Spring Grove dolomite, and Kenwood shale. The Otis and the Coggan members are absent.

The Spring Grove member has an overall thickness of approximately 35 feet. The gypsum is located near the middle of this member. The Spring Grove member is fine-grained, thinly laminated, saccharoidal, buff to brown dolomite, and contains abundant steeply-dipping, calcite-filled fractures. The top of the gypsum bed forms a sharp stratigraphic break with the dolomite and the lower contact is gradational with dolomite below. The contact of the Spring Grove member with the underlying Kenwood shale is also gradational.

Structure

The study area is located near the Mississippi arch (Howell, 1935) between the Forest City Basin to the southwest and the Illinois Basin to the east. The axis of the arch roughly parallels the Mississippi River (Howell, 1935). The regional dip to the west is 6 feet per mile and to the east is 12 feet per mile.

As a result of recent studies by Parker and Harris (196), of the Iowa Geological Survey, on a sub-regional basis and by the writer on a local scale, smaller folds have been found superimposed on the regional structure. These folds have a northwest-southeast trend and display an enechelon pattern of doubly plunging anticlines and synclines. The mine is situated near the crest of one of these anticlines.

During the mapping of the mine, joints were observed in the gypsum as smooth vertical faces. From the small number of joints observed in the mine a vertical joint set is postulated with one group having an attitude of north eight to twelve degrees east and the other north forty-five degrees east. Where the black dolomite lense is absent joints observed in the dolomite roof conform to this joint set.

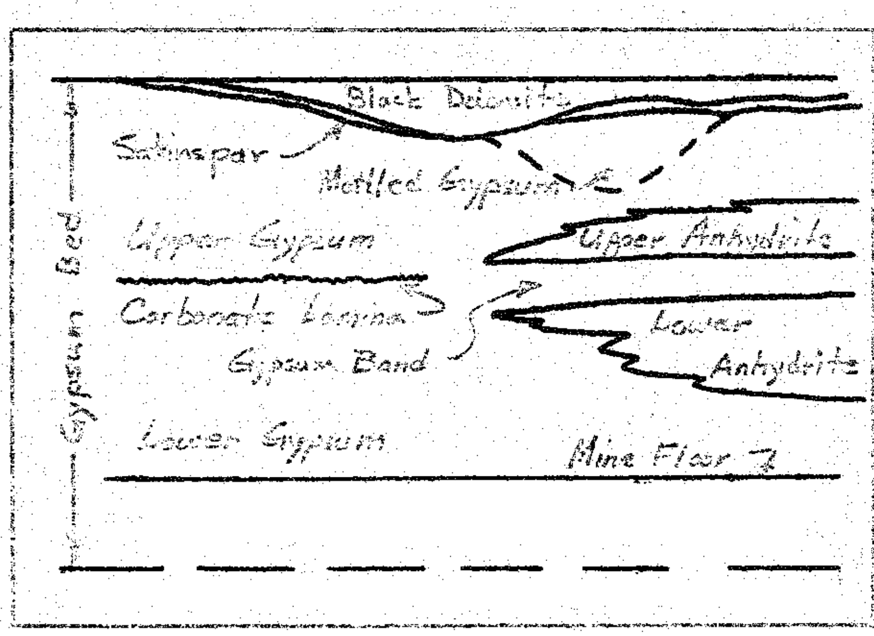
GYPSUM BED

The gypsum bed occurs in the Spring Grove member approximately 3.5 meters below the top of the member. It is approximately 4.5 meters thick with the upper 3.0 meters exposed in the mine. The various units shown in Figure 1 are not all present at any one location.

The gypsum bed is composed of two distinct units separated by a thin carbonate lamina. The upper unit is thick bedded to massive and 1.5 meters thick; the lower unit measures 3.0 meters in thickness and displays thin bedding. Anhydrite lenses occurring in the upper and lower units exhibit differences in dolomite distribution and content, and crystal texture.

The upper gypsum has lenses of black dolomite, satinspar and anhydrite, and the lower gypsum contains anhydrite lenses. Where lenses of anhydrite in the upper and lower gypsum units are adjacent they are separated by an uneven band of gypsum which occurs at the same horizon and in place of the carbonate lamina. The occurence of the gypsum band at this horizon points up the separation plane between the two gypsum units.

FIGURE 1
Schematic of gypsum bed



Upper Gypsum

The upper gypsum is white, fine-grained, thick bedded to massive, contains small amounts of brown dolomite, and has an average thickness of 1.5 meters. In some areas a fine-grained black dolomite occurs as non-oriented, intersecting veinlets near the top of this unit. This type of structure has been described as mottled by Adams (1904). The thickness of the mottled gypsum ranges from 30 to 90 centimeters with an average of 30 centimeters.

Microscopically the gypsum in this unit is fine to coarse-grained with several distinct types of crystals of various size and shape. They range in size from less than 0.035 mm to 0.8 mm, with most displaying an anhedral form.

Dolomite occurs in this unit as very fine-grained equant (0.15 mm) to rectangular (0.14 x 0.09 mm) crystals or in a granular form which does not exhibit well-defined euhedra.

Veins of gypsum cutting the dolomite display characteristic comb structure, transverse structure, and a non-oriented structure.

Black dolomite lenses

The black dolomite lenses are composed of fine-grained, almost lithographic dolomite containing gypsum veins and averaging 30 centimeters in thickness. They range in thickness up to one meter and in some areas are absent. The upper surface of this unit is in contact with an overlying brown dolomite along a sharp undulating interface. The lower surface of the unit is a sharp contact with rock gypsum or in thin lens of satinspar.

Satinspar lenses

White to transluscent satinspar occurs as lenses with a maximum thickness of two centimeters. They are absent in some areas of the mine but where present they show sharp contact with the dolomite above and the gypsum below.

Upper anhydrite unit

The upper anhydrite is pale blue in color, fine-grained, massive and contains thin non-oriented veins of brown dolomite.

The anhydrite crystals are present as euhedral bladed (0.61 x 0.03 mm) and euhedral to subhedral equant (0.04 x 0.04 mm).

Gypsum is present as large subhedral crystals (1.85 x 2.12 mm). Euhedral dolomite crystals occur as rhombs throughout the unit with the concentration of dolomite increasing downward.

The texture of the upper anhydrite is characterized by two textural elements; one element is composed of slightly bent, bladed crystals occurring in spiral-like whirls, in a matrix of smaller equant crystals; the second element contains lath-like crystals oriented with their long axes subparallel. The oriented groups occur as bands. These two textural elements occur together in a pattern dominated by the first element which is difficult to describe with a common textural term.

Gypsum occurs randomly in the anhydrite matrix as large crystals or along definite planes as bands or vein-like bodies ranging up to 3.6 mm in width and extending across the thin section. The vein-like bodies have been observed in hand specimens to be tabular with non-parallel sides and will therefore hereafter be referred to as veins.

The large subhedral crystals of gypsum contain segments of anhydrite crystals displaying optical continuity. The anhydrite segments are separated by the gypsum. The gypsum boundaries are generally irregular; however, some display sharp boundaries which cut individual anhydrite grains. Those gypsum crystals with irregular boundaries appear to have more anhydrite included within them than those which have well-defined faces. Bundy (1956) has reported these in anhydrite studied in Indiana and has used them as evidence of gypsum after anhydrite.

The dolomite is randomly distributed in this unit and is not abundant. Dolomite occurs in the following ways: as individual rhombs; as a granular texture composed of rhombs; and as rhombs oriented in shapes sometimes suggesting relic tabular outlines. The rhombs vary in size from 0.01 to 0.05 mm. Some rhombs occur as rims of dolomite surrounding cores of anhydrite.

Carbonate lamina-gypsum band

The carbonate lamina, which separates the gypsum bed into two units, is present as a brown to black carbonate material of variable thickness (1.8 to 3.3 mm), and occurs at a horizon varying from four to five feet below the roof of the mine. The lamina is composed of a fine-grained granular material, considered to be carbonate because of its high birefringence, and occurs in thin veins cutting gypsum crystals or along the interface between crystals. Gypsum and traces of anhydrite crystals occur within some of the larger areas of the lamina.

Larger bladed crystals of gypsum above and below the carbonate lamina are oriented with their long dimensions parallel to each other and perpendicular to the lamina. This oriented texture does not extend more than eight centimeters above and below the lamina.

Anhydrite lenses occurring in the upper and lower gypsum units are generally adjacent but separated along a horizontal plane by a gypsum band which varies in thickness from a few millimeters up to several centimeters. The gypsum is similar to the upper and lower units except it does not contain dolomite. This gypsum is referred to as the gypsum band.

Lower Gypsum

The lower gypsum is fine-grained, white, contains more brown dolomite than the upper gypsum, and averages 3 meters in thickness.

The brown dolomite occurs in thin, uneven laminations which range up to approximately 6 millimeters in thickness. The dolomite bands are separated by gypsum which ranges from 12 millimeters to 3.8 centimeters in thickness. The dolomite laminations are uneven and in some instances cut across the gypsum to give it a segmented appearance. This type of structure has been termed "pinch and swell" structure by many investigators and "boundinage" (sausage-like) by Riley and Bryne (1961). Both terms, as defined, connote a genetic mechanism which may or may not be responsible for the observed structure; however, pinch and swell adequately describes the appearance of the structure and thus will be used in this study for its descriptive value only.

The texture is exactly the same as the upper gypsum and with the major difference between the two units the amount and occurrence of dolomite.

The dolomite is composed of equant euhedral rhombs varying from 0.12 to 0.02 mm in size with the average around 0.04 mm. The dolomite is cut in places by veins of gypsum which exhibit comb, transverse and non-oriented structures. Many rhombs show a corroded external boundary and some exhibit a carbonate rim with a core of gypsum. There are other rhombs which exhibit zoning of the dolomite.

Lower anhydrite

The lower anhydrite is pale blue in color, fine-grained and banded with brown dolomite. Maximum thickness of the lenses ranges from 15 to 61 centimeters. The brown dolomite occurs as stringers and produces laminations similar to those previously described in the gypsum unit. There is one difference; the dolomite grains occurring in the bands are not as compact as in the equivalent gypsum horizon, but are more dispersed and disseminated throughout the anhydrite.

Microscopically most anhydrite in the lower unit is composed of crystals which exhibit more of an equant or rectangular shape than the combination of lath and equant forms characteristic of the upper anhydrite lenses. This type of structure has been called "pile of bricks" structure by Brown (1931). There is more dolomite and gypsum present than in the upper anhydrite. Dolomite seems to be more abundant in the upper portion of the lense and gypsum dominates the lower portion.

Much of the anhydrite occurs within gypsum as highly corroded and rounded crystals. Large anhedral crystals of anhydrite are present in anhydrite and dolomite.

Gypsum is found in this zone in veins or as random euhedral and anhedral crystals. This occurrence is similar to that described for the upper anhydrite and therefore will not be redescribed here.

Differences between the upper and lower anhydrite lenses are characterized by the dolomite distribution and textural variations of the anhydrite. Dolomite in the upper anhydrite lenses is non-oriented, disseminated, and of a lower concentration than in the lower anhydrite. Dolomite in the lower anhydrite lenses is located along many horizons producing irregular laminations or a banded effect. Dolomite occurring in diffuse laminae in a disseminated manner has the appearance of a finely woven net. The laminae are separated by anhydrite; however, dolomite cuts across the anhydrite and commonly connects the laminae. Textural differences of the anhydrite lenses are characterized by the presence or absence of oriented lath-like grains. The occurrence of these grains in the upper anhydrite lenses produces a gneissic structure which is notably absent in the lower unit.

Dolomite in gypsum produces a bedded effect which has a slightly different appearance than the laminations produced by dolomite in anhydrite. The concentration of the dolomite into thinner laminae in the gypsum develops a sharper contact and a darker color than the similar relationship in anhydrite. This contrast is apparent when bedded gypsum and anhydrite are observed adjacent to each other.

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OSAGE AND KINDERHOOK SERIES

Des Moines County, Iowa

THE GEOLOGICAL SOCIETY OF IOWA

3 June 1967

GUIDEBOOK # 17

Trip Leaders: Mary C. Parker
Fred H. Dorheim
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Field Trip Committee:
Ted Welp, Chairman
Fred Dorheim
Brian Glenister
John Lemish
Robert Miller

INTRODUCTION

The purpose of today's trip is threefold: (1) to view the type section of members of the Burlington Limestone and to observe the evidence for the regional unconformity at the base of the Burlington; (2) to view the Kinderhook Series as it is represented in southeastern Iowa and to observe the variations within the North Hill Group; and (3) to observe the Devonian-Mississippian boundary and discuss some of the related problems.

The Cedar Fork Member at the top and the Dolbee Creek Member at the base of the Burlington are primarily recrystallized crinoidal bioclastic limestone. The middle Haight Creek Member is very cherty and contains much dolomite. The transgressive overlapping of the younger beds of the formation toward the north and west of Burlington is apparent as the Dolbee Creek is present only in extreme southeastern Iowa. Further evidence of the unconformity is the fact that the Burlington Limestone rests on progressively younger beds north and west of Burlington.

The Wassonville is the only member of the Hampton Formation recognized in southeastern Iowa. In Des Moines County the Wassonville is a dolomitic limestone which becomes more dolomitic and argillaceous toward the northwest. The typical ash-gray chert of the Wassonville of northern Henry, Louisa and Washington Counties is conspicuous by its absence in Des Moines County.

The North Hill Group includes in descending order: Starr's Cave (formerly North Hill oolite member of the Hampton Formation), Prospect Hill Siltstone, and McCraney Limestone. At the three stops today where we will see the North Hill Group, only at the Starr's Cave Section are all three formations present. Along Yellow Spring Creek the Prospect Hill is missing and at the Kaser (Leonhard) Quarry the Starr's Cave is missing.

The Devonian-Mississippian boundary is placed, by the Iowa Geological

Survey at the base of the North Hill Group. The fauna, both conodont and ammonoid cephalopods, suggests that the English River and Maple Mill are Devonian. Some workers feel that the English River should be correlated as Mississippian. The Survey recognizes that the English River represents a time-transgressive unit and for practical ease in mapping, particularly in subsurface where in many localities the Maple Mill and English River contact is gradational, the Mississippian-Devonian boundary is placed at the top of the English River-base of North Hill Group.

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ROAD LOG

Mileage

0.0	Jct. U.S. Highways 61 and 34. TURN NORTH on Highway 61.
0.5	Stop sign. Jct. Highway 61 and Sunnyside. TURN RIGHT (east) on Sunnyside.
0.7	Greenhouse on left.
1.0	Irish Ridge Road. TURN LEFT (north)
1.4	Bear left at Florence. CAUTION--curve and hill.
1.65	TURN LEFT on gravel at Sycamore Inn sign. Follow road to Sycamore Inn Parking lot on right.
2.2	STOP 1. STARR'S CAVE SECTION, center NW 1/4 sec. 19, T. 70 N., R. 2 W., Des Moines County. (Section page 6)
2.2	Leave Sycamore Inn parking lot. Turn left.
2.5	TURN LEFT (east). Cross old high-truss bridge.
2.6	STOP. Jct. county road. TURN LEFT (north) on gravel road.
4.3	Cross road. Cross traffic stops.
6.0	Curve right
6.7	Curve left
6.9	Church on left. WATCH FOR TURN.
7.0	TURN RIGHT (east) on dirt road.
7.4	CAUTION. R.R. CROSSING. NO SIGNALS.
7.8	T-road from left.
8.0	T-road from right.
8.3	T-road from left, gravel road.
8.5	Cross road.
9.7	Winding road. Get ready to stop.
9.9-10.3	STOP 2. YELLOW SPRING CREEK SECTION; exposures along the road and creek which cuts the center of the west 1/2 sec. 35, T. 71 N., R. 2 W., Des Moines County. (Section page 7)
10.3	Leave Stop 2.
10.5	STOP. Jct. Iowa Highway 99. TURN LEFT (north) on Highway.

10.9 Bridge.

12.0 T-road from right.

13.5 Road from left.

14.6 T-road from right.

14.9 TURN LEFT. Roadside park on right. STOP 3. TYPE SECTION HAIGHT CREEK MEMBER OF BURLINGTON LIMESTONE: NW cor. sec. 12, T. 71 N., R. 2 W., Des Moines County. (Section page 8)

Leave Stop 3, turn left, back to Highway 99.

15.0 Stop sign. Jct. Highway 99; TURN LEFT (north) on Highway.

15.3 Enter community of Kingston.

15.5 Leave community of Kingston.

16.0 Road from left.

17.3 Road from left.

17.8 Road from right.

18.6 TURN LEFT (west) on blacktop, County Road X.

18.7 TURN LEFT into Dolbee cemetery road.

STOP 4. TYPE SECTION OF DOLBEE CREEK MEMBER, BURLINGTON LIMESTONE: SE 1/4 SE 1/4 sec. 23, T. 72 N., R. 2 W., Des Moines County. (Section page 9)

18.9 Leave Cemetery road. TURN LEFT (west) on blacktop.

Weaver quarry on left. Keokuk-Burlington contact; Cedar Fork and Haight Creek members, Burlington Limestone exposed.

19.6 Raid's Nelson quarry on left. Similar section as Weaver quarry plus part of the Dolbee Creek exposed.

21.3 Cross road.

22.4 Begin winding road.

23.2 Project for "Lady-Bird".

23.3 Road from right.

23.5 Jct. gravel road. SHARP CURVE RIGHT. Stay on blacktop.

23.6 TURN RIGHT into Chautauqua Park, Des Moines County Conservation Board Park. Water and rest rooms available.

LUNCH STOP

23.8 Leave Park. TURN RIGHT on blacktop.

23.9 Village of Kossuth.

24.2 Leave village of Kossuth

24.9 Enter Mediapolis.

25.2 4-WAY STOP.

