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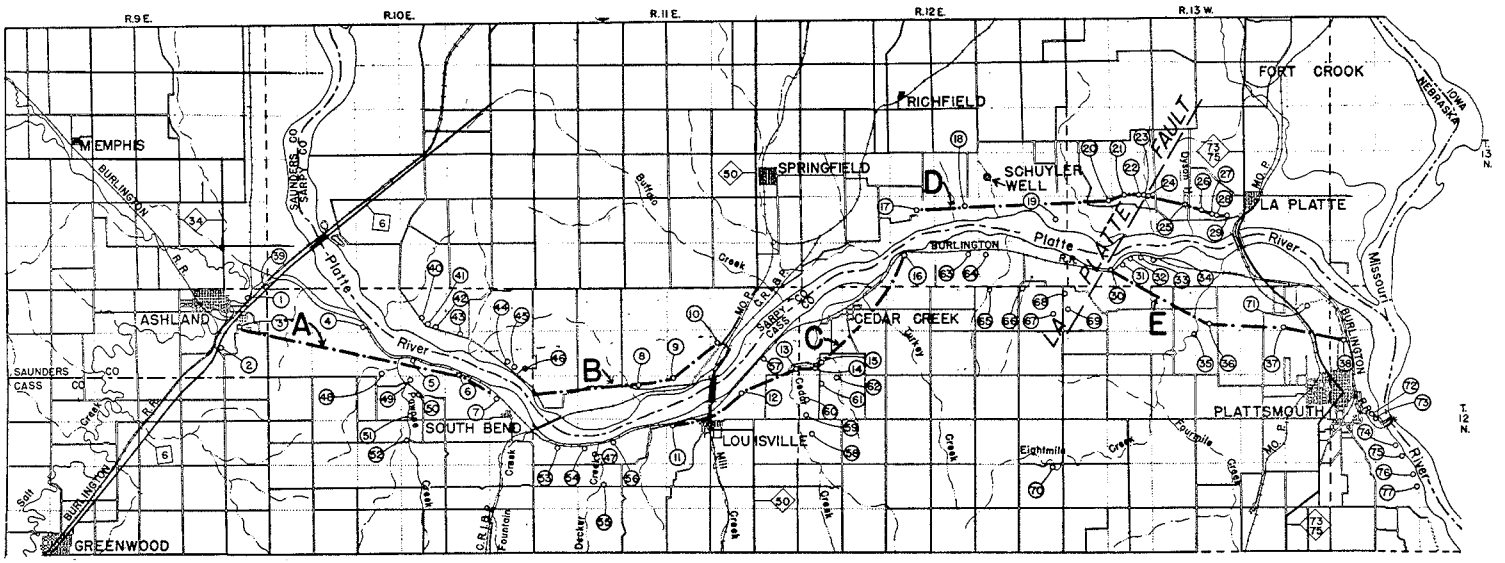

Figure 1.—Key map to the lower Platte Valley area, showing the locations of cross-sections A, B, C, D, and E, and locations of elevation stations.

the Platte Valley and other areas had a direct bearing on the creation of this important survey.

Mid-Period Geologists.—The leading reports of the mid-period geologists of the Northern Mid-Continent region were by J. A. Udden (1903), S. Calvin (1901), E. Haworth (1898), J. E. Todd (1890, 1906), E. H. Barbour (1903), N. H. Darton (1905), J. W. Beede (1898), Charles S. Prosser (1897), Charles R. Keyes (1893), and George L. Smith (1909). All of these geologists made some study in the lower Platte Valley and most of them contributed formation, group, or series names which have application in this area.

The pioneer and mid-period geologists did not have the time and inclination to trace key beds, compare sequences, and define the smaller geologic units. Also, like some later geologists, they failed to recognize the presence of structures and unconformities in the traverses, which led to error in classification. However, these structures and unconformities have been studied in the last few years and we now have adequate factual data for the correlation of most of the Platte Valley beds.

Later Geologic Study.—The more recent geologists to participate in some manner in the correlation relating to the lower Platte Valley are Raymond C. Moore and Norman Newell of the Kansas Survey; Henry Hinds and Frank C. Greene of the Missouri Survey; and G. E. Condra, N. A. Bengtson, Carl Dunbar, C. E. Busby, J. E. Upp, R. H. Lovald, and E. C. Reed of the Nebraska Survey. These workers have made marked progress in the close study and classification of the Upper and Middle Carboniferous [2] rocks of their states and throughout the Northern Mid-Continent region.

Among the leading publications of the more recent geologists of Kansas and Missouri having direct or indirect relations to the lower Platte Valley are those by Dr. R. C. Moore (1917, 1936), Dr. Norman D. Newell (1935), Hinds & Greene (1915), and McQueen & Greene (1938). Those made by the Nebraska geologists are listed later.

Correlation in the Platte Valley.—The Nebraska geologists traced certain key beds between the principal exposures of this area during the period 1900 to 1915, and similar progress was made at that time by G. L. Smith and John L. Tilton in Iowa, and by Henry Hinds and Frank C. Greene in Missouri.

Condra & Bengtson (1915) outlined the major geologic subdivisions of the Platte Valley and correlated them in a general way with the Iowa sections, but although their sections were well measured, failure rightly to interpret the structural features and unconformities of the area resulted in miscorrelation. After 1915 the Pennsylvanian (Upper and Middle Carboniferous) of southeastern Nebraska was studied quite closely and correlated with the Kansas and Missouri sections, but unfortunately not much study was made in the Platte area at that time, and, when Nebraska Geological Survey Bulletin No. 1 on the Pennsylvanian formations was issued in 1927, it carried forward some of the errors which had been made in the correlation of this area in 1915. Soon after this, however, resurveys were made of the Jones Point and Platte Valley sections and their correlation was tied into the classification of the Kansas City sections. A progress report on these surveys was published by Condra as Nebraska Geological Survey Bulletin No. 3, in 1930, but at about this time the Kansas Survey found that errors had been made in the classification of the Iola and other formations at Kansas City, which meant that the nomenclature of certain beds should be changed there and in the Platte Valley. Consequently, the Nebraska Survey faced a new correlation problem and engaged in further study of the Upper Carboniferous formations in Nebraska and adjacent states. The formations at Kansas City were then traced throughout their outcrops in northwestern Missouri, southwestern Iowa, and Nebraska. Dr. R. C. Moore, Frank Greene, and Dr. A. C. Tester joined the senior author in checking the results of this field work and agreement

[2] The Upper Carboniferous is the Virgil and Missouri subseries of the Pennsylvanian, and the Middle Carboniferous is the Des Moines subseries of the Pennsylvanian.

was reached regarding the regional correlation of the Bethany Falls, Dennis, Westerville, Drum, Iola, Wyandotte, Plattsburg, Stanton, and Oread formations and their interstratified shales. It was found that the "Dekalb" of Iowa is the Winterset; that the Westerville, Drum, Iola and Plattsburg are quite uniform throughout their northern distribution; that the Lane shale thins rapidly northward and northwestward; that the thickness of the Argentine member of the Wyandotte formation varies considerably in this region; that the formations of the Platte Valley have about the same facies as at Winterset, Iowa; that the Iola and Lane formations are nearly identical in Iowa and the Platte Valley; and that the Westerville and Plattsburg formations are thinner in Iowa than in Nebraska.

