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Abstract. Conodonts are rare in the Shell Rock Formation, but they support the previous assignment of this formation to the lower part of the Upper Devonian. Conodont species diagnostic of the Lower *Palmatolepis gigas* Zone (Upper Devonian, *to*Iγ) occur in the upper part of the Juniper Hill and in the lower Cerro Gordo members of the Lime Creek Formation. The ranges of conodont species occurring in the Sheffield Formation are indicative of zones *to*Iδ –*to*IIα. The conodont faunas from the Aplington Formation is meager but may indicate zone *to*IV or *to*V. Conodonts from the "English River Siltstone" and the Maynes Creek Member of the Hampton Formation are distinctive of zones upper *cu*I through *cu*II.

The Devonian-Mississippian boundary in north-central Iowa occurs between the Aplington Formation and either the "English River Siltstone", which is not everywhere present, or the Hampton Formation. At one locality the "Maple Mill Shale" overlies the Aplington Formation and here the boundary is between the "Maple Mill" and the overlying "English River Siltstone".

This report is an attempt to recognize Upper Devonian and Lower Mississippian conodont zones in north-central Iowa and to define the Devonian-Mississippian boundary wherever possible. Although the exact zoological affinity of conodonts is not known it seems apparent that they belonged to pelagic organisms. Therefore, conodonts are found in a variety of marine lithofacies and are sufficiently widespread geographically to make them useful in delineating time stratigraphic units. Ziegler (1962b) and Collinson, *et al.* (1962) have presented recent works on Upper Devonian and Mississippian conodont zones.

The conodont zones recognized by Collinson *et al.* (1962) were correlated with similar zones in western Europe. Thus, by correlation with Upper Devonian and Lower Carboniferous stages in western Europe which are the accepted international standards for reference, Collinson *et al.* were able to place the Devonian-Mississippian boundary in the Upper Mississippi Valley. They found Upper Devonian conodont faunas in the Sylamore, Saverton and Louisiana formations which had formerly been placed in the Kinderhook Series. For this reason it was necessary for them to redefine the Kinderhook Series in the type region so that it would include only Lower Mississippian strata. Therefore, they redefined the Kinderhook Series as "bounded

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at the top by the base of the Burlington Limestone and at the bottom by the base of either the "Glen Park" or the "Hannibal".

Correlations with the southeastern Iowa section based on work by Thomas (1949a), Scott & Collinson (1961), Collinson (1961) and Collinson *et al.* (1962) have clarified the position of the Devonian-Mississippian boundary in southeastern Iowa. However, the Upper Devonian and Lower Mississippian Strata of north-central Iowa are sufficiently isolated from exposures in southeastern Iowa (100-150 miles) that correlation between the two areas has been uncertain. For this reason an attempt was made to recognize conodont zones in the Upper Devonian and Lower Mississippian of north-central Iowa so that correlations could be made with the conodont zones of the Upper Mississippi Valley and western Europe.

Except for one core in northern Webster County, the collections were from surface exposures in Hancock, Cerro Gordo, Floyd, Franklin and Butler counties (Figures 1 and 2). The Shell Rock, Lime Creek, Sheffield, Aplington, "Maple Mill", "English River", and Hampton formations were included in this study (Fig. 3). It should be noted that the usage of "Maple Mill" and "English River" for strata in north-central Iowa is of an informal nature. It has not definitely been established that these units correspond to the formations as defined at their type sections in southeastern Iowa.