25.5 R.R. Crossing, 4 tracks.

25.7 STOP. Jct. U.S. Highway 61. TURN LEFT (south) on highway 61.

25.9 Leave Mediapolis.

26.7 T-road from left.

27.2 R.R. Crossing, cross-road. U.S. Gypsum Co.'s mine and plant on right.

28.1 TURN RIGHT (west) on County Road P (gravel).

29.2 Cross-road.

30.8 Cross-road.

31.5 Cross-road

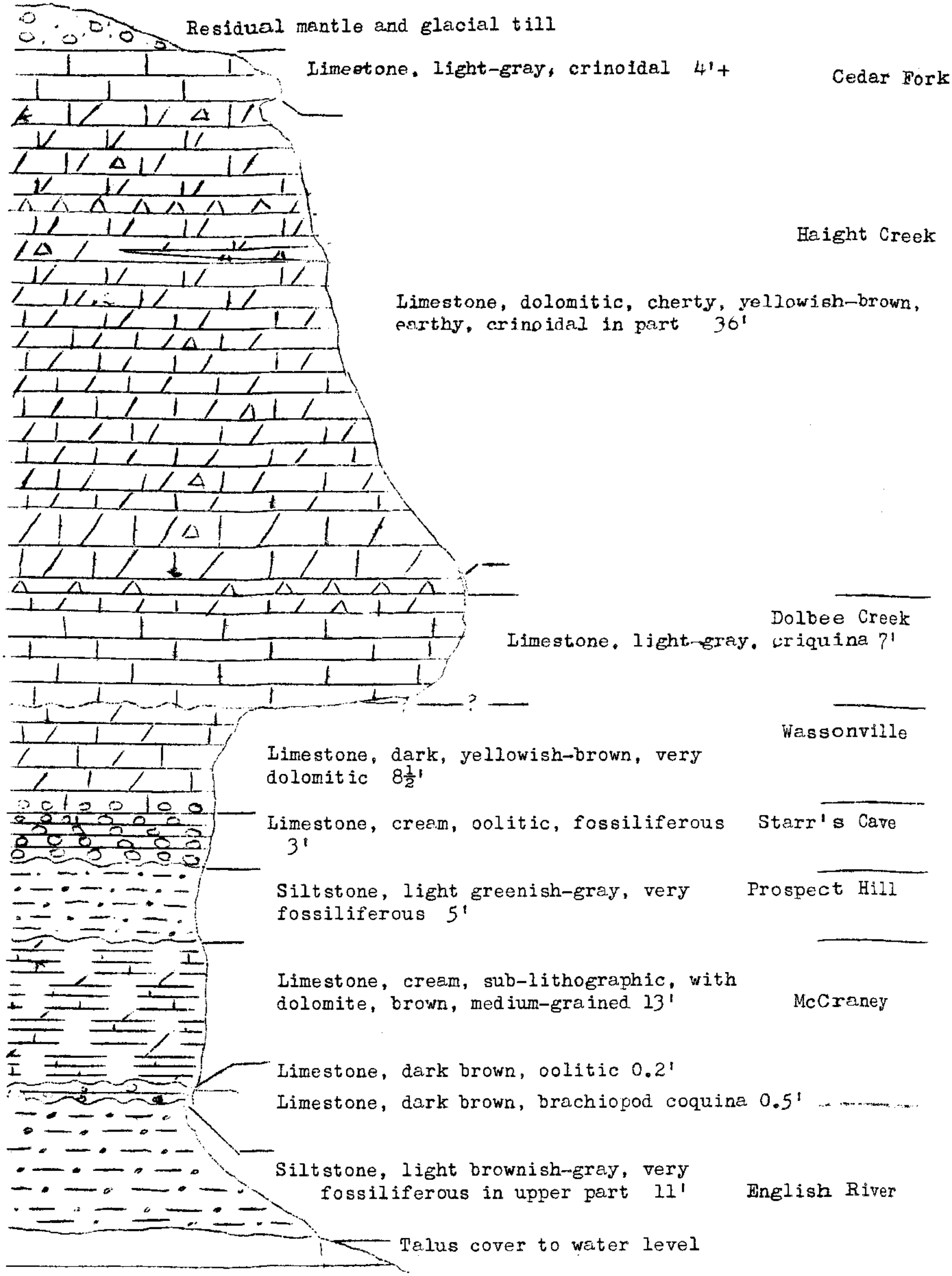
32.7 TURN RIGHT. Entrance to Kaser Quarry (formerly J.T. Leonhard quarry).

STOP 5. TYPE SECTION CEDAR FORK MEMBER, BURLINGTON LIMESTONE:
SE cor. sec. 1, T. 71 N., R. 4 W., Des Moines County.
(Sections pages 9 and 10)

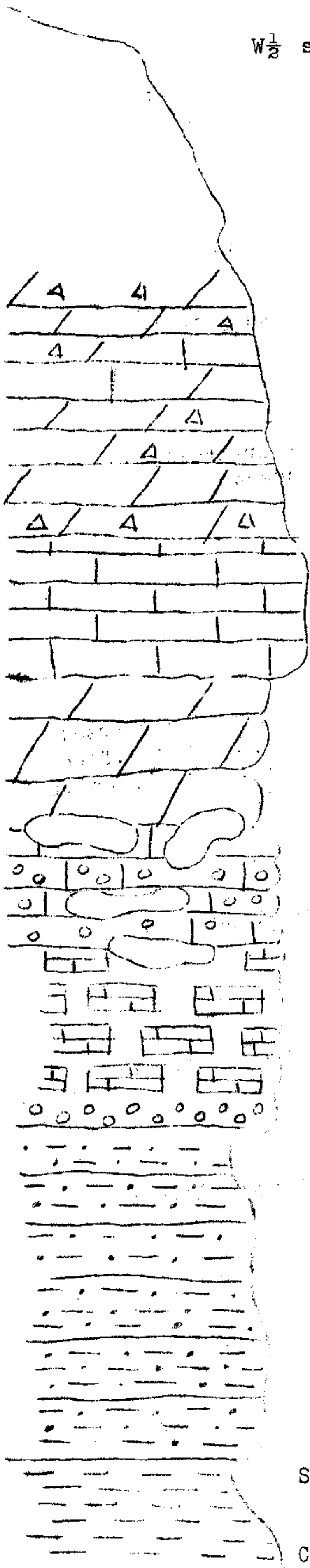
END OF THE TRIP. SOLONG, SO GOOD TO SEE YOU. SAFE JOURNEY HOME SO THAT WE MAY MEET AGAIN AT ANOTHER OUTCROP.

STARR'S CAVE SECTION

CENTER NW$\frac{1}{4}$ sec. 19, T. 70 N., R. 2 W., Des Moines County



YELLOW SPRING CREEK COMPOSITE SECTION
W½ sec. 35, T. 71 N., R. 2 W., Des Moines County



Haight Creek Member

Limestone, dolomitic, cherty and yellowish-brown earthy dolomite 20'

Dolbee Creek Member

Limestone, pale orange, crinoidal 6'

Wassonville

Dolomite, grayish-orange, soft, calcareous, solution cavities and channels 6-7'

Starr's Cave

Limestone, very pale-orange, "oolitic", crinoidal, solution cavities 1-4'

McCraney

Limestone, pale yellowish-brown, sub-lithographic, mottled with patches of yellowish-orange, earthy dolomitic limestone 6'

Limestone, pale orange, oolitic 1'

English River

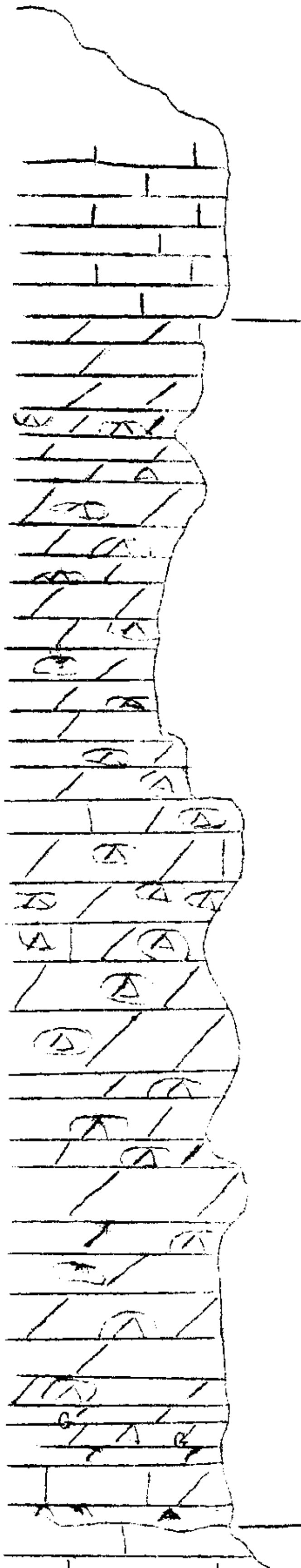
Siltstone, very pale orange, medium to coarse silt grade 14'

Maple Mill

Shale, light greenish-gray, laminated, hard, silty 4-5' exposed

Creek level

HAIGHT CREEK MEMBER, BURLINGTON LIMESTONE
NW cor. sec. 12, T. 71 N., R. 2 W.



Cedar Fork

Limestone, very pale-orange to light gray, coarsely crystalline, very crinoidal, disseminated glauconite 6'

Haight Creek

Dolomite, grayish-orange, fine to medium crystalline and smooth, fossiliferous chert

Dolomite, yellowish-tan, porous and dolomitic chert and calcite-lined vugs

Dolomite, yellowish-brown, finely crystalline, earthy, many nodules of brown dolomitic chert

Limestone, yellowish-gray, finely to medium crystalline, dolomitic, very crinoidal; light gray, mottled, fossiliferous, smooth opaque chert occurs in scattered nodules and lenses. Forms a resistant ledge.

Dolomite, non-resistant; chert along bedding planes

Dolomite, grayish-brown, hard, dense

Dolomite, light brownish-gray to light brown, finely crystalline. Chert in beds and nodules, gray, fossiliferous

Dolomite, brownish-gray, dense, finely crystalline; glauconite, greenish-black pellets

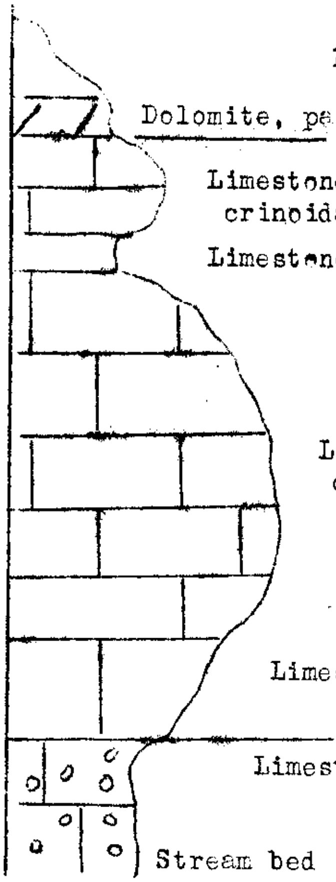
Limestone, coarsely crystalline, crinoidal, glauconitic 39'

Dolbee Creek

Limestone, light yellowish-gray, coarsely crystalline. Chert, light gray, mottled with crinoid fragments 2'

Stream bed

DOLBEE CREEK MEMBER, BURLINGTON LIMESTONE
SE¼ SE¼ sec. 23, T. 72 N., R. 2 W.



Dolomite, pale-orange, laminae of glauconite — Haight Creek

Dolbee Creek

Limestone, grayish-orange, coarsely crystalline, crinoidal calcirudite

Limestone, dolomitic, finely crystalline

Limestone, pale-orange to grayish-orange weathering to dark yellowish-orange, earth texture, massive

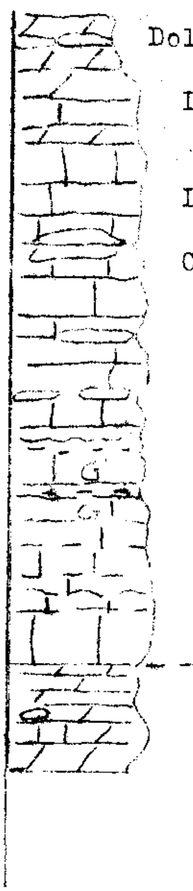
Limestone, coarsely crystalline, Spirifer grimesi abundant

Limestone, oolitic, white, weathers yellow — Starr's Cave

Stream bed

* *

Type Section
CEDAR FORK MEMBER, BURLINGTON LIMESTONE
SE cor. sec. 1, T. 71 N., R. 4 W.



Dolomite, calcareous, finely crystalline — Keokuk Limestone

Cedar Fork

Limestone, very coarsely crystalline, glauconitic, fish-tooth horizon

Limestone, coarsely crystalline, crinoid fragments

Chert lenses and nodules, white, mottled light grey, tripolitic to porcellaneous

Spirifer grimesi abundant. Lenses and nodules of white and mottled chert. Dolomitic, blocky shale at base.

Limestone, coarsely crystalline, greenish-gray, glauconitic

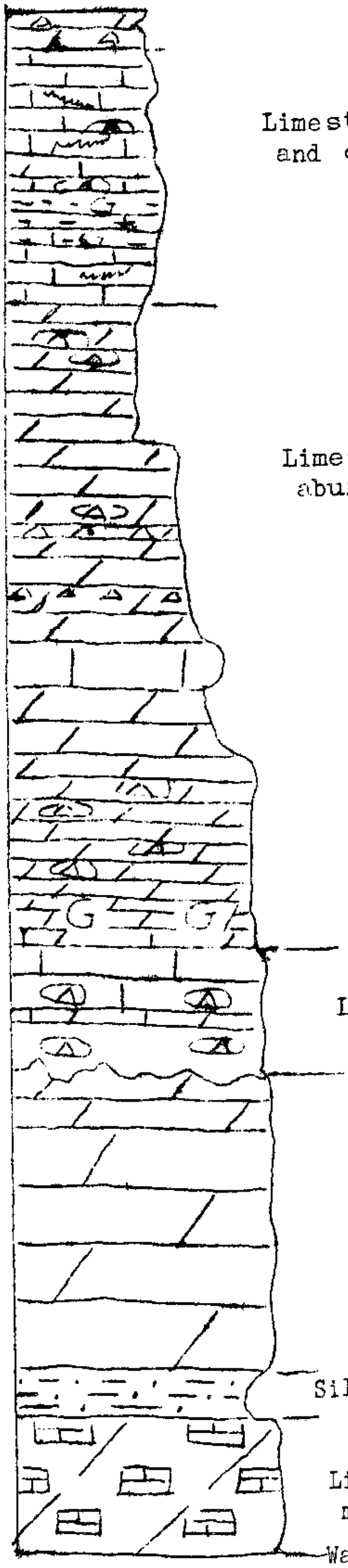
Limestone, light gray, coarsely crystalline, calcite recrystallized from crinoids; disseminated glauconite. Shale partings

Dyzigocrinus

Limestone and dolomite, irregularly mottled — Haight Creek

KASER QUARRY (formerly J. T. Leonhard quarry)

SE cor. sec. 1, T. 71 N., R. 4 W.



Keokuk Limestone

Cedar Fork

Limestone, coarsely crystalline, scattered glauconite and chert, fossiliferous

18'

Haight Creek

Limestone and dolomite, fine to medium crystalline, abundant chert. Heavy glauconite pellets near base

45'

Dolbee Creek

Limestone, coarsely crystalline; chert lenses **white, mottled**, conchoidal and tripolitic

8'

Wassonville

Dolomite, light gray to brown, fractured

Dolomite, brown, irregular dark laminations

20'

Prospect Hill

Siltstone, pale orange 4'

McCraney

Limestone, yellowish-brown, sub-lithographic, mottled with yellowish-orange dolomitic limestone 9'

Water level

THE GEOLOGICAL SOCIETY OF IOWA

GUIDEBOOK 18

June 16, 1967

TRIP #1 EMPHASIS INDUSTRY

Trip Leaders

Stew Mettler
Ernie Myers
Dick Myers

Field Trip Committee

Ted Welp, Chairman
Fred Dorheim
Brian Glenister
John Lemish
Robert Miller

Plant Tours: Courtesy of Concrete Materials Division
Martin Marietta Corporation
Cedar Rapids, Iowa

TRIP #1 EMPHASIS INDUSTRY
ROAD LOG

Starting point - South Jct. U.S. 30 and U.S. 218

0.0 Drive East on U.S. 30 to stop.

1.0 4-way stop. TURN LEFT. Open area to left is old aiport now industrial park. 1/2-mile south, Area 10 Voc-Tech School is under construction.

1.3 New M-G-D Plant on left

1.5 Link-Belt on right - note parking areas.

1.9 Century Block uses fine stone minus 3/8 and sand

2.1 R.R. Overpass.

3.1 STOP LIGHT. TURN RIGHT on Ely Ave. SW

3.5 Fruitland Blvd. TURN LEFT

3.6 C St. SW - TURN LEFT. Note "blow sand" in field on right used as fill, grade preparation and filler in asphalt concrete.

4.2 STOP. TURN RIGHT on 21st St. SW

4.3 STOP. TURN RIGHT on A St. SW

4.5 Gus Glaser and Otis Limestone

4.7 TURN RIGHT into Concrete Materials repair shop area, formerly Otis Quarry.

THIS IS STOP #1

0.0 Start on leaving Otis Quarry

0.2 STOP. RAILROAD

0.6 STOP. RIGHT TURN on 16th Avenue - over the Cedar River and you are on 14th Avenue

0.9 STOP LIGHT. TURN LEFT on 3rd St. SE

1.0 STOP LIGHT. TURN RIGHT on 12th Ave. SE

1.2 TURN RIGHT - 5th St. SE

TURN LEFT on 17th Avenue SE

2.7 Entrance to Sand Plant - Park at the pea gravel pile

THIS IS STOP #2

Start log as you exit Sand Plant gate

0.0 TURN RIGHT.

0.3 Dickely Blvd. TURN RIGHT. Cedar Valley Park on left.

0.7 TURN LEFT on 24th Avenue.

1.0 Dead End - JOG RIGHT then LEFT

1.3 Otis Avenue - Otis-Kenwood Outcrop

2.0 Scar on far right across river is quarry in Otis and Kenwood

3.0 Old quarry on left is Otis-Kenwood - contact is at 12 ft. above floor.

What kind of rock is used in the R.R. ballast?

3.9 Indian Creek and sewage pump station to plant south of river.

4.1 STOP. County Road. TURN RIGHT
Otis-Kenwood contact at eye level

5.6 STOP. Highway 150 - TURN RIGHT

6.7 R.R. Overpass

7.8 Road cut Otis-Kenwood contact top of massive bed at road level

THIS IS STOP #3

8.8 Hartl quarry on right was in earlier G.S.I. field trip

8.9 Cedar River

9.1 Water hole on right flood plain resulted from sand (Novak Pit) excavation, for Highway #150 and U.S.#30 asphaltic concrete.

