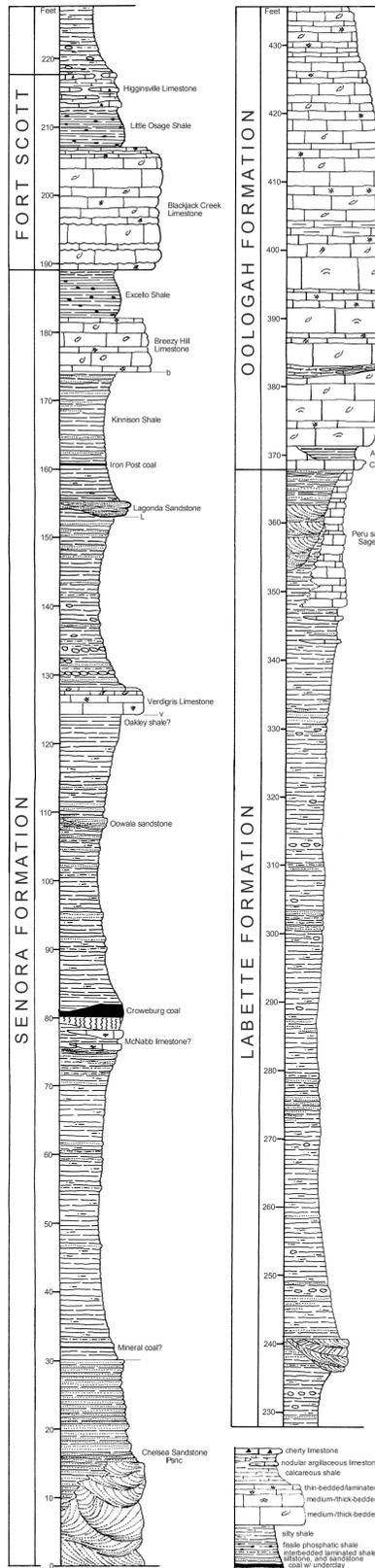
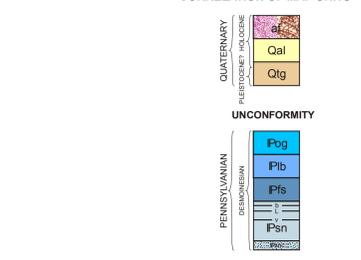


STANDARD REFERENCE SECTION

Main stratotype section for the Sageeyah 7.5-minute quadrangle showing principal formations, members, and beds, their relative stratigraphic positions, general lithologic textures, and average thicknesses. Formal member and bed names are indicated by capitalization (i.e., Chelsea Sandstone), while informal names are given in lowercase (i.e., Peru sandstone). Unit names followed by a 7 indicate that the member or bed was not observed in the field area, but has been reported in adjacent areas or in the subsurface.



CORRELATION OF MAP UNITS



DESCRIPTION OF UNITS

ARTIFICIAL FILL (Holocene) - Natural or artificial talus, slumps, and tailings covering formally exposed areas around active and inactive mining operations.

Qal ALLUVIUM (Holocene) - Clay, silt, sand, and gravel in channels and on flood plains of modern streams. Includes terrace deposits of similar composition located directly above and adjacent to modern channels and flood plains. Thickness: 0 to about 30 ft.

Qtg TERRACE GRAVELS (Holocene and/or Pleistocene?) - Concentrations of locally and distally derived sediment, mostly rounded and subrounded chert and limestone pebbles mixed with a medium-grained quartz sand sediment. Pebbles typically dusky yellow (5Y6/4) to light olive brown (5Y5/6) color; quartz sand sediment more of a light brown (5YR5/6) color. May represent former course of Verdigris River. Thickness: 0 to about 25 ft.