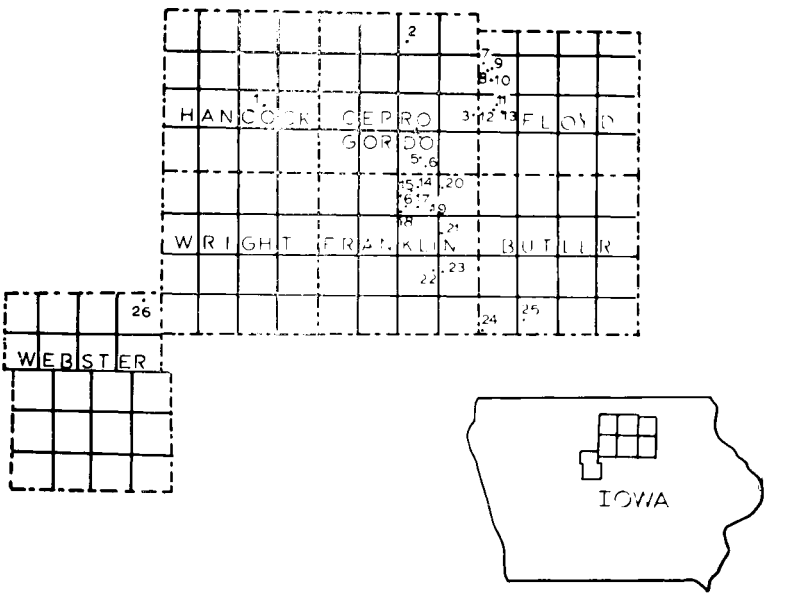

Figure 1. **Locality map.**

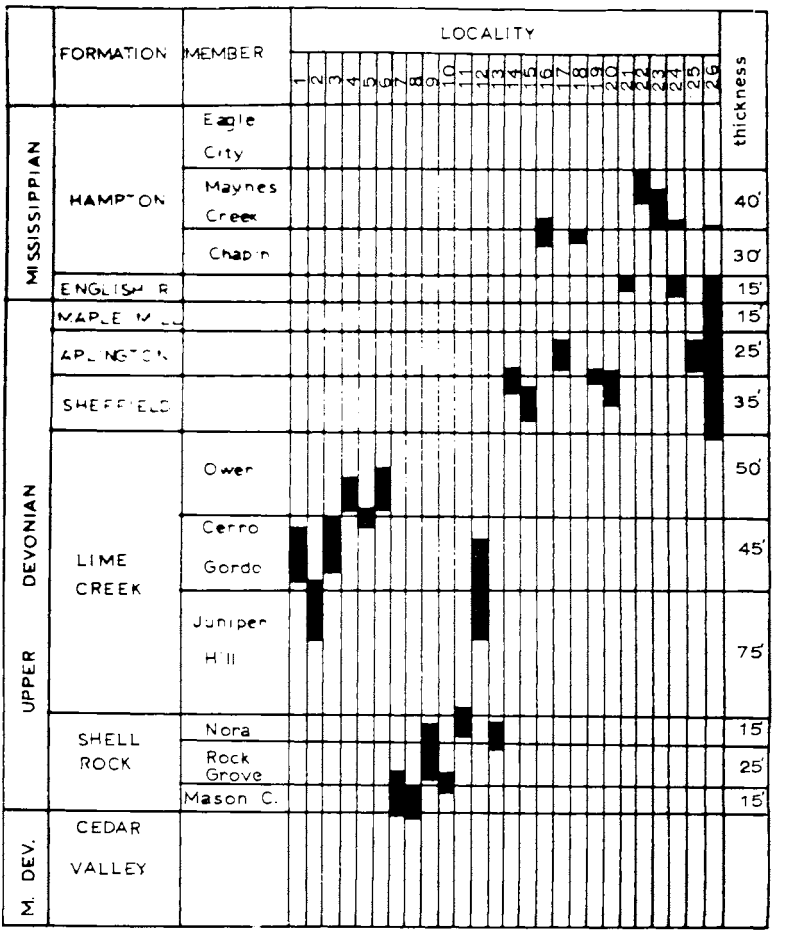

Figure 2. Chart showing portion of the stratigraphic interval sampled.

Sample Localities

The locations of the 26 sampled sections shown on Fig. 1 are given in the Appendix. Samples which proved to be barren were collected from several other localities.

Correlation

Shell Rock Formation

Belanski (1928) described a fauna from the Shell Rock Formation which he considered to be early Upper Devonian. Cooper *et al.* (1942, p. 1780) reported that a fauna similar to that of the Shell Rock is widespread in western North America, occurring in the Jefferson, Muddy Peak, lower Devils Gate, lower Minnewanka and parts of the Sultan and Silverhorn limestones.