9.4 Entrance to C.R. Quarry (Dytrt)

9.6 Road elevation at double box culvert is at elevation of record flood (1961)

9.7 Otis

9.75 LeClair

9.85 Otis

10.6 Park in area designated

Cy: Exploratory
[illegible] T. Myhre
Producer

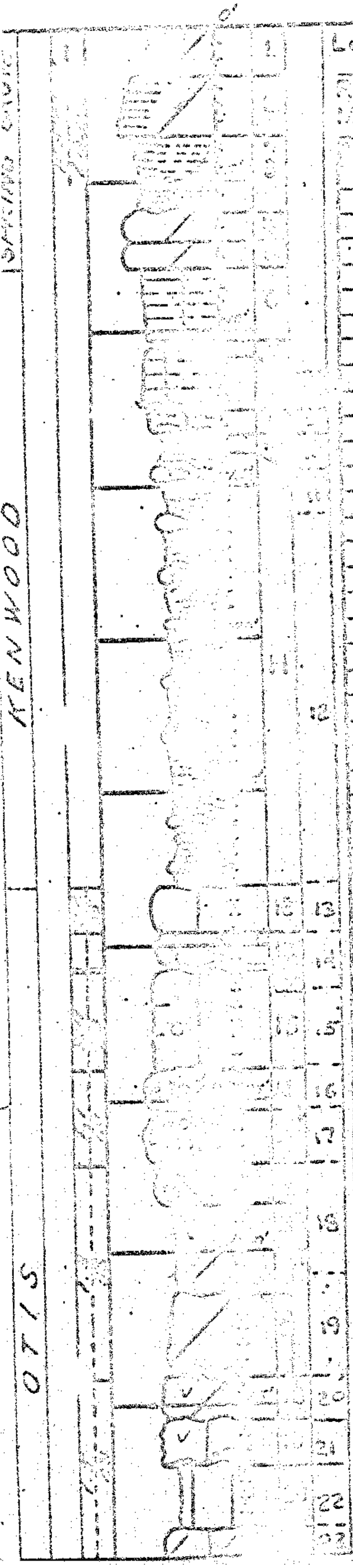
Iowa State Highway Commission

Location: [illegible] Sec. [illegible] T. [illegible] R. 7W Co. [illegible]

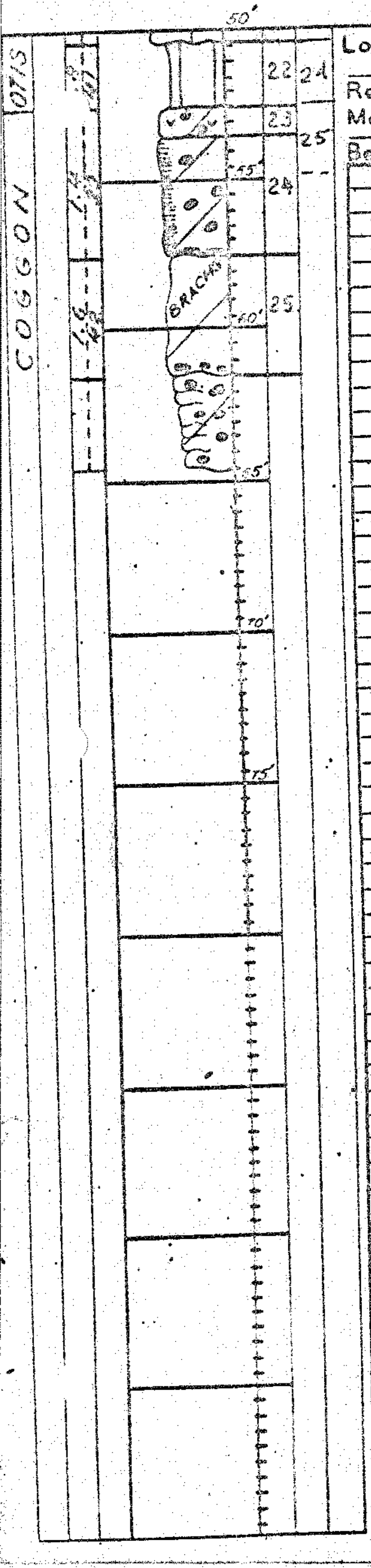
[illegible]

Remarks: [illegible] & Dirks, 8/[illegible]/[illegible]

Measured by: [illegible] Date: [illegible]



	Description	Thk. Ft.
[illegible] Overburden	[illegible] clay	[illegible]
	Spring Grove + 7.8	
1.	Dolo., brown, weathers red, medium grained, numerous wide distinctive color laminations, laminations [illegible] rapidly making bed platy.	1.5
2.	Dolo., [illegible] weathers brownish-gray; fine grained; medium hard, has strong petroliferous odor when struck, massive.	± 2.0
3.	Dolo., [illegible]-gray, weathers gray; fine to medium grained; numerous wide tan color laminations, numerous shale partings, irregular shale band at base, weathers to thin platy beds.	2.5
4.	Dolo., brown, weathers tan, medium crystalline; petroliferous odor, hard, dense, massive.	± 1.0
5.	Dolo., like above but color banded	± 0.8
	[illegible] ± 20'	
6.	Shaly Ls., [illegible], weathers blue; fine grained, [illegible] hard, blocky, massive.	± 2.5
7.	Shale, brown, earthy, very undulating	0.1 to 0.5
8.	Shaly Ls., like bed 6, has a ± 0.2 undulating shale band at base.	1.7
9.	Shaly Ls., [illegible] brown, weathers [illegible] brown, medium grained, soft, fresh surface has a speckled appearance, undulating.	0.8
10.	Shale, calcareous, reddish brown, [illegible]	0.5
11.	Ls. & interbedded calcareous shale, tan to blue gray, weathers gray, medium hard, blocky very irregular bedding.	14.2
	Otis about 22'	
12.	Ls., light yellow, weathers whitish; fine grained, [illegible] dense, massive.	1.5
13.	Ls., dark brown, weathers light gray; fine grained, [illegible] dense, has large calcite vugs, [illegible]	1.2
14.	Shale, [illegible]reous; brown, marks top of [illegible]	[illegible]



Iowa State Highway Commission

Location: NE¼ NE¼ Sec. 1 T. 82 R. 7 Co. Linn

Remarks: Page 2

Measured by: Date: 8/19/58

Bed:	Description	Thk. Ft.
15.	Ls., reddish-brown, weathers dark gray, fine grained to sublithographic, color banded, a few calcite lined vugs, hard, dense, one massive bed.	3.0
16.	Dolo., calcareous, dark brown (forms a distinctive dark zone in working face) fine to medium crystalline 3.0	
A.	Dolo., like above, contains tan lithographic breccia fragments, hard, dense.	1.4
B.	~~Dolo., like above, contains some small brachiopods, hard, dense.~~	1.6
17.	Dolo., reddish-brown, fine to medium crystalline, porous, forms a distinctive "soft" zone in quaary ± 7.0'	
A.	Ls., dolomitic, gray brown, weathers reddish, hard, sublithographic, contains black chert in areas, very similar to bed 16 in weathered face.	1.4
B.	Dolo., reddish-brown, soft, laminated with darker bands, calcite masses & veinlets.	2.9
C.	Dolo., reddish brown to dark gray, fine grained to sublithographic, color laminations like 17B, shale seem at base.	3.0 to 4.0
18.	Dolo., dark brown, medium crystalline, recrystallized in areas, some calcite, massive.	1.3 to 1.5
19.	~~Ls., dark brown to black, finely crystalline nearly a calcite in areas, weathered surface has a knobby appearance, has a 0' to 0.5' lensatic shale seam at base.~~	1.0to1.6
20.	~~Ls., yellowish tan, weathers reddish, fine grained to sublithographic, medium hard, blocky fracture, massive.~~	1.9
21.	Ls., Dolomitic, like bed 19, upper 0.4' argillaceous and filled with black calcite	1.4
22.	Ls., like bed 20	2.2
	Coggon + 12'	
23.	Dolo., tan, weathers reddish tan, fine grained, vesicular, some black chert, massive	1.0

Iowa State Highway Commission

Location: ______ Sec. ____ T. ____ R. ____ Co. ______

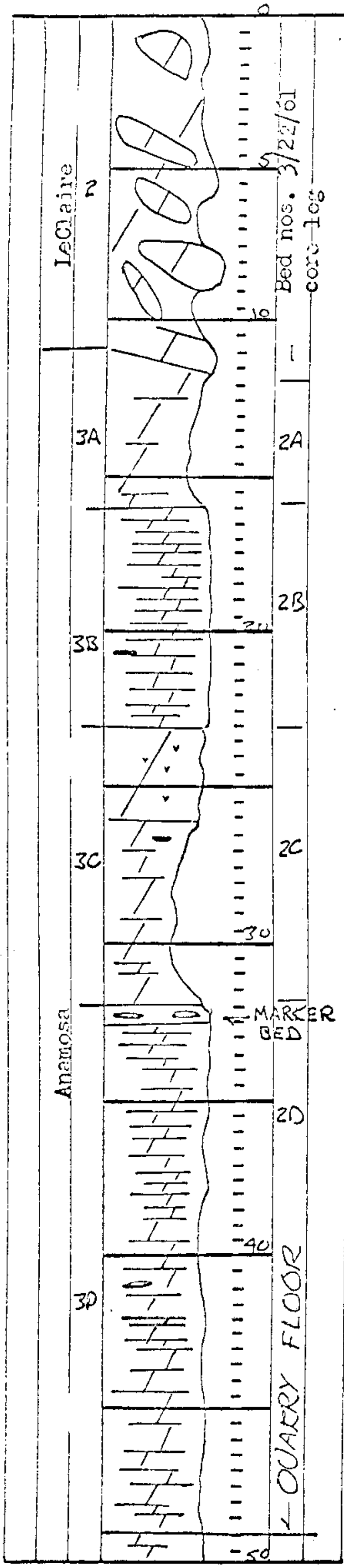
Remarks: ______

Measured by: ______ Date: ______

Unit:	Description	:Thk.
24.	[illegible] ... gray ... [illegible]	[illegible]
25.	Dol... [illegible] ... gray-brown ... [illegible] ... [illegible] ... porous	[illegible]
26.	Dolo..., tan, ... grained, silty, ... [illegible] ... gray chert ... [illegible] ... medium hard, ... [illegible]	[illegible]

Unit No. This Section	5/19/57 Section
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
11	11 & 12
12	13
13	13
14	14
15	15
16	16
17	17
17A	absent
17B	18
17C	19
18	20
19	21
20	22
21	23
22	24
23	25
24	
25	
26	

Iowa State Highway Commission



Location: NE 1/4 Sec. 15 T. 82N R. 6W Co. Linn

Remarks: Conc. Mat'ls. Dytrt Prop. Quarry Face & Core in Quarry Floor | Bed Nos. same as 11/13/61 Generalized log

Measured by: Dirks Date: 12/20/62

Bed: 00: Overburden Description 10 - 50' :Thk.

Coggon

1. Not present in Quarry. (Discribed in 7/11/61 core log)

Anamosa - LeClaire

2. Dolomite, yellowish to reddish-brown, medium grained, as hard, recrystallize masses in an earthy, soft matrix, contains numerous clay pockets, may show high-angle dip, may replace a portion of Bed 3. +11.0

Anamosa

3. Dolo., laminated to distinctively color banded. +68'

(a) Dolo., gray-brown, color banded, soft, earthy, grades to (b) 5-22'

(b) Dolo., brown, laminated with tan sublitho-graphic dolomite, hard 7.0'

(c) Dolo., brown, fine grained, color banded to slightly laminated, has a massive 3.5' bed @ top. 9.0'

(d) Dolo., tan to brown, laminated with tan sublithographic dolomite, has a distinctive 0.5' cherty zone @ top (17.8' to quarry floor) 21.0'

(e) Dolo., brown-gray, medium grained, saccharoidal, distinctively laminated, contains some dark chert. 25.9'

Hopkinton ?

4. Dolo., massive +45'

(a) Dolo., brown, medium crystalline, mottled with yellow earthy dolomite, contains some chert, massive 25.0'

(b) Dolo., gray, medium crystalline, vesicular, contains some white tripolitic chert, massively bedded with thin dark shale partings on bedding planes. 20.2'

Core 62-24

00= (in quarry floor)

Bed	Rec.	Depth
3d	3.3	
3e	25.9	
4a	25.0	
4b	20.2	
Total	74.4	74.9'

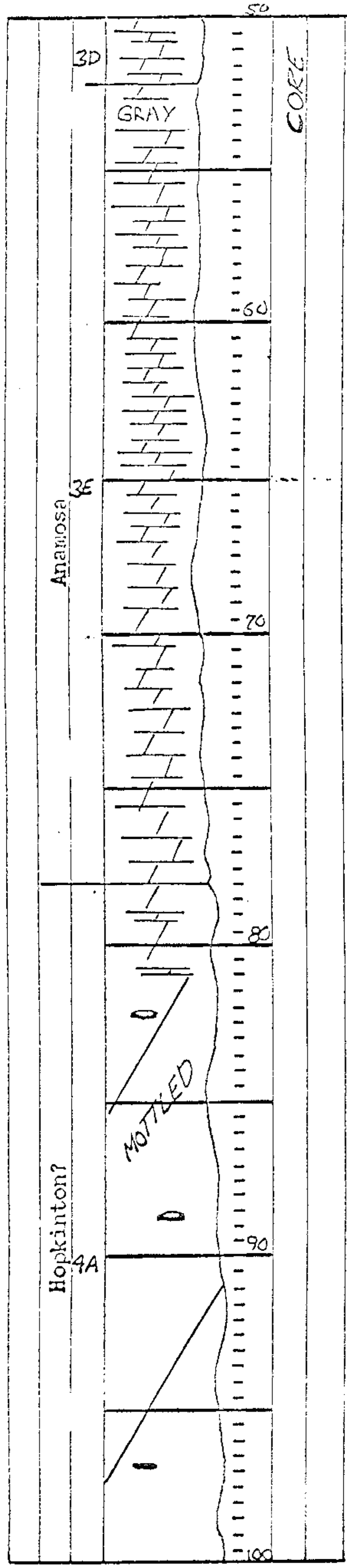
MYERS 9/8/65 ADDITION

(From core 65-2 cored 105.7' into quarry floor)

5. Dolomite; grey; medium crystalline; massive; vesicular; numerous small fossil molds give it a sponge-like appearance; moderately hard 16.6

6. Dolomite; grey; medium crystalline; slightly earthy texture; some chert near top; moderately hard. 7.6'

Iowa State Highway Commission

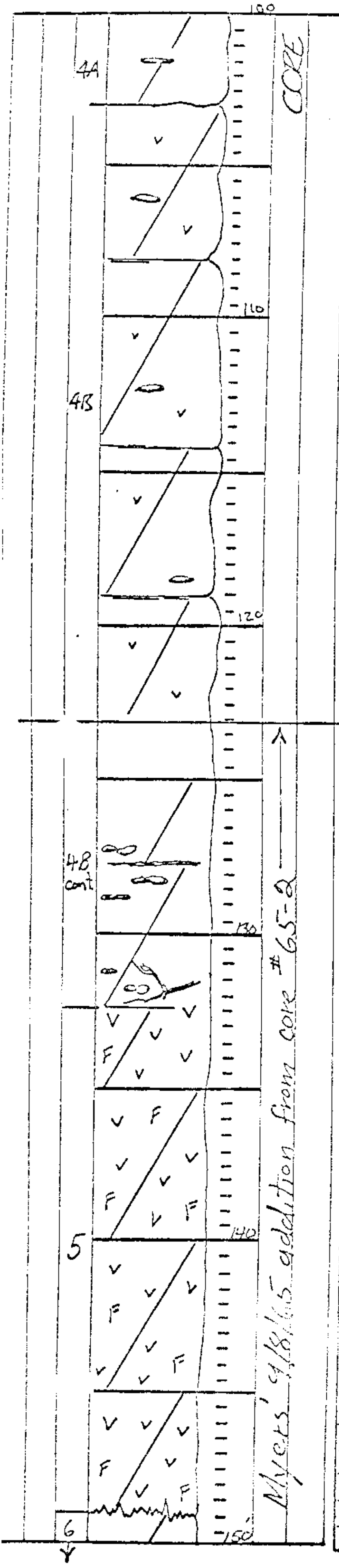


Location: ______________ Sec. ____ T. ____ R. ____ Co. ______________

Remarks: ______________

Measured by: ______________ Date: ______________

Bed:	Description	:Thk.



