Illinois State Geological Survey
Urbana, Illinois

Report on Examination of Geological Conditions along Proposed Routes for Highway between Chester and Rockwood June 30 - 21, 1930 with appended detailed descriptions of bed-rock formations

Purpose. The object of the examination was to ascertain the geologic conditions along the proposed route for State Bond Issue Highway Route No. 150 between Chester and Rockwood. The examination was requested by Mr. G. A. Somerville, District Highway Engineer, Carbondale, Illinois. Mr. Oscar Day of his staff provided transportation and personal guidance during the examination.

Geologic Situation. The proposed route is located along the east wall of the Mississippi valley in the south part of Randolph County. From Chester to Marys River a choice lies between a location on top and one at the foot of the bluff. From Marys River to Rockwood it follows the present road along the foot of the bluff. The bluffs are composed of bedrock belonging to the Chester series of Mississippian age, capped by a thick mantle of loess, which consists of dust blown from the flats in the valley bottom. A little glacial till was found at the mouth of the valley of Marys River. The bedrock generally dips slightly in an easterly direction. but small folds or reversals of dip occur.

The bedrock comprising the bluffs is divided into various formations which from highest to lowest exposed in the area under consideration are Kincaid limestone, Degonia sandstone, Clore limestone, Palestine sandstone, Menard limestone and shale, and Okaw

limestone and shale. Due to their general eastward dip, each of these formations, as they are traced westward, lies higher in the bluff, successively older formations form the surficial rock, the Kincaid and Degonia formations are absent west of Marys River, and east of the river the Okaw formation is below the horizon of possible outcrops (see accompanying geologic map).

Along the main road south out of Chester and in the gully beside it the upper part of the Okaw formation is well exposed, and consists almost wholly of limestone with little or no associated shale. Most of the limestone is coarse-grained and cross-bedded, but some layers are dense and pitted with vertical solution pits.

A fresh cut for Wabash, Chester, and Western Railway where it lies close between a point of the river bluff and Marys River in the NW. 1/4, NE. 1/4, sec. 32, T. 7 S., R. 6 W., provided an excellent exposure of black shale, presumably the upper member of the Okaw formation. The shale is 30 to 60 feet thick, and it is overlain by

Menard limestone that forms a cliff slope. At the south end of the cut, where the railway intersects the highway, shaly argillaceous limestone is exposed beneath the shale. It dips northward more steeply than the railway gradient, so it passes beneath the shale. The same limestone crops out in and along the road east of the railway and along the west bank of Marys River north of the highway, where it dips appreciably northward.

The shale above the limestone crops out along the bank of Patten Branch just above its junction with Marys River. A large spring issues near the top of the bank. Other springs issue along the base of a slope farther west, on the north side of the spur. A V-shaped landslide which has been checked by piling occurs between two branches of a gully in the south-central part of sec. 30, T. 7 S., R. 6 W. The material in the slide appears to consist only of loess, Limestone forms a cliff behind the loess and shale crops out in the east gully at the level of the slide. This particular slide seems to consist of a mass of loess that was deposited against the limestone cliff of the old valley-wall and upon a shale bench. It slides down along the limestone and out over the shale. The movement is encouraged (1) by water which percolates down through the limestone n until it encounters the impervious shale and then moves laterally along the surface of the shale and (2) by waterwhich is discharged in the gullies and soaks out along the top of the shale into the loess. This water lubricates the contact surface between the loess and the shale, so that the loess moves readily under the influence of its own mass weight.

