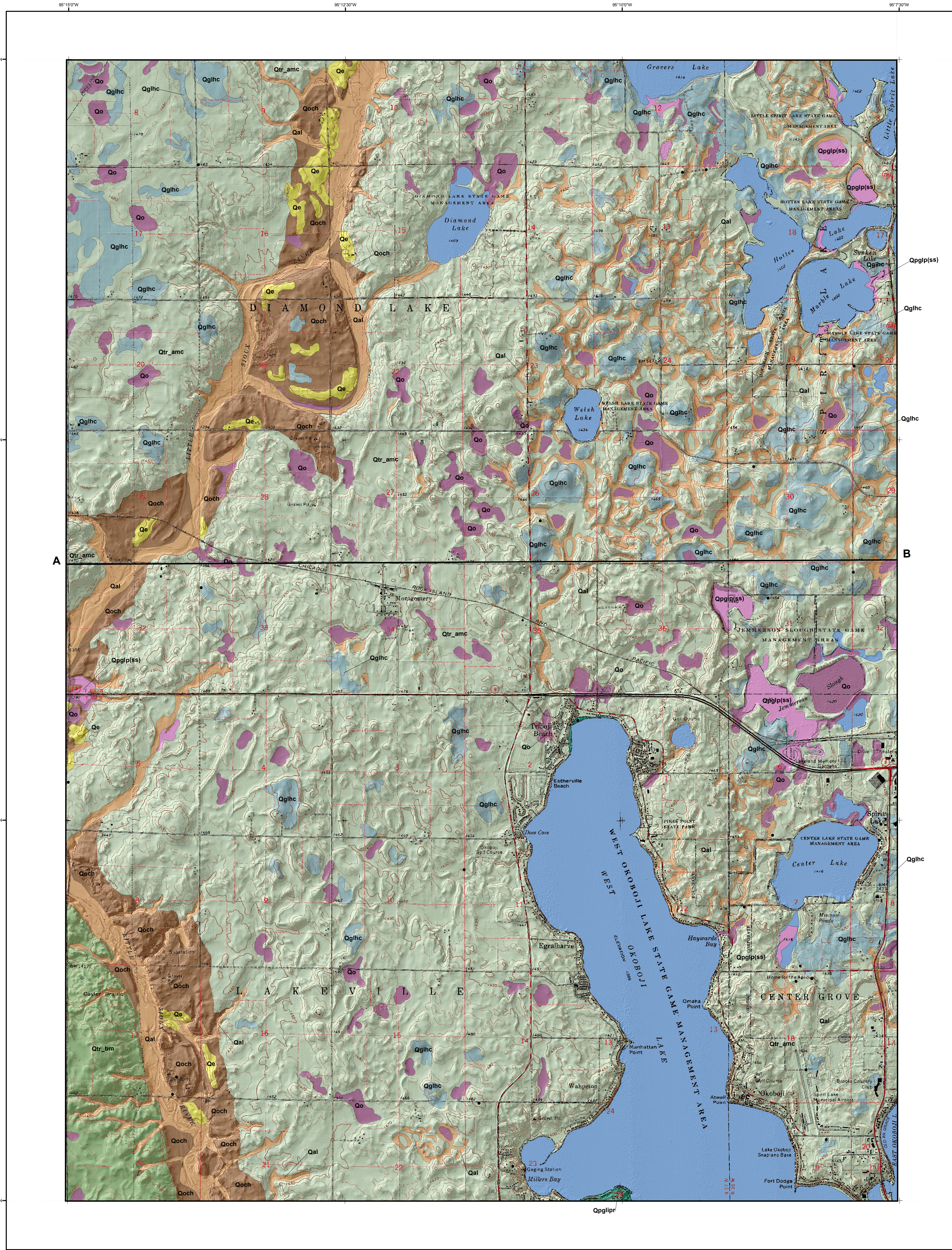


Surficial Geology of the Okoboji (Iowa)

7.5' Quadrangle




SURFICIAL GEOLOGIC MAP OF THE 7.5' OKOBOJI QUADRANGLE

Iowa Geological and Water Survey
Open File Map OFM-12-10
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prepared by
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LEGEND