Iowa State Highway Commission

Location: ______________ Sec. _____ T. _____ R. _____ Co. __________

Remarks: ______________________________

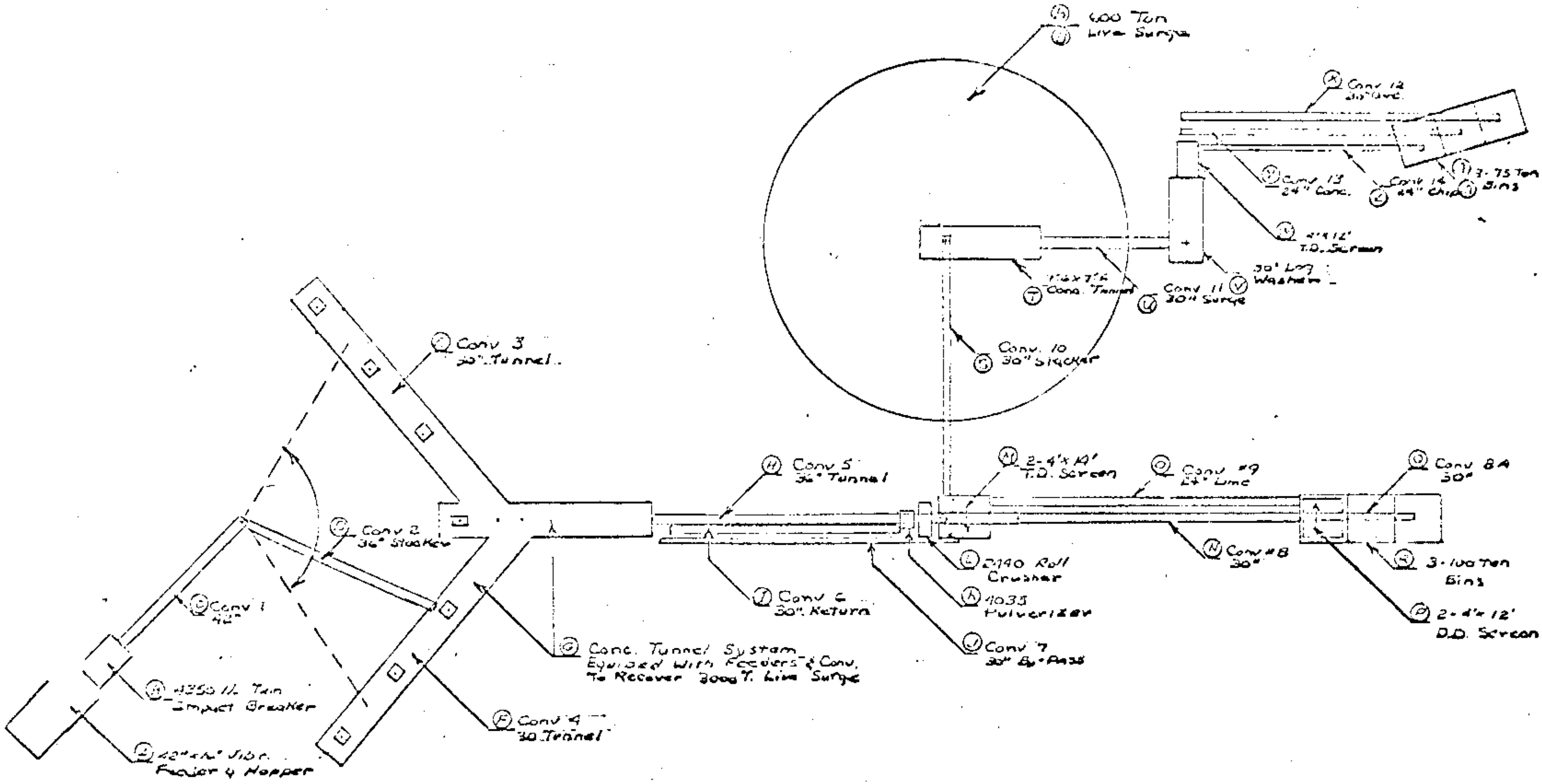
Measured by: ______________________ Date: __________

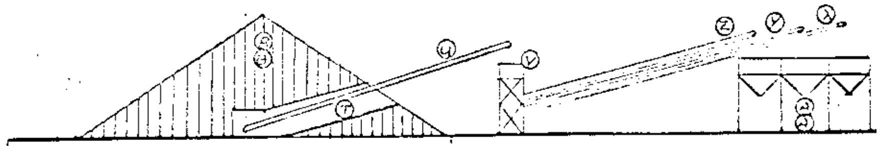
Bed: Description :Thk.

FLOW SHEET

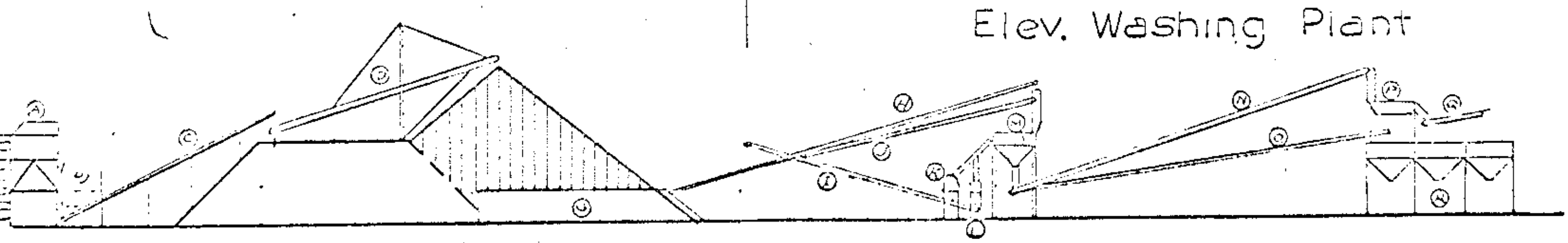
SOUTH CEDAR RAPIDS QUARRY

CONCRETE MATERIALS DIV. MARTIN MARIETTA





Elev. Washing Plant

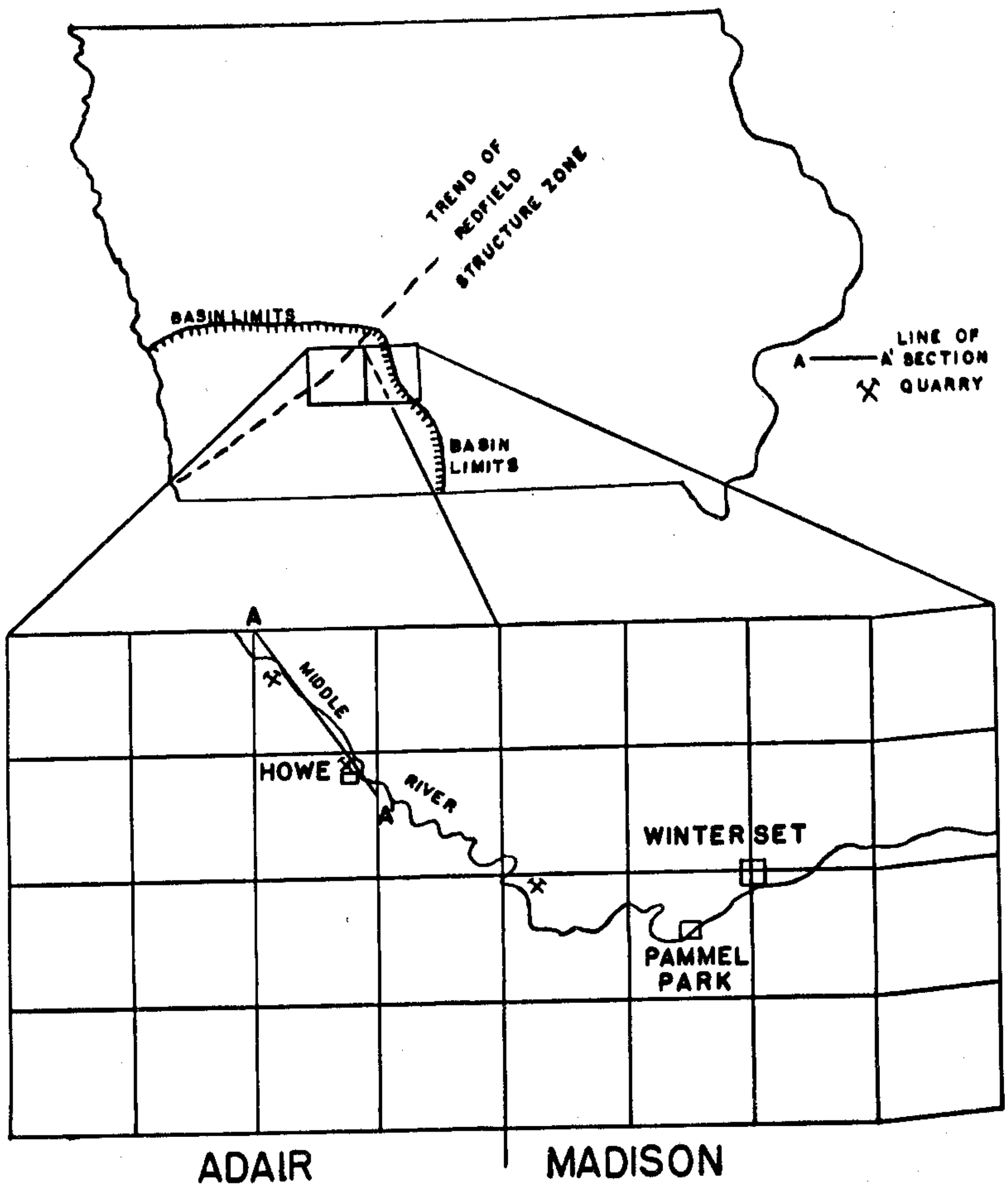


Elev. Main Plant

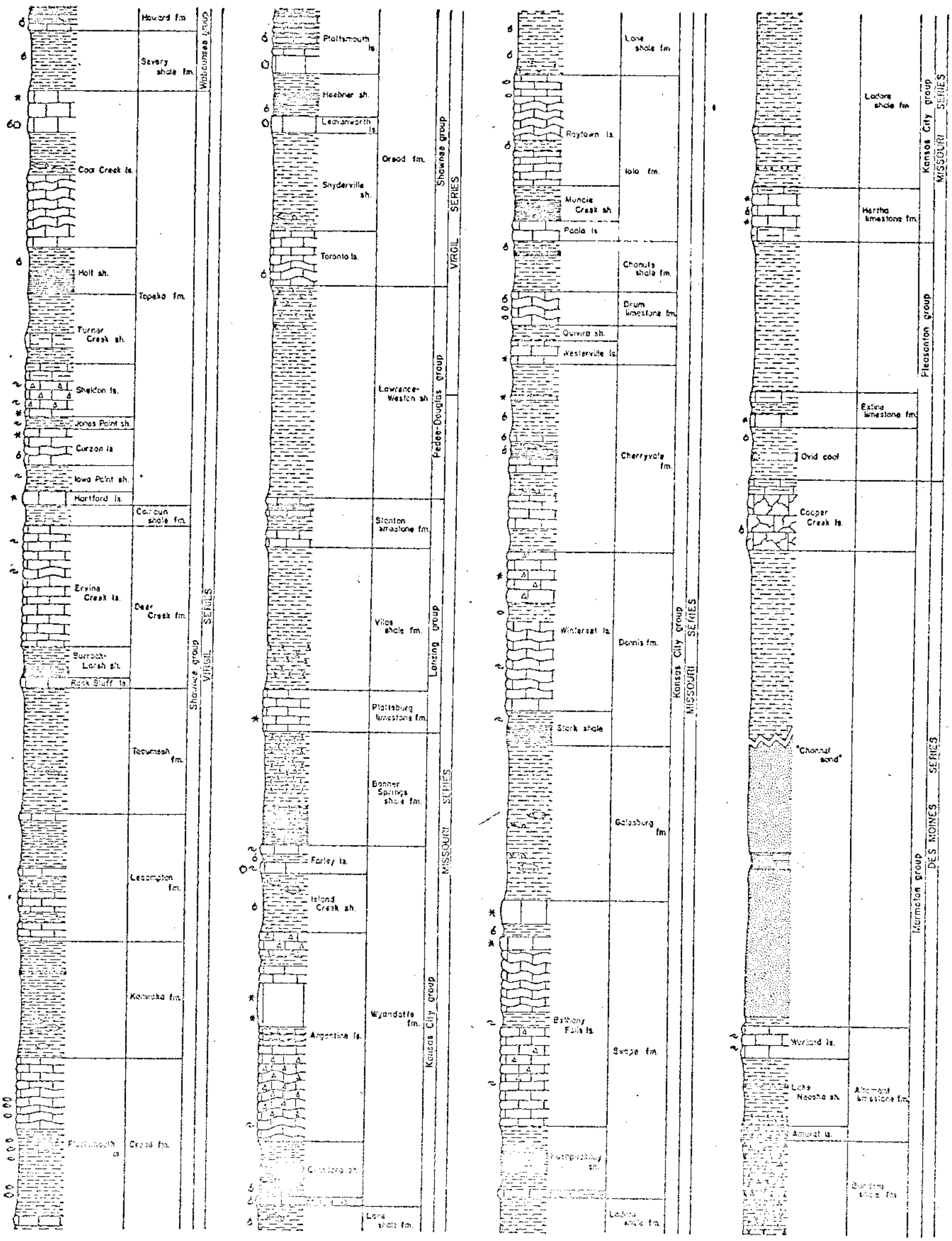
GEOLOGICAL SOCIETY OF IOWA
FIELD TRIP 19
MIDDLE RIVER TRAVERSE
March 23, 1968

by
T. Welp
K. Isenberger
W. Oubberke
J. Myers

LOCATION OF AREA



GRAPHIC COLUMN OF THE ROCKS OF THE PENNSYLVANIAN SYSTEM



G. S. I. FIELD TRIP
MIDDLE RIVER TRAVERSE

T. L. Welp, K. J. Isenberger, W. Dubberke, J. Myers

Introduction

Since 1956 the Iowa State Highway Commission has studied the Pennsylvanian rocks exposed in Iowa and the adjacent states of Nebraska and Missouri, in an effort to locate rock formations that would be suitable for the production of aggregate for use in highway construction work.

The rocks exposed along the Middle River, that extends from the vicinity of Winterset, Madison County to just southwest of Casey, Adair County, a distance of about 35 miles is one of the first areas that has been thoroughly investigated.

Purpose and Scope

The purpose of this trip is to examine Missourian and Virgilian rocks exposed along the Middle River valley and its tributaries in Madison and Adair Counties, Iowa; and to present a correlation and structural interpretation of the exposures in the vicinity of Howe, Adair County.

Lack of subsurface information and a thick mantle of glacial drift has previously obscured the structural features present in the vicinity of Howe. The Howe quarry has been extended southward exposing strata that dip steeply to the southeast, exactly the opposite direction to that assumed by earlier workers. Extensive core drilling in this area has shown this structure to have a structural rise of about 160 feet in a horizontal distance of about 2500 feet. It is possible to trace the beds exposed in the Howe quarry northwestward along the river to Sec. 17, T. 77 N., R. 31 W., where quarrying operations of the Schildberg Construction Company have exposed the sequence from the Winterset limestone to the base of the Bethany Falls limestone.

Previous Work

Early work in this area was done by White (1870), Tilton and Bain (1896), Gow and Tilton (1916), and Tilton (1919, 1920). The most recent work has been done by Wood (1932), Condra and Upp (1933), and Condra and Reed (1937).

Condra and Upp in their 1933 report classified the exposures in the Howe quarry (Sec. 12, T. 76 N., R. 31 W.) as belonging to the Deer Creek formation. Condra and Reed repeated this classification with some modifications in 1937, however they were not too certain of the exact stratigraphic position of these beds.

Stratigraphy

The sequence of rocks exposed along the traverse includes the following formations, from top to base: the Oread, Lawrence, Stranger (?), Vilas (?), Plattsburg, Bonner Springs, Wyandotte, Lane, Iola, Chanute, Drum, Cherryvale, Dennis, Galesburg, Swope, Ladore, and the Hertha. These formations are remarkable in their persistence throughout the midcontinent region, but are considerably thinner in this area than in the type areas.

This northward thinning and the absence of some major limestones has made correlation of the shale units especially difficult, particularly in the Snyderville-Island Creek interval of this traverse.

General Discussion

At each stop there will be a directed discussion regarding the correlation of the exposed rock units. The points for discussion at each stop are listed below.

Stop 1.

Where is the Hertha?

Stop 2.

Reassignment of beds below the argentine. Note especially the index units used for local correlation.

Note the "pebbles" in the Westerville.

Stop 3.

Note the thickness and position of the Hertha below the Bethany Falls. Tunnel is in the Ladore Shale.

Remember Stop 1.

Stop 4.

Basal Argentine, previously designated Iola.

Exposures to the east are the same beds as at Stop 2.

Stop 5.

Reassignment of Farley-Island Creek.

Stop 6.

Is this Oread?

Stop 7.

Reassigned: Previously assigned to Deer Creek formation now assigned to the Swope-Dennis formations.

Note that in the south quarry the beds dip to the south and to the north in the north quarry.

Stops 8 & 9.

Note that Argentine and Winterset outcrop within a few hundred feet of each other in the two quarries.

