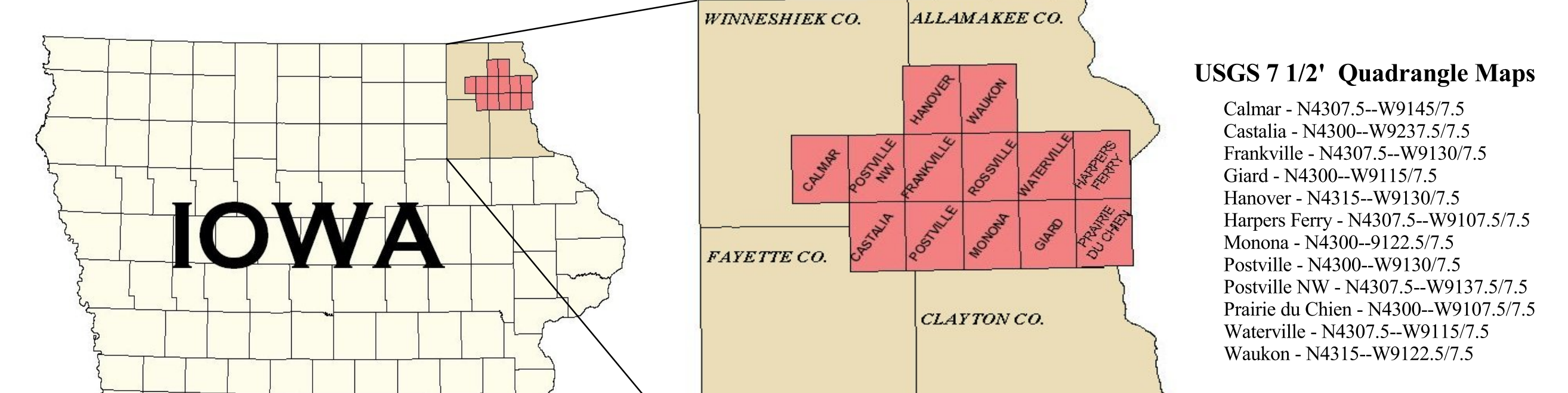


BEDROCK GEOLOGY OF THE QUADRANGLES CONTAINING THE YELLOW RIVER BASIN ALLAMAKEE, CLAYTON, FAYETTE, AND WINNESHEK COUNTIES, IOWA

by
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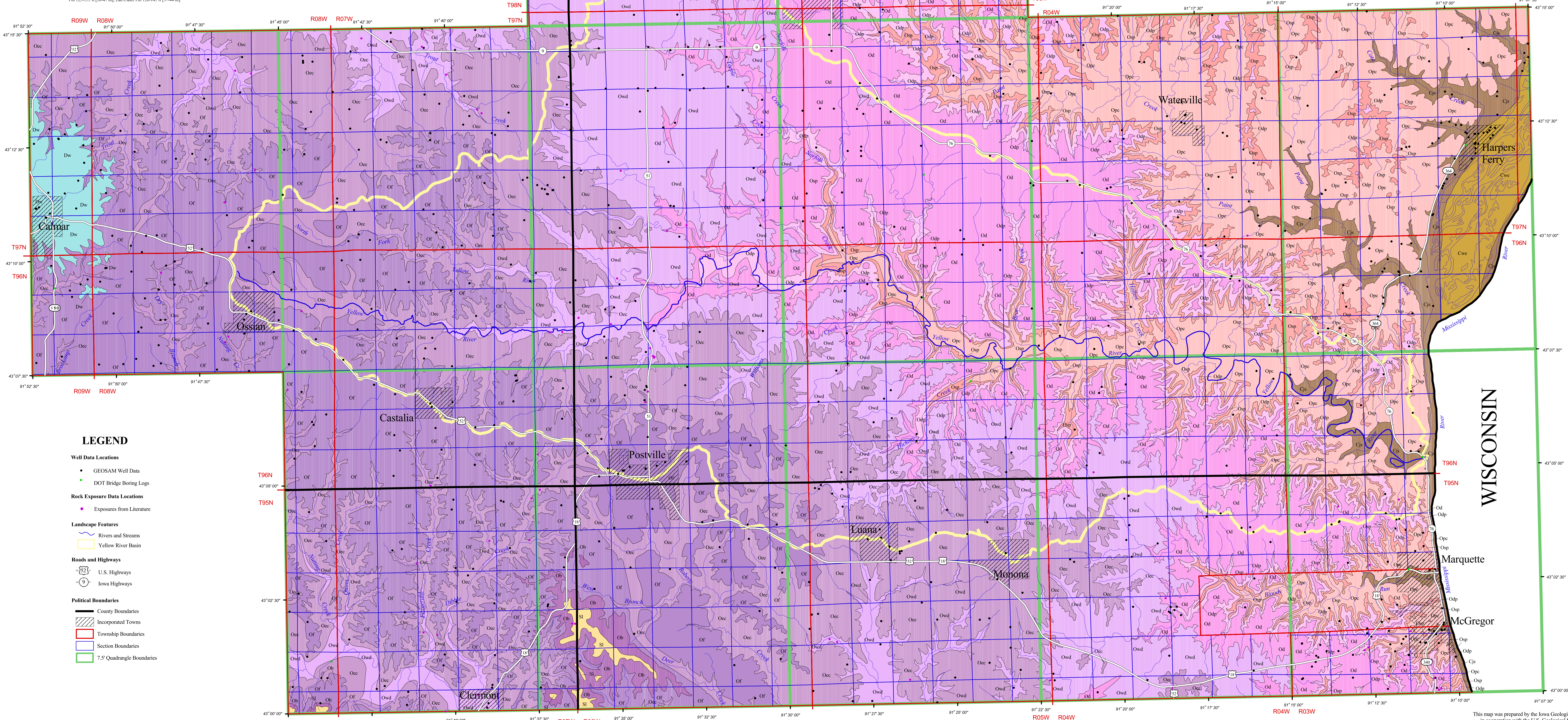
Location of Mapped Quadrangles



LEGEND

Geologic Units

- CRETACEOUS**
- Wauvee Formation**, and **Cretaceous** (upper Allamakee and lower Cretaceous). Lithologies dominated by limestone iron ore, nodular to massive, part sandy; secondary lithologies include hematite, quartz and pyrite, sandstone, gravelly sandstone, clay shale and silt. Mapped only in Waukon Quad. Maximum thickness to 135 ft (41 m) at Iron Hill, the highest elevation in the map area. Low karst susceptibility, but overlies paleokarst surface on Galena Group limestone strata in map area.
- DEVONIAN**
- Wagonwheel Group**, primarily **Spillville Formation**. Local erosional remnants of overlying **Prairie du Chien** Formation. Middle Devonian (upper Fildes-lower Givens). Spillville lithologies dominated by medium to thick bedded limestone, locally to wavy, common shaly beds, minor dolomite limestone, basal shaly limestone, scattered silicified fossils, cherty to very cherty dolomite, sandstone, argillaceous siltstone, silty dolomite, shale. **Prairie du Chien** lithologies include argillaceous dolomite and shaly dolomite, part sandy (Kawarow Member) and limestone and dolomite limestone, part brecciated (Spring Grove Member) and limestone. Mapped only in western Calmar Quad. Spillville is to 90 ft (27 m) thick; **Prairie du Chien** is to 30 ft (9 m) in map area. Spillville is a ledge-forming interval; **Prairie du Chien** is a covered slope-former. Moderate karst susceptibility.