Landslides have also occurred around the spur of the bluff which lies just west of Marys River. A ridge parallelling the bluff has been developed on the south side and small slips exist on the west side. These slides are evidently the result of slippage in the upper

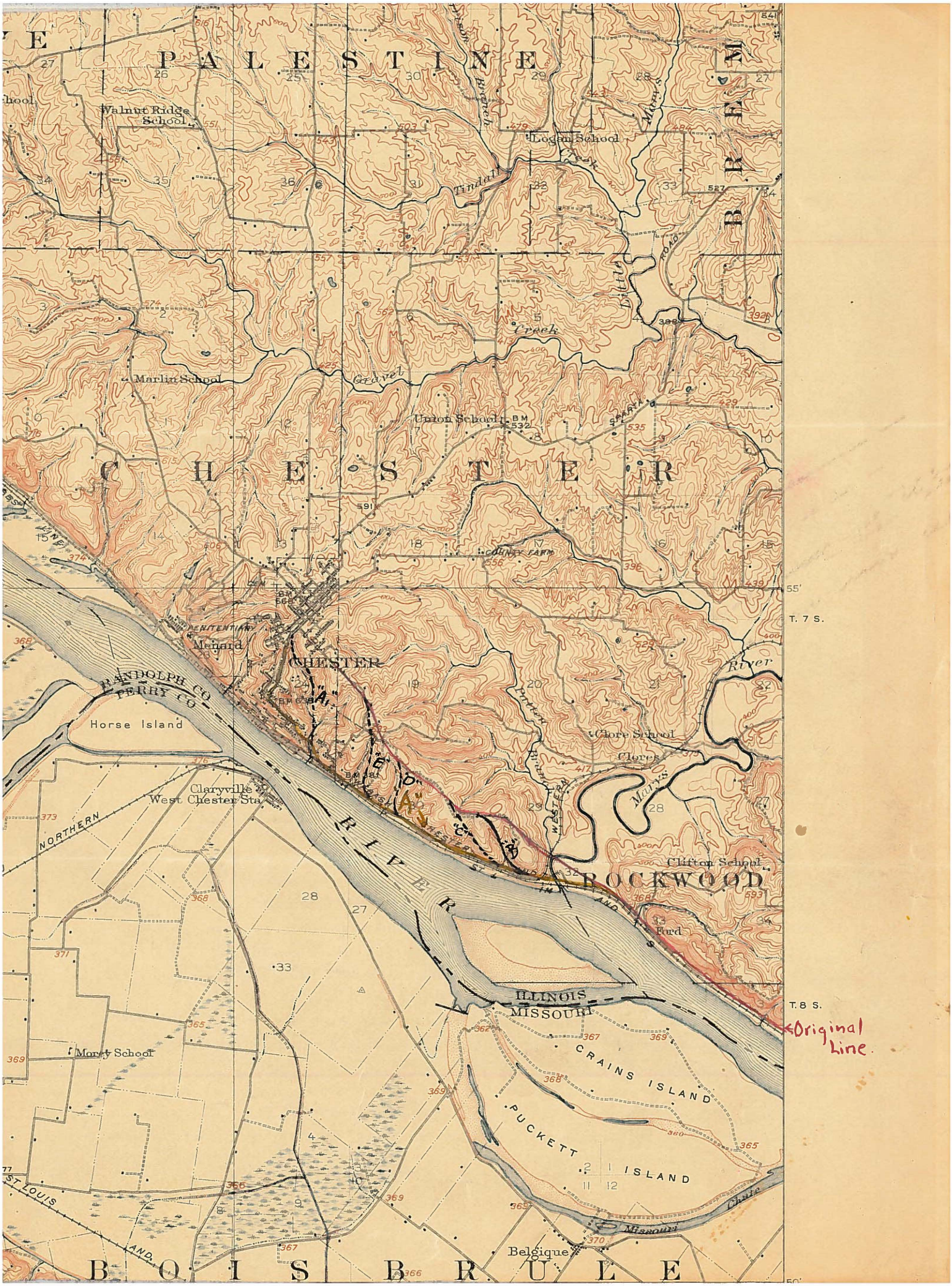
shale member of the Okaw formation.

Problem. The highway engineers desire to know (I) whether landslides may be expected under conditions present or induced by construction of the highway grade and (II) whether one of several alternative locations of the route between Chester and Marys River is to be preferred on account of geologic conditions. The original location followed the top-ridge of the bluff southeast from Chester until it reached Marys River, when it followed down the northeast side of the spur to cross the river on a grade fill. A slight alternation of this line contemplated a grade on the southwest side of the spur. (Line "B"). An alternative location urged by the citizens of Chester followed the present main road out of town.