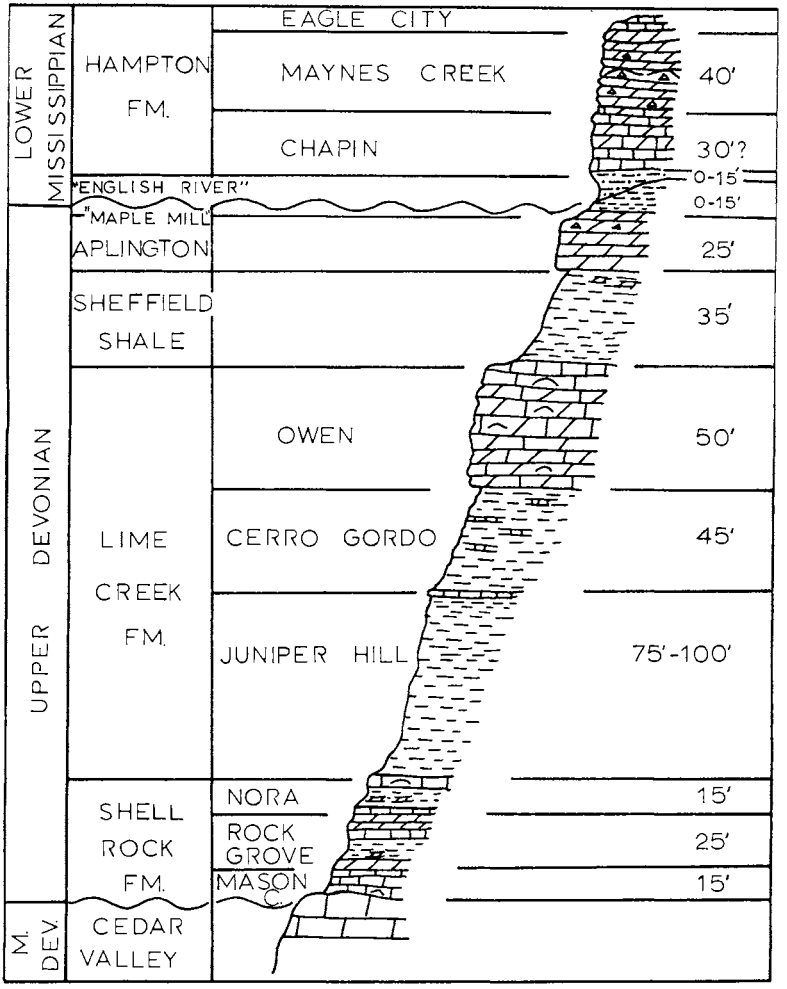

Figure 3. Columnar section.

A meager conodont fauna was recovered from the Shell Rock Formation (Table 1). *Ancyrodella gigas* (*to*Iα -*to*Iδ) was recovered from the Rock Grove Member indicating that the middle and upper members of the Shell Rock are definitely assignable to the *Manticoceras* Zone. Conodont species occurring in the Mason City Member are generally not suitable for distinguishing Middle Devonian from Upper Devonian strata. Two broken specimens from the Mason City are questionably referred to *Polygnathus angustidisca,* a *to*I species.

Except for the presence of *Ancyrodella gigas* and *Polygnathus* cf. *P. angustidisca,* the Shell Rock conodont fauna is similar to

the fauna described by Downs & Youngquist (1950) from the Middle Devonian Cedar Valley Limestone. Thomas (1949b, table 2) listed *Ancyrodella buckeyensis* Stauffer as occurring in the Shell Rock Formation which serves to support the assignment of the Shell Rock to the *Manticoceras* Zone.

Table 1. Occurrences of selected conodont species from the Shell Rock and Lime Creek formations.

Species	European Range	Shell Rock Fm. M.C.	R.G.	Nora	Lime Creek Fm. J.H.	C.G.	Owen
Ancyrodella curvata	*to*Iβγ-*to*Iδ				X	X	
A. gigas	*to*Iα-*to*Iδ		X				
A. lobata	*to*Iα-*to*Iδ				X		
Ancyrognathus irregularis.	*to*Iγ				X		
A. triangularis	*to*Iγ-basal *to*Iδ				X		
Icriodus cymbiformis	*tu-to*IIα		X	X	X	X	X
I. symmetricus	*tu-to*Iδ				X	X	
Nothognathella abbreviata.					X		
N. bicristata	*tmo/to*I-*to*Iγ			X		X	
N. iowaensis	*to*I				X		
Palmatolepis foliacea	*to*Iγ					X	
P. gigas	*to*Iγ-*to*Iδ				X	X	
P. subrecta	*to*Iβγ-*to*Iδ				X	X	
Polygnathus angustidisca	*to*I				X	X	X
P. brevis					X	X	
P. decorosa	*tmo-to*I/*to*II	X	X	X	X	X	
P. deformis n. sp.						X	
P. normalis	*tmo-to*I/*to*II				X	X	X

Lime Creek Formation

The fauna of the Cerro Gordo Member of the Lime Creek is well known, particularly from the Bird Hill and Rockford localities. Belanski (*in* Fenton, 1931) recognized three faunal zones in the Cerro Gordo. They are, in ascending order, the *Douvillina* zone, the *Spirifer whitneyi* zone and the *Strophonella hybrida* zone. Belanski further subdivided these three zones into 30 zonules. However, these divisions are only recognizable in the vicinity of Rockford. Away from Rockford the Cerro Gordo Member becomes more dolomitic and less fossiliferous.

The fauna of the Cerro Gordo, described by Fenton and Fenton (1924), included *Manticoceras regulare* which is now known to occur throughout the Cerro Gordo Member. *Manticoceras* is confined to the lower portion of the Upper Devonian, the *Manticoceras*-Stufe, *to*I, and has a world-wide distribution.

The occurrences of conodont species in the Lime Creek Formation are shown on Table 1. *Palmatolepis gigas* occurs throughout the upper Juniper Hill and in the *Douvillina* zone of the Cerro Gordo. This species is the name bearer of Ziegler's (1962b) *Palmatolepis gigas* (= *P. rhenana*) Zone and has a range of *to*Iγ -middle *to*Iδ. *Palmatolepis foliacea* occurs in the *Douvillina* zone of the Cerro Gordo Member. Bjoraker (1955) has also illustrated *P. foliacea* from the *Spirifer whitneyi* zone of the Cerro Gordo. As *P. foliacea* does not occur above the Lower *Palmatolepis gigas* Zone, middle *to*Iγ, most of the Cerro Gordo and the upper Juniper Hill can be assigned to the Lower *P. gigas* zone.

