The Niagaran (Middle Silurian) Macrofauna of Northern Indiana: Review, Appraisal, and Inventory

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Abstract

During the past 130 years more than 360 subgeneric taxa of macrofossils were identified from a few score collection sites in Niagaran (middle Silurian) rocks cropping out in northern Indiana. These fossils served geology well when primary paleontological objectives were to discover and to describe faunas and to use them for stratigraphic correlation. More than this, they came to occupy a niche of special importance in paleontological and stratigraphic literature because they were closely associated with development of the concept of Silurian reefs.

Emphases in paleontological purpose wax and wane, however, and, particularly in the example of the Niagaran fossils of northern Indiana, much recent revision of their assigned stratigraphic order of succession allows this rhetorical question to be asked: what is the residual value of the long but outdated record of Niagaran species in northern Indiana? The record may prove to be even more meaningful than ever before, and to that end this threefold synthesis of updated paleontological data will be a basis for future studies having primary emphases in phylogeny, paleoecology, biozonation, and economic geology:

1) A listing of 366 taxa of subgeneric rank intended to include all Niagaran macrofossils previously identified in northern Indiana.

2) Identification of all species occurrences in terms of stratigraphic units, distances in feet above or below the base of the Waldron Formation, and paleoenvironments (reef vs. interreef or nonreef).

3) Listing of locations of 46 collection sites representing all the recorded species.

Review

Perspective

Cumulative lists of fossil species have been termed a form of pushbroom paleontology. The species of the Niagaran (middle Silurian) macrofauna of northern Indiana are a little like that. The purpose here, nonetheless, is to sweep them a little farther and to suggest the value of this effort. This fauna[1] is one of the classic North American invertebrate faunas. It may number as many as 400 subgeneric taxa, including the synonyms. During the last half of the 19th Century, these Silurian fossils were caught up in the then-grand task of geologists: to decipher the crustal history of the earth, in large part by describing and correlating the sedimentary rocks and their fossil contents on regional, inter-regional, and intercontinental scales. Marine invertebrate fossils constituted the great tool, and still do. Periodically, however, we must see how well the tool has served and, if necessary, refurbish it.

[1] The macrofauna discussed here comes from the formations in northern Indiana that traditionally have been referred to the Niagaran Series (middle Silurian). Thus, the species from the Kokomo and Kenneth Limestone Members of the Salina Formation are excluded even though they could be the same age as some species assigned to the Niagaran Series. Also excluded, therefore, is the Salina fauna referred by Cumings and Shrock (8) to the so-called "Huntington Dolomite" near Logansport that was not then included in the Kokomo and Kenneth lists.

The Basic Studies

The Silurian age of much of the bedrock exposed in the upper basins of the Wabash River and of the West Fork of the White River in northern Indiana was identified by paleontologic means more than 135 years ago by David Dale Owen (17). Subsequently, many geologists compiled special fossil lists during the course of their late 19th Century county and regional reports. The 1898 catalogue of Indiana fossils (12) numbers 72 subgeneric entries for the Silurian of northern Indiana. By 1904, the time of the first comprehensive study of Silurian paleontology in northern Indiana (13), the list had grown to 110 subgeneric taxa, but that number did not include the corals and some other groups of species. A 1915 list (1) republished in 1926 (5) suggests that the number of valid species had shrunk to less than 100, but at the time of the last full coverage in 1928 (8) approximately 275 species and a few subspecies had been indexed.

Since 1928 the known Niagaran macrofauna has been augmented in two principal ways: 1) by a 1930 list (6) for new faunal discoveries made in a reef at Lapel in Madison County and in the collective strata then called the New Corydon Limestone in the area extending from northern Huntington County to Adams and Jay Counties; and 2) by a 1939 list (3) that treated of faunas common to east-central northern Indiana and adjacent Ohio. Neither of these lists had been integrated with the comprehensive 1928 list in terms of a whole faunal perspective.

