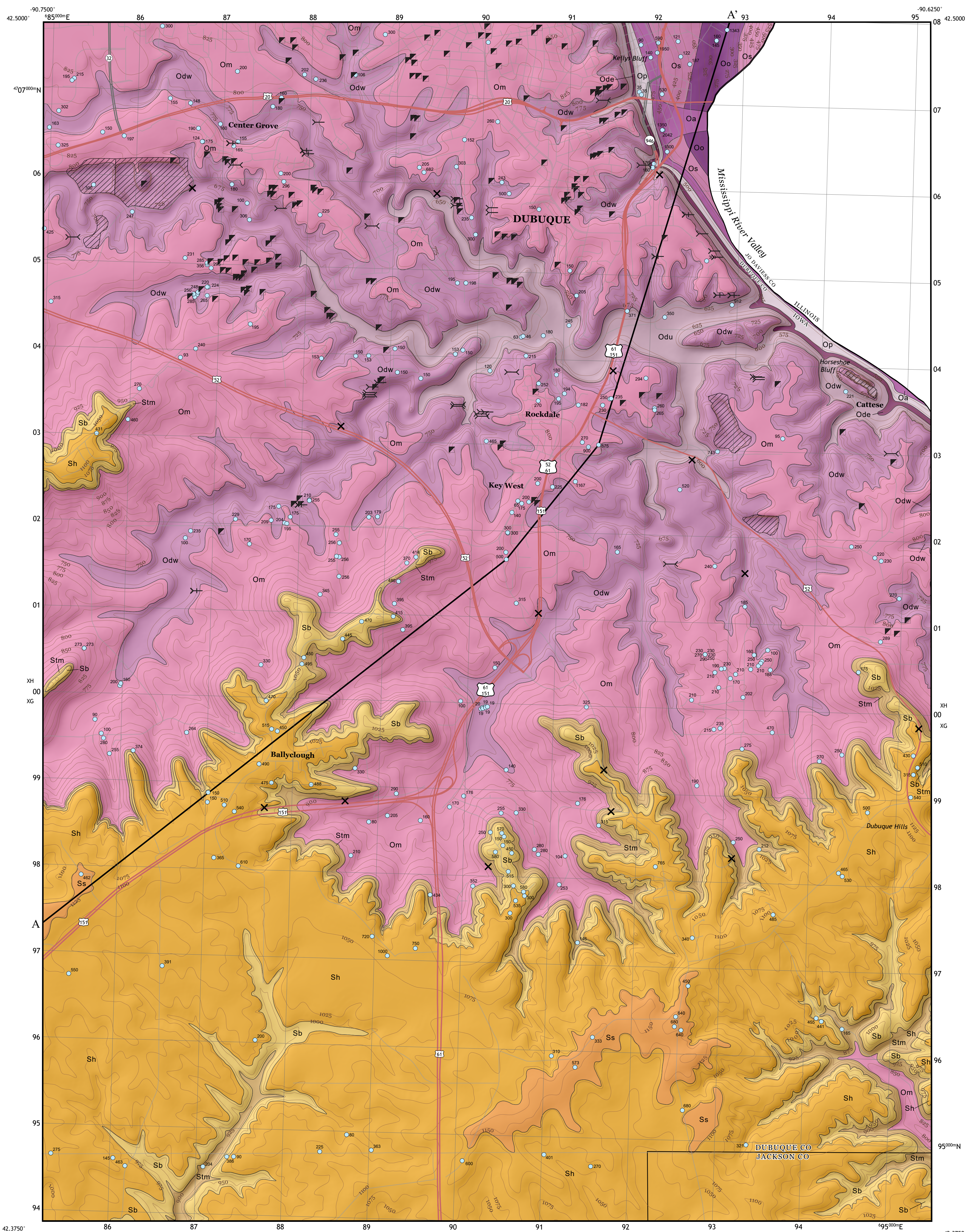# Bedrock Geologic Map of the Dubuque South 7.5' Quadrangle, Dubuque and Jackson Counties, Iowa, and Jo Daviess County, Illinois