Ancyrodella curvata, *to*I(β)γ -to Iγ, occurs in the basal Juniper Hill but no single zone was recognized. *Polygnathus angustidisca*, *to*I, occurs in the Owen Member but again no single zone was recognized in this unit.

In summary, only the Lower *Palmatolepis gigas* Zone has been identified in the Lime Creek Formation. However, the presence of other longer ranging species indicate that the entire formation is early Upper Devonian, *to*I.

Five distinct conodont faunas have been reported from the Sweetland Creek Shale (Klapper and Furnish, 1963). These faunas are referred to Ziegler's *Ancyrognathus triangularis*, Lower *Palmatolepis gigas*, Upper *P. gigas*, and Middle *Palmatolepis triangularis* zones.

Müller and Müller (1957) described conodonts from the Independence Formation of the type area in Buchanan and Benton counties. These conodont faunas are referrable to the *Ancyrognathus triangularis*, Lower *Palmatolepis gigas* and Upper *P. gigas* zones.

It would seem likely that some of these zones in the eastern part of the state should be represented in the Lime Creek and Shell Rock formation of north-central Iowa. The *Ancyrognathus triangularis* Zone, or even lower zones, may be present in the lower Juniper Hill or in the Shell Rock. The lower Juniper Hill is not well exposed, however, and the samples of the basal Juniper Hill did not contain conodonts distinctive of any particular zone. Much of the Owen Member of the Lime Creek and the Shell Rock Formation are dolomitic and contain many stromatoporoids. These units have yielded only very few conodonts.

Sheffield Formation.

Thomas (1925) assigned the Sheffield Formation to the Kinderhook Group. Van Tuyl (1925) also included the Sheffield in the Kinderhook Group but stated that the lower 40 feet may prove to be Upper Devonian. Most of these early references to the Sheffield included the dolomitic beds, which are now known as the Aplington, as part of the Sheffield Formation. Laudon (1935) stated that the Sheffield fauna (from the Aplington) was definitely Devonian but Moore (1935) assigned the Sheffield to the Kinderhook Series.

Younquist and Peterson (1947) described a conodont fauna from the Sheffield shales. They concluded that the abundance of *Icriodus* probably indicated an Upper Devonian age. Müller and Müller (1957, p. 1077) reported that they had secured a "highly advanced species of *Palmatolepis* (*Manticolepis*)" from

the Sheffield Formation and suggested an age of uppermost *Manticoceras* Zone or slightly younger.

The conodont fauna recovered from the Sheffield in the present study corroborates the above conclusion. Forms transitional from *Palmatolepis triangularis* to *P. quadrantinodosalobata* occur in the Sheffield. These forms occur in upper *to*Iδ through lower toIIα strata in Germany (Ziegler, 1962b, table 4). A consideration of the ranges of other species found in the Sheffield (Table 2) supports this correlation with highest *Manticoceras* Zone and/or lower *Cheiloceras* Zone.

Table 2. Occurrences of selected conodont species from the Sheffield, Aplington and "Maple Mill" formations.

Species	European Range	Sheffield	Aplington	"Maple Mill"
Icriodus alternatus	(?) *to*Iδ-*to*IIIα	X	.	.
I. constrictus		.	X	.
I. costatus		.	X	X
I. iowaensis		X	X	.
I. rectus	*to*I/*to*II-*to*IIIα	X	.	.
Nothognathella bicristata	*tmo*/*to*I-*to*Iγ	X	.	.
Palmatolepis triangularis transitional to *P. quadraninodosalobata*	*to*Iδ-*to*IIα	X	.	.
P. minuta minuta	*to*I/*to*II-*to*IIIβ	X	.	.
Pelekysgnathus inclinata		.	.	X
Polygnathus brevicornis		X	.	.
P. brevilamina	*to*Iδ-*to*IIα	X	X	.
P. communis	*to*V-*cu*IIIα	.	X	X
P. nodocostata	*to*Iδ-*to*IIβ	X	.	.
P. pennatuloidea	*to*IIβ-*to*IIIα	.	.	X
P. symmetrica		.	X	X
P. varinodosa		X	.	.
Polygnathus cf. *P. perplexa*		X	X	X
Polygnathus sp.		X	.	.

Aplington Formation.

Stainbrook (1950) excluded the upper, dolomitic portion from the Sheffield Formation and established the Aplington Formation for these carbonate beds. He designated the type section as a quarry just north of Aplington in Butler County. The Aplington is chiefly an argillaceous dolomite with minor amounts of chert.

