## Bedrock Geologic Map of the Danville (Iowa) 7.5' Quadrangle **LEGEND** BEDROCK GEOLOGIC MAP OF **CENOZOIC** THE DANVILLE 7.5' QUADRANGLE, QUATERNARY SYSTEM DES MOINES, HENRY, AND LEE COUNTIES, IOWA 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 varies between 0 and 18 m (0-60 ft), but can Iowa Geological Survey be as much as 64 m (210 ft) thick in the northeastern part of the mapping area. This unit is shown only on the cross-section, not on the map. **Open File Map OFM-17-7 PALEOZOIC** CARBONIFEROUS SYSTEM Ryan Clark, Huaibao Liu, Stephanie Tassier-Surine, and Phil Kerr PENNSYLVANIAN SUBSYSTEM Iowa Geological Survey, IIHR-Hydroscience & Engineering, University of Iowa, Iowa City, Iowa Pcl - Sandstone and Shale (Lower Cherokee Group) Lower-Middle Pennsylvanian. Pennsylvanian units occur as erosional outliers reaching a thickness of up to 14 m (45 ft) within the mapping area. This unit consists of shale/mudstone, light to medium gray, part silty to sandy and fine to medium sandstone, rarely conglomeratic. Some shales are carbonaceous to phosphatic, minor coal, and rare limestone lithologies. Only a few outcrops of this map unit were identified in the Cedar Creek valley located in the northeastern part of Geode State Park in the western portion of GEOLOGICAL SURVEY MISSISSIPPIAN SUBSYSTEM Mpsl - Limestone, Sandstone, and Dolomite (Pella and "St. Louis" Formations) Middle-Upper Mississippian, Meramecian-lower Chesterian This map unit ranges between 9 and 18 m (30 - 60 ft) thick reaching a maximum thickness of 24 m (80 ft) in the mapping area. It is dominated Iowa Geological Survey, Robert D. Libra, State Geologist y limestone, sandstone, dolomitic limestone, and dolomite with minor shale. Limestones of the Pella Formation are typically sub-lithographic with scattered to abundant fossils, primarily brachiopods, echinoderms, and ostracods. The "St. Louis" Formation is dominated by limestone, sandy limestone, sandstone, and dolomite, variably cherty. The limestone facies of this unit can be fossiliferous with brachiopods, echinoderms, Supported in part by the U.S. Geological Survey and several varieties of coral while the dolomitic facies typically exhibit fossil molds. Some fossils are silicified. Sandstones of the "St. Louis" Cooperative Agreement Number G16AC00193 130TH ST Formations are typically very fine to medium quartz sandstones that are poorly to moderately cemented with calcite or quartz. The lower portion National Cooperative Geologic Mapping Program (STATEMAP) of this unit is commonly gray to dark brown dolomite, locally brecciated and sandy, with rare fossils. This mapping unit dominates the bedrock Completed under contract with the Iowa Department of Natural Resources highs north of the Skunk River and is overlain by Quaternary sediments or Pennsylvanian outliers. Outcrops of this mapping unit are found on the ridge tops along the north side of the Skunk River, along Long Creek, and in quarries. Mws - Shale, Dolomite, and Limestone (Warsaw Formation) Upper Osagean. The Warsaw Formation varies in thickness reaching a maximum thickness of approximately 17 m (55 ft). This unit can generally be divided into two major lithologic groupings, a lower argillaceous dolomite sequence and an upper shale-dominated sequence. The upper shale is typically light to medium gray, silty, and variably dolomitic with minor chert, sand, and sparse quartz geodes. The lower dolomite, sometimes referred to as the "geode beds", is argillaceous to shaly, with ACKNOWLEDGMENTS scattered to abundant quartz geodes. Minor limestone units occur locally as thin, lensatic beds with crinoidal packstone/grainstone fabrics. Brachiopods, echinoderm debris, and bryozoans are found throughout this mapping unit, although more common in the carbonate lithologies. Special thanks to Don Smith of Cessford Construction, Co. (Oldcastle Materials), Chuck Manson of Douds Stone, Ryan Gourley of This unit exhibits wide variability leaving only the upper shale or lower dolomite in place, suggesting strong erosional unconformities above the Burlington Parks Department, and Joe Haffner of the Iowa Army Ammunition Plant. Kathy Coleman, Alsace Heinold, Doug and below this mapping unit. Outcrops of this unit are rare due to the selective weathering of the shale creating recessive exposures beneath Walljasper, Dennis Gibbs, Dale McNeeley, Jim Kannenberg, and Doug Fenton are thanked for allowing us access to their property. ledges of overlying "St. Louis" Formation. Zachary Demanett of the Iowa Geological Survey (IGS) and University of Iowa (UI) students Samantha Moser, Ryan McKeon, and Gia DeBartolo prepared well drilling samples for stratigraphic logging. New subsurface geologic data was