The last part of this recorrelation was made in the vicinity of Dyson Hollow, where in 1936 the senior author and W. R. Johnson learned by faunal and lithologic study that what had been there classed as the Winterset limestone is the Stoner limestone member of the Stanton formation and that the beds above and below it are nearly identical with their correlatives in the corresponding sections located farther west. A comparison of the Dyson Hollow, Meadow, and South Bend sections will show the validity of this correlation.

The recorrelation of the beds at Jones Point was made by Condra & Reed (1938), and the principal changes to be made now in the Platte Valley nomenclature given in Nebraska Geological Bulletin No. 3 of 1930 are as follows:

"Iola limestone" becomes the Drum limestone.

"Lane shale" becomes the Chanute shale.

"Plattsburg limestone" becomes the Wyandotte, Lane, and Iola.

"Vilas shale" becomes the Bonner Springs shale.

"Meadow limestone" becomes the Plattsburg limestone.

"Eudora shale" becomes the Vilas-Eudora interval.

"Iatan limestone" becomes the Cass limestone.

RICHFIELD UPLIFT

The profile of the Richfield uplift, which has been called an anticline, is shown by figure 2, p. 8. The flanks of the uplift extend westward to beyond Ashland, northwestward to Fremont and southeastward to the Bartlett syncline in Iowa. Deep well records and outcrops show that a nose of the Richfield uplift extends northward to Omaha and probably farther. A spur of the uplift, extending southward and southwestward to the Redfield arch, is known as the Nehawka anticline. The Bartlett syncline noses out southwestward between the Nehawka anticline and the Redfield arch, but the relations of the Richfield uplift to the Redfield arch in the area south and southwest of Weeping Water are not well known.

The Carboniferous and older formations found in the Richfield uplift have been penetrated in deep wells at Lincoln, Fremont, Nehawka, and at other places. Elevation of the top of the Winterset limestone, for example, is about 1,028 feet in the outcrops south of Richfield and its subsurface elevation is about 210 feet at the Capitol Beach well near Lincoln, 782 feet at Fremont, and 829 feet in the Amerada well located northwest of Nehawka, in sec. 26, T. 11 N, R. 12 E. The Upper Carboniferous formations where drilled in the Amerada well have about the same thickness and character as they do in the outcrops of the Platte Valley (Condra 1939).

Age and Thickness of Rocks.—The Richfield uplift exposes the Upper Carboniferous formations from the top of the Oread formation down to the base of the Ladore shale. The middle and lower parts of the exposed section are correlative with these outcropping in the vicinity of Kansas City, Mo., and the youngest beds exposed are in the flanks of the uplift in the vicinities of Ashland and Plattsmouth, fig. 2. The height of the Richfield uplift, measured from the top of the Oread formation in the Bartlett syncline to what would be its restored position on the Richfield uplift, is about 325 feet of which the rise is about 276 feet from Plattsmouth to within a distance of 5 or 6 miles to the northwest.

The thickness of the Upper Carboniferous beds exposed in the Platte Valley traverse is about 300 feet, below which are the Middle and Lower Carboniferous formations and yet older rocks. E. C. Reed's log of the Schuyler (Uhrhammer) well, located in sec. 23, T. 13 N., R. 12 E., shows that the Upper Carboniferous has been eroded to near the Hertha limestone at this place and replaced principally by Dakota group beds. His log is run herewith to show the thicknesses of the Carboniferous and Pre-Carboniferous rocks at this point in our traverse.

LOG OF SCHUYLER (UHRHAMMER) WELL

Elevation of ground level below derrick floor, 1053.5'

Pleistocene and Dakota group beds, thickness 87.5'
CARBONIFEROUS SYSTEM, 230':
  Upper Carboniferous series, 40':
    Missouri subseries, 40':
      Bronson group, 5'.
        Hertha limestone, 5', elevation top 966'.
      Bourbon (?) group, 35', elevation 961'.
  Middle Carboniferous series, 90':
      Marmaton group, 45', elevation 926'.
      Cherokee group, 45', elevation 881'.
  Lower Carboniferous, 100', elevation 836'.
DEVONIAN SYSTEM, 330', elevation 736'.
SILURIAN SYSTEM, 390', elevation 406'.
ORDOVICIAN SYSTEM, 270'+, elevation 16':
      Trenton group, 155':
        Prosser dolomite, 120', elevation 16.'
        Ion shale, 20', elevation -104'.
        Guttenberg limestone, 15', elevation -124'.
      Black River group, 60', elevation -139'.
      St. Peter sandstone (Chazyan group), 50', elevation -199'.
      Prairie du Chien group, 5', elevation -249'.

Total depth of well, 1310 feet.

NOTE: In the Victor Jeep well, located about 6 miles north of the Schuyler well, the Prairie du Chien group is 230 feet thick and is underlain by 15 feet of Jordan (Cambrian) sandstone which is separated from the Sioux quartzite below by 20 feet of Red Clastics. It is probable, therefore, that the top of the Sioux quarzite is at an elevation of about 514 feet or less below sea level in the Schuyler well location.

Post-Carboniferous Beds. — The Dakota group (Cretaceous) sandstones and shales overlie the eroded surface of the Upper Carboniferous rocks unconformably in the uplands bordering the Platte Valley in this area as far east as near Dyson Hollow on the north and south of Cullom Station on the south. Lying unconformably upon the Cretaceous and Upper Carboniferous rocks are variable thicknesses of Pleistocene deposits, i.e., glacial drift, loess and terrace sand.

La Platte Fault.—This structure cuts across the Richfield uplift with an upthrow of about 50 feet on the west. Beds dip into it on the west, and slowly away from it on the east. Just how far the fault extends northward and southward from the Platte Valley is not definitely known.

