

IOWA GEOLOGICAL SURVEY  
IOWA CITY, IOWA  
H. GARLAND HERSHEY, Director and State Geologist

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**REPORT OF INVESTIGATIONS 4**

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**LA PORTE CITY CHERT — A Devonian  
subsurface formation in central Iowa**

by  
MARY COMBS PARKER

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## CONTENTS

	PAGE
ABSTRACT .....	3
INTRODUCTION .....	4
STRATIGRAPHY .....	4
Stratigraphic Relations and Areal Extent .....	4
Type Section .....	6
Lithological Features .....	6
Contact Relationships .....	7
AGE AND CORRELATION .....	9
ACKNOWLEDGEMENTS .....	12
SELECTED REFERENCES .....	12

## ILLUSTRATIONS

	PAGE
Figure 1. Distribution and thickness map of the La Porte City Chert in Iowa .....	5
2. Percentage logs of well cuttings from the La Porte City Chert .....	8
3. Percentage logs of well cuttings from the La Porte City Chert .....	10

## LA PORTE CITY CHERT—

A Devonian subsurface formation in central Iowa

by

MARY COMBS PARKER

### ABSTRACT

A study of well samples from central Iowa shows that a distinct rock-stratigraphic unit is present beneath the Devonian Wapsipinicon Formation and above the characteristic dolomites and cherts of the Silurian Niagaran Series. This subsurface unit consists primarily of medium- to dark-gray chert and light-gray limestone. The unit has been traced into southwestern Iowa and its boundaries have been fairly well defined. The name La Porte City Chert, derived from the town of La Porte City in southeastern Blackhawk County, is proposed for this formation.

The lithologic characteristics and distribution of the La Porte City Chert in Iowa are shown by graphic well sections and a thickness map.



## INTRODUCTION

A rock-stratigraphic unit is present in central Iowa which is consistent in its stratigraphic position, contains distinct lithologies, and is mappable, although it is nowhere exposed at the surface. This unit has been recognized informally and called the La Porte City by the Iowa Geological Survey. It is here proposed that this unit be recognized formally, be given formational rank, and be named the La Porte City Chert from the name of the town in southeastern Blackhawk County, Iowa where the unit forms the bedrock beneath the glacial till.

## STRATIGRAPHY

## Stratigraphic Relations and Areal Extent

With few known exceptions, the La Porte City Chert is overlain by the Middle Devonian Wapsipinicon Formation. At La Porte City and Washburn, in Blackhawk County, on a northwest-southeast trending anticline this unit is the bedrock under glacial till; in Buchanan County near Independence, the La Porte City is the bedrock in a portion of a buried stream channel; in central Delaware County near the eastern limit of the formation it also forms the bedrock. The La Porte City Chert is underlain by the Silurian Niagaran Dolomite, except in southeastern Polk County and northcentral Hardin County where the Silurian is absent. In those areas the Ordovician Maquoketa Shale is the underlying unit. The La Porte City has been traced into southwestern Iowa as far as Montgomery County. The areal extent of the La Porte City Chert is shown in figure 1. Because no surface exposures have been found, the boundaries must be determined entirely from subsurface information.

The La Porte City dips rather uniformly southwestward from a northwest-southeast trending anticline in southern Blackhawk and northern Benton Counties (altitude is +670 feet) to its southwestern boundary in Montgomery County (altitude is -1024 feet). In southwestern Iowa the Thurman-Redfield structural zone appears to form the present northwestern boundary of the formation. Northeast of the anticline in Benton and Blackhawk Counties, the rocks dip into a shallow syncline and then rise again toward the surface in central Buchanan County. The most favorable areas for finding exposures of the La Porte City