Van Tuyl (1925) suggested that the fossils in the Sheffield (Aplington) dolomites show Chouteau affinites. Laudon (1931) discussed the Sheffield Formation (including Aplington) and listed the dominantly brachiopod fauna. From this faunal evidence, Laudon correlated the Sheffield (including Aplington) with the Chemung of New York. Later (1935, p. 246), Laudon indicated that the Sheffield (including Aplington) should be referred to the Late Devonian, but not necessarily to the Chemung. Moore (1935) believed that the Sheffield (including Aplington) was probably equivalent to the Maple Mill and English River and assigned it to the Kinderhook Series. Cooper *et al.* (1942) stated that the Sheffield (including Aplington) was of middle Upper Devonian age rather than Kinderhook.

Stainbrook (1950), on the basis of a brachiopod fauna, regarded the age of the Aplington as Early Mississippian and he assigned the formation to the lower part of the Kinderhook Series. However, it is now known that most of the original type Kinderhook is of Late Devonian age. Stainbrook (1947) described a brachiopod fauna from the Percha Shale of New Mexico which he considered to be of Early Mississippian age. Because the Aplington and Percha faunas were similar, Stainbrook inferred that the Aplington was of Early Mississippian age, also. However, Miller and Collinson (1951) reported the goniatite *Falciclymenia bowsheri* from the Percha. Previously, this genus was known only from the genotype, *F. falcifera,* from the *Platyclymenia*-Stufe, *to*III-*to*IV. Miller and Collinson concluded that the Percha was of "rather late Upper Devonian age." Stainbrook's correlation of the Aplington with the Percha indicates that the Aplington also is of Late Devonian age.

Schrott (1959) described a small conodont fauna from the Aplington. He regarded the frequent occurrence of *Icriodus* as indicating a Late Devonian age for the Aplington Formation.

The conodont fauna recovered from the Aplington is meager and includes some species which also occur in the Sheffield (Table 2). The fauna includes *Icriodus costatus* and *I. constrictus* which have previously been recorded from the upper Maple Mill Shale (Thomas, 1949a), and the "Clarks Fork" and Englewood formations (Klapper, 1962). Transitional forms from *I. costatus* to *Pelekysgnathus inclinata* are present in the Aplington Formation. *Pelekysgnathus inclinata* has been reported only from the Maple Shale.

Collinson (1961) reported conodont faunas from the type Maple Mill which indicate a correlation with the Saverton Shale of Illinois. Collinson *et al.* (1962) show the upper Maple Mill as correlative of the *to*IV portion of the Saverton. Klapper (1962) recorded *Icriodus costatus* in association with conodonts diagnostic of Zone *to*V. The presence of *I. costatus* in the Aplington may indicate a correlation with Zone *to*IV or *to*V. *Polygnathus communis* occurs in the Aplington and does not appear in strata older than *to*V in Europe. Although the Aplington conodont fauna is meager, it supports the assignment of the Aplington Formation to the Upper Devonian. A correlation with Zone *to*IV or *to*V cannot definitely be made, although it is probable. The Aplington is considered to be a dolomitic facies of the upper Maple Mill Shale.

"Maple Mill Shale"

Bain (1895) used the name "Maple Mill" for the dark gray shales which underline the English River Siltstone in Washington

County. He considered the Maple Mill as basal Kinderhook. Moore (1928) referred to the Maple Mill as the basal member of the Hannibal Formation and considered it as belonging to the Kinderhook Series. In 1935 Moore stated that the English River and "part or all" of the underlying Maple Mill were equivalent to the Hannibal Formation. Laudon (1931) considered the Maple Mill as the basal formation of the Kinderhook Series, resting uncomformtbly on the Sheffield or Cedar Valley formations and conformably underlying the English River Siltstone.

Only the upper 10-20 feet of the Maple Mill Shale are exposed at the type locality but the formation attains a thickness of 200-300 feet in the subsurface. Surface exposures of the Maple Mill are unknown in north-central Iowa but about 10 feet is reported from wells in Franklin County. About 17 feet of "Maple Mill" was recovered from a core at locality 26 in Webster County. As noted previously, Maple Mill is used here in an informal sense for the shales which overlie the Aplington in north-central Iowa. The entire sequence of "Maple Mill", Aplington and Sheffield may actually correspond to the complete Maple Mill Shale of southeastern Iowa.

Peterson (1947) described conodonts which he considered to be from the Maple Mill Shale. The collection included both diagnostic Upper Devonian and Lower Mississippian conodonts. It is probable, therefore, that the Mississippian forms are from the English River Siltstone.

Thomas (1949a) described an Upper Devonian conodont fauna from the Maple Mill Shale. He suggested a correlation with the Saverton Shale of Missouri (Grassy Creek of his usage).

