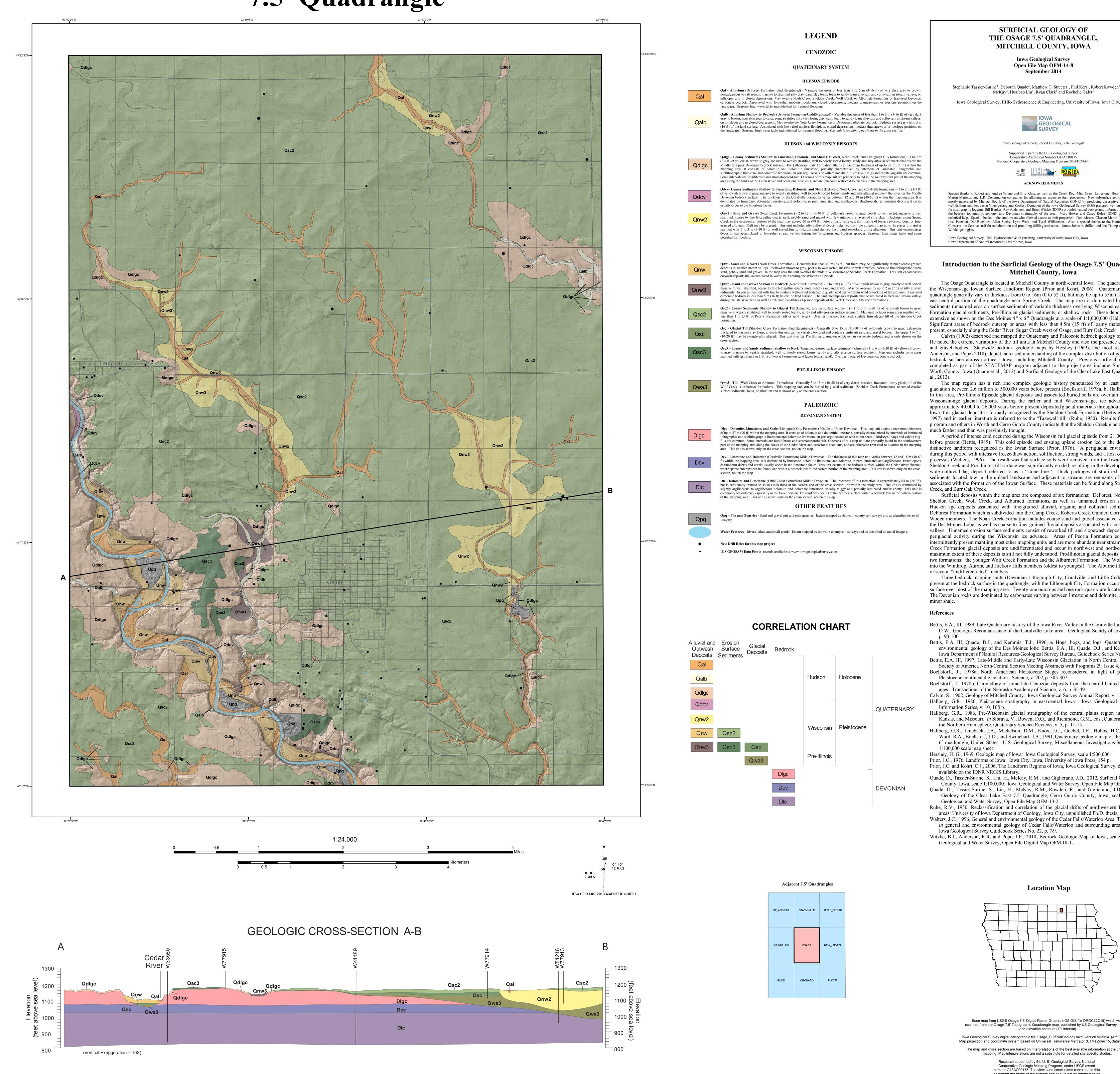
# Surficial Geology of the Osage (Iowa) 7.5' Quadrangle



## SURFICIAL GEOLOGY OF THE OSAGE 7.5' OUADRANGLE, MITCHELL COUNTY, IOWA

Iowa Geological Survey **Open File Map OFM-14-8** September 2014

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much farther east than was previously thought.