Pog OOLOGAH FORMATION (Pennsylvanian, Desmoinesian) - The section exposed in the Sageeyah Quad primarily represented by the Pawnee Limestone Member of the Oologah Formation; limestone characterized by a medium gray (N5), medium dark gray (5B5/1), to locally yellowish gray (5Y7/2) in lower half of formation, becoming more grayish orange (10YR7/4) and yellowish gray (5Y7/2) in upper half. Lower third to half of formation represented by alternating thin- to medium bedded, very wavy, skeletal and whole-fossil mudstones and wackestones; generally, thinner bedded limestones of the lower part of the Oologah tend to have a wackestone texture and yellowish-gray hue, while thicker bedded limestones have a lime mudstone texture and bluish-gray hue; bedding varies between 1-16" thick. Fossils dominated by numerous species of brachiopod, phylloid algal, and crinoid debris; fenestrate and ramose bryozoans present in thicker beds, while bivalve-filled burrows also common in some sections with a large complement of interlaminated, medium dark gray (N4) argillaceous wackestone beds; lower contact of shale interval, as well as subsequent Oologah limestone beds above shale interval, strongly concave, giving middle part of formation a large-scale cross-bed appearance. The upper half of exposed Oologah tends to be more regular, thin-bedded, slightly argillaceous, fossiliferous mudstone, bedding planar to slightly wavy, ranging from 2.5" thick to less than 1" thick, except for a phylloid algal content.

Base of Oologah usually has a 3-15" thick shale section (Anna Shale), overlying a thin (2-12") thick, medium gray (N5) limestone texturally similar to the Oologah proper (named the Childers School Member in some reports). The Anna Shale is medium dark gray (N4) to moderate olive brown (5Y4/4), well-laminated, locally calcareous or phosphatic, silty clay shale, in sections where the Childers School Limestone is absent the Anna Shale is nearly indistinguishable from the underlying shales of the Labette Formation.

Only lower 65 to 70 ft of the Oologah Formation exposed in quad.

Pib LABETTE FORMATION (Pennsylvanian, Desmoinesian) - Light olive gray (5Y5/2) to dusky yellow (5Y6/4) occasionally medium light gray (N6) laminated, very silty to sandy, micaceous, concretionary clayshale; concretions dusky red (5R4/2) to moderate red (5R5/4), composed of hematite and/or siderite(?), and usually occur sporadically throughout formation as 1-3" diameter discoid-shaped clasts. Clayshale predominantly medium to coarse grained, although some narrow horizons are weakly calcareous (particularly those associated with abundant concretions). Locally, various non-descript very sandy or sandstone horizons occur; mostly these sand horizons are planar laminated to thin-bedded, but one at 15 ft above base of the Labette is trough cross-bedded.

Near top of the formation a thick sequence of either interbedded sandstone and shale (Peru sandstone), or limestone (Sageeyah limestone) may occur. Where present, the base of the Peru sandstone occurs above shale; consisting of thin-bedded, silty, calcareous, argillaceous sandstone, thin- to medium-, trough-cross-bedded, fine-grained, non-calcareous, argillaceous sandstones, alternating 6" to 3" with intervals consisting of well-laminated, calcareous, very fine-grained sandstone and shale; from top to base: Cowles sandstone (5Y4/4), slightly argillaceous, locally thin-bedded, silty sandstone; Peru sandstone (5Y4/4), well-laminated, locally calcareous or phosphatic, silty clay shale, in sections where the Childers School Limestone is absent the Anna Shale is nearly indistinguishable from the underlying shales of the Labette Formation.

In the map area the Labette Formations varies between 120 to 180 ft thick, but averages closer to 150 ft thick.

Pfs FORT SCOTT FORMATION (Pennsylvanian, Desmoinesian) - Consists of three members, in descending order: 1) the Higginsville Limestone; 2) the Little Osage Shale; and 3) the Black Jack Creek Limestone. Thickness of the formation is about 25 to 32 ft, averaging closer to 28 ft thick.