Concept of Silurian Reefs

The Niagaran macrofauna of northern Indiana has been allied with the development of a major geologic concept, that of fossil reefs. The many outcropping Silurian reefs in the upper Wabash basin also are objects of classic study. Once thought to be evidences of structural upheaval, by Gorby (11), for example, or to have origins like that of Mississippi River mudlumps (13), they are now understood in their true significance. It is partly the fossils in the lists mentioned above that have provided such convincing evidence in the particularly capable hands of Cumings and Shrock (7, 8, 9) that the Silurian faunas and reefs of northern Indiana have assumed a special place in paleontological and stratigraphical literature. Credit must also be given to Phinney (18), however, who in 1891 proposed that organic reefs probably accounted for the previously misidentified moundlike structures in northern Indiana, and before him, to Chamberlin (4), who in 1877 ascribed such origins to similar Silurian rock structures in eastern Wisconsin.

That these earlier fossil studies served a vital need, there can be no doubt, but in later years increasing need to scrutinize the meaning and usefulness of the old faunal lists of Niagaran species has arisen.

Appraisal

Stratigraphic Revision

As one measure of the need, we have learned that the validity of conclusions resulting from the biostratigraphic studies mentioned above has suffered more than might be expected because of the lack of subsurface data to be used along with fossil species for the identification and correlation of the Silurian rock units. Many of the species listed in the 1928 compilation (8) as Liston Creek species are in fact Louisville species; some of the listed Huntington species belong to a reeflike, or at least to a bioclastic, high-energy facies in the Salina Formation; the remaining Huntington species for the most part represent reef, reef-flank, and near-reef faunas of the same ages as the more strictly interreef Mississinewa and Liston Creek faunas; and the New Corydon species now are to be assigned to parts of the section ranging from the Salamonie upward to the Liston Creek. (See Figures 1 and 2 herein for the order of Silurian stratigraphic succession in northern Indiana and Pinsak and Shaver (19), Shaver *et al.* (24), and

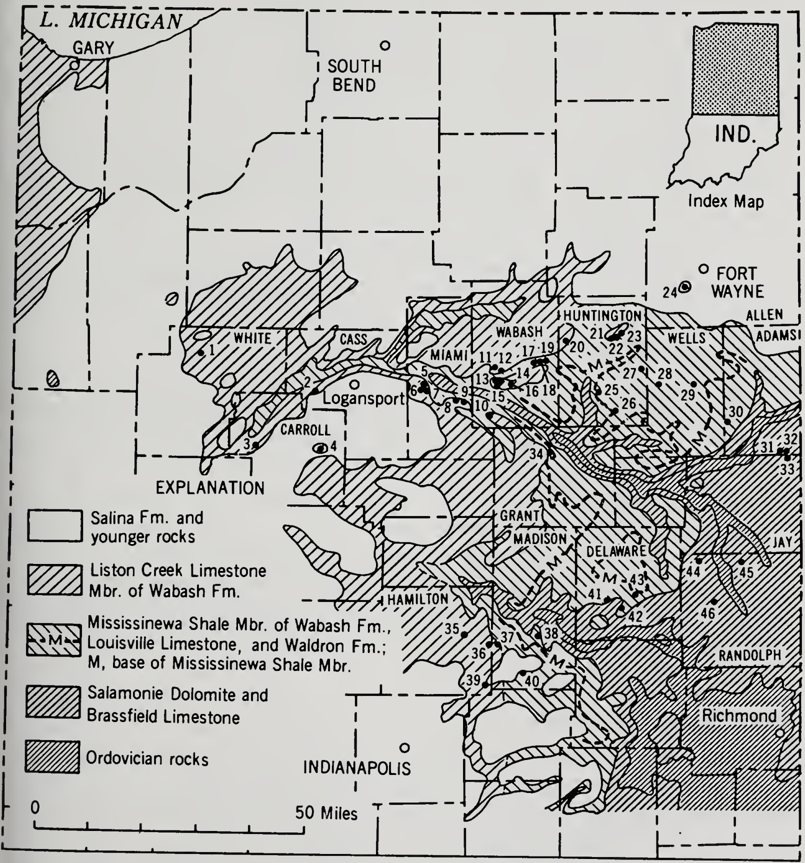

FIGURE 1. *Map of northern Indiana showing areal distribution of Niagaran (middle Silurian) rock units and fossil-collection sites. The Brassfield Limestone, included with the Salamonie Dolomite in one map unit, belongs to the Alexandrian Series (lower Silurian). See Appendix 2 for exact geographic coordinates of collection sites and Figure 2 for their relative stratigraphic positions.*