Opinion. I. Judging from the character of the bedrock exposed along the bluffs, it appears that landslides should not be expected along that portion of the route southeast of Marys River but that they might be induced between Chester and Marys River.

Southeast of Marys River the present highway is situated on a bench developed mainly on talusof Palestine sandstone. The Menard formation lies concealed under the talus, but as it is mainly a solid limestone it contributes no conditions particularly favorable for sliding. Consequently there seems little reason to expect landslides, provided that the grade of the present highway is not materially disturbed in preparing the grade for the new highway.

Between Marys River and Chester any location of the highway must cross the shaly, uppermost member of the Okaw formation of which the alternating beds of limestone and shale provide most favorable conditions for landslides. The route of the highway should be selected so that as far as possible its grade coincides with the


PALESTINE
CHESTER
ROCKWOOD
Walnut Ridge School
Logan School
Marlin School
Union School
Menard
CHESTER
Horse Island
Claryville
West Chester Sta.
Clore School
Clifton School
Ford
Morey School
Belgique
RANDOLPH CO.
PERRY CO.
ILLINOIS
MISSOURI
RIVER
CRAINS ISLAND
PUCKETT ISLAND
Gravel Creek
Tindall Branch
Little Mary's Road
Mary's River
Pretty Branch
Missouri
Chute
NORTHERN
ST. LOUIS
T. 7 S.
T. 8 S.
Original Line.

present slopes, thus insuring a minimum of cut and fill.

II. The original line has an advantage in that it follows the bluff ridge for as long as possible, thus obviating much cut and fill and also any culverts. However, it has distinct disadvantages in that it cuts across the shale member of the Okaw. formation on the down-dip slope when it descends from the ridge to cross Marys River and at the same time it intersects several springs. All of the water that soaks down through the loess mantle and percolates through the limestone tends to run northeastward down the slope of the upper surface of the shale; it is for this reason that so many springs occur on the northeast side of the spur and none on the southwest side. Therefore, under the influence of the natural dip of the shale, its tendency to be soft and slippery when wet, and the constant seepage of spring water, it seems very probable that a highway constructed along the proposed line would be likely to slide down and out of line.

The other line ("B") by which the proposed route would descendfrom the top of the bluff to cross Marys River avoids the disadvantages which exist along the original line, but it also encounters disadvantages in that it crosses the landslides on the southwest side of the spur. It may be possible to plan and construct the grade so that the slides would not be disturbed, and thus decrease the likelihood of further sliding, but this would not assure safety.

The other alternative route "A" has an advantage in that it would follow the base of the bluff where conditions are already more or less stable. It would avoid much cut and fill, but it would involve construction of numerous culverts. I understand that there is some possibility that the right of way of Wabash, Chester, and Wabash Railway might be obtained, the railroad then using the St. Louis,

Iron Mountain, and Southern Railway. If this possibility should materialize, the "A" location for the highway would have an additional advantage in that it would have an even greater width of stabilized grade. However, it has disadvantages in that it follows established streets through Chester and consequently it has a limited possible right-of-way, it must make undesirable short, sharp turns, and it would have a very steep grade in descending from the bluff to the valley.

Recommendations. I. In constructing the highway southwest of Marys River the grade of the present highway should be followed and preserved so far as possible. For most of the distance, the grade will be constructed in the Palestine sandstone formation or in its talus, in which construction should not induce much sliding. However, the slope of the talus should not be interrupted too seriously or its equilibrium will be disturbed and then talus slides will occur. The blocks of sandstone encountered in preparing the grade should not be blasted to pieces if they can be moved bodily to the outer shoulder or slope of the new grade where, due to their size and weight, they will help to hold the grade in place.