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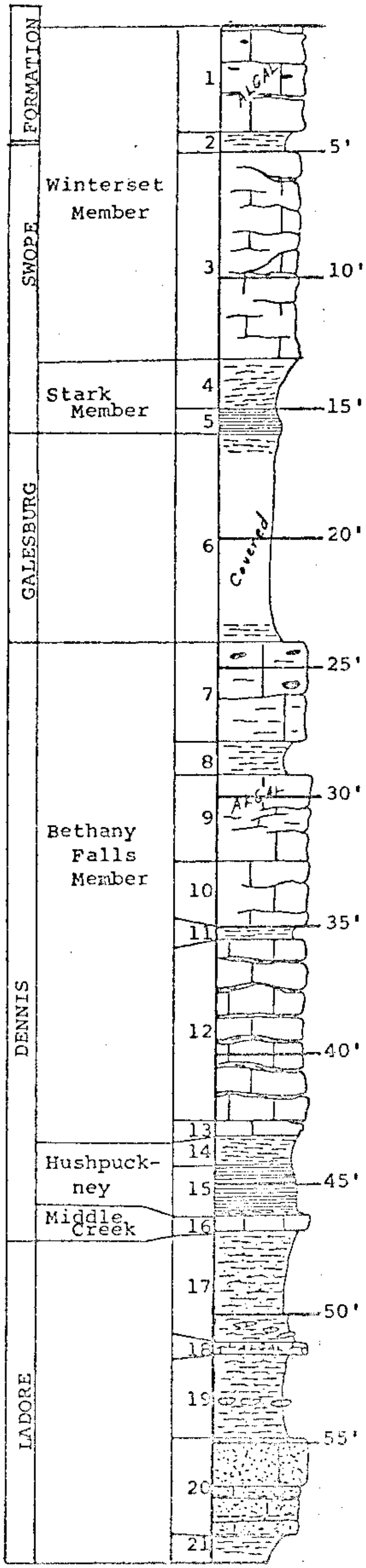
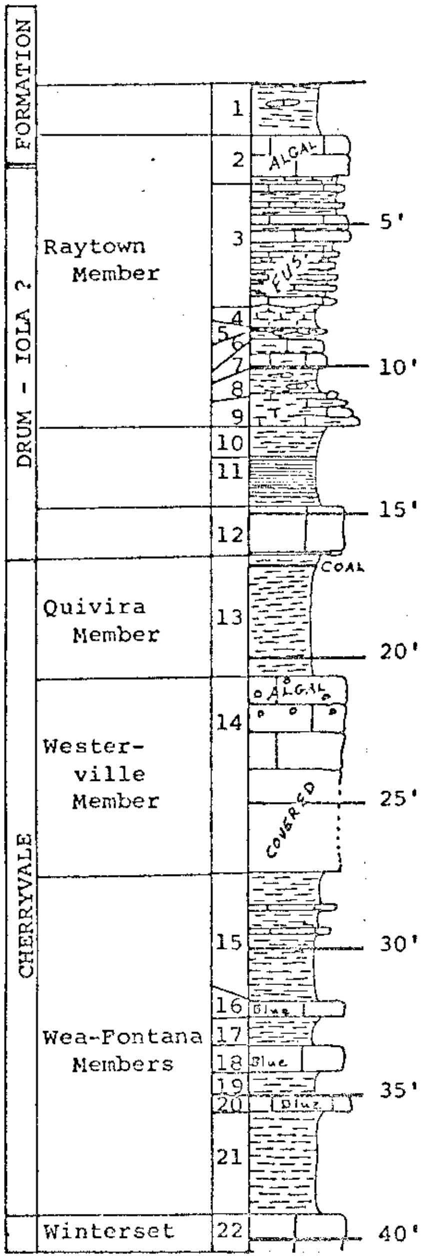
STOP 1: EXPOSURE ALONG STREAM CUTBANK
Location: E½ NW¼ Sec. 22 T75N R28W, Madison Co., Iowa



		Thickness (feet)
	Winterset Member	
1.	Ls., gray, algal, contains some chert nodules and lenses.	4.0
2.	Shale, gray-green.	0.7
3.	Ls., gray, fine grained, fossiliferous, thin shale seams and partings give beds of 0.5 to 1.0 feet.	8.0
	Stark Member	
4.	Shale, gray to buff, fossils at top.	2.0
5.	Shale, black, fissile.	1.0
6.	Shale, covered.	8.3
	Bethany Falls Member	
7.	Ls., gray, as two massive beds, chert nodules in upper bed, lower bed more argillaceous, several fossiliferous zones.	3.8
8.	Shale, gray-green.	1.3
9.	Ls., gray, fine grained, algal, hard @ top with small fossil fragments, middle of bed has numerous shale partings and is soft, brachipods are found in middle of bed.	3.4
10.	Ls., gray, fine grained, massive to bedded, fossiliferous.	3.0
11.	Shale, gray-green.	±0.5
12.	Ls., gray, fine grained, shale partings and seams give thin irregular beds 0.4 feet thick	7.0
13.	Ls., gray to buff, argillaceous, very fossiliferous.	0.6
	Hushpuckney Member	
14.	Shale, gray-green, fossils.	1.2
15.	Shale, black, fissile.	1.8
	Middle Creek Member	
16.	Ls., dark gray-brown.	0.4
17.	Shale, olive to gray-green, calcareous, silty, brown limestone nodules in basal portion.	4.2
18.	Ls., brown to bluish-gray, algal, numerous shale partings give bed nodular character,	0.5
19.	Shale, gray-green, silty, some limestone nodules.	3.3
20.	Sandstone, buff to tan, massive 2.0 foot bed at top in some areas, otherwise consists of thin sandstone beds (0.05 - 0.10 feet) separated by thin shale partings.	2.0-4.0
21.	Shale, gray-green.	+0.5

STOP 2: SOUTH PAMMEL PARK ROAD SECTION

Location: NW¼ Sec. 22 T75N R28W, Madison Co., Iowa

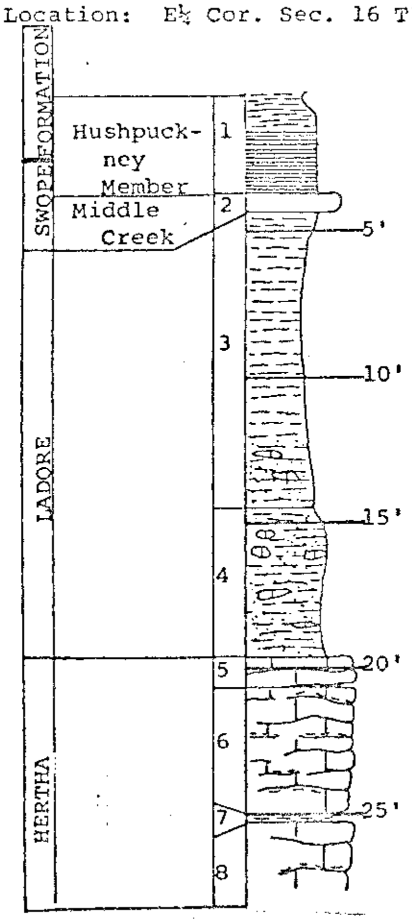


		Thickness (feet)
1.	Shale, light gray, silty, limestone nodules.	
	Raytown Member	
2.	Ls., gray, algal to crinoidal, massive to bedded, soft argillaceous zone at base.	1.8
3.	Ls., gray, very fine grained to sublithographic, thin beds 0.3' separated by shale seams, fossiliferous- crinoids, fusulinids, brachs, etc.	4.0
4.	Shale, gray, limestone nodules at top, very calcareous, fossiliferous.	0.8
5.	Ls., dark purplish brown, as one continuous nodular bed with some brown chert.	0.2
6.	Shale, buff.	0.2
7.	Ls., gray to buff, as two subequal beds separated by a thin shale, argillaceous	1.0
8.	Shale, green-buff,hard, limestone lenses.	0.8
9.	Ls., gray-brown, argillaceous, nodular.	1.0
10.	Shale, green-buff,	0.9
11.	Shale, black, blocky to fissile, thin lighter colored zone in middle, bottom 0.2' is light gray.	1.6
12.	Ls., mottled brown-gray and gray-buff, massive with thin bed at base.	1.9
	Quivira Member	
13.	Shale, gray-buff-green, has a distinctive one-half inch coal smut about 0.2' from top of bed.	4.0
	Westerville Member	
14.	Ls., gray, algal, small dark limestone fragments scattered throughout bed (pebble bed), 3.3' exposed-rest is covered. exposed beds are generally massive 1.0' units.	6.6?
	Wea-Fontana Members	
15.	Shale and Ls., shale is dark gray-green, limestone is dark blue, both are fossiliferous.	4.5
16.	Ls., dark blue, fine grained, argillaceous.	0.5
17.	Shale, gray-green to buff.	1.0
18.	Ls., dark blue, small brachipods.	0.8
19.	Shale, gray-green to buff.	0.7
20.	Ls., dark blue, fine grained, top is very fossiliferous.	0.5
21.	Shale, green to buff, becomes very calcareous in bottom portion.	3.5
22.	Ls., massive - TOP OF WINTERSET LIMESTONE	

STOP 3: EXPOSURE AT EAST END OF TUNNEL IN PAMMEL STATE PARK

(Section starts at base of Bethany Falls Ls.)

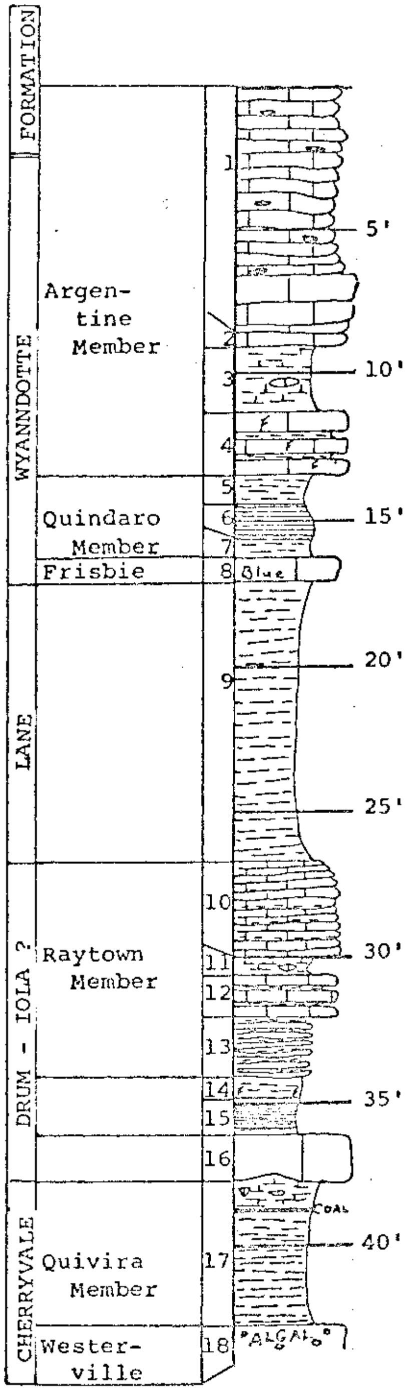
Location: E½ Cor. Sec. 16 T75N R28W, Madison Co., Iowa



		Thickness (feet)
	Hushpuckney Member	
1.	Shale, gray at top going to a fissile black toward base, base partially covered.	3.8
	Middle Creek Member	
2.	Ls., gray, very fine grained, argillaceous, contains crinoid fragments.	0.5
3.	Shale, poorly exposed, greenish-gray at top red at bottom, silty, calcareous, contains limestone nodules at base.	10.8
4.	Shale,green, silty, very calcareous, filled with limestone nodules, gradational boundary with bed above.	5.5
5.	Ls., light gray, very fine grained, hard and dense, algal fragments, thin shale parting at base.	1.0
6.	Ls., tannish gray, fine grained, argillaceous partings, algal and crinoid fragments, a few large brachipods.	4.5
7.	Shale, calcareous, limestone stringers.	0.3
8.	Ls., similar to Bed 6, a little more massive.	+3.5

STOP 4: NORTH PAMMEL PARK ROAD SECTION

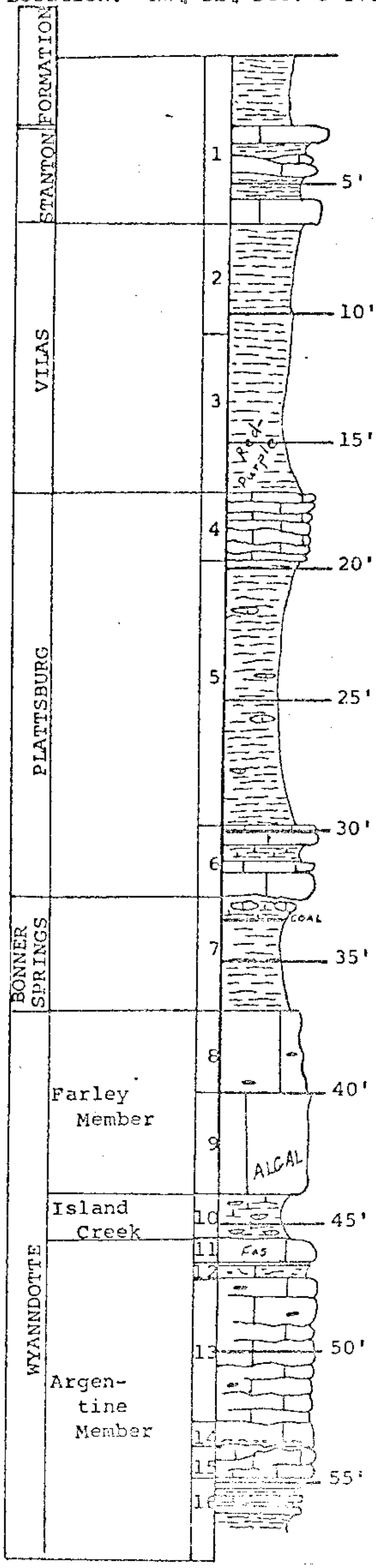
Location: SE¼ 3, NE¼ 10, NW¼ 11 T75N R28W, Madison Co., Iowa



		Thickness (feet)
	Argentine Member	
1.	Ls., gray, thin wavy beds, lower 2.0' as two or three massive beds, some brown nodular chert.	8.5
2.	Ls., buff, argillaceous and soft.	0.5
3.	Shale, gray to buff, limestone nodules and calcareous zones.	2.1
4.	Ls., gray, as three beds of limestone separated by thin shale bands, very fossiliferous.	2.1
	Quindaro Member	
5.	Shale, gray, argillaceous.	1.0
6.	Shale, black, fissile	1.5
7.	Shale, gray to buff.	0.5
	Frisbie Member	
8.	Ls., blue gray, fine grained, argillaceous, large brachipods.	0.7
9.	Shale, gray to buff, locally red in lower 1.5', calcareous at base.	10.5
	Raytown Member	
10.	Ls., gray, thin wavy beds, some shale seams between beds.	3.5
11.	Shale, green, limestone nodules.	0.5
12.	Ls., gray, as three beds with shale between.	1.5
13.	Ls., and Shale.	2.0
14.	Shale, green, very fossiliferous.	0.7
15.	Shale, black, semi-fissile, bottom 0.1' is gray.	1.3
16.	Ls., gray, usually as one massive bed.	1.9
	Quivira Member	
17.	Shale, gray to green, has a distinctive one-half inch coal smut about 1.0' from top of bed.	5.0
	Westerville Member	
18.	Ls., gray, algal, small dark limestone fragments (pebble bed)	

STOP 5: STANZEL QUARRY

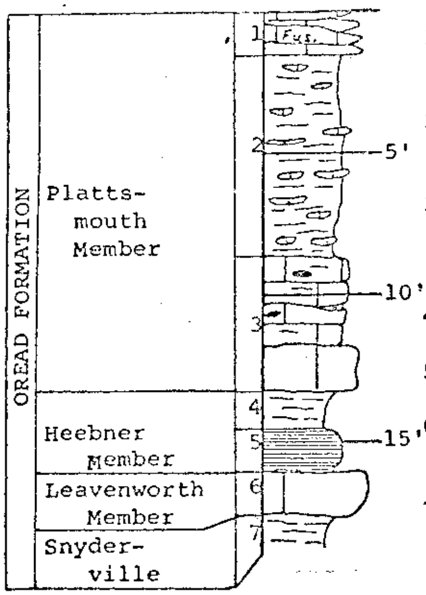
Location: NW¼ SE¼ Sec. 5 T75N R29W, Madison Co., Iowa.



		Thickness (feet)
1.	Shale and Ls., consists of dark gray shale with several layers of fossiliferous blue limestone.	
2.	Shale, blue-gray, fossiliferous at top.	5.0
3.	Shale, red, calcareous.	6.5
4.	Ls., greenish-gray, weathers nodular, "oatmeal texture" due to abundance of algae.	2.0
5.	Shale, bluish-gray top and bottom, some maroon in middle.	10.0
6.	Ls., blue-gray, pyritic and shaly at top.	3.0
7.	Shale, olive to dark gray, with a 1" coal smut about 0.7' from top, numerous limestone nodules.	4.0
	Farley Member	
8.	Ls., light ~~gray to green~~, argillaceous to shaly in zones, some brown chert.	3.0
9.	Ls., light gray, algal clastic, has distinctive "oatmeal texture", massive.	4.0
	Island Creek Member	
10.	Shale, green, interbedded with argillaceous limestone.	1.8
	Argentine Member	
11.	Ls., light gray-tan, clastic, filled with fusulinids, massive to two subequal beds.	1.0
12.	Ls., tan, sublithographic, nodular, clastic in zones, contains abundant dark chert, numerous green shale partings.	0.4
13.	Ls., light gray to tan, sublithographic with crystalline zones, numerous dark chert nodules in upper 3.0', thin bedded, shale parting marks base.	5.4
14.	Ls., similar to Bed 13, as one bed, shale and chert band marks base.	1.0
15.	Ls., gray-tan, sublithographic, numerous argillaceous partings.	1.1
16.	Ls., gray, fine grained, thin bedded with distinctive shale partings on bedding planes.	1.0-1.5

STOP 6: EXPOSURE ALONG STREAM CUTBANK

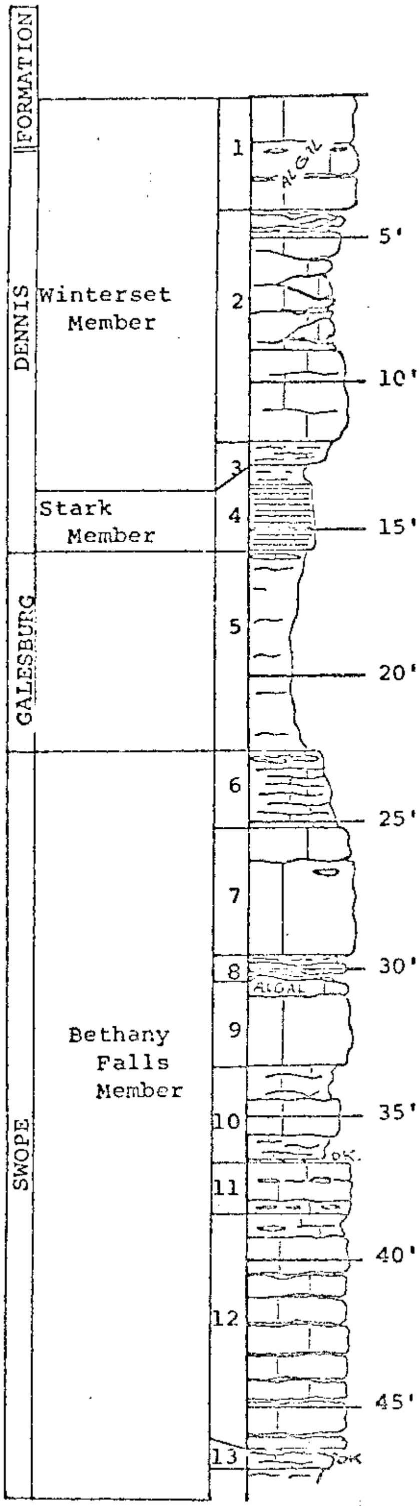
Location: NW¼ Sec. 7 T75N R29W, Madison, Co., Iowa



	Thickness (feet)
Plattsmouth Member	
1. Ls., light gray to buff, thin bedded, filled with fusulinids.	
2. Ls. and Shale, weathers buff, numerous fossils.	6.8
3. Ls., dark-bluish gray, contains some dark chert, fossiliferous, bottom 1.0' is massive rest is unevenly bedded.	4.5
Heebner Member	
4. Shale, gray.	1.2
5. Shale, black, fissile, lower 0.2' is gray.	1.5
Leavenworth Member	
6. Ls., dark bluish-gray, one massive bed, contains algal masses.	1.1
Snyderville Member	
7. Shale, gray.	+1.0