### Introduction to the Surficial Geology of the Osage 7.5' Quadrangle, Mitchell County, Iowa

The Osage Quadrangle is located in Mitchell County in north-central Iowa. The quadrangle is located on massive to well stratified, coarse to fine feldspathic quartz sand, pebbly sand and gravel. May be overlain by up to 2 m (7 ft) of silty alluvial the Wisconsin-age Iowan Surface Landform Region (Prior and Kohrt, 2006). Quaternary deposits in this carbonate bedrock is less than 5 m (16 ft) below the land surface. The unit encompasses deposits that accumulated in river and stream valleys quadrangle generally vary in thickness from 0 to 16m (0 to 52 ft), but may be up to 55m (180 ft) thick on the east-central portion of the quadrangle near Spring Creek. The map area is dominated by unnamed loamy sediments (unnamed erosion surface sediment) of variable thickness overlying Wisconsin-age Sheldon Creek Formation glacial sediments, Pre-Illinoian glacial sediments, or shallow rock. These deposits are regionally extensive as shown on the Des Moines 4° x 6° Quadrangle at a scale of 1:1,000,000 (Hallberg et al., 1991). Significant areas of bedrock outcrop or areas with less than 4.5m (15 ft) of loamy material over rock are Calvin (1902) described and mapped the Quaternary and Paleozoic bedrock geology of Mitchell County. He noted the extreme variability of the till units in Mitchell County and also the presence of significant sand Qsc3 - Loamy and Sandy Sediment Shallow to Rock (Unnamed erosion surface sediment) - Generally 1 to 6 m (3-20 ft) of yellowish brown and gravel bodies. Statewide bedrock geologic maps by Hershey (1969), and most recently by Witzke, o gray, massive to weakly stratified, well to poorly sorted loamy, sandy and silty erosion surface sediment. Map unit includes some areas

Anderson, and Pope (2010), depict increased understanding of the complex distribution of geologic units at the bedrock surface across northeast Iowa, including Mitchell County. Previous surficial geologic mapping completed as part of the STATEMAP program adjacent to the project area includes Surficial Geology of Worth County, Iowa (Quade et al., 2012) and Surficial Geology of the Clear Lake East Quadrangle (Quade et

The map region has a rich and complex geologic history punctuated by at least seven periods of glaciation between 2.6 million to 500,000 years before present (Boellstorff, 1978a, b; Hallberg, 1980, 1986). In this area, Pre-Illinois Episode glacial deposits and associated buried soils are overlain by much younger Wisconsin-age glacial deposits. During the earlier and mid Wisconsin-age, ice advances dating from approximately 40,000 to 26,000 years before present deposited glacial materials throughout the map area. In Iowa, this glacial deposit is formally recognized as the Sheldon Creek Formation (Bettis et al., 1996, Bettis, 1997) and in earlier literature is referred to as the "Tazewell till" (Ruhe, 1950). Results from this mapping program and others in Worth and Cerro Gordo County indicate that the Sheldon Creek glacial materials extend

A period of intense cold occurred during the Wisconsin full glacial episode from 21,000 to 16,500 years before present (Bettis, 1989). This cold episode and ensuing upland erosion led to the development of the distinctive landform recognized as the Iowan Surface (Prior, 1976). A periglacial environment prevailed during this period with intensive freeze-thaw action, solifluction, strong winds, and a host of other periglacial ft) within the mapping area. It is dominated by limestone, and dolomite, in part, laminated and argillaceous. Brachiopods, processes (Walters, 1996). The result was that surface soils were removed from the bwan Surface, and the chimoderm debris and corals usually occur in the limestone facies. This unit occurs at the bedrock surface within the Cedar River channel,

Sheldon Creek and Pre-Illinois till surface was significantly eroded, resulting in the development of a regionwide colluvial lag deposit referred to as a "stone line." Thick packages of stratified loamy and sandy sediments located low in the upland landscape and adjacent to streams are remnants of solifluction lobes associated with the formation of the Iowan Surface. These materials can be found along Sugar Creek, Spring

> Surficial deposits within the map area are composed of six formations: DeForest, Noah Creek, Peoria, Sheldon Creek, Wolf Creek, and Alburnett formations, as well as unnamed erosion surface sediments. Hudson age deposits associated with fine-grained alluvial, organic, and colluvial sediments include the DeForest Formation which is subdivided into the Camp Creek, Roberts Creek, Gunder, Corrington, Flack, and Woden members. The Noah Creek Formation includes coarse sand and gravel associated with outwash from the Des Moines Lobe, as well as coarse to finer grained fluvial deposits associated with local stream and river valleys. Unnamed erosion surface sediments consist of reworked till and slopewash deposits associated with periglacial activity during the Wisconsin ice advance. Areas of Peoria Formation eolian materials are intermittently present mantling most other mapping units, and are more abundant near stream valleys. Sheldon Creek Formation glacial deposits are undifferentiated and occur in northwest and north-central Iowa. The maximum extent of these deposits is still not fully understood. Pre-Illinoian glacial deposits in Iowa consist of two formations: the younger Wolf Creek Formation and the Alburnett Formation. The Wolf Creek is divided into the Winthrop, Aurora, and Hickory Hills members (oldest to youngest). The Alburnett Formation consists of several "undifferentiated" members.

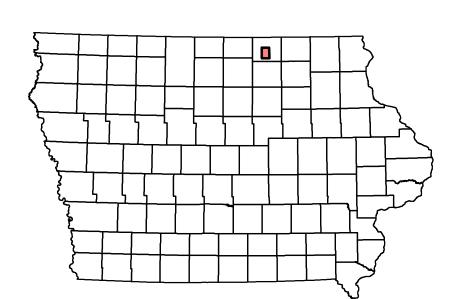
> Three bedrock mapping units (Devonian Lithograph City, Coralville, and Little Cedar formations) are present at the bedrock surface in the quadrangle, with the Lithograph City Formation occurring at the bedrock surface over most of the mapping area. Twenty-one outcrops and one rock quarry are located in the map area. The Devonian rocks are dominated by carbonates varying between limestone and dolomite, accompanied with minor shale.