II. The advantages and disadvantages of the original line and its alternatives "A" and "B" have been discussed. In general, it seems that the line by which the original line descends from the bluff to Marys River is so hazardous, especially because it is on the downward side of the natural dip of the rock, that it should hardly be adopted.

In view of the disadvantages possessed by the other two alternatives, "A" and "B", additional possible alternate routes were sought. Four were found, of which one, "E", appears to have considerable promise. It leaves the original line about a mile southeast

of Chester and descends to the valley by way of a gully behind Coles Mill. It possesses the advantages of route "A" in that it would follow the old highway, or the combined old highway and railway right of way if the latter becomes available, and it would avoid the disadvantages by not entering Chester through established streets with the consequent narrow right of way, sharp turns, and steep grade. It would leave the present high way sufficiently far southeast of Coles Mills that it could take advantage of an old grade for a secondary road and thus possess a low gradient all the way up the gully. It would require some excavation along the gully slope, but field examination suggested that no serious slides should be induced if the route be so planned that every natural slope and gradient be utilized to advantage and excessive excavation and fill be avoided. The tendency for slides would be reduced by the fact that whatever excavation might be required would be on the upward slope of the rock.

The second suggested alternative ("C") lies near "B", but it would avoid some of the slides that "B" crosses and might be so aligned as to make a more gentle grade than could be obtained for "B".

A third possible alternative ("D") follows another gully from the valley to the top of the bluff. It possess no apparent advantages not offered by "C" or "E"; on the other hand it does not utilize so much of the present highway as does "E" and would probably involve a steeper grade than either "C" or "E".

A fourth possible alternative line (A1") offers only the advantage that it might avoid the steep grade encountered by "A" in Chester. However, "A1" might encounter other difficulties not immediately apparent as regards property in Chester.

Local conditions and situations may direct a final choice of a route, but route "E" seems most desirable when physical factors alone are considered.

George E. Eblaw

George E. Eblaw
Geologist and Head
Areal & Engineering Geology Division

Approved:

M. M. Leighton

M. M. Leighton, Chief

Appendix

Summarized descriptions and detailed geologic sections of bedrock formations.

The Kinkaid formation, which has a full thickness of about 80 feet, consists principally of hard, compact, gray, crystalline limestone in regular beds a foot or more thick, separated by thin seams of blue sandy shale which are most common in the lowermost part of the formation.

The Degonia formation, which ranges from 70 to 150 feet thick, consists of thin-bedded, shaly sandstone, gray, very sandy shale, and massive coarse-grained sandstone usually soft but locally sufficiently resistant to form bluffs 40 - 50 feet high.

The Clore formation consists mostly of hard, compact, fine to medium-grained limestone, some of which is more or less crystalline. A considerable amount of platy black, blue, and gray sandy shale is associated with the limestone, especially in the lowermost part of the formation.

The Palestine formation, which is about 45 feet thick, is a soft but massive, light to dark brown, fine to medium-grained sandstone which stands as a vertical bluff in most places. It contains some sandy shale.

The Menard formation, which is about 75 feet thick, consists mostly of hard, dark gray, dense to fine-grained limestone in regular beds one to five feet thick separated by light gray calcareous shale or dark blue-gray to black argillaceous shale in thin seams or lenticular beds as much as 15 feet thick.

Only the upper part of the Okaw formation, which has a total thickness of about 275 feet, is exposed from Chester to Marys River. The formation is divided into a lower member of crystalline, detrital limestone about 200 feet thick and an upper member consisting predominantly of light gray crystalline limestone in thick, massive beds separated by bluish-gray to black shale in lenticular beds as much as 15 feet thick. The basal part of the upper member is generally sandy.

The specific character of the bedrock may be best exemplified by the following detailed stratigraphic sections at a few localities along the route.