Collinson (1961) noted that he and Allan J. Scott had recovered conodont faunas from the type section of the Maple Mill which indicate that this formation is correlative with the Saverton Shale of Missouri. Collinson *et al.* (1962) correlated the upper Maple Mill with the *to*IV portion of the Saverton Shale.

Samples from "Maple Mill" cores at locality 26 contained *Pelekysgnathus inclinata* and *Icriodus costatus* which Thomas (1949a) reported from the type locality of the Maple Mill. Other species that occur in the "Maple Mill" at locality 26 are shown on Table 2.

"English River Siltstone"

Bain (1895) used the term "English River" from the "sandstones and gritstones" underlying the Wassonville Dolomite and overlying the Maple Mill Shale in Washington County. Moore (1928) considered the English River as a member of the Hannibal Formation. Laudon (1931) regarded the English River as a formation in the Kinderhook Series. He stated that the English

River unconformably underlies the Hampton Formation and conformably overlies the Maple Mill Shale in southeast Iowa. Moore (1935) considered the English River as a formation in the Kinderhook Series.

House (1962, p. 263) recognized clymeniid ammonoids in the English River Siltstone at Burlington, Iowa This is the first evidence suggesting the presence of upper Famenian ammonoids, (*Clymenia* Zone-*Wocklumeria* Zone), in North America. Therefore, the Devonian-Mississippian boundary at Burlington must be drawn above the English River and below the base of the McCraney.

Collinson (1961) mentioned the presence of Upper Devonian conodonts in the English River Siltstone at Burlington. However, conodont faunas from the English River at the type locality in Washington County are of Lower Mississippian age (Thomas, 1949a; Collinson, 1961). Conodonts from the "English River Siltstone" in north-central Iowa indicate a Lower Mississippian age (upper *cu*I-*cu*IIα), although no single zone can be recognized (Table 2).

A study of well logs of the Iowa Geological Survey indicates that two siltstones are sometimes present in north-central Iowa. The upper one has been called "Prospect Hill" and the lower one "English River." A carbonate unit separates those two siltstones in some sections and it has been called "McCraney". Only one siltstone was encountered in surface exposures and it is referred to as "English River" in this report. However, the exact assignment of this siltstone cannot be made without a regional stratigraphic analysis and the usage "English River" herein is in an informal sense. Conodont faunas reported from the English River and Prospect Hill (Thomas, 1949a; Youngquist and Patterson, 1949) are nearly identical.

The "English River" is apparently not everywhere present in north-central Iowa but where present it represents the oldest Mississippian unit. It underlies the Hampton Formation and overlies the "Maple Mill" or Aplington formations. Well logs for Franklin County indicate that a siltstone overlies the "Maple Mill" at some localities. At subsurface locality 26 the "English River" is also present, overlying the "Maple Mill."

Hampton Formation.

Laudon (1931) proposed the name "Hampton" for strata of the Kinderhook Series in north-central Iowa. The name is derived from the city of Hampton in Franklin County. The Hampton was divided into four members: the Chapin, the Maynes Creek, the Eagle City and the Iowa Falls. The names of these members had been proposed by Van Tuyl (1925). In south-

Table 3. Occurrences of selected conodont species from the English River Siltstone and the Maynes Creek Member of the Hampton Formation.

Species	European Range	English River	Maynes Creek
Elictognathus bialata	*cu*I-*cu*IIα	X	.
Polygnathus inornata	*to*V-*cu*IIIα	X	.
P. longipostica		X	.
P. symmetrica		X	.
P. communis	*to*V-*cu*IIIα	X	X
P. scobiniformis		X	.
Spathognathodus crassidentatus		X	X
S. linquiferus		.	X
Spathognathodus sp.		.	X
Siphonodella cooperi		X	.
S. duplicata var. A		X	.
S. obsoleta	middle *cu*I-*cu*IIβ/γ	X	X
S. quadruplicata		X	X

eastern Iowa, Laudon divided the Hampton Formation into the North Hill (lower) and Wassonville (upper) members. In (1935) Laudon stated that the Hampton should be redefined by excluding the North Hill Member and the "lower gray limestone ledges" of the Chapin. Workman and Gillette (1956) removed the North Hill Member of Laudon (1931) and elevated it to a group which included the McCraney, Prospect Hill and Starrs Cave formations.

The Chapin and Maynes Creek members, as used by Laudon (1931), are included in this report. The Iowa Falls and Eagle City members are not treated.

Chapin Member.

Van Tuyl (1925) used the name "Chapin" for the "limestones, dolomitic limestones and fine grained yellow sandstones" which underlie the Maynes Creek. The Chapin was named for exposures in a small quarry one mile west of Chapin, Franklin County. Van Tuyl gave the Chapin formational status.