- SILURIAN**
- Lower Silurian**, undifferentiated strata (and Lindover). Includes **Wauvee** Formation in south-western Castalia Quad, combined **Iron Ore** and **Mora-Blanding** Formations in south-western Postville Quad. **Wauvee** Formation is dominated by fossiliferous limestone and dolomite (lower part locally cherty to upper part). The **Mora-Blanding** Formation is dominated by fossiliferous dolomite, medium to thick bedded in lower part, thin to medium bedded upper part, fossiliferous, scattered silicified fossils, cherty to very cherty (especially in upper part). Maximum thickness in map area: **Wauvee** Formation to 40 ft (12 m). See also **Mora-Blanding** Formation in 68 ft (21 m). Silurian strata are ridge-forming intervals. Moderate karst susceptibility.
- ORDOVICIAN**
- Brainard Member**, **Maquoketa Formation** (Upper Ordovician, upper Richmond). Lithologies dominated by green-gray to blue-gray dolomite shale, part silty; minor thin dolomite and argillaceous dolomite interbeds and nodules. Mapped only in southern Castalia and Postville Quads. Thicknesses approximate 70-100 ft (21-33 m) where capped by Silurian strata. Brainard is a covered slope-forming interval. Low karst susceptibility.
 - Fort Atkinson Member**, **Maquoketa Formation** (Upper Ordovician, middle Richmond). Lithologies dominated by fossiliferous limestone, dolomite limestone, dolomite, part very cherty, part cherty to very cherty (especially in lower half), lower limestone strata are variably argillaceous, minor thin shale partings. Thicknesses vary in map area between 25 and 65 ft (7.5-20 m) (thickest to west), commonly 35-45 ft (10-14 m) thick. Ledge-forming interval. Moderate to high karst susceptibility, nodules common in some areas.