CENOZOIC QUATERNARY SYSTEM

HUDSON EPISODE

- Qo** - Depression (Deforestation/Wooden Mbr) Generally 2.5 to 6 m (8-20 ft) of black to very dark gray, calcareous, loam, and silty clay loam colluvium and organic sediments in drained and undrained closed and semi-closed depressions. Overlies gray, calcareous, loam diamicton (Dows Fm./Morgan/Mbr) or Noah Creek Fm. sand. Associated with low relief features that occupy depressions and low sage on the landscape. Supports wetland vegetation and can be permanently covered by water. High water table.
- Qal** - Alluvium (Deforestation/Wooden Mbr) Variable thickness of less than 1 to 5 m (3-16 ft) of very dark gray to brown, noncalcareous to calcareous, massive to stratified silty clay loam, clay loam, loam to sandy loam, and silt loam. Usually overlies a gray, calcareous, massive, dense loam diamicton (Dows Fm./Morgan Mbr). Small postglacial lake beds usually associated with very low relief plain with reticulate-linked depression systems and occasionally on hummocky moderate relief terrain. High water table.
- Qppl(ss)** - Lake Sediment small-scale landform features (Dows Formation/Wooden Mbr) Generally less than 3 m (10 ft) of dark grayish brown, massive, calcareous, silty clay loam or silt loam overlying a thin (<1 m) ball increment of sand and gravel. Unit overlies yellowish to grayish brown, calcareous, stratified loam to silt loam to sandy loam diamicton (Dows Fm./Morgan Mbr) or it may overlie a gray, calcareous, massive, dense loam diamicton (Dows Fm./Morgan Mbr). Small postglacial lake beds usually associated with very low relief plain with reticulate-linked depression systems and occasionally on hummocky moderate relief terrain. High water table.
- Qe** - Sand Dunes and Sand Sheets (Pavia Formation-sand facies) Generally less than 3 m (10 ft) of yellowish brown, massive, calcareous, loamy sand to fine sand. It may overlie yellowish-brown, coarse-grained sand and gravel (Noah Creek Fm.), or it may overlie yellowish to grayish brown, usually calcareous, stratified loam to silt loam to sandy loam diamicton (Dows Fm./Morgan Mbr). Usually restricted to a narrow belt along major river valley bottoms or adjacent uplands on the Des Moines Lobe. Off the Des Moines Lobe this unit is not restricted to dunes along valley areas and may occur as sand stringers overlying unannealed erosion surface loamy sediments.
- Qpplpr** - Ice push ridge features (Deforestation/Wooden Mbr) Generally 3 to 5 m (10-16 ft) of dark gray, dark grayish brown, dark brown to dark yellowish brown, medium to coarse sand, gravelly sand to pebbly gravel, with possible inclusions of fine-grained organic-rich silt. Unit overlies gray, calcareous, stratified loam to sandy loam diamicton, textures can be quite variable (Dows Fm./Morgan Mbr) or it may overlie a gray, calcareous, massive, dense loam diamicton (Dows Fm./Morgan Mbr). Lake sediment associated with extant lakes of the Des Moines Lobe. High water table.