Laudon (1931) considered the Chapin as the basal member of the Hampton Formation. He stated that the Chapin consisted of an upper 8 feet of oolitic limestone and a lower 24 feet of thin bedded gray limestone. He remarked that the upper oolitic portion was exposed at the type quarry. Laudon considered the Chapin to correlate with the North Hill Member (of his 1931 usage) of southeastern Iowa and noted that the fauna of the Chapin was closely related to the fauna of the Chouteau of Missouri.

The lithology of the Chapin at the type quarry is similar to the Maynes Creek, except that it does not contain chert. No oolitic beds could be found at the type quarry although some of the crinoidal debris give certain beds a pseudo-oolitic appearance. The type section is not a good one and it is questionable if the Chaplin at its type locality should be distinguished from the Maynes Creek Member. However, at LeGrand in Marshall County a well developed oolite occurs below the Wassonville (a Maynes Creek correlative). The name "Chapin" is used

here to refer to the exposures at the type quarry but this member was not recognized in other surface exposures. No conodonts were obtained from the Chapin.

A short distance west of the type Chapin quarry the Aplington is exposed along a creek bank. If a siltstone is present at the base of the Kinderhook here it must be very thin. It is probable that the Chapin represents the basal Mississippian unit at this location.

Stainbrook (1950, p. 367) reported an exposure of the Aplington-Chapin contact near the middle of the section line between sections 13 and 14, T. 91 N., R. 19 W., Geneva Township, Franklin County. This section was visited but is very poorly exposed at the present time. Samples were collected and processed for conodonts but proved to be barren. At this locality the beds referred to the Chapin by Stainbrook were stated to be oolitic. These beds could not be found but a sublithographic limestone was noted which is distinct from any unit in the Aplington.

Maynes Creek Member.

Van Tuyl (1925) prosposed the Maynes Creek for exposures along Maynes Creek in Franklin County. He considered it as a formation in the Kinderhook Group, overlying the Chapin and underlying the Eagle City. The Maynes Creek is a brown, cherty dolomite. The cherts are generally fossiliferous. The Maynes Creek correlates with the Wassonville of southeastern Iowa and is similar lithologically.

Laudon (1931) regarded the Maynes Creek as a member of the Hampton Formation. He considered the Maynes Creek fauna as related to the Chouteau of Missouri.

Youngquist and Downs (1961) described a small conodont fauna from the Wassonville which indicated a Kinderhook age. The small conodont fauna obtained from the Maynes Creek is indicative of a Kinderhook age, upper *cu*I-*cu*IIα (Table 3).

Summary and Conclusions

With the exception of the Lower *Palmatolepis gigas* Zone, distinct zones have not been recognized in the Upper Devonian and Lower Mississippian strata of north-central Iowa. For this reason, the occurrences and ranges of selected conodont species are shown on tables 1-3. The European ranges are taken from Bischoff and Ziegler (1957), Bischoff (1957), Helms (1961), Voges (1959) and Ziegler (1958, 1962a, 1962b). The correlations discussed in the previous section and shown in figure 4 are based on these ranges and occurrences.

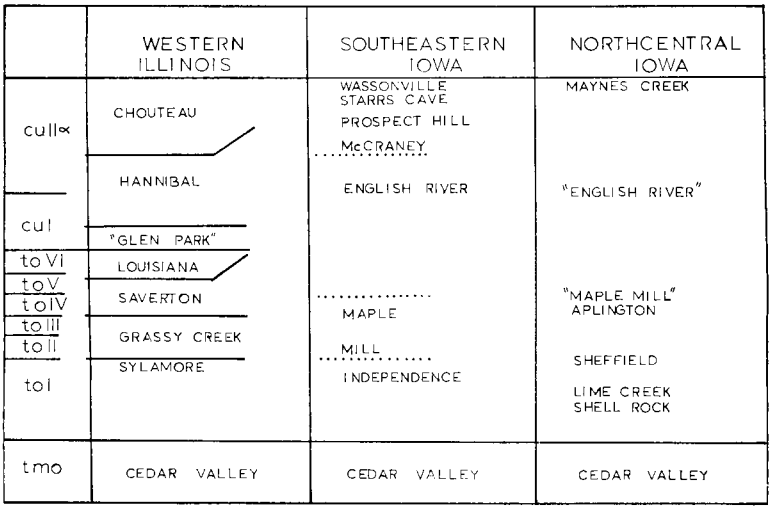

Figure 4. Correlation chart. The columns representing W. Ill. and SE. Ia. are adapted from Collinson (1961) and Collinson *et al.* (1962).