generated by Tanner Mkeo - Limestone, Dolomite, Chert, and Shale (Keokuk Formation) Upper Osagean. The Keokuk Formation typically ranges from 12 to 23 Hartsock and Diar Ibrahim, UI Department of Earth and Environmental Sciences students, by producing descriptive logs of water m (40 - 75 ft) in thickness with a maximum thickness of 26 m (85 ft) in the mapping area. This unit is dominated by tan to gray interbedded well drilling samples. UI students Nick Lefler and Katie Grob helped with checking well locations and data management. Zachary skeletal limestones displaying packstone/grainstone fabrics. Nodular to bedded chert, in part fossiliferous, are common in the lower half of the Demanett and Tanner Hartsock also assisted with field work. Bill Bunker, Ray Anderson, Bob McKay, and Brian Witzke (Iowa sequence. Dolomite, variably argillaceous, and thin shales also occur throughout the unit. The unit displays multiple hardground surfaces and Department of Natural Resources- retired) provided valued background information concerning the bedrock topography, geology, bone beds with scattered to abundant fish debris, the most prominent of these serves as a marker bed at the base of the formation (sometimes and Mississippian stratigraphy of the area. Thanks also to Rick Langel (IGS) for managing the Iowa geologic sampling database referred to as the Burlington-Keokuk or B-K bone bed). Brachiopods, crinoids, bryozoans, solitary corals, and fish bones and teeth occur (GeoSam). Administrative support was provided by Megan Delaney, Rosemary Tiwari, Teresa Gaffey, Angi Roemerman, and ROOSEVELT ST throughout this unit as both abraded debris and partly articulated specimens. Molds of sponge spicules are noted in the dolomite facies. Traces of glauconite and locally abundant geodes were also observed within the mapping area. Outcrops of this unit are typically found along the Skunk River and its tributaries and in select quarries along the southeastern boundary of the mapping area. Mb - Limestone, Dolomite, and Chert (Burlington Formation) Lower Osagean. The Burlington Formation can be up to 27 m (90 ft) thick in the mapping area. This unit is subdivided into three members (in ascending order; the Dolbee Creek, Haight Creek, and Cedar Fork), characterized by distinct lithologic groupings. The Dolbee Creek Member is dominated by white to tan skeletal limestone displaying Introduction to the Bedrock Geologic Map of the Danville 7.5' Quadrangle, packstone/grainstone fabrics and nodular to bedded chert. The Haight Creek Member is characterized by dolomite with an intermittent unit of skeletal limestone (sometimes referred to as the "middle grainstone") and thick beds of chert. A glauconite-rich zone marks the lower contact Des Moines, Henry, and Lee Counties, Iowa between the Dolbee Creek and can be used as a regional marker bed. Fossil molds are also present in the dolomite facies. The Cedar Fork Member is a pure white crinoidal packstone limestone unit which is usually differentiated from the packstones of the overlying Keokuk Formation by its white appearance. Occasional fish debris and glauconite are also observed in this member. Outcrops of the Burlington The majority of the Danville Quadrangle lies within the Southern Iowa Drift Plain landform Formation are typically found along the Skunk River and its tributaries in the far southeastern corner of the mapping area, as well as in select region (Prior, 1991) with a small portion of the southeast corner lying within the Mississippi Alluvial quarries along the southeastern boundary of the mapping area. Plain. This area hosts glacial deposits over 500,000 years old containing a thick till package mantled by Mk - Dolomite, Limestone, and Siltstone (Kinderhookian formations) Lower Mississippian. The Kinderhookian sequence ranges in thickness loess draped over upland hill slopes. Numerous rills, creeks, and rivers branch out across the landscape from 6 to 15 m (20 - 50 ft) with a maximum thickness of 23 m (75 ft) in the mapping area. This unit comprises three formations (in ascending order; the McCraney, Prospect Hill, and Wassonville), characterized by distinct lithologic groupings. The McCraney Formation is composed of shaping the old glacial deposits into steeply rolling hills and valleys. alternating beds of sparsely fossiliferous, sub-lithographic limestone and dark brown, unfossiliferous dolomite; generating a unique "zebra The thickness of Quaternary materials overlying the bedrock surface varies widely across the striped" appearance in outcrop. A basal oolite is locally present. The Prospect Hill Formation is a light to medium gray, dolomitic siltstone that grades to shale in some locations. This unit is often laminated