 - Elgin and Chertown Members**, **Maquoketa Formation** (Upper Ordovician, lower Richmond). Elgin Member dominated by dolomite, argillaceous dolomite, and dolomite limestone, part cherty to very cherty, thin shale interbeds, variably fossiliferous (dolomite more shaly in upper part), much of unit is openely fossiliferous to unfossiliferous, narrow dolomite common; lower part dominated by limestone and dolomite limestone with shaly interbeds, trilobites common in some beds (excavation of "Isabelle" and "Annapolis beds"); basal strata include a purple phosphatic (on **Hubert** Fin surface) and dark brown argillaceous shale partings. Chertown Member dominated by gray to green argillaceous limestone, dolomite limestone, and dolomite interbeds. Total Elgin-Chertown thickness in map area varies between 100 and 157 ft (30-47 m); commonly 110-135 ft (34-41 m) (thickest to southwest). Chertown Shale at top of interval varies 10 to 30 ft (3-9 m) thick. Slope- to ledge-forming interval. Chertown Shale with low karst susceptibility. Elgin Member variably shows low to moderate karst susceptibility; karst collapse in underlying Galena Group strata may slope through lower Elgin strata and develop sinkholes in portions of the map area.
 - Wise Lake and Dubuque Formations**, upper Galena Group (Upper Ordovician, Galena, Marcellus, and Newell). **Wise Lake** Fin (lithologies dominated by dense limestone, medium to thick bedded, fossiliferous, chert free except in basal beds; common dolomite, fossiliferous burrow motifs and nodules in many beds; limestone-dolomite facies across northern and western map area, typical south-western facies). **Dubuque** Fin (characterized by limestone, thin to medium bedded, fossiliferous, part coarse crystalline, common thin shale interbeds, chert free, dolomite in southwest. Total **Wise Lake-Dubuque** thickness in map area varies 90-110 ft (27-34 m). **Wise Lake** Fin 60-73 ft (18-22 m) (thickest to north), **Dubuque** Fin 30-37 ft (9-11 m). Ledge- and cliff-forming interval. High karst susceptibility, sinkholes common to abundant.
 - Danish Formation**, middle Galena Group (Upper Ordovician, middle-upper Chertown). Lithologies dominated by dense limestone, thin to medium bedded, fossiliferous, part argillaceous, scattered thin shale and shaly interbeds in lower half, scattered common chert nodules in some units; minor dolomite, fossiliferous burrow motifs in some beds. Limestone dominated across most of map area, but **Danish** becomes dolomite dominated by dolomite limestone and dolomite facies in south-western map area. Thickness varies 110-145 ft (34-44 m) (thickest to north). Ledge- and cliff- to ledge-forming interval. High karst susceptibility, sinkholes common to abundant.
- DEVELOPING LOWER SILURIAN GROUP**, **Prairieville**, **Greenwood Formation** (Upper Ordovician, Turlington-lower Chertown). **Greenwood** lithologies dominated by shale to sandstone map area, dominated by limestone with interbedded shale to southeast (includes **Castalia**, **Spiegel**, **Ferry**, **Centerville**, **Iron Ore**, **Shale**, **Green**, **Galena**, **Carleton**, **Salisbury** brachiopod shell coquina; limestone, part nodular to wavy bedded, fossiliferous; lower **Danish** strata (includes **Ferry**). Dominated by shale throughout map area. **Prairieville** lithologies dominated by dolomite in basal part, part sandy. **Prairieville** Member upper part dominated by dense limestone, fossiliferous, part wavy bedded with shaly interbeds (McGregor Mbr). **Greenwood** Shale dominated by shale, green-gray, argillaceous, part sandy to silty, part phosphatic, minor siltstone, sandstone. Total interval ranges 75-97 ft (23-29 m) (thickest to north), **Prairieville** ranges 62-87 ft (19-26 m) (thickest to north), **Greenwood** ranges 24-31 ft (7-10 m) (thickest to south) (elementary ranges 3-10 ft (0.9-3 m) thick). Interval forms an interbedded succession of shale and limestone, generally poorly exposed slope-former, commonly slumped. Carbonate beds are lead-ledge formations. Low to moderate karst susceptibility, generally an aquifer interval above Cambrian-Ordovician aquifer (Jordan-Prairie in Chertown); spring spots common above shale units, **Taylor-Prairieville** limestone strata locally with solution and mechanical karst.