WISCONSIN EPISODE

- Qghlc** - Collapsed lake sediments-hummocks isolated ice-walled lake plain (flat-topped hummocks) (Dows Formation-Lake Mills Mbr./Morgan Mbr.) Generally less than 3 m (10 ft) of dark grayish brown, massive, calcareous, silty clay loam to silt loam, often overlying a thin ball increment of sand and gravel (<1 m). It overlies yellowish to grayish brown, usually calcareous, stratified loam to silt loam to sandy loam diamicton, textures can be quite variable (Dows Fm./Morgan Mbr.). Isolated ice-walled lake plains comprise a portion of this landform area. Other hummocks consist of less than 15 m (49 ft) of yellowish to grayish brown, usually calcareous, stratified loam to silt loam to sandy loam diamicton (Dows Fm./Morgan Mbr.). Overlies gray, calcareous, massive, dense loam diamicton (Dows Fm./Morgan Mbr.). Moderate to high-relief hummocky landform area with 3 to 10 m of local relief.
- Qoch** - Valley train overwash (Noah Creek Formation) Generally 3 m (10 ft) to less than 8 m (26 ft) of dark gray, dark grayish brown, dark brown to dark yellowish brown, medium to coarse sand, gravelly sand to pebbly gravel, with possible inclusions of fine-grained organic-rich silt. Unit overlies gray, calcareous, massive, dense loam diamicton (Dows Fm./Morgan Mbr.). In valley positions, it is buried by Deforestation Fm. alluvium. Low-relief landform expressed as broad terraces; long, narrow longitudinal terraces; or cusped-shaped point terraces. Terraces associated with the major valleys are bounded on a gray, calcareous, massive, dense loam diamicton (Dows Fm./Morgan Mbr.).
- Qtr_anc** - Tilt ridge (Dows Formation-Morgan, Pilot Knob, or Lake Mills Mbr.) Generally 9 to 15 m (27-49 ft) of yellowish to grayish brown, usually calcareous and fractured, stratified loam to silt loam, stratified sands and gravels to sandy loam diamicton, textures can be quite variable. Overlies gray, calcareous, massive, dense loam diamicton (Dows Fm./Morgan Mbr.). The Alden Mbr. in this mapping unit can extend to depths in excess of 25 m (82 ft). This sediment package overlies the Sheldon Creek Formation diamicton or Pre-Illinois age sand/fractured diamicton. Moderate to high-relief hummocky landform features exceed 3 to 10 m (10-33 ft) of local relief. This landform is associated with the Altamont Moraine Complex and is characterized by moderate to high relief hummocky, eroded land features, and ice-walled lakes. Seasonal high water table.
- Qtr_bm** - Tilt ridge (Dows Formation-Morgan Mbr.) Generally 3 to 15 m (10-49 ft) of yellowish to grayish brown, usually calcareous and fractured, stratified loam to silt loam, stratified sands and gravels to sandy loam diamicton, textures can be quite variable. Overlies gray, calcareous, massive, dense loam diamicton (Dows Fm./Morgan Mbr.). The Alden Mbr. in this mapping unit rarely extends to depths greater than 15 meters (49 ft) and overlies the Sheldon Creek Formation diamicton. At the DML margin, this landform may be marked with a thin layer of Pavia Formation silt. Low to moderate relief hummocky landform features exceed 3 to 5 m (10-16 ft) of local relief. This landform is associated with the Bemis Moraine. Seasonal high water table.

WISCONSIN AND PRE-ILLINOIS EPISODE

- Qu** - Glacial Till (Dows Formation and Sheldon Creek Formation-undif.) Generally 3 to 50 m (10-170 ft) of yellowish brown to gray, calcareous, fractured to massive, clay loam, at depth this unit can be variably textured and contain significant sand and gravel bodies. It is not important to see few Pierre Shale clasts in core samples. This unit overlies the much older Pre-Illinois age diamicton. Pre-Illinois sediments are generally not more than 9 to 50 m (27-170 ft) of very dense, massive, fractured, heavy glacial till of the Wolf Creek or Altamont Formations. These formations are undifferentiated and shown only in the cross-section.

Other Mapping Units

- Water Features** Rivers, lakes and small ponds formed by blockage of drainageways and river channels. Extent mapped as shown in county soil surveys and as identified on aerial imagery.
- Drill Holes** Indicated by small black circles.

Introduction to the Surficial Geology of the Okoboji 7.5' Quadrangle

The Okoboji Quadrangle is located in Dickinson County in northwestern Iowa. The mapping area encompasses the western margin of the Late Wisconsin-age Des Moines Lobe (DML) landform region, the most recently glaciated region of the state (Piper and Rober, 2006). The DML is the product of a Late Wisconsin lobate extension of the Laurentide ice sheet that flowed down a regional topographic low into Iowa approximately 15,000 years before present and reached its terminal position at Des Moines about 13,800 RYBP. The DML landform is bounded by six Wisconsin topographic highs on the east (Mississippi embayments) and west (Wisconsin glacial deposits comprising the Prairie Coteau). In the mapping area, the DML consists of a complex suite of depositional landform and sediment sequences related to vegetational, soil, and postglacial sedimentation. The DML is characterized by the hummocky terrain that forms ancient belts of moraine complexes and sanding plains with thick increments of supraglacial sediment (>3 m). In the map area, the Bemis Moraine (terminal end moraine) occupies a narrow swathe of the map area in the extreme southwest portion of the map (west of the Little Sioux River valley). The rest of the map is dominated by the younger Altamont Moraine Complex (AMC) which is mapped as a complex till fan north of the DML. The landscape is characterized by a complex sediment package and a host of geomorphic features ranging from kames, eskers, closed and semi-closed depressions, and ice-walled lakes on the moraine surface, and kame-type terraces on the eastern wall of the Little Sioux River Valley in the southern part of the map area. A dominant feature on the map is West Okoboji Lake. The lake-bottom sediments associated with this area and lake are categorized into post-glacial age deposits known as the West Okoboji Member of the Deforestation Formation (Betts et al., 1996). The West Okoboji Member represents the organic-rich silt deposits associated with lake sedimentation from kames, eskers, closed and semi-closed depressions, and ice-walled lakes on the moraine surface, and kame-type terraces on the eastern wall of the Little Sioux River Valley in the southern part of the map area. A dominant feature on the map is West Okoboji Lake. The lake-bottom sediments associated with this area and lake are categorized into post-glacial age deposits known as the West Okoboji Member of the Deforestation Formation (Betts et al., 1996). The West Okoboji Member represents the organic-rich silt deposits associated with lake sedimentation from kames, eskers, closed and semi-closed depressions, and ice-walled lakes on the moraine surface, and kame-type terraces on the eastern wall of the Little Sioux River Valley in the southern part of the map area. A dominant feature on the map is West Okoboji Lake. The lake-bottom sediments associated with this area and lake are categorized into post-glacial age deposits known as the West Okoboji Member of the Deforestation Formation (Betts et al., 1996).