1. Gully behind Coles Milling Company, within city limits of Chester; NW. 1/4 sec. 30. T. 7 S., R. 6 W.

	Thickness Feet	Inches
Loess	?	?
Menard formation		
Limestone, fine-grained gray and tan	14	6
Unexposed	4	9
Limestone, gray, medium-grained	1	7
Unexposed	39	0
Okaw formation		
Limestone, gray, fine-grained at top, otherwise medium-grained, in beds 3 to 8 inches thick; two chert layers, each 2-3 inches thick, persistent near base	10	9
Unexposed		10
Limestone, light gray, medium-grained	1	5
Chert, blue, persistent		3
Limestone, light gray, medium-grained, in beds 6 to 10 inches thick	1	4
Unexposed		10
Limestone, light gray, fine to medium-grained, in beds 3 to 6 inches thick	2	9
Unexposed	1	6
Sandstone, buff, yellow, and brown, fine-grained, soft, in beds 1/2 to 4 inches thick	3	10
Unexposed	31	0
Sandstone, buff, yellow, and brown, fine-grained, soft, in two massive beds	6	2
Shale, silty, carbonaceous, dark gray to grayish-black, platy	2	7

Unexposed		6
Limestone, light gray, coarsely granular, fossiliferous, in three beds	2	6
Shale, silty, yellow to brown, platy		6
Shale, carbonaceous, dark gray to black, fine-grained, platy, fossiliferous; contains a few small lenses of argillaceous limestone	3	4
Limestone, light to dark gray, granular, detrital, fossiliferous	11	7
Shale, calcareous, dark gray, platy; contains a limestone layer 1 inch thick; locally grades laterally into shaly limestone	1	9
Limestone, gray, coarsely granular, detrital	4	0
Limestone, gray, coarsely granular; extends under railway culvert	25±	

2. Along road and Kent creek from Ford to Elm Grove School; center of N. 1/2, sec. 33, T. 7 S., R. 6 W.

Palestine formation		
Sandstone, brown, fine-grained, compact, thin bedded	---	---
Shale, grayish-black, thinly laminated	2	11
Menard formation		
Limestone, gray, dense, fine-grained; contains masses of crystalline calcite	7	6
Limestone, bluish-gray, medium crystalline	3	6
Limestone, gray, dense, finely crystalline, fossiliferous	4	0
Limestone, gray, finely granular, fossiliferous	2	0
Unexposed	13	6
Limestone, grayish-white, granular, oolitic, in beds about a foot thick	6	4

3. Slope of bluff at "Station 956"; NW. 1/4, SE. 1/4, sec. 33, T. 7 S., R. 6 W.

Degonia formation		
Sandstone, blocks only		
Clore formation		
Limestone, blocks only		
Shale, calcareous and containing lenses of limestone in upper part, sandy near bottom, black	12	0
Palestine formation		
Sandstone, shaly	40±	---
Menard formation		
Limestone, ledge	8-10	

4. Small gully in bluff slope, near "Station 920"; NW. corner of sec. 3, T. 8 S., R. 6 W.

Degonia formation		
Sandstone, shaly at base	40-60	
Clore formation		
Limestone, argillaceous, dark gray, medium crystalline, compact		8
Limestone, shaly	9	4
Shale, buffish-gray, compact, thick-bedded	2	3
Clay, earthy, yellow to buff; probably a weathered argillaceous limestone or calcareous shale	1	7
Shale, blackish-green, thinly laminated	3	11
Limestone, blackish-gray, weathering brown, fine-grained	2	1
Limestone, light gray, fine-grained, weathers slabby	2	4
Limestone, fine-grained, compact; finely crystalline locally granular	1	2
Limestone, shaly, dark gray, granular	1	1
Limestone, fine-grained, weathers slabby	1	6
Limestone, argillaceous, shaly, thin-bedded, compact		9
Limestone, fine-grained, crystalline		10
Limestone, argillaceous, thin-bedded		6
Limestone, fine-grained, crystalline	3	3
Limestone, dark gray, fine-grained, compact in beds 3-6 inches thick	4	5
Limestone, like above, in one bed	2	4
Shale, grayish-black	2	1
Limestone, siliceous, dark gray, weathers brown	4	0
Shale, grayish-black	2±	10
Palestine formation		
Sandstone, thin bedded to massive	7	6
Shale, silty, black	8+	0