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Introduction

The Dubuque South 7.5' Quadrangle is situated at the intersection of three landform regions, the East-Central Drift Plain, Paleozoic Plateau, and Mississippi Alluvial Plain. The southern third of the mapping area is marked by the Silurian Escarpment, a prominent ridge of resistant Silurian-age dolostones that mark the boundary between the East-Central Drift Plain and the Paleozoic Plateau. Both of these landform regions are characterized by thin (<30 feet) glacial deposits of loess and/or till draped over Silurian- and Ordovician-age bedrock units. The Mississippi Alluvial Plain occupies the northeastern corner of the quadrangle and is bounded by steep bluffs of Ordovician-age carbonates of the Galena Group. The Mississippi River incised more than 300 feet in Middle and Lower Ordovician rocks that are overlain by alluvial sediments.

The bedrock surface of the Dubuque South Quadrangle is dominated by strata of the Ordovician System with carbonates of the Silurian System occupying the southern third of the mapping area. The Silurian succession consists primarily of fossil moldic dolostone with variable chert. The Ordovician strata in the mapping area begin with shales of the Maquoketa Formation followed by carbonates of the Galena Group. The Galena Group consists of four formations, in descending order: Dubuque, Wise Lake, Dunleith, and Decorah. The Dubuque, Wise Lake, and Dunleith formations are primarily dolostone with chert occurring in the Dunleith. The Decorah represents a distinctive package of fossiliferous limestone and shale, with the shale marking the base of the unit, thus making it an easily identifiable contact between the Galena Group and the underlying Platteville Formation. The Platteville