Hornady and Brock, in an unpublished report on Cass county made in 1933, conclude that a northeast-southwest fault crosses the Platte Valley and continues southwestward through Fourmile Creek Valley. Later studies show, however, that there probably is no fault here and that the strata have a low southeastward dip from the La Platte fault to Plattsmouth and beyond.

Outcrops.—Natural outcrops, quarry openings, and railroad and highway cuts occur in sufficient numbers in the area to facilitate the sectioning of the Upper Carboniferous formations and the construction of cross-sections. In places, however, the Pleistocene and Cretaceous formations cover the valley sides and the general uplands for considerable distances, making the survey of the older formations difficult.

Unconformities.—Two well-defined unconformities occur in the Upper Carboniferous series of this area, one at the base of the Lawrence shale and the other at the base of what is supposed to be the Stranger shale formation. The upper unconformity is marked by pebbles and erosional surface, and the lower one is marked by erosion extending locally through the Weston shale and probably into the upper part of the Stanton formation. The Iatan limestone, if it was deposited here, apparently was eroded. The Nehawka limestone, a conglomeratic facies, which is thought to be correlative with the Tonganoxie sandstone of the Kansas Survey classification, lies on

the lowest eroded surface of this unconformity.

CROSS-SECTIONS

The formations exposed in the traverse between Ashland and Plattsmouth are now shown by comprehensive cross-sections or segments lying along the lines shown in figure 2. The elevation stations, numbered 1 to 78, were run by instrument traverse in 1936 by Oliver J. Scherer and J. C. Maher from Biloxi datum obtained from the Burlington railroad. The "shots" were taken not more than 200 feet apart. The station elevations probably average a little less than they would be according to Coast and Geodetic Survey datum.

The formations, members, and zones of members of these sections are designated by numbers and letters in order to form a stratigraphic net for use in close, future lithologic and faunal study.

CROSS-SECTION A, ASHLAND TO SOUTH BEND

This section is measured on exposures in highway cuts, ravines, bluffs and quarries located between one-half mile southwest of Ashland station and north of South Bend. The section, measured in feet and tenths of feet, is as follows:

1. Oread formation, about 47′:
   (1) Kereford–Plattsmouth limestone, base in highway cut southwest of Ashland, best shown in road cut and upland bordering Pawnee Creek Valley 3½ miles east and one-quarter mile south of South Bend, thickness about 20′.
   (2) Heebner shale, in highway cut southeast of Ashland and in Pawnee Creek Valley, bluish gray above, black and fissile below, 5′.
   (3) Leavenworth limestone, highway cut southeast of Ashland and in Pawnee Creek Valley, bluish gray, blocky, 1.5′–1.8′.
   (4) Snyderville shale, ravine southeast of Ashland and in Pawnee Creek Valley, largely red, top and bottom bluish gray, 12′.
   (5) Weeping Water limestone, in Pawnee Creek Valley west of South Bend, formerly well exposed in south-side ravine southeast of Ashland, gray, massive to shaly, quite fossiliferous, 8′–9′.
2. Lawrence formation, upper portion best shown in Pawnee Creek Valley and basal portion in new Burlington quarry northwest of South Bend, largely argillaceous shale, top bluish gray, middle red, lower portion gray, thickness about 20′.

   UNCONFORMITY: observed in old Burlington quarry northwest of South Bend.
3. Stranger formation, about 18′:
   (1) Shale, in older Burlington quarry, bluish gray, argillaceous, pelecypodal, pebbly at top, about 2′.
   (2) Cass (Haskell ?) limestone, Burlington quarry, gray to variegated; top, massive, middle, irregular and in part algal; basal 1 foot bluish gray and dense and overlain by 1′–2′ of black, fossiliferous fissile shale; total thickness 15′+.
   (3) Shale, bluish gray, 1′+.

   UNCONFORMITY: marked by small pebbles and erosion.
4. Weston formation, old Burlington quarry, top eroded; remaining portion argillaceous shale, bluish gray at top, largely reddish, with an old form of *Rhombopora lepidodendroides* at base, 13′.
5. Stanton formation, at Burlington quarries, 31.8′:
   (1) South Bend limestone, largely massive, with shale seams, chert at top, all quite fossiliferous, 9.8′.
   (2) Rock Lake shale, largely red and argillaceaus, bluish at top and base, 6′.
   (3) Stoner limestone, light to dark gray, top wavy bedded, part massive, top shaly, most of it quite fossiliferous, about 16′.

   NOTE: The Cass limestone forms rapids on Salt Creek at Ashland and waterfalls in the ravines farther east; outcrops in the W½ of sec. 14, T. 12 N., R. 10 E., in the center of sec. 16, T. 12 N., R. 10 E., at several points in Pawnee Creek Valley; and in the quarries and ravines northwest of South Bend. The South Bend limestone forms a rapids on the new Salt Creek channel south of highway No. 6, east of Ashland, outcrops in the railroad cut west of the mouth of Salt Creek, and occurs higher in the slopes southeastward towards South Bend.

On the east side of the Platte, the South Bend limestone, Rock Lake shale, and the Stoner limestone are exposed intermittently from about two miles southeast of Linoma Beach to east of South Bend, where the next cross-section begins.

ELEVATIONS IN CROSS-SECTION A.—Figure 1 shows the locations of the station elevations listed in the preceding cross-section. Unless otherwise recorded, these elevations and the other elevations given in this report

are at the tops of the formations or members. The altitudes or elevations along cross-section A are as follows: No. 1, near top of Cass limestone, 1050′; No. 2, Leavenworth limestone, 1088′; No. 3, Weeping Water limestone, 1082′; No. 4, South Bend limestone, 1058′; No. 5, South Bend limestone, 1068′; and No. 6, Cass limestone, 1100′. Study of these elevations and those given in following sections will serve to show the dip and general structural relations of the formations in the area described.

CROSS-SECTION B, SOUTH BEND TO MEADOW STATION

The upper formations in the old quarries and natural outcrops across the valley from South Bend are continuations of those exposed at the Burlington quarries northwest of the town. The section from the Cass limestone to the base of the Stanton here is nearly identical zone by zone with that at the Burlington quarries, and the beds next below to the river level are the Eudora shale, 2.2′; Captain Creek limestone, 1.7′; Vilas shale, 3.5′; Plattsburg formation, about 10′, and the top of the Bonner Springs shale is about 7′–8′ above the mean river level.