Higginsville Limestone: Poorly exposed and highly recessive interval, only observed as a series of discontinuous limestone beds and float nodules that occur on steep hill-sides. The limestone is locally a moderate orange pink (5Y8/4) to grayish yellow (5Y7/4), slightly argillaceous, locally cherty mudstone; most likely interbedded with calcareous shale. Thickness of member probably about 5 ft based on float trail.

Little Osage Shale: Similar to the Excello Shale of the Senora Formation, a medium dark gray (N4) to dark gray (N3), well-laminated to fissile, phosphatic clayshale; upper 5-8' a light brownish gray (5YR6/1), blocky-bedded, silty, calcareous, fossiliferous clayshale. Phosphate nodules throughout lower part of member, occurring as 0.25-0.5", ovoid-shaped clasts. Thickness from 5-8 ft, averaging about 6.5 ft.

Black Jack Creek Limestone: Light gray (N7) to medium light gray (N6), thin to medium, wavy bedded, whole-fossil wackestone and mudstone. Bedding varies from 2" to as much as 16" thick, with thicker bedding more frequent toward top of exposure; wavy bedding contacts due (in part) to stromatolitic bedding; limestone in upper 1-3 ft of member exhibiting wavy laminated bedding and more fragmentary bioherms compared to lower parts of member. Fossils dominated by spirifer and productid brachiopods, and crinoid debris, algae and fusulinids common in some intervals. Thickness from 10-20 ft, averaging close to 18 ft.

Psn SENORA FORMATION (Pennsylvanian, Desmoinesian) - Complex sequence of silty and concretionary clayshale interbedded with a number of mappable limestone and sandstone members (including b, Brezzy Hill Limestone, L, Lagonda Sandstone, v, Verdigris Limestone, Psn, Chelsea Sandstone), and various minor sandstone intervals (including Gowanus Sandstone, and the Iron Post, Croweburg, and Mineral coal beds).

A silty to sandy clayshale, interlamated with 0.16-1" thick very fine-grained sandstone and siltstone beds is the predominant lithology of the formation; silt and sand content increasing adjacent to significant sandstone intervals (such as the Chelsea or Lagonda sandstones); clayshale bedding laminated, becoming blocky where deeply weathered; color variable, ranging, from the most frequent to infrequent: medium light gray (N6), brownish gray (5YR4/1), grayish orange (10YR7/4), very pale orange (10YR8/2), dark yellowish orange (10YR6/2), pale brown (5YR5/2), light brown (5YR5/6), grayish yellow (5Y8/4), and yellowish gray (5Y7/2); typically, shale associated with concretionary zones tend to be more orange or brown, instead of gray in hue; clay is predominant cement, calcite rare.

Clayshales immediately above coal seams tends to be harder, silt-free, slightly phosphatic, with slightly thicker laminated bedding, and are weakly calcareous, color usually a medium dark gray (N4).

The interlamated sandstones and siltstones are friable to poorly indurated, usually a very pale orange (10YR8/2), pale orange (10YR8/2), or dark yellowish orange (10YR6/2); sandstone more common than siltstone, typically fine- to very fine-grained; predominant cement is clay, with a possible weak siliceous.

Ironstone concretions occur sporadically throughout the shale section, but concentrations may occur just above the Verdigris Limestone; concretions composed predominantly of hematite, may range as 0.5-2" thick, dense discontinuous beds in the concentrated horizons, but normally as small (between 1-2") individual, hollow, ovoid-shaped clasts; color a light red (5R6/6) to moderate red (5R5/4).

A number of prominent stratigraphic horizons occur in the Senora Formation, these are in descending order:

Excello Shale: Predominantly a medium dark gray (N4) to dark gray (N3), well-laminated to fissile, phosphatic clayshale; however, upper 2.5" a light brownish gray (5YR6/1) to pale brown (5YR7/2), laminated, slightly silty, calcareous, fossiliferous clayshale. Phosphate nodules throughout lower part of member, occurring as 0.25-0.5", ovoid-shaped clasts. Thickness from 3-6 ft, averaging 4 ft.