LEGEND

CENOZOIC QUATERNARY SYSTEM

HUDSON EPISODE

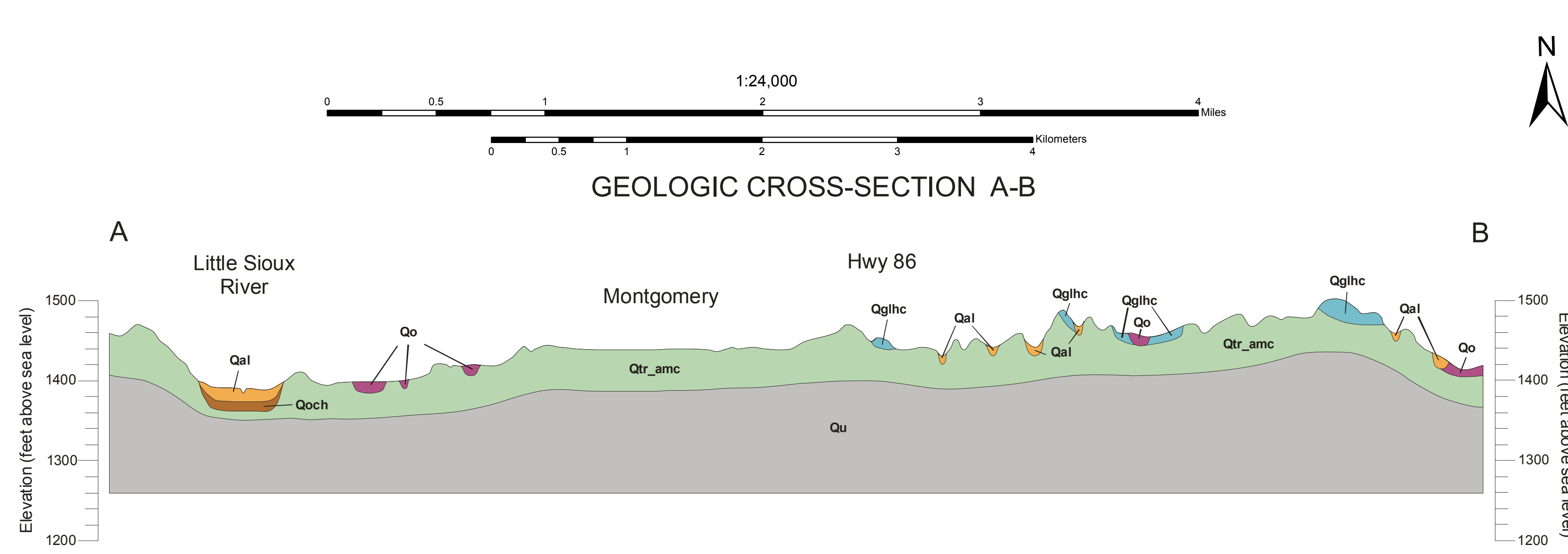
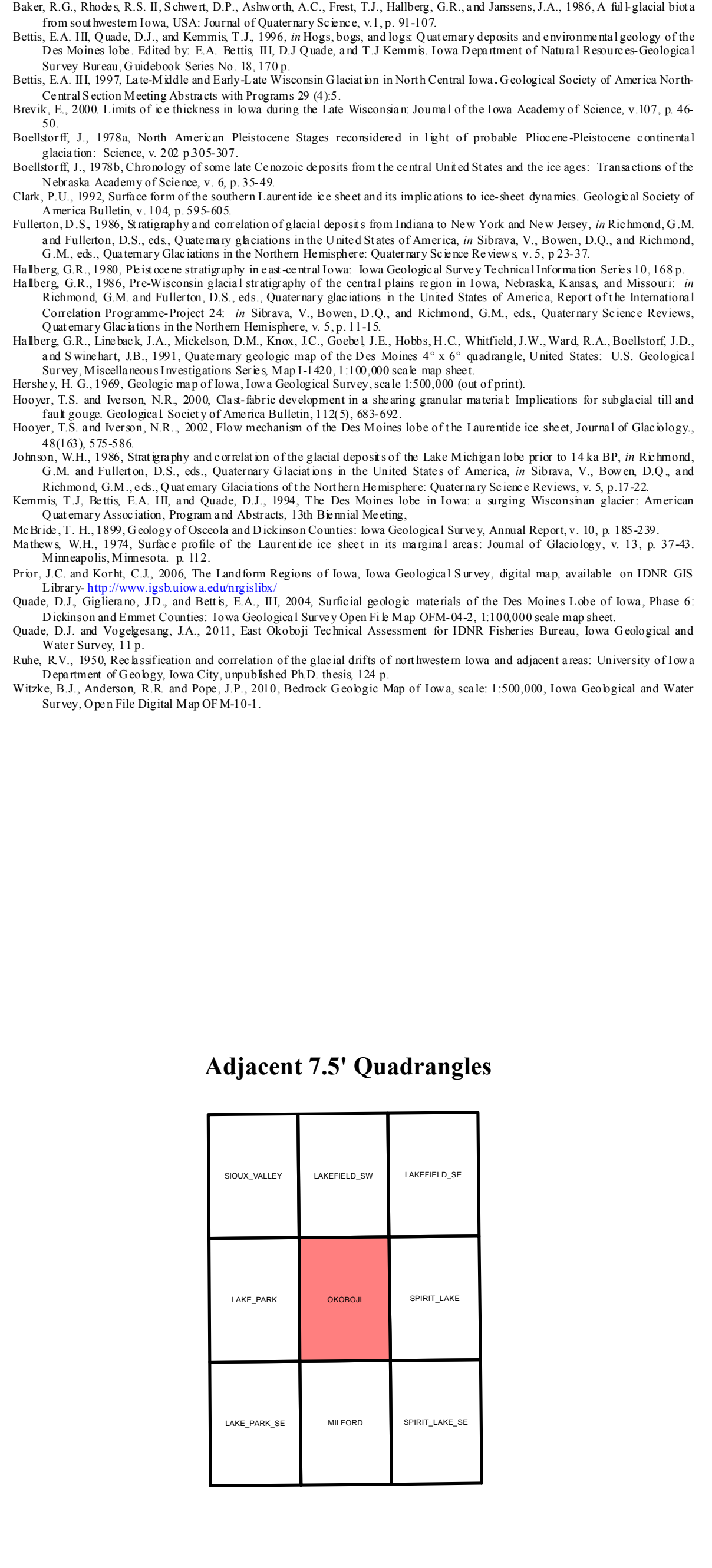
- Qo** - Depression
- Qal** - Alluvium
- Qppl(ss)** - Lake Sediment small-scale landform features
- Qe** - Sand Dunes and Sand Sheets
- Qpplpr** - Ice push ridge features

WISCONSIN EPISODE

- Qghlc** - Collapsed lake sediments-hummocks
- Qoch** - Valley train overwash
- Qtr_anc** - Tilt ridge
- Qtr_bm** - Tilt ridge

WISCONSIN AND PRE-ILLINOIS EPISODE

- Qu** - Glacial Till



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.

Base map from USGS Okoboji 7.5' Digital Raster Graphic (DSG GIS File DRGB13.tif) which was scanned from the Okoboji 7.5' Topographic Quadrangle map, published by the Geological Survey in 1970, photorevised 1980. Topographic contours and land features based on 1986 aerial photography, field checked in 1970. Land elevation contours (10 intervals) also derived from 2010 data.

Iowa Geological and Water Survey digital cartographic file: DSG_GIS/SurficialGeology.mxd, version: 10/26/12 (AGS 10.1)

Map projection and coordinate system based on Universal Transverse Mercator (UTM) Zone 15, datum NAD83.