From opposite South Bend, the South Bend limestone and older beds rise eastward in regular succession and are exposed intermittently north of the river to near Meadow Station and south of the river to and beyond Louisville. In places along these stretches the Upper Carboniferous beds are deeply mantled with Dakota group beds and Pleistocene deposits. The section at Kiewitz quarry located on the north side of the valley west of Meadow Station is as follows:

1. Stanton formation, high in valley side, 33.9′:
   (1) South Bend limestone, in old quarries to the west, top eroded, largely maroon, argillaceous, 6′–8′.
   (2) Rock Lake shale, largely maroon, argillaceous, 6′.
   (3) Stoner limestone, 16.7′:
      a. Limestone, light gray, stained red with shale from above, argillaceous, slabby, weathers buff, 2.5′–3′.
      b. Limestone, gray, bedded or massive, dense, 9′.
      c. Shale, gray, argillaceous but with much calcareous material, with *Cyclotrypa barberi* and several other fossils, 2.8′.
      d. Limestone, one or two bluish gray layers, weathers brownish, quite fossiliferous, 1.7′–1.8′.
   (4) Eudora shale, top bluish gray and argillaceous to arenaceous; lower portion black, 2′+.
   (5) Captain Creek limestone, 1.8′:
      a. Limestone, one or two bluish layers, .7′ or more.
      b. Shale, bluish gray to very dark, argillaceous, bedded, very fossiliferous, 1′ or less.
      c. Limestone seams, .2′+.
2. Vilas formation, 4.7′:
   a. Shale, bluish, gray above, calcareous at base, 1.5′.
   b. Lime seam, bluish gray, .4′–.5′.
   c. Shale, bluish, locally reddish at base, argillaceous, base uneven, 2.8′.
3. Plattsburg formation, 10′:
   (1) Spring Hill limestone, bluish gray, locally mottled red in upper portion, weathers yellowish, top uneven, 5′.
   (2) Hickory Creek shale, bluish, argillaceous, 1′–3′; average, 1.8′.
   (3) Meadow limestone, bluish gray, massive, forms large blocks, weathers yellowish, quite fossiliferous, 3′.
4. Bonner Springs formation, bluish gray argillaceous shale, with thin fossiliferous layer, near top, about 7′.
5. Wyandotte formation, 28.5′:
   (1) Farley limestone, gray, massive in upper portion, about 5′. The basal portion of this limestone is transitional to shale (2).
   (2) Island Creek shale, bluish gray, argillaceous, 1.5′+.
   (3) Argentine limestone, gray, upper two-thirds wavy, bedded and massive; lower portion with shaly partings; thickness, 22′.
   (4) Quindaro shale and Frisbie limestone, missing in this section or united with the Argentine member.
6. Lane formation, gray shale, .5′–.7′:
7. Iola formation, about 3.3′.
   (1) Raytown limestone, dark gray, argillaceous, .7′.
   (2) Muncie Creek shale, bluish above, black below, fossiliferous, 1.7′–2′.
   (3) Paola limestone, dark gray, argillaceous, .7′.

   NOTE: The Iola members are exposed in the drainways on the Kiewitz quarry floor. The Drum limestone is exposed northeast of the Rock Island station at Meadow and the top of the Westerville limestone was formerly

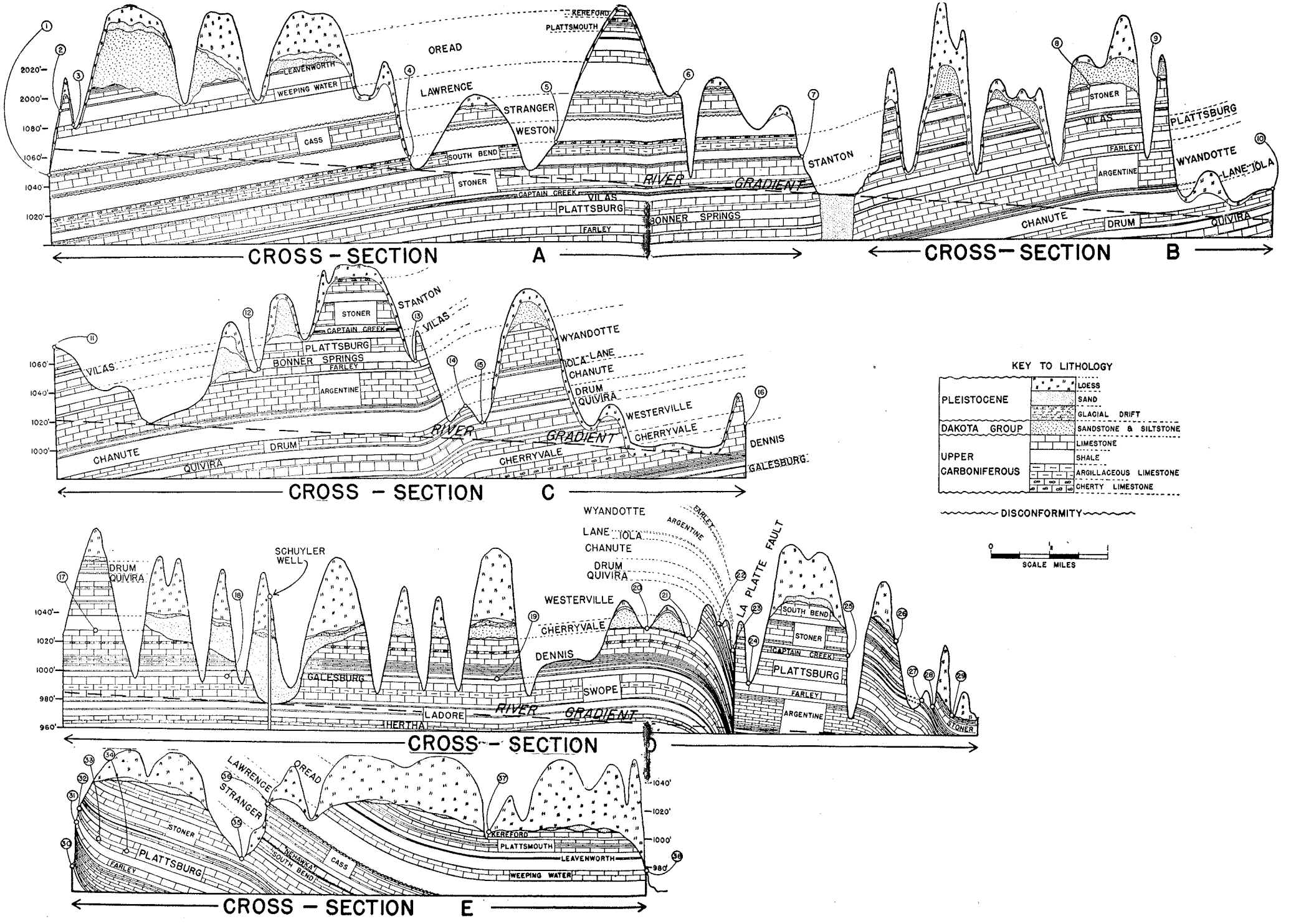

Figure 2.—Cross-sections of the lower Platte Valley traverse.

exposed in a low drainageway three-eights of a mile farther northeast.