- Bettis, E.A., III, 1989, Late Quaternary history of the Iowa River Valley in the Coralville Lake area in Plocher, O.W., Geologic Reconnaissance of the Coralville Lake area: Geological Society of Iowa Guidebook 51,
- Bettis, E.A. III, Quade, D.J., and Kemmis, T.J., 1996, in Hogs, bogs, and logs: Quaternary deposits and environmental geology of the Des Moines lobe: Bettis, E.A., III, Quade, D.J., and Kemmis, T.J. (eds.): Iowa Department of Natural Resources-Geological Survey Bureau, Guidebook Series No. 18, 170 p. Bettis, E.A. III, 1997, Late-Middle and Early-Late Wisconsin Glaciation in North Central Iowa: Geological
- Boellstorff, J., 1978a, North American Pleistocene Stages reconsidered in light of probable Pliocene Pleistocene continental glaciation: Science, v. 202, p. 305-307. Boellstorff, J., 1978b, Chronology of some late Cenozoic deposits from the central United States and the ice ages: Transactions of the Nebraska Academy of Science, v. 6, p. 35-49. Calvin, S., 1902, Geology of Mitchell County: Iowa Geological Survey Annual Report, v. 13, p. 293-352. Hallberg, G.R., 1980, Pleistocene stratigraphy in east-central Iowa: Iowa Geological Survey Technical

Society of America North-Central Section Meeting Abstracts with Programs 29, Issue 4, p. 5.

- Information Series, v. 10, 168 p. Hallberg, G.R., 1986, Pre-Wisconsin glacial stratigraphy of the central plains region in Iowa, Nebraska, Kansas, and Missouri: in Sibrava, V., Bowen, D.Q., and Richmond, G.M., eds., Quaternary Glaciations in the Northern Hemisphere, Quaternary Science Reviews, v. 5, p. 11-15. Hallberg, G.R., Lineback, J.A., Mickelson, D.M., Knox, J.C., Goebel, J.E., Hobbs, H.C., Whitfield, J.W.,
- Ward, R.A., Boellstorf, J.D., and Swinehart, J.B., 1991, Quaternary geologic map of the Des Moines 4° x 6° quadrangle, United States: U.S. Geological Survey, Miscellaneous Investigations Series, Map 11420, 1:100,000 scale map sheet. Hershey, H. G., 1969, Geologic map of Iowa: Iowa Geological Survey, scale 1:500,000. Prior, J.C., 1976, Landforms of Iowa: Iowa City, Iowa, University of Iowa Press, 154 p.
- Prior, J.C. and Kohrt, C.J., 2006, The Landform Regions of Iowa, Iowa Geological Survey, digital map, available on the IDNR NRGIS Library. Quade, D., Tassier-Surine, S., Liu, H., McKay, R.M., and Giglierano, J.D., 2012, Surficial Geology of Worth
- County, Iowa, scale 1:100,000: Iowa Geological and Water Survey, Open File Map OFM-12-2. Quade, D., Tassier-Surine, S., Liu, H., McKay, R.M., Rowden, R., and Giglierano, J.D., 2013, Surficial Geology of the Clear Lake East 7.5' Quadrangle, Cerro Gordo County, Iowa, scale 1:24,000: Iowa Geological and Water Survey, Open File Map OFM-13-2. Ruhe, R.V., 1950, Reclassification and correlation of the glacial drifts of northwestern Iowa and adjacent
- areas: University of Iowa Department of Geology, Iowa City, unpublished Ph.D. thesis, 124 p. Walters, J.C., 1996, General and environmental geology of the Cedar Falls/Waterloo Area, The Iowan Surface, in general and environmental geology of Cedar Falls/Waterloo and surrounding area, Northeast Iowa
- Iowa Geological Survey Guidebook Series No. 22, p. 7-9. Witzke, B.J., Anderson, R.R. and Pope, J.P., 2010, Bedrock Geologic Map of Iowa, scale: 1:500,000, Iowa Geological and Water Survey, Open File Digital Map OFM-10-1.

# **Location Map**



Base map from USGS Osage 7.5' Digital Raster Graphic (IGS GIS file DRGC32C.tif) which was scanned from the Osage 7.5' Topographic Quadrangle map, published by US Geological Survey in 2013 Land elevation contours (10' interval). lowa Geological Survey digital cartographic file Osage\_SurficialGeology.mxd, version 9/15/14 (ArcGIS 10.1) The map and cross section are based on interpretations of the best available information at the time of mapping. Map interpretations are not a substitute for detailed site specific studies. Research supported by the U.S. Geological Survey, National Cooperative Geologic Mapping Program, under USGS award number G13AC00175. The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U. S. Government.