with vertical and horizontal burrow fabrics and faint cross stratified bedforms. quadrangle ranging from 0 to 18 m (0-60 ft), reaching a maximum thickness of 64 m (210 ft) in the Fossils are rare to absent although fossil molds are locally abundant. The Wassonville Formation, now including the former Starrs Cave northern part of the mapping area. Shallow bedrock information from the soil surveys in Des Moines, Formation as the basal member, consists of massive dolomite that is variably cherty grading into dolomitic limestone lower in the section. The basal Starrs Cave Member is a fossiliferous limestone with packstone/grainstone fabrics and is commonly onlitic. Crinoids (partly articulated) Henry, and Lee counties (Brown, 1983; Seaholm, 1985; and Lockridge, 1979) was used for identifying are the dominant fossil type of the Starrs Cave Member. A diverse assemblage of brachiopods are present with lesser amounts of blastoids, potential bedrock outcrop locations during field mapping activities. Bedrock outcrops were found mostly starfish, corals, bryozoans, and trilobites reported. Outcrops of the Kinderhookian are found just outside the southeastern corner of the mapping area and in the sump pit of a quarry located along the southeastern boundary of the mapping area. along the Skunk River and its tributary creeks like Mud Creek and Cedar Creek, primarily in the eastern half of the quadrangle. Outcrops exposed are comprised of Pella and "St. Louis", Warsaw, and Keokuk formation rocks with one outcrop of Pennsylvanian bedrock. Subsurface information was mostly derived Der – Siltstone and Shale (English River Formation) Upper Devonian, lower to upper Famennian. The English River Formation is up to 6 m from the analysis of water well cutting samples reposited at the Iowa Geological Survey (IGS). (20 ft) within the mapping area. This unit is dominated by gray to olive green siltstone with apparent bioturbated fabrics. Bivalves and brachiopods are common, especially in the upper beds, with scattered to abundant fossil molds as well. This unit appears only in the cross-Lithologic and stratigraphic information from these samples are stored in the online GeoSam database of the IGS. Geologic information from five quarries, 26 outcrops, and more than 180 private and public Dss - Shale (Saverton Shale Formation) Upper Devonian, lower to upper Famennian. The Saverton Shale Formation can be up to 36 m (120 ft) wells within the Danville Quadrangle and the surrounding area were used for bedrock geologic mapping within the mapping area. This unit is dominated by green-gray shale, commonly burrowed with sparse to absent macro-fossils. This unit appears The Mississippian System (now Subsystem) was historically proposed for the succession of strata exposed in the Mississippi River Valley between Burlington, Iowa and southern Illinois. Therefore, the OTHER FEATURES bedrock exposures in southeastern Iowa take on a special significance as they comprise part of the historic New drill holes for this map project "body stratotype" on which the concept of the Mississippian System was defined and based (Witzke et al., 2002). The Mississippian had been primarily a North American chronostratigraphic label roughly synonymous with the Lower Carboniferous of the Old World. After approval by the Subcommission on Carboniferous Stratigraphy in 1999 and ratification by the International Union of Geological Sciences IGS GEOSAM data points – records available at www.iowageolocialsurvey.org and the International Commission on Stratigraphy in 2000, the Carboniferous System was officially Middletown subdivided into lower and upper subsystems, the Mississippian and Pennsylvanian, respectively. As such, the Mississippian now has meaning and application as a major subdivision of geologic time not only in North America, but as a globally defined subsystem. The bedrock strata seen in the Danville Quadrangle and surrounding area provide a significant historic reference for the Mississippian as a whole. The conundrum that is the Mississippian in Iowa has been the subject of curiosity for many previous workers. Owen (1852) and Hall (1857) were the first to recognize that the abundant bedrock exposures in southeastern Iowa likely correlated with those observed farther down the Mississippi River Valley. Decades later, Van Tuyl (1923) took on the ambitious task of correlating all of the Mississippian AGENCY RD A units across Iowa. Many of their lithologic interpretations were valuable, however, the correlations were, Bedrock Hillshade- shades of gray show the bedrock surface as it would be illuminated by an artificial light source from the NW direction and continue to be, subject to revision as later