ELEVATIONS IN CROSS-SECTION B.—No. 7, Stoner limestone. 1057′; No. 8, Stoner limestone, 1105′; No. 9, Stoner limestone, 1109′; and No. 10, Drum limestone, about 1033′.

CROSS-SECTION C, LOUISVILLE TO CEDAR CREEK

This segment is measured south of the Platte, from west of the Ash Grove quarries at Louisville to about 2 miles northeast of Cedar Creek. At Louisville the elevations of the beds are a few feet lower than they are north and west of Meadow. This is shown by comparing the elevations of the Argentine limestone at the west end of this section and the east end of the preceding section. The section exposed below the Dakota group of beds at the new and old Ash Grove quarries northeast of Louisville is as follows, divisions 4-9 being measured below the floor of the old quarry located 2 miles northeast of Louisville:

1. Plattsburg formation, all eroded at places, remaining in new quarry, 10′:
   (1) Spring Hill limestone, 3′–6′.
   (2) Hickory Creek shale, 1′–1.5′.
   (3) Meadow limestone, about 4′.
2. Bonner Springs formation, bluish gray shale, with a limy fossiliferous zone near top, about 8′.
3. Wyandotte formation, in new and old quarries, 28′:
   (1) Farley limestone, 4′–7′.
   (2) Island Creek shale, 1′–2′.
   (3) Argentine limestone, 21′+.
   (4) Quindaro shale and Frisbie limestone, missing or united with the Argentine member.
4. Lane formation, gray shale, .7′.
5. Iola formation, about 3′:
   (1) Raytown limestone, .5′–.7′.
   (2) Muncie Creek shale, 1.2′–2′.
   (3) Paola limestone, .7′.
6. Chanute formation, 14′:
   a. Shale, bluish, argillaceous, .7′–.8′.
   b. Claystone, gray and mottled, calcareous, .5′.
   c. Shale and claystone seams, 2.5′.
   d. Claystone, gray, calcareous, .8′.
   e. Shale, gray, argillaceous, 3.5′.
   f. Limestone, gray, quite fossiliferous, .5′ or more.
   g. Shale, olive colored, with yellowish brown mottling in lower portion, 5.5′.
7. Drum formation, 9′:
   a. Limestone, weathered yellowish, shaly, 1.5′+.
   b. Limestone, gray, dense, massive layers, 5′.
   c. Shale, gray, calcareous, .3′.
   d. Limestone, gray, .3′–.4′.
   e. Shale, gray, calcareous, .7′+.
   f. Limestone, gray, dense, forms large blocks, .8′+.
8. Quivira formation, 6′:
   a. Shale, olive colored, argillaceous, .8′.
   b. Shale, black, calcareous, 1′.
   c. Shale, gray, .3′+.
   d. Shale, bluish, argillaceous, .3′–.4′.
9. Westerville formation, dark gray, massive limestone, pebbly at top, with small gastropods, about 6′ exposed to railroad level at foot of slope.

The South Bend limestone, Rock Lake shale, and the Stoner limestone are quite well exposed in the east side of Cedar Creek Valley about 2 miles east of Louisville. Northeastward from this point, for a distance of about 1 mile, older beds become exposed down to the top of the Westerville formation. Formerly the interval from the middle of the Stanton to the base of the Argentine was well exposed in quarries located in the branch of Cedar Creek Valley southwest of the town of Cedar Creek, but these quarry faces are now badly covered.

In the spur of the bluffs northeast of the town of Cedar Creek, the outcrops are of beds from the middle of the Westerville limestone to the middle of the Galesburg shale.

The valley sides north of the river for most of the distance from Meadow to one-half mile west of the PWA quarry located 2¼ miles south of Richfield, are deeply mantled with loess, drift, and colluvial materials. As noted before, however, the Drum limestone (elevation 1033′) outcrops just northeast of the Rock Island station at Meadow and the top of the Westerville was formerly exposed in a drainway at near the bluff line about three-eighths of a mile yet farther northeast of the station.

ELEVATIONS ALONG CROSS-SECTION C.—No. 11, Stoner limestone, 1071′; No. 12, Farley limestone, 1055′; No. 13, Farley limestone, 1061′; No. 14, Drum limestone, 1029′; No. 15, Westerville limestone, 1018′; and No. 16, Winterset limestone, about 1022′.

CROSS-SECTION D, RICHFIELD TO LA PLATTE

This part of the profile extends along the north side of the Platte Valley from the Richfield (PWA) quarry to near the town of La Platte. The beds in the PWA quarry are 4 feet or more higher than they are at the end of the preceding cross-section located across the river to the south. The measured section at the PWA quarry follows:

1. Chanute formation, bluish gray, argillaceous shale, top eroded, formerly exposed, 10′; now exposed, 7′.
2. Drum formation, about 9′:
   a. Limestone, wavy bedded, weathered yellowish, 1.5′–2′.
   b. Limestone, dark gray, dense, in massive layers, 4.5′–5′.
   c. Shale, bluish gray, argillaceous, 1.2′+.
   d. Limestone, dark gray, massive, dense, fossiliferous, 1′.
3. Quivira formation, bluish gray, argillaceous shale, calcareous at top and base, with a thin carbonaceous layer 1.5′ below top, thickness 6.5′.
4. Westerville formation, about 18′:
   a. Limestone, gray, massive, dark gray limestone pebbles at top, with fusulinids and small gastropods, 2′.
   b. Limestone, gray massive or irregular, with small fusulinids in lower portion and *Myalina subquadrata* in upper portion, 2′–3′.
   c. Shale, bluish gray, argillaceous to calcareous, fossiliferous, 1.5′.
   d. Limestone, dark gray, dense, with poorly defined weathered vertical channels, contains *Pinna,* brachiopods, and other fossils, 2′.
   e. Limestone, gray, massive, may have shale seam near middle carries many small fusulines, 4′.
   f. Shale, bluish gray, massive, argillaceous, with fenestrated bryozoa, *Orbiculoidea, Chonetes granulifer,* and crinoid joints, 1′–1.3′.
   g. Limestone, gray, impure, 1′–1.5′.
   h. Shale, bluish gray, massive, argillaceous, 1′–1.2′+.
   i. Limestone, medium dark gray, massive, oolitic, base uneven, forms large blocks, 3′–5′.