the Chicago, Danville, Fort Wayne, and Muncie sheets of the Indiana Geological Survey Regional Geologic Map for establishment of present understanding of stratigraphic order.) To whatever extent such problems with stratigraphic identification call into question the validity of the older lists, it seems at least equally clear that new stratigraphic collation is needed to enhance the residual value of the early paleontologic work.

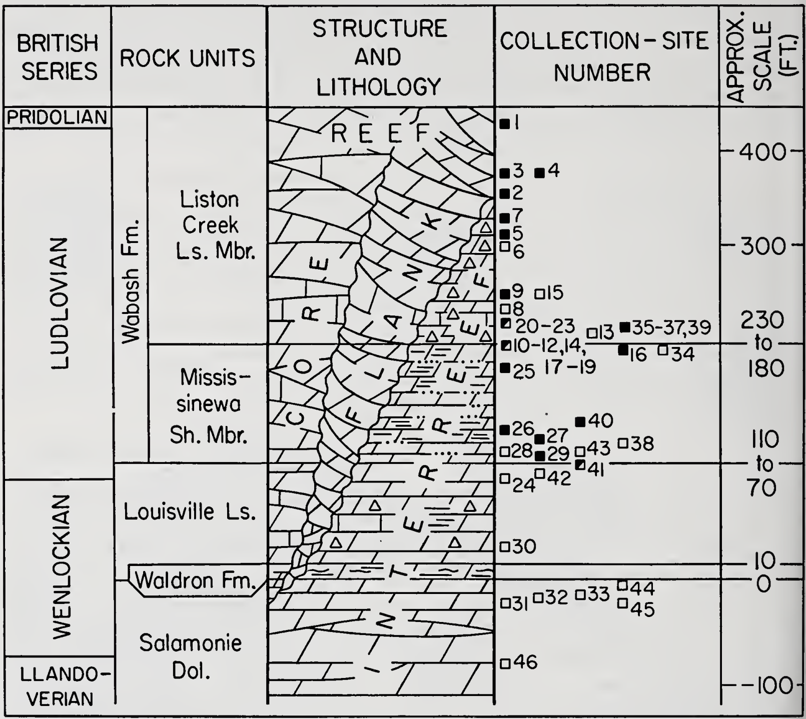

FIGURE 2. *Chart showing stratigraphic relationship for collection sites for 366 species of Niagaran (middle Silurian) macrofossils of northern Indiana. See Figure 1 and Appendix 2 for geographic locations of sites. Symbols: solid squares, reef or reef-flank sites; open squares, interreef or nonreef sites; half-closed squares, both kinds of sites.*

Paleontological Purpose

The main body of the accumulated list of Niagaran macrofauna (Appendix 1) has seen little addition for several decades. It reached its present proportions during a period when an unstated prevalent theme was that the identification of fossil species and their description was sufficient justification in itself for paleontological study, although such effort, to be sure, was usually made for the purpose of stratigraphic correlation. Further, early paleontological work was conducted with an appreciable amount of comfort provided by the type-specimen method employed in taxonomy. Even though the paleontologist's basic purpose may have been to correlate, it was easy for him during the period of fossil discovery to assume that his particular collection was a more independent entity than later years have proved it to be.

Expectably, then, present usefulness of paleontological work that is decades old suffers somewhat in proportion to changing methods and emphases. All the early objectives may still be valid, whether identification, description, or correlation, but present objectives in paleontology certainly partake more of phylogenetic and paleoenvironmental considerations. Updating of data on stratigraphic order and facies relationships is a prerequisite.