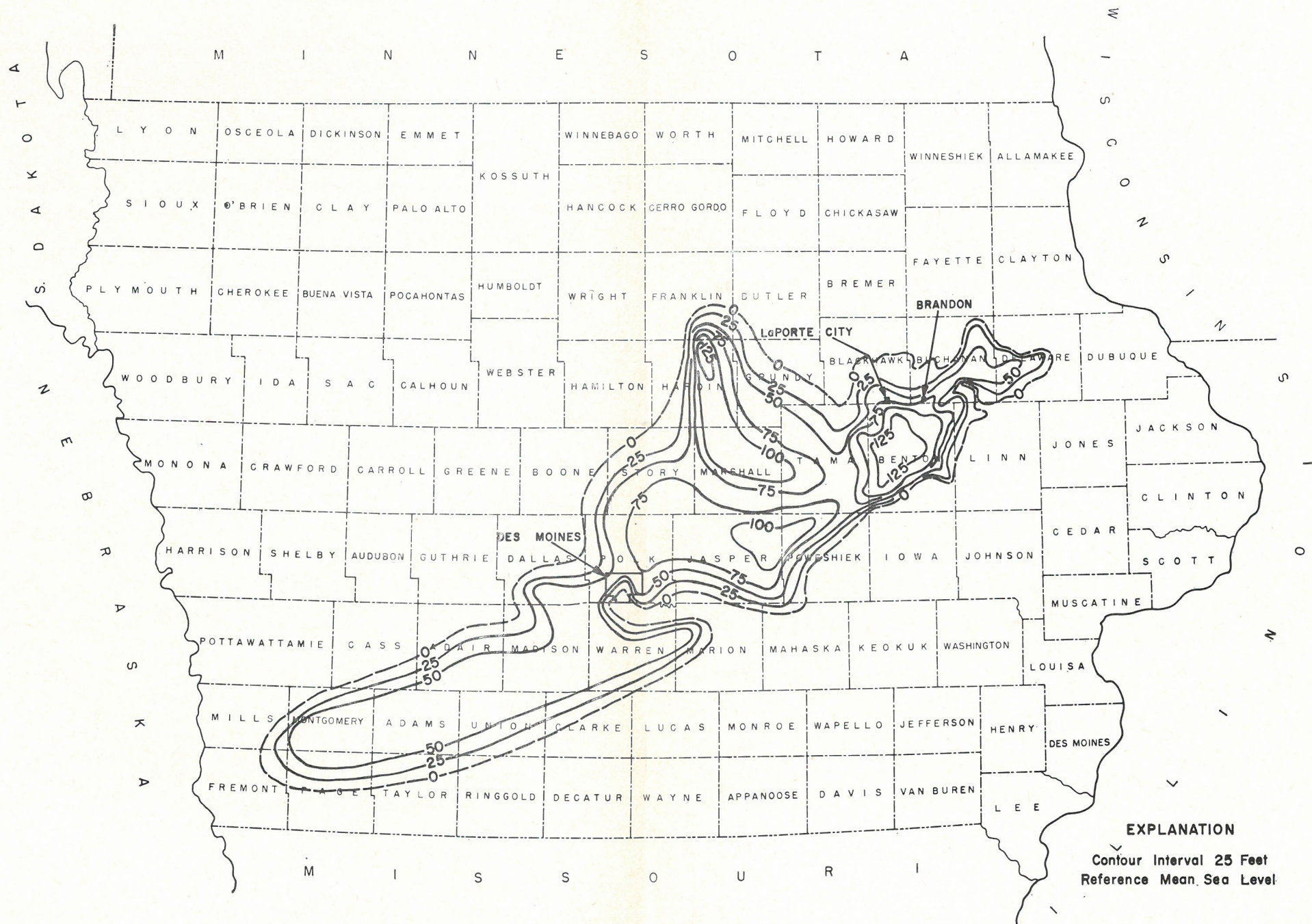


Figure 1. Map of Iowa showing the distribution and thickness of the La Porte City Chert.



Chert would be along the crest of the anticline northwest of La Porte City in Blackhawk County, and along the northern boundary of the formation in Buchanan and Delaware Counties. In both of these areas the La Porte City Chert approaches the land surface structurally.