workers attempted to piece the Mississippian into the global stratigraphic framework. Harris and Parker (1964) provided inspirational insights into the structural context of southeastern Iowa by identifying a series of northwest-southeast trending anticlines STRATIGRAPHIC COLUMN that were later found to be superimposed on the larger northeast-southwest trending structural feature known as the Mississippi Arch (Witzke et al., 1990, p. 5). Many questions remain regarding the stratigraphic correlations within the Mississippian such as whether the "St. Louis" Formation in Iowa truly belongs in the St. Louis Formation or should some of the upper members be reassigned to the St. Genevieve Formation; whether the Prospect Hill Formation is an offshoot of the Hannibal Formation in Missouri and Illinois; and whether the McCraney Formation is correlative to the McCraney in Illinois or if it should become a new stratigraphic interval (as proposed by Witzke et al., 2002). Although the Lithostratigraphic Mississippian bedrock in southeastern Iowa is no longer a widely used aquifer due to low yields and locally poor water quality, many of the bedrock units are highly desirable sources of aggregate, thus necessitating the continued effort to gain a better understanding of the local and regional stratigraphic characteristics and relationships of the Mississippian System in southeastern Iowa. The mapping area is dominated by bedrock of the Mississippian System that was deposited in a variety of marine environments from the late Kinderhookian to early Chesterian, approximately 355 – 330 million years ago (Ogg et al., 2008). Kinderhookian strata represent a sequence of interbedded carbonates and siltstones that unconformably underlie the Burlington Formation (early Osagean) and are not exposed at the bedrock surface within the mapping area. The Burlington, Keokuk, and Warsaw lower Cherokee formations (collectively the Augusta Group of Witzke et al., 2010) represent a relatively conformable package of marine rocks deposited during the Osagean transgressive-regressive (T-R) cycle. Interpreted as part of the central middle shelf of the Osagean sea that transgressed toward the northwest and the Transcontinental Arch, the Burlington Formation rocks were deposited across a vast subtidal epicontinental shelf that stretched from Illinois and Iowa into central Kansas and Oklahoma (Lane, 1978; Witzke et al., 1990, p. 55). The Keokuk and Warsaw formations represent the regressive phase of the Osagean T-R cycle punctuated by a stark unconformity below the overlying Pella and "St. Louis" formations, regionally displaying up to 40 m (130 ft) of erosional relief (Witzke et al., 2002). The Pella and "St. Louis" formations are mapped as one unit due to their stratigraphic complexity and questionable correlation to the type sections in Missouri and Illinois (Witzke et al., 1990, p. 23). The Pella and "St. Louis" formations were deposited in a near-shore environment as evidenced by mudflat facies rocks, evaporites and associated collapse breccias, and increased terrigenous sandstone deposits; with periods Pella or "St. Louis" of brackish and/or lacustrine deposition interpreted from coal deposits and root casts (Witzke et al., 2002). Pennsylvanian bedrock units of the lower Cherokee Group occur as erosional outliers and are not well exposed in the mapping area. For a more detailed description of the lithologic units and further discussion of mapping methodologies, please refer to the accompanying Summary Report. **References:** Brown, M.D., 1983: Soil Survey of Des Moines County, Iowa. 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Bedrock topography raster created internally for this map project. lowa Geological Survey digital cartographic file Danville\_BedrockGeology.mxd, version 6/30/17 (ArcGIS 10.3) Map projection and coordinate system based on Universal Transverse Mercator (UTM) Zone 15N, datum NAD83. 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 G16AC00193. 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. Burlington Fm. 1:24,000 9 MILS **UTM GRID AND 2017 MAGNETIC NORTH** Kinderhookian **DECLINATION AT CENTER OF SHEET** Adjacent 7.5' Quadrangles Lithologies Symbols **Location Map** ⊗ Geodes Dolomite Dolomite △ Chert Dolomitic shale NEW LONDON PLEASANT GROVE SPERRY, IOWA Oolitic Fossiliferous Packstone Argillaceous zone English River Fm. Der ○ Breccia Limestone ~ Unconformity Lithographic Limestone DANVILLE WEST BURLINGTON IOWA Sandstone Sandy Limestone Saverton Shale Fm. | Dss WEST POINT FORT MADISON DALLAS CITY Siltstone <sup>1</sup>Global stratigraphic units <sup>2</sup>Regional stratigraphic units GEOLOGIC CROSS-SECTION A-A' ≗ 400-300-Vertical exaggeration=10x