STOP 7: HOWE QUARRY

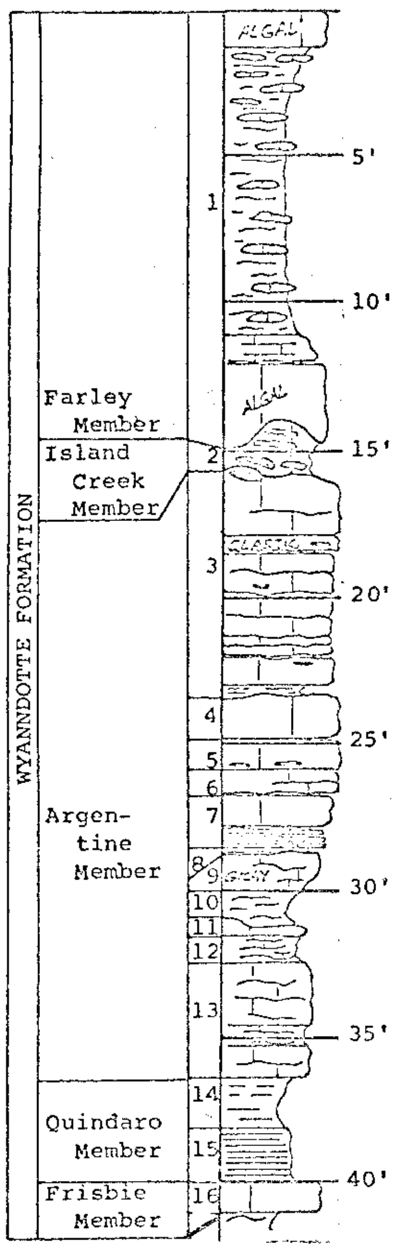
Location: SW¼ Sec. 1 T76N R31W, Adair Co., Iowa



		Thickness (feet)
	Winterset Member	
1.	Ls., tan, algal, contains some dark chert.	2.2-4.0
2.	Ls., gray-brown, fine grained to sublithographic	7.9
	(a) Ls., argillaceous, grades to shale in areas. 0.6'	
	(b) Ls., as thin irregular beds with shale on bedding planes, contains fossils. 4.3'	
	(c) Ls., similar to 2b but more massively bedded. 3.0'	
3.	Ls., gray, very argillaceous, grades to shale at base.	0.7-1.0
	Stark Member	
4.	Shale, black, fissile, top 0.5' gray and blocky.	2.7-3.3
5.	Shale, greenish-gray, blocky.	6.0-7.5
	Bethany Falls Member	
6.	Ls., greenish-gray, very fine grained, very argillaceous, has rubble zone at top.	2.7
7.	Ls., tan, fine grained, contains some dark chert, massive with distinctive 1.0' bed at top.	4.1
8.	Shale and Ls., gray, as calcareous shale at top and bottom with argillaceous limestone band near the center.	0.6-1.0
9.	Ls., tan, fine grained, top 0.5' algal.	2.8
10.	Ls., brown to gray, fine grained, as three subequal beds, the upper being argillaceous, the middle hard and the lower is very argillaceous, has a distinctive dark zone at base.	3.3
11.	Ls., light brown, fine grained, contains dark chert nodules, numerous algal fragments.	1.8
12.	Ls., light brown, very fine grained to finely clastic, as 0.3 to 0.5' wavy beds with argillaceous material on bedding planes.	±8.0
13.	Ls., gray, argillaceous, has distinctive dark shale band at top.	±0.5
14.	Shale, gray.	

STOP 8: MENLO QUARRY

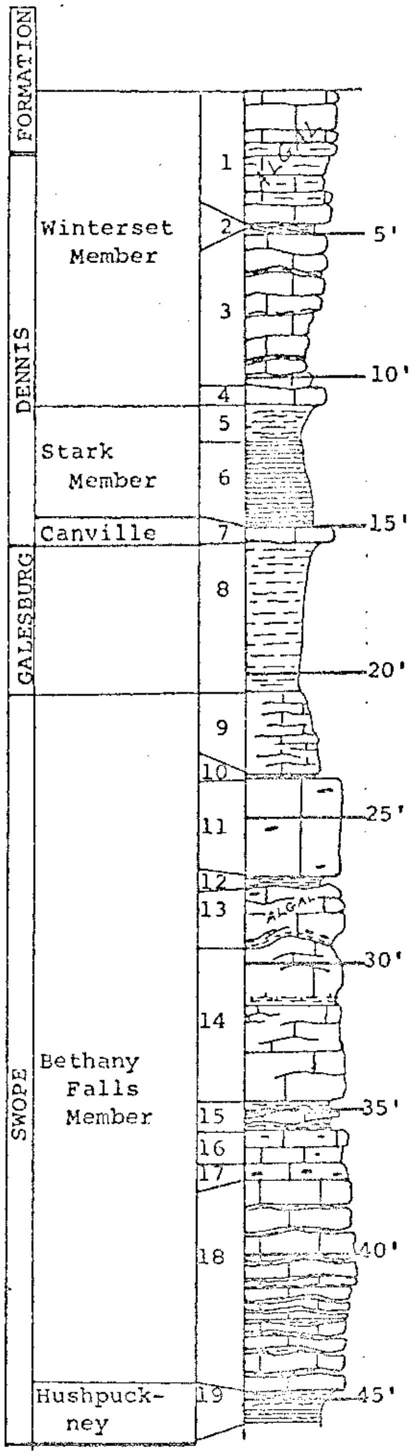
Location: SE¼ Sec. 17 T77N R31W, Adair Co., Iowa



		Thickness (feet)
	Farley Member	
1a.	Ls., tan to greenish, algal clastic.	0-1.3
1b.	Shale, greenish-gray, numerous limestone nodules.	0-9.7
1c.	Ls., gray-tan, algal clastic.	1.5-4.1
	Island Creek Member	
2.	Ls., rubble, abundant green shale.	0.4-3.9
	Argentine Member	
3a.	Ls., gray-tan, sublithographic to medium crystalline, massive to bedded, some dark chert, gradational with bed above.	2.0-2.4
3b.	Ls., tan to brown, algal clastic, may contain chert, distinctive marker bed.	0.3-0.6
3c.	Ls., tannish-gray to reddish brown, sub-lithographic to medium crystalline, thin wavy beds, some dark chert.	3.5-5.0
3d.	Shale, green, soft.	0.1-0.4
	--(Beds 4 through 6 generally occur as one unit)--	
4.	Ls., tan to brown-gray, sublithographic to medium crystalline, shale parting at base.	1.0-1.3
5.	Ls., similar to Bed 4, as one bed.	0.9-1.3
6.	Ls., similar to Bed 4, massive to thin bedded, distinctive shale band at base.	1.0
7a.	Ls., tan-gray, fine grained, as one bed.	0.8-1.1
7b & c.	Ls., tan-gray, fine grained, as two or three beds with shale on bedding planes.	0.4-0.6
8.	Shale, olive to dark gray, calcareous.	0.1-0.3
9.	Ls., gray, fine grained, argillaceous.	1.0-1.7
10.	Shale, greenish to dark gray.	0.8-1.5
11.	Ls., blue-gray, fine grained.	0.0-0.5
12.	Shale, gray, calcareous.	0.8-1.2
13.	Ls., gray, fine grained, very argillaceous.	2.6-4.0
	Quindaro Member	
14.	Shale, gray to dark gray.	1.5
15.	Shale, black, fissile.	1.7
	Frisbie Member	
16.	Ls., blue-gray, fine grained.	0.7-1.0

STOP 9: JEFFERSON QUARRY

Location: NW¼ NW¼ Sec. 17 T77N R31W, Adair Co., Iowa



		Thickness (feet)
	<u>Winterset Member</u>	
1.	Ls., gray, algal, some soft argillaceous zones, very fossiliferous.	4.5
2.	Shale, buff-green, discontinuous, can contain thin limestone lenses.	0.5
3.	Ls., gray, fine grained, shale on bedding planes, fossiliferous.	5.5
4.	Ls., dark gray, fine grained, fossiliferous.	0.5
	<u>Stark Member</u>	
5.	Shale, buff, silty, hard at top.	1.3
6.	Shale, black, fissile.	2.5
	<u>Canville Member</u>	
7.	Ls., dark blue gray, fine grained, fossiliferous.	0.5
8.	Shale, gray, silty.	5.7
	<u>Bethany Falls Member</u>	
9.	Ls., green-gray, fine grained, very argillaceous, rubble zone at top.	3.0
10.	Shale green to buff.	0.1
11.	Ls., light gray, medium grained, massive, some dark chert, algal, very fossiliferous.	3.5
12.	Shale, gray to buff, brachipods.	±0.5
13.	Ls., gray, algal, uneven base with chert nodules in lower 0.5'	2.0
14.	Ls., gray, fine grained, numerous shale partings, thin bedded.	5.1
15.	Shale buff to gray, has a limestone lense in the middle.	1.0
16.	Ls., brownish-gray, hard, occasional dark chert nodule.	1.0
17.	Ls., buff to gray, nearly filled with chert.	0.5
18.	Ls., light gray, thin uneven beds becoming more argillaceous toward base, fossiliferous.	7.0
	<u>Hushpuckney Member</u>	
19.	Shale, poorly exposed in sump, gray at top becoming black and fissile toward bottom	

Mississippian - Devonian of North-Central Iowa. ~~[illegible]~~ ~~Iowa Geological Soc.~~

G.S.I. Field Trip 20

June 29, 1968

Trip Leaders: Fred H. Dorheim, Don L. Koch, Mary C. Parker

General section involved.

Mississippian.

Maynes Creek, cherty dolomite.
Chapin - crinoidal, "oolitic" limestone.
Prospect Hill - siltstone.
McCraney - sub-lithographic limestone and dolomite, chippy.

Devonian.

English River - siltstone.
Maple Mill - shale.
Aplington - cherty dolomite with crinoidal "oolite" at base.
Sheffield - shale.
Lime Creek (Owen) - limestone.

Stop 1: SW¼ NE¼ sec. 35 T.91N., R.19W., left creek bank (index fossil Paryphorencus brach)

Don Nelson's "cystoid find"

Chapin - 1½' crinoidal, pseudo oolitic
Prospect Hill - 6½' extremely weathered
McCraney - 13½', no oolite exposed. # lithographic - sublithographic
Maple Mill or Sheffield - found by digging in stream bed.

Stop 2: NW¼ NE¼ sec. 21 T.91N., R.19W., left creek bank

tree in creek horses

Exposed:
Maynes Creek - 31½' much chert, crinoidal zone
In cores:
Prospect Hill - 16½' max.
McCraney - 9-11'
Maple Mill or Sheffield - 16'
Aplington or Owen - 9' to T.D.

Stop 3: Cen. sec. 15 T.91N., R.19W.

electric station

a. 1/8 mi. E.
McCraney, in road ditch. over Aplington?

b. 1/8 mi. N.
Chapin? Basal McCraney over (Aplington), or upper facies of the McCraney ? crinoidal "oolite"
or
Eagle City over Maynes Creek.

omit c. 1/8 mi. W.
Chapin or basal McCraney in road ditch.

d. ½ mi. W. south of bridge.
(Aplington) or Maynes Creek.

→ e. W.½ cor. SE¼ sec. 10 T.91N., R.19W., quarry scar east of bridge.
1st stop after lunch (large cottonwood)
(Aplington over Sheffield,)
or
Maynes Creek over Maple Mill,
or
Maynes Creek over Sheffield.

omit f. NE¼ SE¼ sec. 10 T.91N., R.19W.
Basal Aplington over Sheffield
or
Chapin over Maple Mill.

abandoned quarry in hill behind farmstead

Stop 4: S. of N½ cor. sec. 14 T.91N., R.19W., abandoned quarry and creek bed.
Maynes Creek over Chapin,
or
Aplington. - pink basal oolite zone, crinoidal

Stop 5: E.½ cor. sec. 14 & SW¼ sec. 13 T.91N., R.19W.
McCraney over Aplington.

Stop 6: W.½ SE¼ sec. 13 T.91N., R.19W., along creek.
Basal Aplington over Sheffield
or
Chapin over Maple Mill.

Stop 7: N. of E.½ cor. sec. 13 T.91N., R.19W. & N. of W.½ cor. sec. 18 T.91N., R.18W.
Owen.

Note: Just outside the area, in SE¼ NE¼ SW¼ SE¼ sec. 16 T.91N., R.19W., the Nancy Abbas well shows the following section:

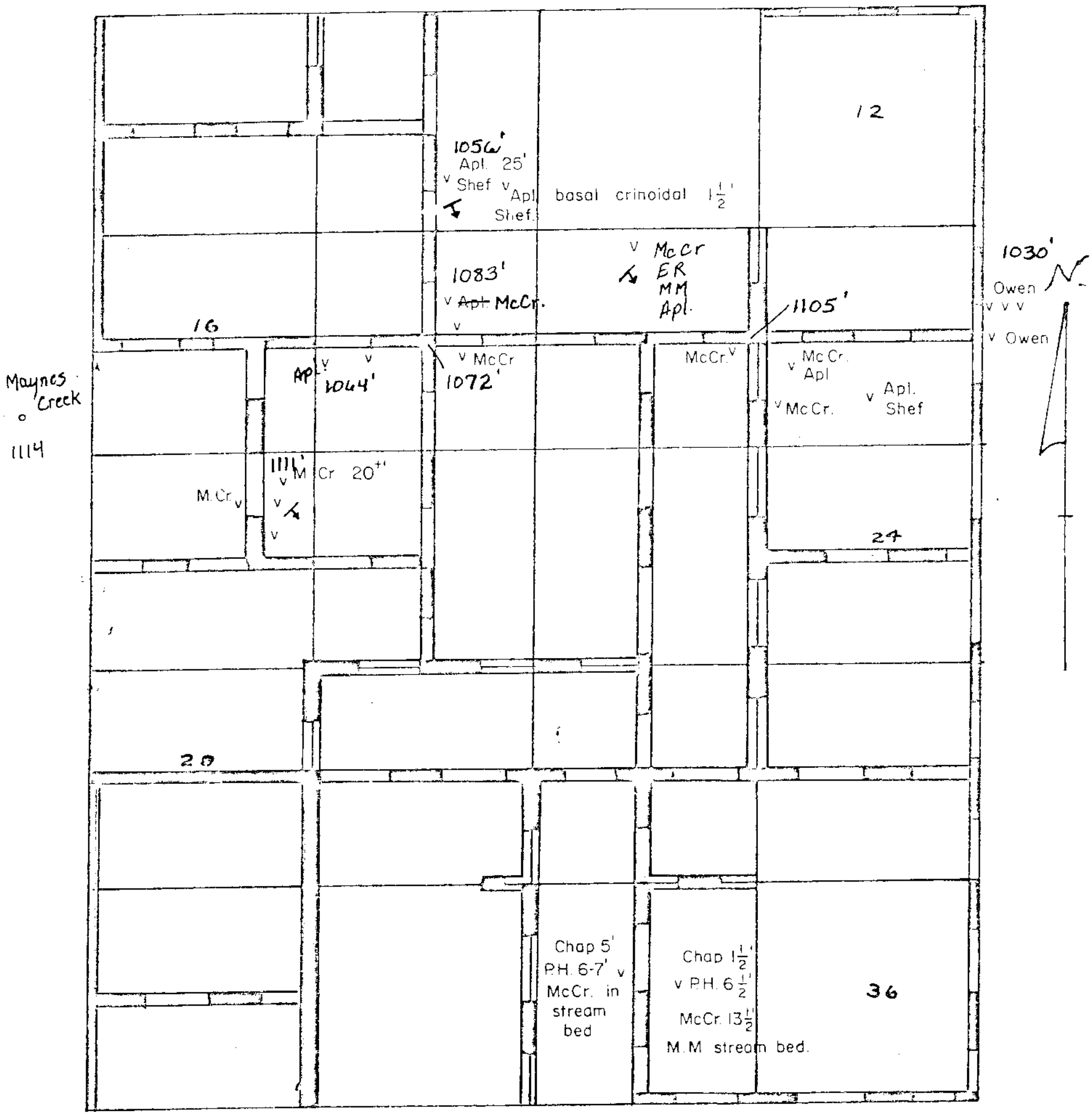
0 - 8' ... Pleistocene.
8 - 28' ... Maynes Creek dolomite.
28 - 43' ... Prospect Hill siltstone.
43 - 53' ... McCraney limestone and dolomite.
53 - 63' ... Maple Mill shale.
63 - 84' ... Aplington dolomite.
T.D. 84'

Lime Creek
Owen
'gastropods - Floydia gigantea

Stop 8: Sit down and discuss what you have seen.