The thickness of the La Porte City Chert ranges from 25 feet to 145 feet. The average thickness is 50 feet. The greatest thicknesses have been recorded in wells at Iowa Falls, Garrison and Grinnell.

### Type Section

Because no surface exposures of the La Porte City Chert are known, the type section is designated in the La Porte City town well, NE/C SW $\frac{1}{4}$  sec. 25, T. 87 N., R. 12 W., Blackhawk County, Iowa. The well was drilled in 1948 to a depth of 250 feet. The land surface elevation is 815 feet above sea level. The top of the La Porte City occurs at a depth of 95 feet, the base at a depth of 150 feet. The formation is overlain by Pleistocene till and underlain by Silurian Niagaran Dolomite. Although the La Porte City is overlain by Pleistocene till in this well and may have been subjected to some erosion, it appears that practically a full section is present which is representative of the formation in the type area.

A reference section is designated in the Brandon town well, NW $\frac{1}{4}$  SW $\frac{1}{4}$  sec. 27, T. 87 N., R. 10 W., Buchanan County, Iowa. The well was drilled in 1955 to a depth of 405 feet. The land surface elevation is 838 feet above sea level. The top of the La Porte City occurs at a depth of 180 feet, the base at a depth of 230 feet. The formation is overlain by the Coggon Member of the Wapsipinicon Formation and underlain by the Silurian Niagaran Dolomite. Logs of the well cuttings of the La Porte City town well and of the Brandon town well are shown in figure 2. The samples of the well cuttings are on file in the Iowa Geological Survey sample library at Iowa City, Iowa.

### Lithologic Features

The outstanding lithologic feature of the La Porte City is chert which ranges in color from white to dark gray. Medium to dark gray is the most distinctive color although there is a considerable quantity of associated lighter colored chert. The lighter

chert also may occur interbedded between the darker layers. The cherts are smooth, even-textured, and cryptocrystalline. In many wells approximately 25 percent of the white and lighter gray chert is tripolitic. Chert is the diagnostic lithology throughout the entire areal extent of the La Porte City. Samples of the La Porte City from all wells in Tama and Toledo, in Tama County, and all wells in Polk County (fig. 3) consist of 90 to 100 percent chert. Locally wells in Blackhawk, Buchanan, Hardin, Story, Marshall, and Dallas Counties consist of 90 to 100 percent chert.

The second most dominant lithology is limestone found near the eastern and western limits of the La Porte City Chert. The limestone generally is light in color, ranging from very pale-orange to yellowish-orange and yellowish-gray to light gray. The limestone generally is finely crystalline, but lithographic or fragmental textures are also present.

A third lithology consisting of yellowish-orange to light gray, fine to medium crystalline dolomite occurs in this unit in central Iowa. Minor lithologies include small amounts of quartz sand and unctuous red or green clays, which locally are found near the top of the formation.

Fragmented crinoid ossicles and ostrocods are present in the well cuttings of the La Porte City Chert, but no detailed study of the taxa has been made.

### Contact Relationships

The La Porte City Chert is overlain by the Wapsipinicon Formation, except where the La Porte City Chert approaches the surface structurally, or where the Wapsipinicon has been removed by pre-Pleistocene erosion.

The members of the Wapsipinicon Formation are in ascending order: Coggon Dolomite, Otis Limestone, Kenwood, Spring Grove, and Davenport and the younger members of the Wapsipinicon overlap the older ones. In Buchanan, Blackhawk, Benton and eastern Tama Counties the La Porte City is overlain by the Coggon Dolomite Member. Both the Coggon and Otis members pinch out in western Tama County and from western Tama County to southwestern Iowa the Kenwood Member overlies the La Porte City Chert.