Formation consists of an upper fossiliferous and nodular limestone unit followed by an unfossiliferous dolostone that is commonly sandy and phosphatic. Below the Platteville is the Glenwood Formation, a thin (<10 feet) shale overlying the St. Peter Formation. The St. Peter Formation, a distinctive pure quartz sandstone, is typically less than 50 feet thick but is observed to fill apparent paleovalley or paleokarst features where it abruptly expands to over 300 feet thick. The base of the Ordovician succession in the mapping area is the Prairie du Chien Group consisting of the Shakopee and Oneota formations. The Shakopee Formation consists of a crystalline, sandy dolostone, minor sandstone, and traces of chert. The underlying Oneota Formation is also a crystalline dolostone with more chert and less sand than the Shakopee.
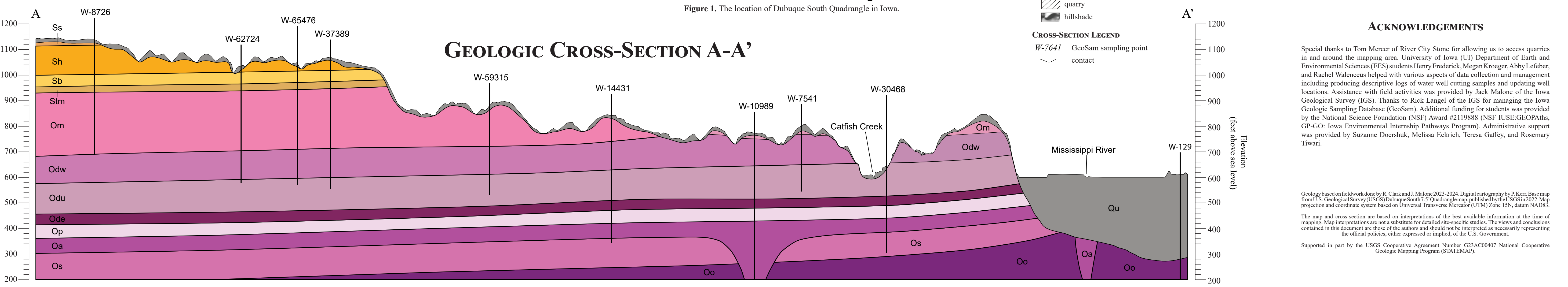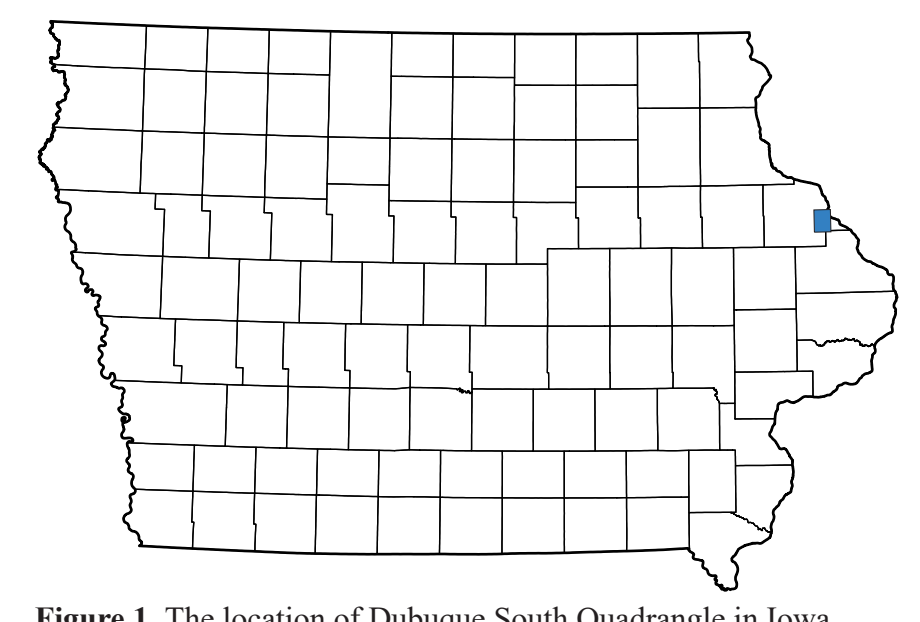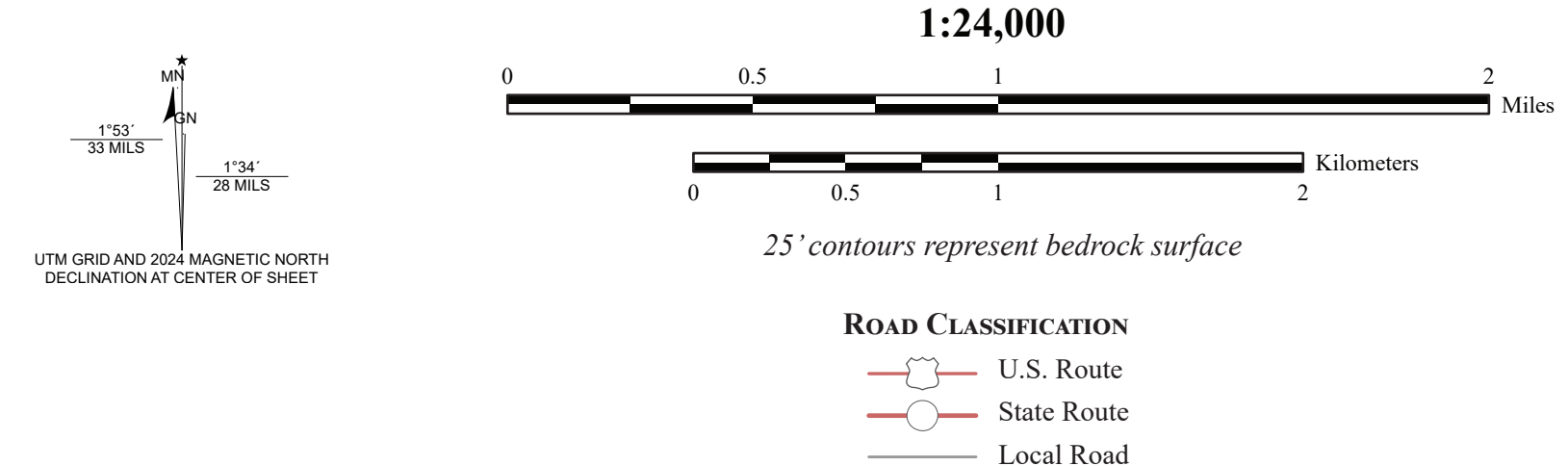
Numerous bedrock exposures exist in the mapping area, primarily exposing dolostones of the Silurian System along the escarpment as well as Galena Group carbonates along road cuts, stream valleys, and the Mississippi River Valley. Four active and two abandoned rock quarries occur in the quadrangle. Geologic reconnaissance as well as 15 bedrock outcrops, three active quarries, and two abandoned quarries within the mapping area was conducted during field activities. Additional subsurface information was derived from the analysis of more than 350 borehole records, over 150 of which have lithologic strip logs. An additional 30 strip logs were created for this mapping project. For a more detailed account of data resources, mapping methods, and stratigraphy, please refer to the Summary Map Report of the Dubuque South 7.5' Quadrangle.