Kinnison Shale: Medium light gray (5YR4/1), grayish orange (10YR7/4), very pale orange (10YR8/2), dark yellowish orange (10YR6/2), to medium light gray (N6), with local dark yellowish orange streaks along bedding contacts and fractures, alternating thin to medium, wavy bedded, whole-fossil and skeletal wackestone and mudstone. Bedding varies from 3-16" thick, with thinner bedding characterized by skeletal textures, and medium bedding a characteristic whole-fossil texture. Small products and mesolobids common along with large crinoid stems, chaetoid sponges present. Thickness about 7 ft.

Brezzy Hill Limestone (b): Grayish orange (10YR7/4) to medium light gray (N6), with local dark yellowish orange streaks along bedding contacts and fractures, alternating thin to medium, wavy bedded, whole-fossil and skeletal wackestone and mudstone. Bedding varies from 3-16" thick, with thinner bedding characterized by skeletal textures, and medium bedding a characteristic whole-fossil texture. Small products and mesolobids common along with large crinoid stems, chaetoid sponges present. Thickness about 7 ft.

Iron Post coal: Poorly exposed; where observed, however, is mostly characterized by a black (N1) carbon smear 1-1.5" thick; locally it may become a 3-6" coal seam.

Lagonda Sandstone (L): Grayish orange (10YR7/4), dark yellowish orange (10YR6/2), very pale orange (10YR8/2), friable, planar to sometimes wavy laminated, infrequently thin-bedded, fine- to very fine-grained, slightly siliceous sandstone; calcite cement rare. Bedding usually no more than 0.15-0.25" thick, but may reach 3" thick in some outcrops; ripple-bedded surfaces with internal tabular cross-lamination common. Thickness ranges from 6" to 2.2 ft.

Verdigris Limestone (v): medium dark gray (N4) skeletal mudstone; but may weather to a medium light gray (N6), grayish red (5R4/2), or grayish orange (10YR7/4) color. Represented either by a single massive bed, or by a couple of 9-12" thick planar limestone beds; top 3-4" becoming a wavy laminated whole-fossil mudstone to wackestone, with large productid brachiopods and large crinoid stems. Thickness about 3.5-5 ft.

Croweburg coal: Poorly exposed in map area, where observed in old mine workings represented by a black (N1) to grayish black (N2), 0.5-2" thick coal bed overlying a comparably thick very light gray (N6) to light bluish gray (5B7/1) underlay. Locally, a pair of 9-12" thick, whole-fossil mudstones separated by a 6" thick clayshale interval, informally named the McNabb limestone by some geologists, occurs immediately above the underlay.

Chelsea Sandstone (Psn): Variable sandstone unit that can be locally segregated into two zones. Lower zone well exposed, consisting of a pale reddish brown (10YR4/2), dark yellowish brown (10YR7/4), grayish orange (10YR8/2), to locally moderate yellow (5Y7/6), pale greenish yellow (10YR8/2), or pale olive (10Y6/2), moderately indurated, medium- to thin-bedded, fine- to medium-grained, calcareous trough-cross-bedded sandstone. Trough cross-bed sets vary from 0.2" to 3" thick, average 5" thick. Thickness of basal Chelsea in map area varies from 8-15 ft, but averages closer to 11 ft. Upper zone of the Chelsea poorly exposed, evidenced often times only by the presence of a sandy loam soil, as opposed to a clay loam; where exposed consists of a pale yellowish brown (10YR6/2) to light brown (5YR6/4), friable, thin-bedded to often planar laminated, weakly calcareous, micaceous, fine-grained sandstone. Thickness varying from 15-25 ft thick, averaging closer to 17 ft. Average thickness of the Chelsea Sandstone is about 30 ft, base not present in map area.