## LA PORTE CITY CHERT

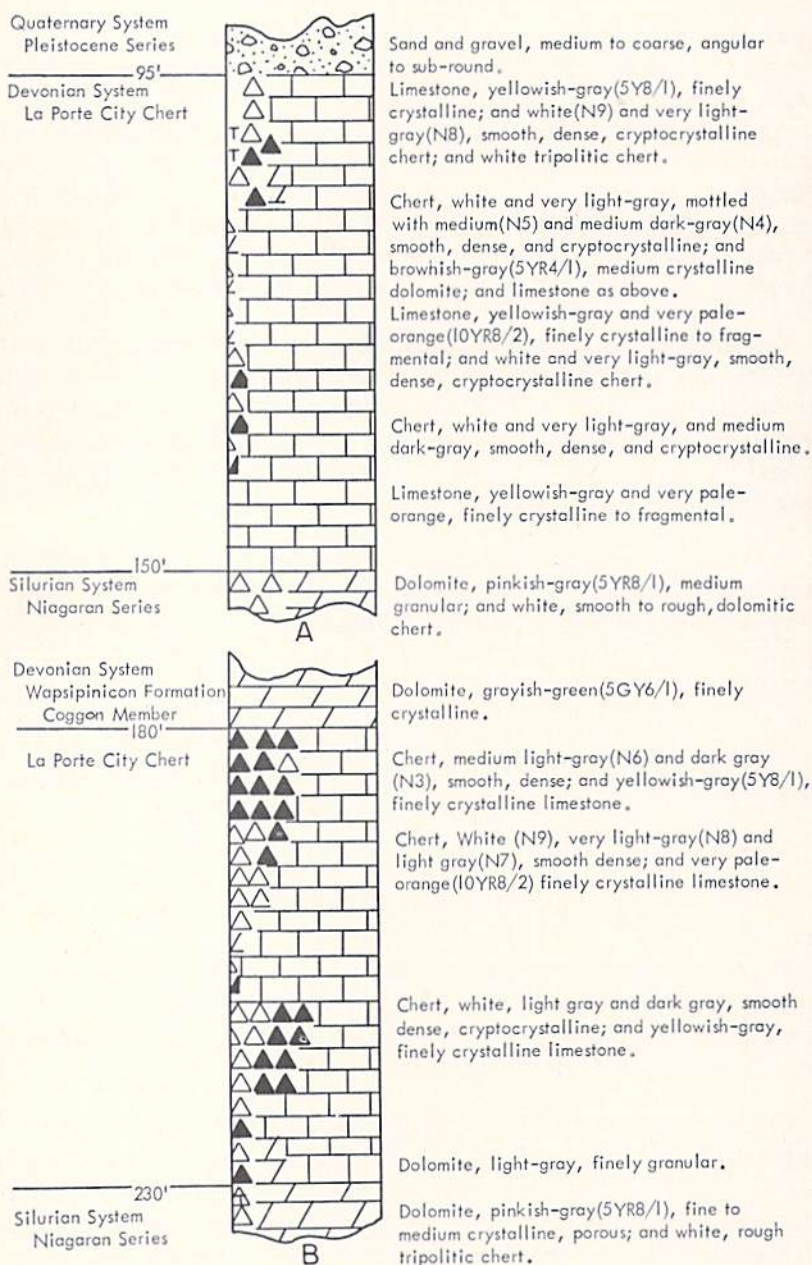


Figure 2. Percentage logs of well cuttings from the La Porte City Chert at A. type section of the La Porte City Chert, La Porte City town well, NE/C SW  $\frac{1}{4}$  sec. 25, T. 87 N., R. 12 W., Blackhawk County, B. reference section, Brandon town well, NW  $\frac{1}{4}$  SW  $\frac{1}{4}$  sec. 27, T. 87 N., R. 10 W., Buchanan County.

The Coggon member consists of dark reddish-brown to grayish-brown, fine to very finely crystalline, non-porous dolomite. The Kenwood member consists of argillaceous limestone or dolomite and (or) shale in which rounded, sand-sized, dark gray to black chert and quartz grains are embedded. Calcite scalenohedrons and rhombs and white to gray chert are often associated with the carbonates. Gypsum is noted also in the Kenwood of Tama County and occurs throughout the Kenwood in Western Iowa.