GSI Field Trip

June 29, 1968



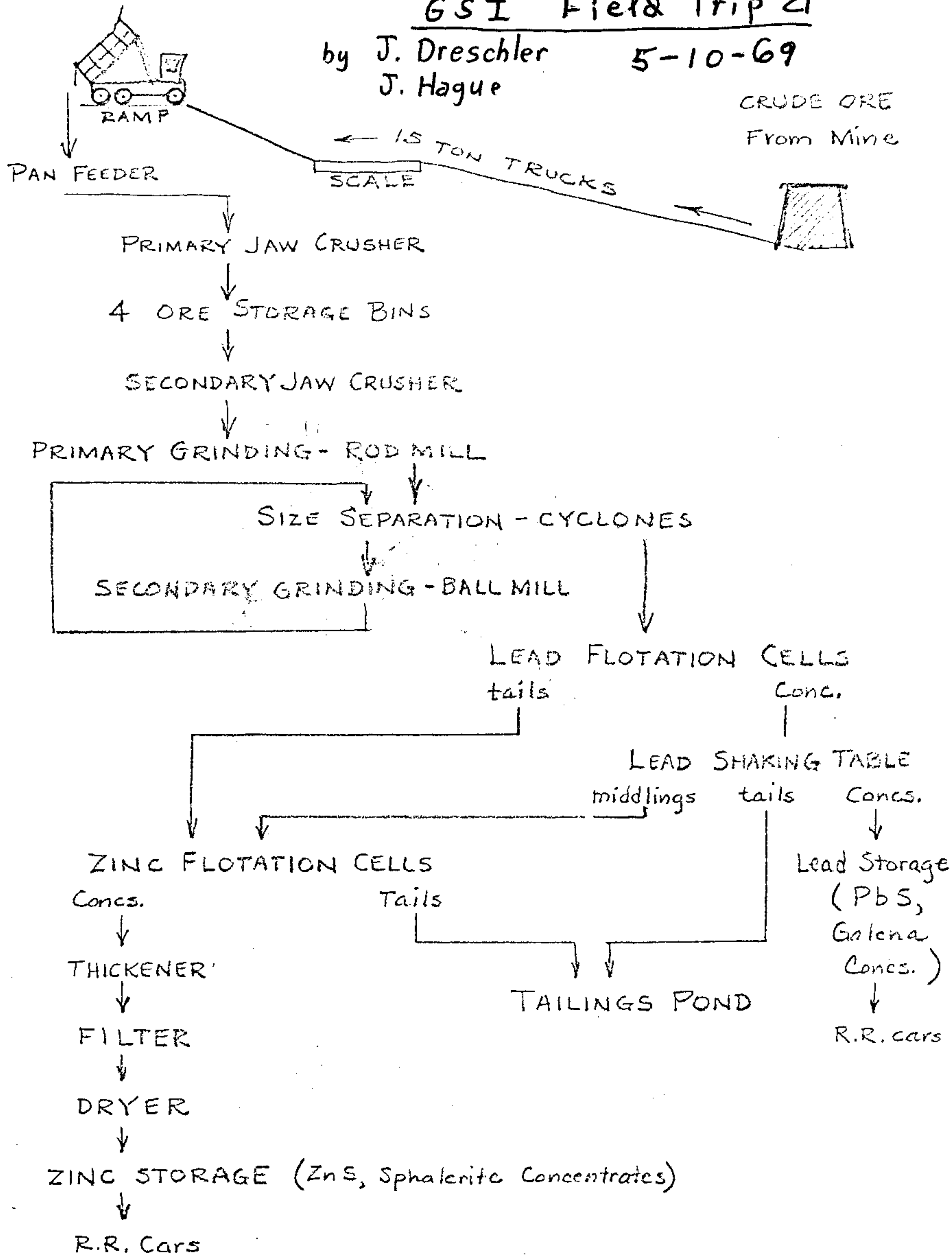
Part of T 91 N., R 19 W.

FLOW SHEET - ELMO MILL

GSI Field Trip 21

by J. Dreschler
J. Hague

5-10-69



The New Jersey Zinc Co.
Platteville, Wisconsin

THE GEOLOGICAL SOCIETY OF IOWA

GUIDEBOOK 23

15 August, 1970

GEOLOGY AND GEOHYDROLOGY OF THE RED ROCK DAM, MARION COUNTY, IA.

Compiled by: Vern Greenwood
U.S. Army Engineer District
Corps of Engineers
Rock Island, Illinois

RED ROCK RESERVOIR
HOWELL DAM SITE
DES MOINES RIVER, IOWA

DESIGN MEMORANDUM NO. 13

GEOLOGY AND SOILS

I - INTRODUCTION

1. General.- The Red Rock Reservoir is located on the Des Moines River in south-central Iowa. It lies in the Dissected Till Plains Section of the Central Lowland Province, which includes all of Iowa except the north-central and the northeastern "driftless area" portions, northern Missouri, northeastern Kansas, eastern Nebraska, and southeastern South Dakota. As the term implies, the area has a mature topography developed on the materials deposited directly and indirectly by continental glaciation.

2. Most of the bedrock in Iowa is sedimentary. The structure of the beds is that of a shallow, broad syncline whose axis slopes gently southerly. Prior to the Pleistocene, the bedrock was eroded to a surface of less slope than that of the bedding, so that the eroded surface presented outcrops of successively older formations in the up-dip directions to the northwest, the north, and the northeast.

II - THE RESERVOIR AREA

3. Location.- Plate 1 shows the location of the reservoir area. The reservoir lies in parts of Marion, Jasper, Warren, and Polk Counties. The dam site is 142.9 miles above the mouth of the Des Moines River. The reservoir area is about 37 miles in length, extending to the downstream environs of Des Moines, the State Capitol.

4. Topography.- The flood plain of the river in the reservoir area varies in width from about a mile to almost 3 miles. Flood plains are also developed along the chief tributaries, Whitebreast Creek and South and Middle Rivers. Above the valley floors the topography is steep to rolling for a few miles from the streams. Although most of the area in the vicinity of the reservoir is in a mature stage, some interstream areas are almost flat. Generally, the valley sides of the Des Moines River and its major tributaries slope gently, owing to the absence of resistant bedrock. In a few reaches, however, where a thick formation of sandstone outcrops, as near the town of Red Rock, the bluffs are practically vertical. Relief along the Des Moines River is on the order of about 150 feet.

5. Mantle.- The entire reservoir area has probably been covered by deposits of the Nebraskan and certainly by deposits of the Kansan glaciers. Successive stages of later glaciation did not extend into the area, though the Mankato lobe of the Wisconsin extended southward as far as Des Moines. Because of an uneven preglacial surface and erosion since its deposition, the till of the two glacial stages varies considerably in thickness. Most of whatever deposits of till filled the major stream valleys have been removed. The till is lacking also on some of the steeper slopes. Beneath the uplands it reaches depths of 100 feet or more. Associated with till are occasional strata or pockets of sand.

6. Loess was deposited on the Kansan till. In and immediately adjacent to the reservoir area the loess ranges in thickness from zero on the steeper valley sides to an average of about 15 feet on the uplands.

7. The broad valley floors of the Des Moines River and its major tributaries are covered with alluvium, a silty to sandy loam, ranging in thickness from a few to about 15 feet in thickness. This is generally underlain

by glaciofluvial sand and gravel. A post-Kansan and pre-Wisconsin stream in the location of the present Des Moines River flowed at levels 30 to 40 feet below the present riverbed. The filling of this former channel is a mixture of boulders, cobbles, pebbles, and sand, the coarser at the bottom and sand with little gravel at the top. In some parts of the State there are preglacial channels a hundred feet or more below the present drainage courses in the vicinity of these channels. As far as is known, there is no preglacial channel in the vicinity of the reservoir deeper than the one below the present course of the Des Moines River.

8. Bedrock.- The bedrock beneath the reservoir area, to a depth of a few thousand feet, is sedimentary, of Paleozoic age. Shales, sandstones, and limestones constitute the surface and near-surface rock, the shales predominating. The general dip of the strata is to the south-southwest, about 10 feet per mile. Variations in the dip occur as the result of minor local deformation.

9. The distribution of the surface bedrock in the reservoir area is shown on plate 2. The Des Moines series of the Pennsylvanian system is the surface bedrock over practically the entire area. As surface bedrock, the Mississippian system is represented only in the lower part of the Des Moines River valley in the vicinity of the dam site.

10. The Pennsylvanian Des Moines rocks are typically shales, varying in hardness, texture, and color. The colors are generally black or gray. The black, carbonaceous shales are usually hard and laminated, and the gray tend to be softer, sometimes clay-like, and massive. Other types are sandy, and some may be described as siltstones. Interbedded in the shales are occasional sandstones, limestones, and coal. These interbedded strata are generally thin and of limited extent. An exception is the Red Rock sandstone, a formation more than a dozen miles long, about 3 miles wide, and more than 100 feet thick. It was apparently laid in a channel cut into the shales. In the Des Moines River valley it outcrops near the town of Red Rock. Similar formations exist in other parts of the State.

11. The Mississippian surface bedrock consists of sandstone and limestone. At the dam site these extend to 60 or 70 feet below the flood plain and are underlain by massive dolomitic shale to an additional depth of at least

70 feet. The upper Mississippian limestones outcrop in a few places and are quarried in several places in the general vicinity of the dam site. The rock is used chiefly for road surfacing and for agricultural lime.

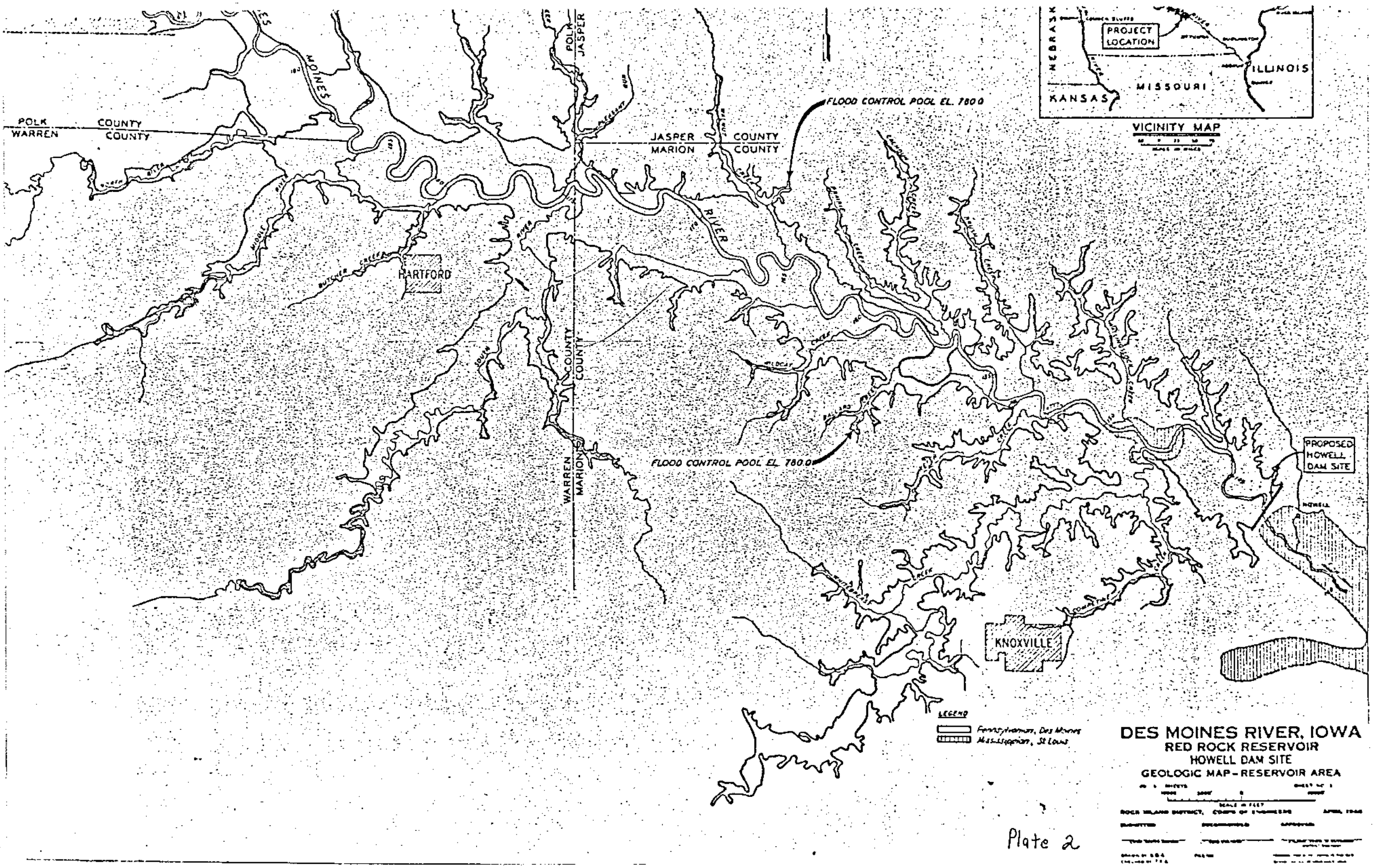
12. The contact between the Mississippian and Pennsylvanian rocks, representing an erosional surface, is rather irregular. For example, at the dam site within about half a mile, Mississippian limestone is found in the bluff 80 feet higher than the lowest Pennsylvanian shale encountered beneath the flood plain.

13. Displacements of strata, as far as can be determined from outcrops, quarries, and from borings at the dam site, are of small magnitude. Occasional small faults of no more than a few inches displacement are observed in quarries in the Mississippian rocks in the vicinity of the reservoir. Occasional slicken sides are noted in cores of borings obtained at the dam site.

14. A considerable distance to the west of the reservoir area there is a displacement of quite large magnitude. This is the Thurman-Wilson fault, extending from the southwest corner of the State to about 30 miles west of Des Moines. The greatest vertical displacement, about 300 feet, is at the southwest end of the fault, the southerly side being downthrown. In some places it is believed to pass into a steep monocline. The time of displacement is post-Pennsylvanian and pre-Cretaceous. No evidence of recent faulting on any scale has been observed in this part of Iowa.

15. Earthquakes have been experienced in the midwestern states in recent times. Two have been centered in northeastern Illinois in 1909 and 1912. Two others, 7 weeks apart, were centered in northwestern Illinois, occurring in November 1934 and in January 1935. None is known to have affected the vicinity of the Red Rock reservoir. The shock of November 1934 appears to have been the most severe, but its duration was only momentary. It was described as having an intensity of 6 in the Rossi-Forel scale. Locks and dam No. 15 in the Mississippi River, within the area believed to have been most severely affected, were not damaged in any way, nor were other structures such as bridges spanning the Mississippi River in the area.

7. Engineering characteristics of bedrock. The formation of the gypsum domes resulted in intense fracturing of the overlying limestones and sandstones. After cutting of the Des Moines River valley, ground water had free access through the fractured rocks to the gypsum, resulting in removal of some of the gypsum. Such removal has resulted in subsidence and further fracturing of the overlying rocks. The space formerly occupied by gypsum has been partially filled with detrital material, silts, clays, sands, and fragments of rock, from the overlying rocks. The ready access of ground water to the fractured formations has resulted in some weathering along joints and seams, solutions of limestone with clay filling of the cavities, and leaching of sandstone. The cementing material in the latter is calcium carbonate. Uncemented phases of the sandstone (product of leaching) are generally less prevalent with depth.



VICINITY MAP
PROJECT LOCATION
NEBRASKA
KANSAS
MISSOURI
ILLINOIS
PROPOSED HOWELL DAM SITE
FLOOD CONTROL POOL EL. 780.0
FLOOD CONTROL POOL EL. 780.0
POLK COUNTY
WARREN COUNTY
JASPER COUNTY
MARION COUNTY
POLK
JASPER
WARREN COUNTY
MARION COUNTY
MOINES
RIVER
HARTFORD
KNOXVILLE
LEGEND
Pennsylvanian, Des Moines
Mississippian, St Louis
DES MOINES RIVER, IOWA
RED ROCK RESERVOIR
HOWELL DAM SITE
GEOLOGIC MAP - RESERVOIR AREA