Stratigraphic Column and Legend

System	Global Series	Global Stage	Regional Series	Regional Stage	Group	Formation	Map Symbol	Lithology	Thickness (in feet)	Lithostratigraphic Unit Description
						Quaternary undifferentiated	Qu		0–30	**Qu – Undifferentiated Unconsolidated Sediments** - Consists of loamy soils developed in loess, glacial till, and colluvium of variable thickness, and alluvial clay, silt, sand, and gravel. The total thickness of the Quaternary deposits typically varies between 0 and 10 m (0 - 30 ft) but can be up to 100 m (330 ft) thick in the northeastern part of the mapping area. This unit is shown only on the cross-section, not on the map.
SILURIAN		WEN-LOCK	SHEIN-WOODIAN			Scotch Grove	Ss		<40	**Ss – Dolostone** - The Scotch Grove Formation is found as discontinuous patches reaching a maximum thickness of 12 m (40 ft) in the southern portion of the mapping area. This unit consists of relatively pure dolostone with scattered to abundant fossil molds and rare chert. Crinoids are the dominant fossil of this unit with lesser brachiopods, bryozoa, and corals.
	LLANDOVERY	AERONIAN	TELY-CHIAN			Hopkinton	Sh		50–130	**Sh – Dolostone and Chert** - The Hopkinton Formation dominates the bedrock surface of the southern third of the mapping area, reaching a maximum thickness of 40 m (130 ft). This unit consists of fine to medium crystalline dolostone, skeletal moldic in part, and scattered to abundant chert primarily in the lower half of the unit. Fossil moldic fabrics are dominated by crinoids and brachiopods (pentamerids most notably) creating highly porous zones that appear hackly in weathered exposures. Solitary and colonial corals, stromatoporoids, bryozoa, and trilobites also occur in this unit.
						Blanding	Sb		30–60	**Sb – Dolostone and Chert** - The Blanding Formation is a cherty dolostone unit ranging from 9 to 18 m (30 - 60 ft) thick in the mapping area. Dolostone lithologies appear similar to the Hopkinton however abundant chert nodules, bands, and distinct beds typify this unit. The chert is typically white but may also be shades of gray and tan, it occurs as both tripolitic (chalky) and smooth varieties.
			RHUD-DANIAN			Tete des Morts				**Stm – Dolostone** - The Tete des Morts and Mosalem formations mark the base of the Silurian and vary dramatically in thickness from 10 to 33 m (30 - 110 ft) within the mapping area. The Mosalem Formation is a wavy-bedded, argillaceous dolostone with chert nodules and shale partings. This unit exhibits wide thickness variations over short distances which is interpreted as the result of filling in paleovalleys on the eroded Maquoketa Formation surface. The Tete des Morts Formation is an argillaceous, massively bedded dolostone. The Tete des Morts and Mosalem generally thin towards the west within the mapping area. These units were mapped as a single unit due to the thickness variations and difficulty of differentiation in subsurface well logs.
						Mosalem	Stm		30–	
ORDOVICIAN			RICHMONDIAN			Maquoketa	Om		100–250	**Om – Shale, Dolostone, and Phosphorite** - The Maquoketa Formation reaches a maximum thickness of 78 m (255 ft) within the mapping area. The Maquoketa is expressed as gentle slopes between the Silurian Escarpment above and the cliff-forming carbonates of the Galena Group below. This unit consists of three distinct members (in ascending order): Elgin, Brainard, and Neda. The Elgin Member (known as the Scales Shale Member in Illinois) consists of argillaceous dolostone and interbedded brown-gray shale where it is thickest (70 ft) and grades to dominantly shaly south and east of the mapping area where it thins to less than 30 feet. The dolostone facies of the Elgin is locally fossiliferous with several nautiloid packstone beds. The lower half of the Elgin is typified by gray-brown organic and phosphatic shales, often with abundant graptolite films, and a basal granular phosphorite