- St. Peter Sandstone** (Middle Ordovician, Chertown). Dominated by sandstone, quartzite, fine to medium grained, fine coarse grained, slightly argillaceous in upper part, sandstone poorly consolidated and shaly, but not commonly bed cemented basal beds locally with most shale, sandstone, and conglomerate (bed, dolomite chert). Thickness varies 20-25 ft (6-8 m), especially overlying deeply eroded surface on **Prairie du Chien** Group; thickest St. Peter sand locally in south-eastern map area (**Paul** State Park to 225 ft (69 m)), average 35-60 ft (11-18 m) thick across most of map area (locally 70-100 ft (21-30 m)), average 50-80 ft (15-24 m) in **Hanover** and **Waukon** Quads (locally 80-117 ft (24-36 m)). Lower St. Peter generally a slope-former; upper St. Peter commonly a ridge-former. Low karst susceptibility; very permeable.
 - Prairie du Chien Group**, **Onawa** and **Shalopopek Formation** (Lower Ordovician, Turlington-lower Chertown). Dominated by dolomite, part cherty; secondary quartzite sandstone and sandy dolomite. Dolomite beds mostly sandstone, scattered to common wavy and wavy, part laminated to unstratified, part intercalated, locally brecciated units; sandstone units mostly very fine to medium grained, rare coarse grained, calcareous, chert nodules in some units, scattered shaly beds, quartzite nodules and masses. **Onawa** Fin subdivided into lower **Onawa** (includes **Wauvee** Mbr) and upper **Onawa** (includes **Hubert** Mbr) (see also **Onawa** and **Chertown** Members). **Shalopopek** Fin subdivided into lower **New Richmond** Mbr (sandstone, sandy dolomite, minor chert) and upper **Wauvee** Mbr (dolomite, part sandy to cherty, minor gray shaly). Total **Prairie du Chien** thickness in map area generally varies 200-315 ft (61-96 m) (thickest to north), locally thicker (to 320 ft (98 m) thick) where capped by thick St. Peter section. **Shalopopek** Fin generally 60-100 ft (18-30 m) thick (locally absent where St. Peter is thick); **Onawa** Fin generally 150-225 ft (46-69 m) thick (locally less where **Hubert** Mbr). Generally a ledge- to cliff-forming interval, upper **Shalopopek** commonly a slope-former. Moderate to high karst susceptibility, but sinkholes only locally common.
- CAMBRIAN**
- Jordan Sandstone**, **St. Lawrence** and **Low Rock Formations** (Upper Cambrian, upper **Sageons-Sursum**, upper **Franconia-Torpeuskann**). **Jordan** Sandstone is the only exposed Cambrian rock unit in the map area. **St. Lawrence** and **Low Rock** are sandstone units only, beneath alluvium of the **Mississippi Valley** and its tributaries. **Jordan** Sandstone dominated by sandstone, part cross-bedded, very fine to medium grained, upper strata part medium to very coarse grained; minor sands, dolomite and dolomite concretion, minor intra-layers. **St. Lawrence** Fin dominated by dolomite, part silty, and dolomite siltstone, part argillaceous, part fossiliferous, minor very fine sandstone, silty shale, glauconitic, stratoclastic units. **Low Rock** Fin dominated by sandstone, very fine to fine grained, diatomaceous to very glauconitic, common greenish, slightly micaceous, scattered fine fossiliferous, basal beds dolomite, minor dolomite. Total thickness 200-310 ft (61-96 m). **Jordan** Sandstone to 100 ft (30 m) thick; **St. Lawrence** Fin 60-100 ft (18-30 m) thick; **Low Rock** Fin 100-140 ft (30-43 m). Low karst susceptibility, **Jordan** very permeable. **St. Lawrence** and **Low Rock** forms outcrop interval above **Wauvee** aquifer.
 - Wauvee and East Galena Formations** (Upper Cambrian, upper **Majamas-Sageons**; **Deshalb-lower Franconia**). Interval represented only by subcrop south **Mississippi River** alluvium. **Wauvee** Fin dominated by sandstone, fine to coarse grained, upper part fossiliferous (includes **Mbr**). **East Galena** Fin dominated by sandstone, very fine to fine grained, part argillaceous, and shale, silty, gray to green-gray, part glauconitic, secondary siltstone, argillaceous siltstone, minor dolomite, minor dolomite; part fossiliferous, forms outcrop interval above **M** **Sanna** aquifer. Total thickness 243-300 ft (74-91 m). **Wauvee** Fin (25-155 ft (7.5-47 m)). **East Galena** Fin (120-145 ft (37-44 m)).



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Universal Transverse Mercator Projection, UTM Zone 15, North American Datum 1927