   UNCONFORMITY: ?.
5. Cherryvale formation, 15′–16′:
   a. Limestone-siltstone, medium dark gray, massive, top uneven, forms large blocks, about 4.5′. This division is a silty to sandy transition between the Cherryvale and the Westerville formations. In places it carries very small fusulines.
   b. Shale, black, mottled dark gray, massive, becoming fissile at exposures, 1.9′.
   c. Mudstone-limestone, dark gray, fossiliferous, .2′–.3′.
   d. Shale, bluish gray, argillaceous to calcareous, massive, crumbly, 7′.
6. Dennis formation, about 25′:
   (1) Winterset limestone, about 21′:
      a. Limestone, gray, massive, forms large block, 7′.
      b. Limestone, similar to above, with dark chert near the top, 6′ or more.
      c. Limestone, weathers buff, 3′ or more.
      d. Shale, calcareous, .4′–.5′.
      e. Limestone, buff, soft, 2′.
      f. Shale, calcareous near top, fossiliferous at base, .7′–.8′.
      g. Limestone, bluish gray, .6′–.7′.
      h. Shale, .5′.
      i. Limestone, dark gray, dense, hard, .8′.
   (2) Stark shale, top portion bluish gray, argillaceous shale; basal portion black and fissile shale; thickness 2.5′+.
   (3) Canville limestone, 1.5′+:
      a. Limestone, bluish, dense fossiliferous, .2′–.3′.
      b. Shale, bluish, argillaceous, .5′.
      c. Limestone, bluish, dense, *Linoproductus prattenianus* common, .7′.
7. Galesburg formation, bluish gray, argillaceous shale, 5′ or more.
8. Swope formation, thickness 14′ or more, about 9′ exposed.
   (1) Bethany Falls limestone, exposed east of PWA quarry, 9′.
      a. Limestone, dark gray, massive, dense, brittle, 2.7′.
      b. Shale, calcareous, grades into limestone at top and bottom, 2′.
      c. Limestone, bluish gray, massive, irregular, 2.5′.
      d. Limestone, grayish, nodular, weathers shaly, 1.5′ exposed above Platte Valley bottomland.

The Dennis, Galesburg, and Swope formations crop out intermittently on the north side of the Platte from the PWA quarry to the Carlile quarry, which is located about 4¼ miles west and one-half mile south of the town of La Platte, or 1⅛ miles west of the La Platte fault where it crosses the Platte Valley floor. The

Dakota group beds lie rather low and unevenly in the valleyside in this part of the traverse and the Bethany Falls limestone drops eastward from an elevation (top) of 998 feet at the PWA quarry to 990 feet at the Carlile quarry. From the Carlile quarry northeastward the bedrock is obscured by alluvial material except for a stretch west of the fault where the Westerville, Cherryvale, and Dennis formations are quite well exposed, dipping southeastward into the fault. The formations are thought to continue (subsurface) eastward on a low dip from the Carlile quarry to the fault zone, and, if this is true, they drop only about 9 feet in the Richfield uplift from south of Richfield to near the fault.

The Stoner limestone is exposed just east of the fault, forms the upper waterfall in Dyson Hollow, and drops to the bottomland level just west of highway No. 73. The beds have a low dip from the fault to near La Platte.

The South Bend limestone has been quarried at several places west and east of Dyson Hollow and is now worked along with the Stoner in a new PWA quarry here. The Farley limestone is exposed on the creek bed about 200 yards east of the fault and eastward to beyond Dyson Hollow, where the normal section from the Stoner down to about the middle of the Argentine is well shown. The comprehensive section exposed between the fault and west of La Platte is as follows:

1. Stanton formation, about 30′:
   (1) South Bend limestone, at new quarry (PWA) east of Dyson Hollow, top eroded, gray, dense, oolitic, with many fusulinids, 6′ of basal portion remaining.
   (2) Rock Lake shale, in PWA quarry, top .7′, dark gray, the remainder bluish gray, massive and argillaceous-calcareous; thickness about 4′.
   (3) Stoner limestone, about 15.5′.
      a. Limestone, forms upper waterfall in Dyson Hollow, light gray to dark gray, weathers yellowish at top; usually dense and massive; some chert above the middle; with fusulines, bryozoa, and brachiopods; thickness about 11′.
      b. Shale, dark gray, calcareous, with nodular limestone, fossiliferous, with *Cylotrypa barberi, Fenestrellina, Septopora, Polypora, Fistulipora, Rhombopora, Chonetina flemingi, Chonetes granulifer, Composita subtilita, Marginifera wabashensis, Neospirifer dunbari, Juresania ovalis, Dictyoclostus portlockianus, Squamularia perplexa, Allorisma* sp., *Lophophyllum* sp., crinoid stems, etc., 2.5′–3.1′.
      c. Limestone, bluish gray, base very uneven, 1′–2′.
   (4) Eudora shale, upper portion bluish gray and argillaceous; lower portion black, carbonaceous; 1.7′–2′.
   (5) Captain Creek limestone, 2′:
      a. Limestone, forms a waterfall in Dyson Hollow, dark bluish gray, one bed, .5′.
      b. Shale, upper portion greenish blue, argillaceous; lower portion black, very fossiliferous, with *Chonetes granulifer, Chonetina flemingi, Amboceolia planoconvexa, Derby* sp., *Juresania, Linoproductus, Polypora,* and several species of Ostracods, 1′.
      c. Limestone, dark bluish gray, dense, .5′.
2. Vilas formation, 6′–7′:
   a. Shale, black, fissile, .8′.
   b. Claystone, bluish, jointed, slatelike, .8′.
   c. Shale, upper portion bluish, argillaceous; middle, dark, bedded to slabby; lower portion greenish bluish gray, argillaceous, 5.5′.
3. Plattsburg formation, forms two small waterfalls, about 12′:
   (1) Spring Hill limestone, gray, massive, top uneven, main portion gray, separated by a shale seam below middle, 6′.
   (2) Hickory Creek shale, about 1.3′:
      a. Shale, bluish to black, bedded, .5′.
      b. Limestone, dark irregular, fenestrated bryozoa common, .3′–.5′.
      c. Shale, black with gray mottlings, bedded, carbonaceous to argillaceous, .3′–.5′.
   (3) Meadow limestone, dark bluish gray, massive, with concretionary forms in upper portion, conchoidal to shelly fracture with bluish chert locally; black, shaly streaks along middle; forms large blocks; about 5′.
4. Bonner Springs formation, in bluff just west of the mouth of Dyson Hollow, 9.5′:
   a. Shale, bluish gray, bedded, argillaceous, 1′.
   b. Sandy mudstone, dark gray, massive, irregular, .5′.
   c. Shale, bluish gray, massive, argillaceous, with lime, sandy, 4′.
   d. Shale, reddish, argillaceous, 2′ or less.
   e. Shale, greenish, argillaceous, 2′.
5. Wyandotte formation, about 17′ exposed in foot of bluff west of mouth of Dyson Hollow:

(1) Farley limestone, 5.1′.
   a. Limestone, impure, shaly at top, 4′.
   b. Limestone, dark gray, dense, granular, very hard, with pelecypods, brachiopods and crinoid joints, 1.1′.
(2) Island Creek shale, bluish, crumbly, argillaceous, 2′.
(3) Argentine limestone, west of mouth of Dyson Hollow, upper portion weathered buff, remainder gray and massive, about 10′ exposed.