horizon. The basal Maquoketa phosphorite overlies an impressive sculpted hardground surface developed on the uppermost Galena Group (Dubuque Formation) and hosts an abundant diminutive fauna. The Brainard Member is a green-gray, occasionally blue, dolomitic clay shale with notable pyrite nodules. Thin argillaceous dolostone stringers appear locally throughout the member and some may be fossiliferous displaying excellent preservation. The Brainard represents a widespread aquitard separating the Silurian and Galena aquifers. The Neda Member is a thin (<5 ft) discontinuous shale, often containing abundant iron ooids giving the unit a notable dark red hue. The Neda is typically preserved only where the full thickness of the Maquoketa Formation avoided extensive pre-Silurian erosion. This unit was not observed in exposure or subsurface logs within the mapping area.
	UPPER		KATIAN	CINCINNATIAN	Galena Group	Dubuque	Odw		100–122	**Odw – Dolostone** - The Dubuque and Wise Lake formations represent the upper two formations of the Galena Group and range in thickness from 30 to 38 m (100 - 125 ft) collectively. The Wise Lake Formation is a massive, vuggy dolostone that can be over 30 m (100 ft) thick and displays a distinctive popcorn texture on weathered exposure surfaces. This unit commonly exhibits solutionally-widened fractures that host galena and sphalerite amid dark red clay, presumably residuum from dissolution of the host dolostone, representing the quintessential "Mississippi Valley Type" (MVT) zinc-lead mineralization that led to the development of the tri-state mining district. Fossils in the Wise Lake are sparse, however a distinctive receptaculitid algae (aka sunflower coral) occurs near the middle of the unit. The uppermost formation of the Galena Group is the Dubuque Formation which is a thin- to medium-bedded dolostone to dolomitic limestone with thin interbedded shales. The dolomitic limestone facies hosts scattered to abundant crinoids. The Dubuque Formation hosts a distinctive hardground surface at the top where it is overlain by the Elgin Member of the Maquoketa Formation. This hardground is often karstic with irregularly-shaped vugs that are commonly filled with calcite and lesser pyrite, sphalerite, marcasite, and galena. This unit is typically less than 12 m (40 ft) thick. The Dubuque and Wise Lake formations were mapped as a single unit due to the gradational nature of their contact and similar lithologies.
				EDENIAN		Wise Lake				
			SANDBIAN	CHATFIELDIAN		Dunleith	Odu		<135	**Odu – Dolostone and Chert** - The Dunleith Formation achieves a maximum thickness of 41 m (135 ft) within the mapping area. The Dunleith is primarily a massive dolostone, similar to the Wise Lake, although it includes notable white-gray chert nodules and bands throughout the unit and is much less vuggy. Receptaculitid algae fossils are also common in portions of this unit. The Dunleith transitions to dolomitic limestone near the base and the contact between the Dunleith and Decorah is gradational and conformable.
			MOHAWKIAN			Decorah	Ode		<40	**Ode – Limestone and Shale** - The Decorah Formation averages 10 m (35 ft) in thickness within the mapping area. The Decorah Formation stands out from the rest of the Galena Group formations with its shaly lithology and abundance of fossils, primarily brachiopods and crinoids. This mapping unit consists of three members (in ascending order): Spechts Ferry, Guttenberg, and Ion. The Spechts Ferry Member is a distinctive green-gray clay shale less than 10 feet thick and contains lenses of brachiopod shell hash where the fossils appear black due to phosphatic replacement. The Guttenberg Member is a dense, wavy-bedded limestone, partly sub-lithographic, interbedded with dark brown organic shales. This unit can be quite fossiliferous and ranges from 10 to 15 feet thick. The Ion Member is an argillaceous and fossiliferous dolomitic limestone usually not more than 10 feet thick.