The upper contact of the La Porte City is marked by the occurrence of the smooth to granular, smoky to black, bedded chert and light-colored limestone. These lithologies are in sharp contrast to either the overlying brown dolomite of the Coggon or the conglomeratic nature of the rocks of the Kenwood.

The lower contact of the La Porte City is placed at the base of the smoky chert and the top of the light gray, fine to medium crystalline dolomite and white granular and tripolitic chert of the Silurian.

In a few localities where the Silurian rocks are absent, the La Porte City Chert lies directly on the shales of the Maquoketa Formation.

### AGE AND CORRELATION

The La Porte City Chert has been considered by some to be a facies alteration of the Silurian dolomite and chert. In some respects this would be an adequate explanation, for it is in the proper stratigraphic position to be Silurian in age.

The rocks of this section, however, have more affinity with the Devonian lithologies than with the Silurian lithologies. The Devonian contains numerous limestones, many of which are fragmental or lithographic to very finely crystalline and are light-colored. Limestone in the Silurian is very rare in Iowa. The medium to dark gray chert of the La Porte City also more closely resembles Devonian chert than it does Silurian chert. Dark colored chert-sand and nodules occur at the base of the Solon Member of the Cedar Valley Formation and in the Davenport and Kenwood Members of the Wapsipinicon Formation. The