The upper Juniper Hill and most of the Cerro Gordo members of the Lime Creek Formation are assigned to the Lower *Palmatolepis gigas* (= *P. rhenana*) Zone, *to*Iγ. Ranges of species occurring in the Sheffield suggest an assignment to zones *to*Iδ -*to*IIα. The Aplington Formation may correlate with Zone *to*IV or *to*V. The "English River Siltstone" and Maynes Creek Dolomite contain species with ranges which indicate upper *cu*I-*cu*IIα. *Siphonodella quadruplicata* and *S. obsoleta* occur in the "English River" and Maynes Creek. These species are listed as characteristic of the *Siphonodella quadruplicata-S. crenulata* Assemblage Zone of the upper Hannibal and lower Chouteau (Collinson *et al.*, 1962). These two species are not confined to this zone, however. Collinson *et al.* (1962) correlate the *Siphonodella quadruplicata-S. crenulata* Assemblage Zone with the lower part of the *cu*IIα Zone of the Lower Carboniferous of Europe.

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APPENDIX

Sample Localities

1. Concrete Materials Quarry, S.W. of Garner, SE¼, SE¼, sec. 11, T. 95 N., R. 24 W., Liberty Township, Hancock County.
2. Northwestern Portland pit in Mason City, NW¼, SE¼, sec. 8, T. 96 N., R. 20 W., Mason City Township, Cerro Gordo County.
3. Road cut on S. side of county road D, Bird Hill, NE¼, NE¼, sec. 24, T. 95 N., R. 19W., Owen Township, Cerro Gordo County.
4. Old quarry on E. Side of Hwy 65, SW¼, SE¼, sec. 3, T. 94 N., R. 20 W., Geneseo Township, Cerro Gordo County.
5. E. side of Hwy 65, SW¼, SW¼, sec. 22, T. 94 N., R. 20 W., Geneseo Township, Cerro Gordo County.
6. Lillibridge Quarry, S. of Rockwell, SE¼, SW¼, sec. 26, T. 94 N., R. 20 W., Geneseo Township, Cerro Gordo County.
7. E. bank of Shell Rock River, NE¼, SE¼, sec. 7, T. 96 N., R. 18 W., Rock Grove Township, Floyd County.
8. S. of Nora Springs on Shell Rock River, SW¼, NW¼, sec. 17, T. 96 N., R. 18 W., Rock Grove Township, Floyd County.
9. Old quarry E. of Nora Springs, center NE¼, sec. 17, T. 96 N., R. 18 W., Rock Grove Township, Floyd County.
10. Old Rock Grove Mill site, S.E. of Nora Springs, SW¼, NE¼ sec. 20, T. 96 N., R. 18 W., Rock Grove Township, Floyd County.
11. N. bank of Lime Creek, W. of Rockford, SE¼, SE¼, sec. 9, T. 95 N., R. 18 W., Rockford Township, Floyd County.
12. S.W. of Rockford, center NW¼, sec. 16, T. 95 N., R. 18 W., Rockford Township, Floyd County, Rockford Brick and Tile Co. pit.
13. N. bank of Lime Creek, S. of Rockford, W. of bridge, SW¼, NE¼, sec. 15, T. 95 N., R. 18 W., Rockford Township, Floyd County.
14. E. side of Hwy 65, SW¼, SW¼, sec. 10, T. 93 N., R. 20 W., Clinton Township, Franklin County.
15. Sheffield Brick and Tile Co., pit, center NW¼, sec. 16, T. 93 N., R. 20 W., Ross Township, Franklin County.
16. W. of Chapin, SW¼, SW¼, sec. 29 T. 93 N., R. 20 W., Ross Township, Franklin County.
17. E. of Hwy. 65, opposite Chapin Road, SW¼, SW¼, sec. 27, T. 93 N., R. 20 W., Ross Township, Franklin County.
18. W. of Chapin, NE¼, NE¼, sec. 31, T. 93 N., R. 20 W., Ross Township, Franklin County.
19. E. of Chapin, NW¼, NW¼, sec. 36, T. 93 N., R. 20 W., Ross Township, Franklin County.
20. Old pit E. of Sheffield, SW¼, SE¼, sec. 7, T. 93 N., R. 19 W., West Fork Township, Franklin County.
21. Creek bank, N.E. of Hampton, NE¼, SW¼, sec. 18, T. 92 N., R. 19 W., Ingha Township, Franklin County.
22. Phillip's Quarry, N.W. of Geneva, SE¼, NE¼, sec. 13, T. 91 N., R. 20 W., Reeve Township, Franklin County.
23. Phillip's Quarry, N.W. of Geneva, center, NW¼, sec. 18, T. 91 N., R. 19 W., Geneva Township, Franklin County.
24. Old quarry, N.E. of Ackley, SW¼, NE¼, sec. 31, T. 90 N., R. 18 W., Washington Township, Butler County.
25. Quarry, N. of Aplington, SW¼, SW¼, sec. 20, T. 90 N., R. 17 W., Monroe Township, Butler County.
26. Northern Natural Gas Co., Peterson #1 core, N. of Vincent, NE¼, NE¼, NE¼, NW¼, sec. 10, T. 90 N., R. 27 W., Newark Township, Webster County.