ELEVATIONS, CROSS-SECTION D.—No. 17, Winterset limestone, 1028′; No. 18, Bethany Falls limestone, 998′; No. 19, Canville limestone, 996′; No. 20, Winterset limestone, 1026′; No. 22, Westerville limestone, 1038′; No. 23, Drum limestone, 1019′; No. 24, Farley limestone, 993′; No. 25, Captain Creek limestone, 1013′; No. 26, South Bend limestone (eroded), 1025′; No. 27, Captain Creek limestone, 995′; No. 28, base of Stoner limestone, 978′; and No. 29, Chert zone in Stoner limestone, 973′.

THE LA PLATTE FAULT.—This structure, as noted before, is in the east flank of the Richfield anticline. Its throw has been determined by comparing elevations on known horizons located east and west of the fault line. For example, the elevation of the Farley limestone on the floor of Walnut Creek just east of the fault is 993.4 feet and the elevation of the Drum limestone just west of the fault is 1019 feet. The Stoner-Drum interval is about 82 feet. Thus, by allowing for the dip of the Drum from the point where the elevation was taken to the fault line, the faulting is found to be 50 feet or more. This amount of displacement has been verified by measurements made south of the river, where, in the NW¼ of the SW¼ of sec. 16, T. 12 N., R. 12 E., the altitude of the Farley limestone on the upthrow side of the fault is 1068 feet and the top of the Farley in the SE¼ of NW¼ of the NW¼ of sec. 32, T. 13 N., R. 13 E., on the downthrow side is 1019, a difference of 49 feet. Apparently the La Platte fault extends northward, probably into Iowa, but just how far it reaches in the opposite direction is not known. There is some evidence, however, that it reaches to near Weeping Water.

CROSS-SECTION E, OREAPOLIS TO PLATTSMOUTH

This cross-section is based on exposures located 2½ miles west of Oreapolis Station, in Eightmile and Fourmile valleys, in a ravine northwest of Plattsmouth and in the bluffs extending from the Platte Valley to below Plattsmouth. The strata dip southeastward and constitute the exposed interval from the top of the Oread formation down to the Chanute shale.

There are no Carboniferous exposures close to Oreapolis Station; consequently the rest of this cross-section is measured on the outcrop 2½ to 3 miles or more west and southwest of the station, as follows:

1. Stanton formation, about 34′ exposed:
   (1) South Bend limestone, badly covered, top eroded, gray, massive, oolitic at places, weathers yellowish in lower portion, 4′–6.5′ shown.
   (2) Rock Lake shale, bluish gray, argillaceous, with indurated bands in upper portion, about 6′.
   (3) Stoner limestone, about 16.7′:
      a. Limestone, top light gray and somewhat argillaceous, the rest darker gray, dense, with some bluish gray chert and fossiliferous, about 12′.
      b. Shale, gray, argillaceous to calcareous, weathers buff, with *Cyclotrypa barberi* and several other species like those at Dyson Hollow, 3.5′.
      c. Limestone, dark bluish gray, dense, with crinoid joints, bryozoa and brachiopods, .7′ or more.
      d. Shale, wavy, dark, 0–.1′.
      e. Limestone, dark blue, dense, .5′.
   (4) Eudora shale, bluish, largely argillaceous, with some fine sand at top, 2′.
   (5) Captain Creek limestone, 2.4′:
      a. Limestone, bluish, weathered yellowish, with *Allorisma* and other fossils, .7′.
      b. Shale, dark, bedded, part fissile, with *Chonetes granulifer, Ambocoelia, planoconvexa, Rhombopora lepidodendroides,* etc., .7′.
      c. Limestone, bluish gray, massive, fossiliferous, 1′.
2. Vilas formation, about 4.6′:
      a. Shale, dark bedded, weathers yellowish brown, .8′–1′.
      b. Claystone-limestone, bluish gray, argillaceous, base uneven, 1.5′+.
      c. Shale, sandy, ostracodal, 1.1′.
      d. Shale, bluish gray and dark, 2.2′.

3. Plattsburg formation, 12.2′:
   (1) Spring Hill limestone, about 6′+:
      a. Limestone, light gray, massive, top uneven, weathers buff, fusulinids common, 3′ or more.
      b. Shale seam, agrillaceous to calcareous, .4′–5′.
      c. Limestone, massive, weathers buff, fossiliferous, 2′.
   (2) Hickory Creek shale, dark gray, massive, argillaceous to limy, with *Chonetes,* fenestrated bryozoa, etc., 1.5′.
   (3) Meadow limestone, bluish, concretionary, massive, irregular, fossiliferous, 4′–5′.
4. Bonner Springs formation, not well exposed, dark gray shale above, greenish blue shale below, about 7′.
5. Wyandotte formation, about 25′:
   (1) Farley limestone, weathered slabby, yellowish at top, dense in lower portion, about 5′.
   (2) Island Creek shale, bluish gray, argillaceous, 1′–2′.
   (3) Argentine limestone, gray; weathered yellowish at top; main portion light gray and massive; lower portion separated by thin wavy shale seams near top with bryozoa, *Composita, Marginifera, Squamularia,* etc., 18′ or more.
   (4) Quindaro shale and Frisbie limestone, probably missing.
6. Lane formation, gray shale, calcareous, 1.5′ or less.
7. Iola formation, 3.6′:
   (1) Raytown limestone, 1.8′:
      a. Limestone, bluish gray, earthy, .8′–1′.
      b. Shale, gray, .4′–.5′.
      c. Limestone, bluish, earthy, .3′+.
   (2) Muncie Creek shale, .8′–.9′.
      a. Shale, gray, .7′.
      b. Shale, dark, carbonaceous, .1′–.2′.
   (3) Paola limestone, gray, earthy, .8′.
8. Chanute formation, brownish, sandy shale, top .7′ exposed.