## LA PORTE CITY CHERT

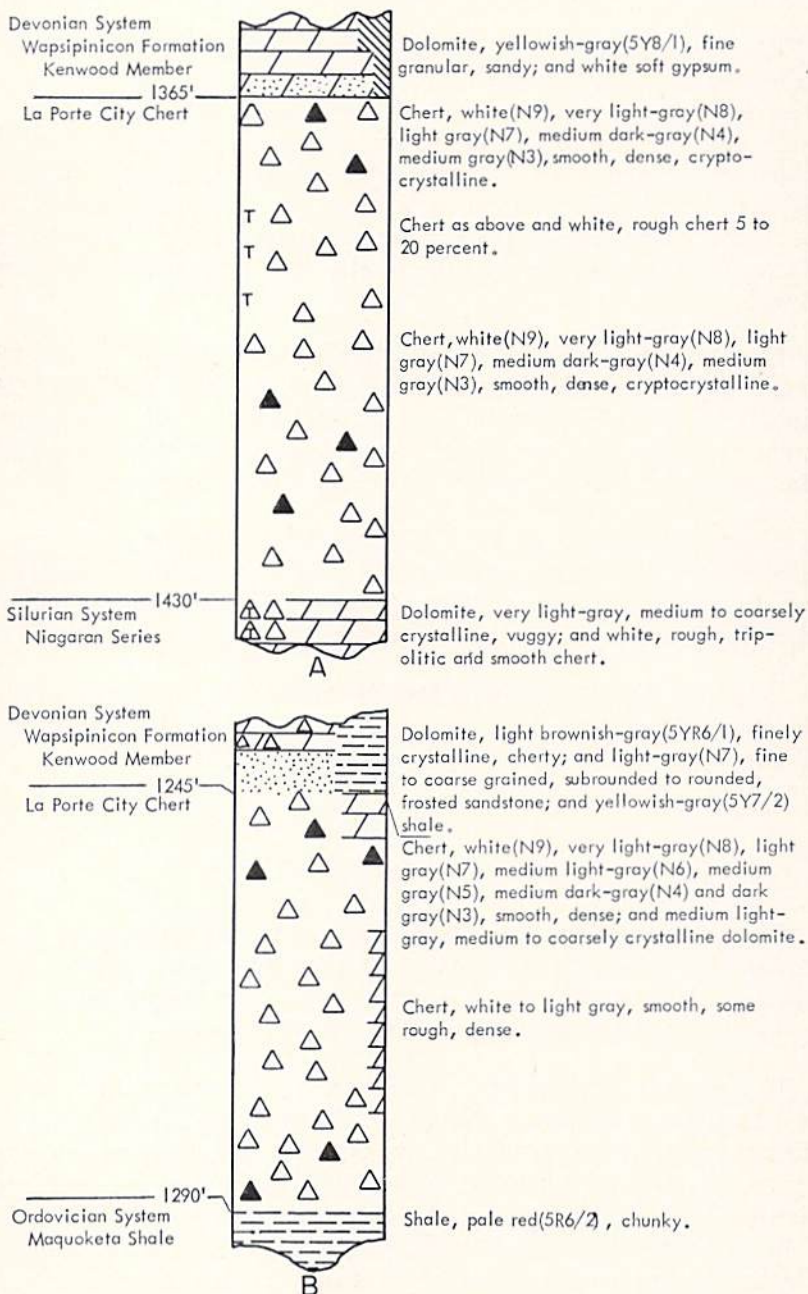


Figure 3. Percentage logs of well cuttings from the La Porte City Chert at A. Ankeny town well, NE 1/4 NE 1/4 NW 1/4 sec. 23, T. 80 N., R. 24 W., Polk County, B. Avon, General Mills, Inc., NW 1/4 SW 1/4 SE 1/4 sec. 28, T. 78 N., R. 23 W., Polk County.



cherts of the Silurian are for the most part white and tripolitic, although light gray and yellowish-gray, smooth and granular cherts are present.

If the La Porte City is considered a facies of the Silurian, the Silurian attains a greater thickness in the area of the occurrence of the La Porte City than in adjacent areas where it is absent. This unit does not appear to be a diagenetic alteration of a portion of the Silurian rocks. Instead it appears to be an additional unit superimposed on the Niagaran.

If the La Porte City Chert is of Devonian age it is either a lower member of the Wapsipinicon Formation or it is older than the Wapsipinicon. The uniform thickness of the Wapsipinicon and its respective members make it seem rather unlikely that a basal member should attain a thickness of 140 feet within 10 miles of its border (fig. 1). It is more likely that the unit is separate from the Wapsipinicon.

The possibility then of the La Porte City Chert being of Devonian age, separate from and older than the Wapsipinicon, must be considered. Most of the lithologic evidence points to this conclusion and the stratigraphic relationships support this as well. The La Porte City Chert possesses the requirements for formational rank, i.e. lithologic homogeneity, distinctive lithologic features, and definitive geographic boundaries.

This section possibly represents Silurian and (or) Devonian sediments that were reworked during pre-Wapsipinicon time. The fragmental character and orange color of some of the limestones and the dark color of some of the cherts suggests this. The presence of unctuous clay (interpreted as representing cavity or fracture fillings), the presence of sand, and the scarcity and abraded condition of the fossils suggests reworking of earlier-deposited material.

The fauna which occurs in the restricted Clear Creek Chert of Illinois and in the restricted Camden Chert of Tennessee has been correlated with the Schoharie fauna (Lower Devonian) of New York. Faunas similar to those found in the Clear Creek and Camden Cherts occur in the Sallisaw Sandstone and Pinetop Chert of Oklahoma. The Lower Arkansas Novaculite of southwestern Arkansas and the Penters Chert of northeastern Arkansas, although containing few fossils, are also correlated with the

Camden and Clear Creek Cherts because of their lithologic similarity. The stratigraphic position and lithologic similarities to the Clear Creek Chert and to the Camden Chert suggest that the La Porte City Chert may be an age equivalent. It is proposed that the La Porte City Chert be assigned a Lower Devonian age, possibly equivalent to the Schoharie.

#### ACKNOWLEDGEMENTS

Most of the early sample studies and delineation of the boundaries of the La Porte City Chert were made by Ruth Wehner Denney when she was employed by the Iowa Geological Survey in the 1950's. Subsequent work by various members of the Survey staff has contributed greatly to the data and conclusions herein presented.

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