5. Gully in bluff, NE. 1/4, NW. 1/4 sec. 3, T. 8 S., R. 6 W.

Clore formation		
Limestone, grgillaceous, dark gray, weathers brown		10
Palestine formation		
Sandstone, buff, in beds 1 to 14 inches thick	13	4
Shale, silty, black, thinly laminated	10	5
Menard formation		
Limestone, light to dark gray; beds 4 to 20 inches thick, weathers into thin brown slabs	9	0
Shale, silty, gray to grayish-black	1	5
Limestone, dark gray, granular, fossiliferous, slabby		10
Shale, grayish-black, thinly laminated		10
Limestone, dark gray, granular		8
Shale, grayish-black, laminated	1	2
Limestone, light gray, medium crystalline; weathers brown; layer of dark gray chert about a foot above base	3	11

Limestone, gray, granular	3	1
Shale, black, thinly laminated	2	8
Limestone, gray, medium crystalline, compact, fossiliferous; thick beds	8	7
Shale, calcareous, buff, fossiliferous		10
Limestone, dark gray, granular		10
Unexposed	16	3
Limestone, gray, finely crystalline, compact, with shale partings	2	10
Shale, dark gray, fossiliferous		
Limestone, dark gray, very finely crystalline, compact	3	8
Limestone, dark gray, granular	1	6
Limestone, bluish-gray, finely crystalline, compact, fossiliferous	3	5
Shale, calcareous, soft	2	1
Limestone, gray, fine-grained, compact	1	8
Limestone, dark gray, granular		10

6. Gully in bluff, SW. 1/4, NW. 1/4, sec. 2, T. 8 S., R. 6 W.

Degonia formation		
Sandstone, buff, fine-grained, massive	6	4
Clore formation		
Limestone, dark gray, finely crystalline, compact	1	5
Unexposed, probably shale	13	9
Limestone, light gray, weathers whitish; finely crystalline, compact	2	7
Limestone, gray medium crystalline	6	0
Limestone, dark gray, fine-grained, compact, contains irregular nodules of bluish-black chert	3	4
Limestone, buffish-white, granular, lenticular bed	2	6
Limestone, dark gray, fine-grained, compact, contains chert nodules	3	0
Shale, gray, thick-bedded	8	7
Shale, black, thinly laminated	5	9
Limestone, argillaceous, gray, weathers brown	1	10
Palestine(?) formation		
Shale, silty, grayish-black	3	1
Unexposed	10	3
Shale, silty, grayish-black	4	6
Palestine formation		
Sandstone, shaly, greenish-gray, fine-grained, compact, thin-bedded		

7. Bluffs at Rockwood, center of north side of Sec. 18, T. 8 S., R. 5 W.

Loess, brown	15	0

Clore formation		
Limestone, gray fine-grained, hard	7	7
Limestone, gray coarse-grained	2	9
Limestone, gray, medium-grained, hard	5	9
Limestone, gray, coarse-grained, in beds 3 to 12 inches thick	1	5
Limestone containing 2 persistent chert beds		6
Limestone and sandy shale alternating in very thin beds		5
Shale, sandy, dark gray, platy	1	10
Limestone, gray, fine-grained, compact, hard		6
Unexposed	48	3
Palestine formation		
Sandstone, massive soft, in beds 1 to 6 feet thick	43	0
Unexposed	26	

8. Bluff about 5/8 mile northwest of Cora; center of Sec. 17, T. 8 S., R. 5 W.

Menard formation		
Limestone, gray, medium-grained, hard	2	0
Limestone, gray, fine-grained, hard, in beds 6 to 18 inches thick	9	1
Shale, very calcareous, light gray, thin-bedded		2
Limestone, dark gray, fine-grained, hard		2
Shale, calcareous, dark gray, thin-bedded		3
Limestone, light gray with dark gray and brown layers, fine grained	5	7