Plate 2

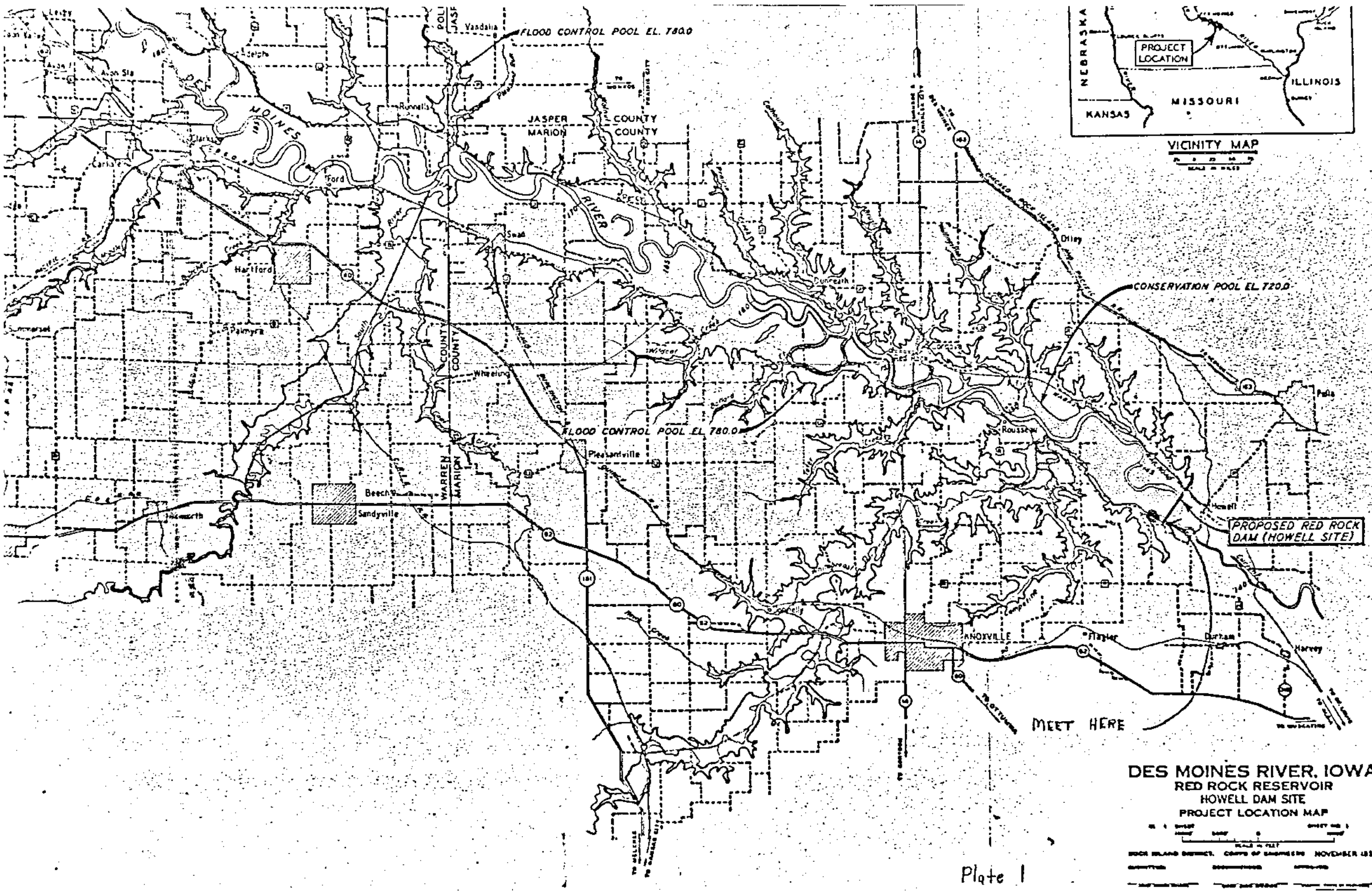
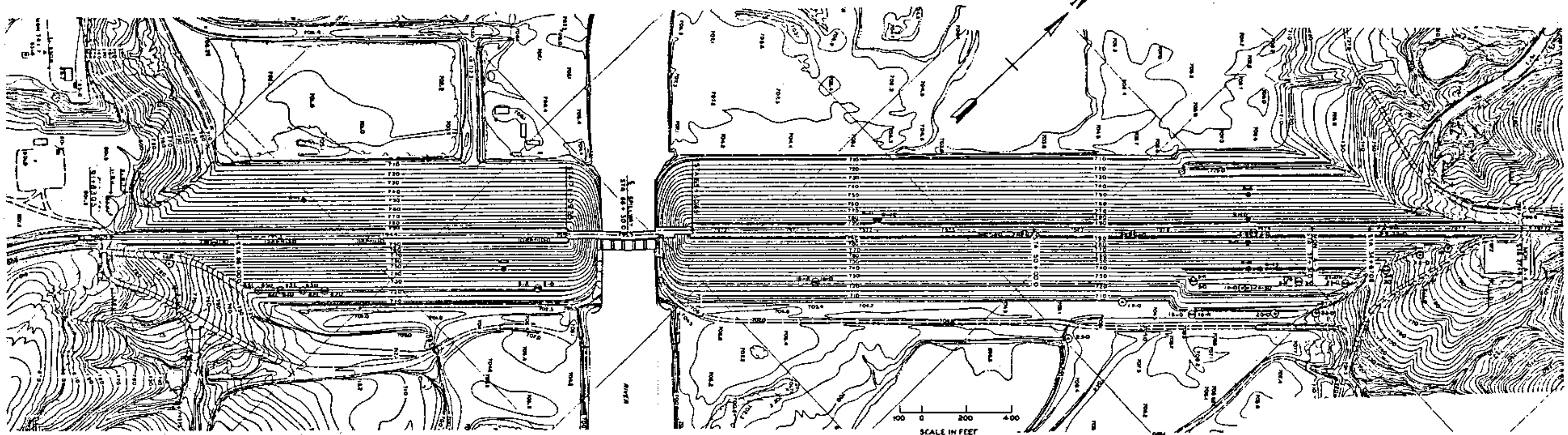
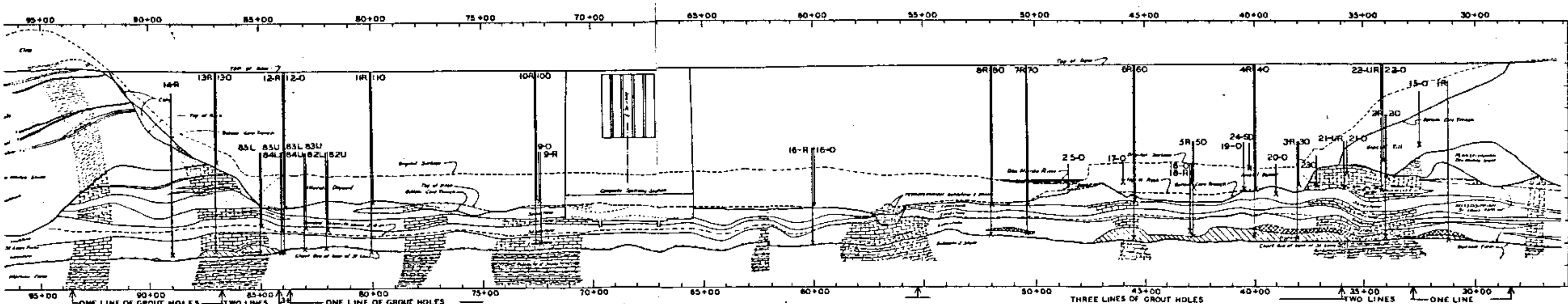

FLOOD CONTROL POOL EL. 780.0
JASPER
MARION
COUNTY
COUNTY
DES MOINES RIVER
CONSERVATION POOL EL 720.0
FLOOD CONTROL POOL EL 780.0
PROPOSED RED ROCK DAM (HOWELL SITE)
WARREN
MARION
COUNTY
COUNTY
Vandalia
Runnells
Hartford
Palmyra
Wheeling
Swan
Pleasantville
Beech
Sandyville
Ford
Carlisle
Otley
Pella
Rousseau
Howell
KNOXVILLE
Flagler
Durham
Harvey
MEET HERE
PROJECT LOCATION
NEBRASKA
KANSAS
MISSOURI
ILLINOIS
VICINITY MAP
DES MOINES RIVER, IOWA
RED ROCK RESERVOIR
HOWELL DAM SITE
PROJECT LOCATION MAP
NOVEMBER 1957

Plate 1



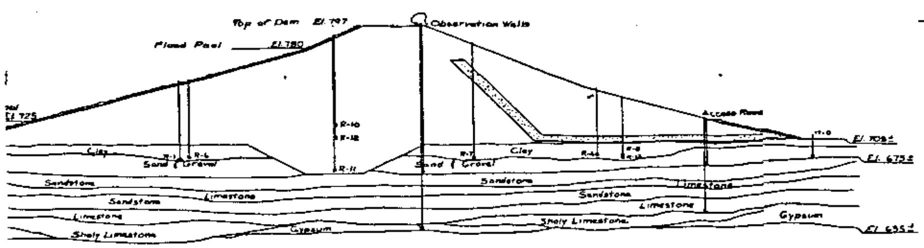
PLAN



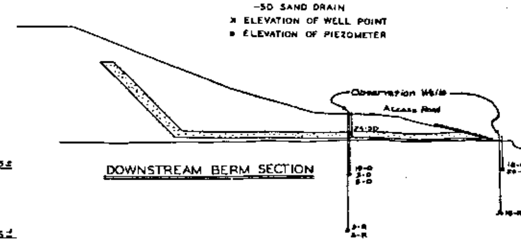
GEOLOGIC PROFILE ALONG CENTERLINE OF DAM

LEGEND:
- ● CONSTRUCTION PORE PRESSURE PIEZOMETERS
- ⊙ SEEPAGE OBSERVATION WELLS
  - -R ROCK GYPSIFEROUS ZONE
  - -L LOWER ROCK GYPSIFEROUS ZONE
  - -U UPPER ROCK SANDSTONE
  - -O OVERBURDEN
  - -UR UPPER ROCK LIMESTONE
  - -SD SAND DRAIN
- x ELEVATION OF WELL POINT
- ▪ ELEVATION OF PIEZOMETER

NOTES:
1. ROCK PROFILE VARIES DOWNSTREAM FROM CENTERLINE. SEE DETAIL LOG OF INSTALLATION FOR 2-O, 21-O, 23-O, 20-O, 6-O, 25-O, 7-O AND 11-O. ROCK AND OVERBURDEN PROFILE OF DOWNSTREAM LEFT BANK AND ABUTMENT SHOWN SEPARATELY.
2. CONSTRUCTION GROUTING DATA SHOWN IN FOUNDATION REPORTS, BINDERS 1 THROUGH 4.



TYPICAL SECTION



DOWNSTREAM BERM SECTION

REVISION	DATE	DESCRIPTION	BY
1	12 Nov 70	Added notes, legend and scout information	

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
ROCK ISLAND, ILLINOIS

DES MOINES RIVER, IOWA
RED ROCK RESERVOIR

DAM
INSTRUMENTATION
OBSERVATION WELLS
LAYOUT AND SECTIONS

SHEET DRAWING NO

PLEISTOCENE LAKE CALVIN - Landforms and Landuse of an Ancient Lake Basin in Southeast Iowa

Field Trip Guide 24

Sponsored by: Geology Section, Iowa Academy of Science
Geological Society of Iowa
Iowa Geological Survey

Led by: Jean C. Prior
Iowa Geological Survey

April 29, 1972

Lake Calvin is the name given to a distinctive lowland feature in southeastern Iowa, comprising portions of Louisa, Muscatine, Cedar, Johnson, and Washington Counties. (See Fig. A.). The Lake Calvin area offers a variety of landscape features reflecting a geologic history of erosion and deposition by ice, water, and wind. Stream-disected glacial deposits form the rolling uplands which border the Lake Calvin basin. Sharply defined bluffs mark the basin outline and the topographic change from upland to lowland. The basin itself, an erosional feature cut into the glacial drift, is partially filled with sorted and stratified stream and lake deposits. Remnants of these deposits form broad, flat terrace surfaces throughout the lake basin. Abrupt scarps mark the elevational differences between these terraces, constructed during former high water levels, and the current flood plain surface. The flood plains bordering the Iowa and Cedar Rivers contain the area of overflow during flood periods, and thus define the present level of erosion and deposition within the basin. The exposure of this vast area of water-laid sediments to the wind has resulted in the formation of sand dunes, some as isolated hummocks on terrace margins, others so concentrated as to provide undulating sand-dune topography, particularly in the eastern portions of the basin. Most of the dunes are anchored with a vegetative cover.

The landforms of the Lake Calvin area provide good examples of how the terrain influences man's use of the land and his agricultural practices. The rolling uplands are well drained and extensively used for cultivated crops. The steep slopes into the lake basin are frequently timber covered or used as permanent pasture. Within Lake Calvin, the flat, flood-protected terrain of the terraces offer good sites for permanent building and major transportation facilities, such as the Iowa City Airport. The alluvial sediments beneath the terrace and flood plain areas provide economic sources of sand and gravel. In the past, flood plains have been a frequent site for dumps and landfills. This misuse of the land can cause serious pollution of surface and groundwater resources. A wiser and more beneficial use of flood plain lands is seen in the Cone Marsh conservation and wildlife management area. This area provides recreational usage

Iowa Academy of Science Annual Meeting
Iowa City, Iowa

in addition to the protection of wildlife habitats. The Lake Calvin basin is extensively cultivated with the usual agricultural crops of corn and soybeans. Some expanses of the level lands are locally poorly drained, due to fine silt and clay near the surface, and require the use of drainage ditches and subsurface tiles. Other areas, underlain by sand, specialize in vegetable crops such as watermelons and cantaloupes, as these crops are grown more profitably under these soil conditions than general farm crops.

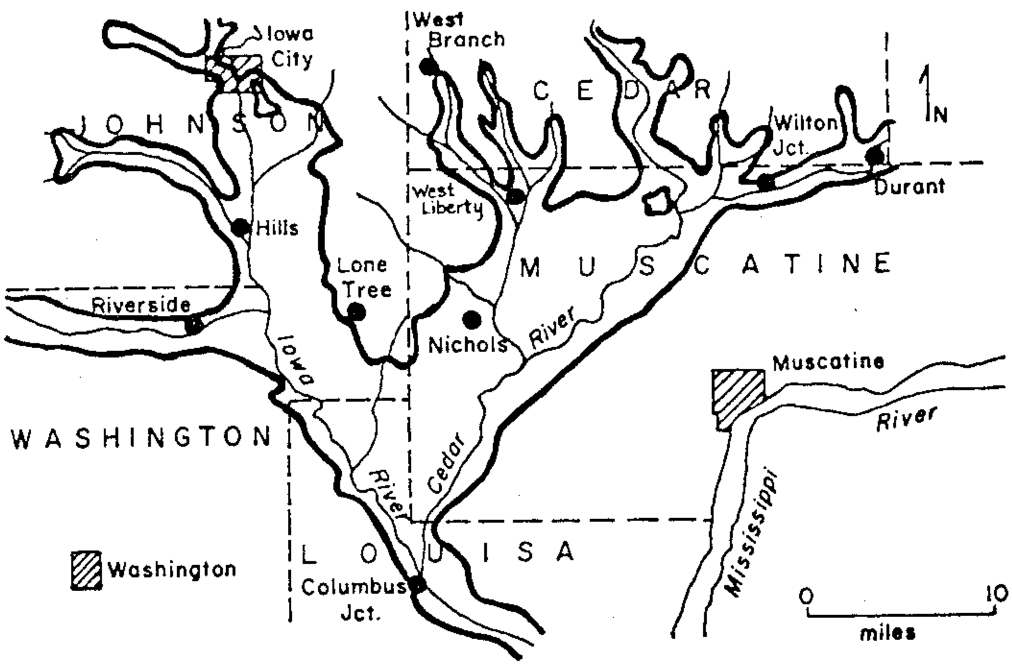


Fig. A
(after Schoewe, 1920)

Lake Calvin was first recognized as a lacustrine feature in 1894 by Dr. Samuel Calvin. In 1898, J. A. Udden published his "Geology of Muscatine County" and named the feature for Calvin, who was then State Geologist and Chairman of the University of Iowa Geology Department. In 1920, W. H. Schoewe produced the first and only major study of the Lake Calvin area as his PhD dissertation, published as an Iowa Geological Survey Annual Report. Since that time A. C. Trowbridge of the University of Iowa, P. R. Shaffer of the Illinois Geological Survey and R. V. Ruhe of Iowa State University have published material relating to Lake Calvin.

Lake Calvin, surrounded on the north and west by Kansan glacial-drift uplands and on the east by Illinoian drift uplands, is believed to be the site of a Pleistocene lake. It has been traditionally accepted as an ice-marginal feature, formed as the Illinoian glacial ice advanced from the east ponding the drainage from the Mississippi, Maquoketa, Wapsipinicon, Cedar and Iowa Rivers against the Kansan uplands to the west. The lake basin is V-shaped in outline with the apex at Columbus Junction where the Iowa and Cedar Rivers join. One arm extends NE along the Cedar River to the Wilton Junction - Durant area, and the other extends NW along the Iowa River as far as Iowa City. There are three distinct terrace surfaces within the basin area, the high and low terraces, generally confined to the Iowa River segment, and an extensive intermediate terrace present only in the Cedar River portion.

Wisconsin loess covers the adjacent uplands and the high and intermediate terrace surfaces; the low terrace is not loess mantled. Subsurface studies show the terrace sediments to be composed of beds of sand, gravel, silt and clay, and to vary in thickness from 35 to 105 feet (including loess cover), with a mean thickness of 66 feet. Recent investigations have raised questions concerning the age and mode of formation of Lake Calvin, and have indicated the need for reexamination of the area. Radiocarbon data obtained by Ruhe, and earlier by Shaffer, as well as results of drilling indicate the Lake Calvin terraces are not related to Illinoian glaciation, and are Wisconsinan in age.

Road Log

Starting mileage begins on south side of Iowa City. Johnson County.

	Miles	
	0.0	Junction Hwy. 218 and road south to Iowa City landfill.
	0.6	Gravel pit on right; low terrace sediments.
	1.0	Gravel pit on left; low terrace sediments.
	2.2	West valley wall of Lake Calvin seen to the west; travelling on low terrace.
	2.6	Crossing segment of glacial drift uplands west of Lake Calvin.
	3.5	Return to Lake Calvin, low terrace.
	5.9	Turn left (east) on county road into Hills, Iowa.
	6.2	Cross bridge, note dump on left; Iowa River flood plain.
	7.1	Cross Iowa River.
	7.6	Turn right (south) on W-66 at 4-way Stop; travelling on low terrace again.
	8.4	High terrace scarp on left; low terrace scarp to flood plain seen on right.
	8.8	Drop from low terrace to flood plain.
	11.7	Junction Iowa Hwy. 22, turn left (east); travel up slope to high terrace.
	12.8	Turn south on W-66 at Iowa Light and Power Coop. station.
	13.8	High terrace scarp to Iowa River flood plain on right.
Stop #1	14.2	Note terrace scarp on right and behind.
	14.9	Turn left (east) on gravel road.
	15.8	Sand dunes.
	16.8	Town of Lone Tree seen to northeast; topography gradually rising from high terrace to upland.
	18.0	Turn left on county blacktop X-14; continue north into Lone Tree.
	20.0	Rest stop in city park, Lone Tree. Leave park and return south on X-14.
	22.8	Descending to high terrace surface; note west valley wall in distance (to the right).
	24.7	Curve left (east) and note high terrace surface and upland to the north.
	25.6	Curve right (south); enter Louisa County.
	26.1	Note drop from high terrace to flood plain on the left. Slow.
	26.6	Turn left (east) on county X-14.
	27.9	Turn right (south) on gravel road; intermediate terrace.
	28.6	Note intermediate terrace scarp to flood plain and Cone Marsh Wildlife Mgt. Area.
	30.0	Turn right (west) on gravel road. Slow.
	30.7	Drop off intermediate terrace to flood plain; cross Cone Marsh, noting vegetation and wildlife. Slow.
	31.9	Turn right (north); rising to high terrace surface.

Stop #2 32.8 Enter Cone Marsh access road.
33.0 Leave Cone Marsh, turn right (north).
33.8 Turn right (east) to join Louisa-Muscatine County G-28; travel again on intermediate terrace surface. Note north shoreline to left.
36.8 Junction Iowa Hwy. 70. Cross and turn right (south).
37.3 Turn left (east) on county road G-28 .
40.8 Cross Cedar River; continue east on G-28.
41.8 Turn left (northeasterly) on blacktop.
42.7 Upland - intermediate terrace margin. Sandy terrain.
Stop #3 44.8 Turn left on X-43. Note sand dune topography and road cuts in sand dunes.
48.3 Junction Iowa Hwy. 22; turn right (southeast) on 22.
48.8 Turn left (north) on gravel road.
49.5 Road angles northeasterly; on intermediate terrace with uplands to east.
Stop #4 49.7 Note relationship of uplands, intermediate terrace, and flood plain.
52.0 Turn left (north) on gravel road. Will drop from upland to flood plain.
53.8 Turn right (southeast) on gravel road. Return to uplands.
57.0 Junction with X-54. Turn left (north) on blacktop. Note sand in road cuts along the way.
58.5 Turn left (west). Leave upland, drop to intermediate terrace.
59.0 Off terrace onto flood plain. Note change in road grade.
61.1 Cedar River bridge; sand pit on left; return to intermediate terrace.
62.6 Turn right (north) on X-46. Note magnitude of intermediate terrace.
64.3 Note shore line of Lake Calvin in distance.
65.6 Turn left (west) on Highway 6. Follow north shoreline of Lake Calvin. Note lake basin on left.
66.5 Reentrant of Lake Calvin.
70.1 Enter town of West Liberty, Iowa.
87.1 Return to Iowa City.

* * * * *

NOTES