Scattered outcrops occur in Fourmile Valley and its main tributary, Eightmile Valley. The Cass limestone is exposed in the east side of Fourmile Valley, in the SE¼ of sec. 3, T. 12 N., R. 13 E, located about 2¾ miles northwest of Plattsmouth, and in Eightmile Valley, in the NW¼ of sec. 30, T. 12 N., R. 13 E., located 1 mile south and 6 miles west of Plattsmouth. The base of the Cass limestone at the last location is 10.5 feet above the Nehawka limestone, which is exposed on the creek bed and lies very close to the South Bend limestone. The latter outcrops in the creek bank a short distance eastward. The Weston shale, as noted above, thins or is completely eroded here, and the shale next below the Cass limestone is 10.5 feet thick here compared with only about 1 foot at the Burlington quarry section. The Nehawka limestone, too, is quite well developed here and has not been found to occur at either the Burlington quarry or certain other places within the area.

The Plattsmouth limestone is exposed in a ravine west of highway No. 73 about 1 mile northwest of Plattsmouth and at various places in the bluffs to beyond Plattsmouth. The comprehensive section in this part of the traverse is as follows:

1. Oread formation, 45′+:
   (1) Kereford–Plattsmouth limestones, in ravine northwest of Plattsmouth and the river bluffs, top eroded, gray, dense, part oolitic, 15′–20′.
   (2) Heebner shale, typically shown in bluffs below mouth of ravine south of Missouri River bridges, 3.5′–4′.
   (3) Leavenworth limestone, in bluffs, bluish gray, dense, 1.3′.
   (4) Snyderville shale, in bluffs, blue and gray at top and base, largely maroon, 12′–14′.
   (5) Weeping Water limestone, near level of bluffland road under river bridges and in bluffs northeast of city, quite fossiliferous, 7′.
2. Lawrence formation, exposed to river level south of river bridges, largely shale, gray above and below, middle maroon, 10′±.

ELEVATIONS, CROSS-SECTION E.—No. 30, Iola limestone, 978′; No. 31, Farley limestone, 1009′; No. 32, Meadow limestone, 1019′; No. 33, Meadow limestone, 997′; No. 34, Meadow limestone, 989′; No. 35, base of Stoner 998′; No. 36, Cass limestone, 1024′; No. 37, Kereford limestone, 1005′; and No. 38, Weeping Water limestone, 976′.

Additional Elevations.—The following elevations (at tops of limestone), for stations not listed in connection with the descriptions of the cross-sections, are given for those who may wish to have them for use in close stratigraphic study of the area.

No.		*Feet*
39	Cass limestone	1066
40	Captain Creek limestone	1050
41	Base of Stoner limestone	1053
42	Captain Creek limestone	1046

43	Stoner limestone	1072
44	Stoner limestone	1067
45	Stoner limestone	1068
46	Stoner limestone	1068
47	Stoner limestone	1055
48	Base of Cass limestone	1078
49	Near top of Cass limestone	1091
50	Cass limestone	1093
51	Leavenworth limestone	1131
52	Leavenworth limestone	1118
53	Stoner limestone	1052
54	Fusulinid zone of Stoner limestone	1051
55	Stoner limestone	1053
56	Fusulinid zone of Stoner limestone	1058
57	Westerville limestone	1018
58	Stoner limestone	1095
59	Stoner limestone	1118
60	Stoner limestone	1110
61	Captain Creek limestone	1194
62	Farley limestone	1072
63	Winterset limestone	1006
64	Winterset limestone	1001
65	Near top of Westerville limestone	1022
66	Westerville limestone	1002
67	Iola limestone	1036
68	Argentine limestone	1069
69	Near top of Farley limestone	1060
70	South Bend limestone	1070
71	Kereford limestone	1002
72	Weeping Water limestone	969
73	Weeping Water limestone	963
74	Leavenworth limestone	984
75	Plattsmouth limestone	1000
76	Weeping Water limestone	966
77	Plattsmouth limestone	993

CONCLUSIONS

Correlation of the Upper Carboniferous formations and members of the lower Platte Valley has been difficult to accomplish, owing to the prevalence of Pleistocene and Cretaceous mantle and the presence of geologic structures, but is now made with assurance, except the part of the section in which the unconformities occur, ie., the interval between the Lawrence shale and the Stanton formation. The Cass limestone, which has been correlated from time to time as the Iatan, Haskell, or Amazonia, probably is correlative with the Haskell limestone of the Kansas Survey; the Amazonia is missing, owing to non-deposition; and the Iatan may have been eroded, if it was ever deposited here.

The South Bend limestone of the Stanton formation is correlative with the "Little Kaw" limestone of Kansas and has priority. Also, the Rock Lake, Stoner, and Meadow members are the "Victory Junction," "Olathe" and "Merriam" members of Kansas and have priority over them. This original correlation was made by Dunbar and Condra and has been checked by Dr. Moore and others since the Kansas Survey proposed the correlative names. The Meadow limestone is the "Merriam" limestone of the Kansas Survey.

The Richfield uplift was first described on a basis of local folding in beds which were wrongly correlated. It was then supposed that the strata dip northwestward from the Nehawka anticline into a shallow syncline located between it and the Richfield uplift, but it is now known that they lift quite regularly from the Bartlett syncline to the La Platte fault, beyond which they rise rapidly for a short distance and then very slowly to the vicinity of Richfield.

The Nehawka anticline is only a spur or nose of the Richfield uplift extending southwestward to the Redfield anticline.

Stone was quarried and lime was burned in this area at a very early date. Some of the quarries which were operated between 1850 and 1870 are now represented by pit-like depressions in the valley sides and some of them have been reopened the last few years. The lime kilns have been destroyed. Limestone is being quarried for use in road building and in the navigation development of the Missouri River. Much stone and shale remain for future production. Some stone has been mined by tunneling as at Meadow and Louisville.

The Ash Grove Company uses various shales and limestones in the interval between the South Bend and Westerville, in the manufacture of portland cement.

There is extensive sand and gravel production from the alluvial deposits of the area.

Some clay is produced from the Dakota group beds for use in the manufacture of brick, tile, and pottery.

There may be some chance for oil and gas discovery in the area lying just east of La Platte fault. A well is being drilled on the Nehawka anticline.

Further subsurface investigation should be made of the northern and northwestern parts of the Richfield uplift to determine the high point on this structure and whether it has oil and gas possibilities.

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