			TURINIAN			Platteville	Op		40–60	**Op – Limestone and Dolostone** - The Platteville Formation is a carbonate unit ranging from 12 to 18 m (40 - 60 ft) in thickness. This unit consists of two members in the mapping area, the McGregor and underlying Pecatonica. The McGregor Member is a wavy-bedded, fossiliferous limestone unit. Exceptionally preserved and abundant brachiopods occur in this member along with crinoids, trilobites, bryozoa, snails, and ostracodes. The Pecatonica Member is a slightly argillaceous, sandy, dolostone with small but abundant fossil molds and notable phosphatic grains and pellets, especially in the lower part.
	MIDDLE	DARRI-WILLIAN	WHITE-ROCKIAN	CHAZYAN	Ancell Group	Glenwood	Oa			**Oa – Sandstone and Shale** - The Ancell Group consists of the St. Peter and Glenwood formations, mapped as one unit due to the fact that the Glenwood is typically less than 1.5 m (5 ft) thick. The St. Peter Formation is a fine to medium grained, friable, well sorted, well rounded (often with frosted grains), pure quartz sandstone, typically about 15 m (50 ft) thick. The sandstone typically appears clear or white but due to iron oxide staining can display brilliant shades of red. The thickness of the St. Peter can vary wildly over short distances (see cross-section) expanding to more than 92 m (300 ft) thick within the mapping area. This variation is likely due to infilling of paleochannel and/or paleokarst features occurring on the highly weathered surface of the underlying Prairie du Chien Group, a characteristic observed throughout northeastern Iowa. The Glenwood Formation is a green-gray, non-calcareous shale that is locally discontinuous.
						St. Peter				
	LOWER	TREMADOCIAN	IBEXIAN	STAIRSIAN	Prairie du Chien Group	Shakopee	Os		<150	**Os – Dolostone and Sandstone** - The Shakopee Formation is the uppermost formation of the Prairie du Chien (PdC) Group and achieves a maximum thickness of 45 m (150 ft) within the mapping area. This unit consists of pure crystalline, sandy dolostone with occasional sandstone lenses, minor shale, and traces of chert. Oolitic fabrics are notable in both the dolostone and chert facies. Fossil molds are common assisting with the overall porous nature of the unit. The entire PdC Group coupled with the overlying St. Peter Formation and underlying Cambrian-age Jordan Formation collectively represent the "Cambrian-Ordovician" Aquifer (aka Jordan Aquifer) that serves as a vast underground supply of good to excellent drinking water.
			SKULLROCKIAN			Oneota	Oo		30–120	**Oo – Dolostone and Chert** - The Oneota Formation is a pure crystalline dolostone with abundant chert in the upper two-thirds and minor sand in the lower one-third. This unit is approximately 30 m (100 ft) thick in the mapping area. Oolitic fabrics are notable in both the dolostone and chert facies. Chert appears as white and gray nodules in both tripolitic and smooth varieties.

Map Symbols

- ⊙_{400} water well with total depth
- × outcrop
- ⊼ mine shaft
- adit
- ⊣ closed adit
- ⊢ trench
- unit contact
- cross-section
- quarry
- hillshade

Lithologies

- dolostone
- limestone
- sandstone
- sandy dolostone
- shale
- unlithified sediments

Lithology & Fossil Symbols

- argillaceous zone
- calcite-filled vugs
- chert
- phosphatic
- unconformity

Adjoining Quadrangles

1	2	3
4	5	5
6	7	8

1. Sherrill, IA
2. Dubuque North, IA, WI, IL
3. Kieler, WI
4. Peosta, IA
5. Menominee, IA, IL
6. Bernard, IA
7. Zwingle, IA
8. La Motte, IA

1:24,000

UTM GRID AND 2024 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

25' contours represent bedrock surface

Road Classification

- U.S. Route
- State Route
- Local Road

Figure 1. The location of Dubuque South Quadrangle in Iowa.

Cross-Section Legend

- W-7641 GeoSam sampling point
- contact

Geologic Cross-Section A-A'

10x vertical exaggeration