Refinement of Reef Concept

During the 1940's and 1950's H. A. Lowenstam (14, 15, 16) helped significantly to refine the still-developing concept of Silurian reefs, a concept that has much taken from it to be applied throughout the geologic column, even to the classification of modern reefs. A reef and its organic skeletal structure are partly what they are in contrast to what they are not, and it remained for Lowenstam (14) to put to rest any lingering question of the value of distinction between reef and interreef faunas of Silurian age. Few geologic applications are more dramatic than that made to the traditional geologic belief in the so-called "southern and northern Silurian faunas" and in the two supposedly separate North American seaways and an intervening barrier. Any such remaining paleogeographic concept vanished upon Lowenstam's (14) distinguishing between interreef ("southern") and reef ("northern") faunas. So much of the northern collections from the Great Lakes area proved to consist of reef faunas that sometimes the reef dominance tended to obscure the significance of the lesser parts of northern collections that are at least *nonreef*, if not always strictly *interreef*, in origin. Although distinctions between reef and interreef faunas were made in the earlier period of study, the so-called Huntington fauna, as one example, was thought to come from a distinctly younger formation rather than from the reef to near-reef facies it represents of the basically interreef Mississinewa Shale and Liston Creek Limestone Members of the Wabash Formation (Fig. 2). Thus, even this basic distinction remained until this time to be completed for northern Indiana. A vital part of the Lowenstan concept of Silurian reefs is the interdependence of community (and possibly organic) evolution and the growth of reefs in terms of structure, geometry, composition, and environmental factors. Obviously, no completely valid weighing of this relationship has yet been made in northern Indiana, because so many species (as indicated above) have remained confused in their stratigraphic identities. A study to be published in 1974 (23), however, integrates the Niagaran macrofauna of northern Indiana with modern stratigraphy and the reef concept. The results suggest a major paleogeographic role for the fauna and the reefs in the depositional regimen of the Silurian evaporate-carbonate sequence in the Michigan Basin.

Economic Considerations

A further significance of Silurian reef faunas is economic inasmuch as nearly 100% of reef rock is made up of fossil material, although not at all wholly of taxonomically identifiable entities, and economic exploitation of the reefs presently is increasing, not decreasing.

Much of the crushed stone and other stone-resource industry in northern Indiana and elsewhere in the Great Lakes area is based on Silurian reefs. Reserves, for example, are a function of reef geometry. At the time of writing, buried Silurian reefs formed major reservoirs for oil production in Michigan and formed lesser ones in Illinois and in Indiana. In southwest Indiana the petroleum industry was engaged in a new burst of exploration interest in buried reef structures.

No exaggerated assessment of economic value in modernizing the faunal lists is intended, but it seems obvious that the older paleontological work has become more valuable for pursuing newer kinds of geologic studies than ever its perpetrators thought possible. Whether these studies emphasize environmental reconstruction (*e.g.*, of paleogeographic and physical factors), diagenesis (including dolomitization and development of porosity), or reef geometry and composition, they have potential economic application, and they suggest that interested paleontologists would do well to take their turn with the pushbroom.

Inventory

Revised Macrofaunal List

Some 366 macrofaunal taxa of subgeneric rank have been appraised from the Niagaran rocks of northern Indiana (Appendix 1) in terms of their geographic sources and stratigraphic positions (Figs. 1 and 2, Appendices 1 and 2) and listed in accord by major taxonomic group and facies (nonreef or interreef and reef, including reef flank) (Appendix 1). Three primary literature sources (3, 6, 8) yielded most of the names, but nine other sources, noted as footnotes to Appendix 2, completed the record. The record that is intended to be complete as of early 1973 is the one of fossil names and geographic and stratigraphic positions for each, not at all the list of authors who recorded occurrences. Each source thus yields at least one name or occurrence that would not have appeared otherwise in the list. The list probably has omissions, and interested readers are invited to inform the compiler of omissions.

Some of the sources contain sufficient synthesis of earlier information as to eliminate therein synonyms and invalidly proposed names, as well as to carry forward the more soundly used names. I have not rendered my own taxonomic judgment; that is, I have included what would be synonyms in newer taxonomic work, and have accepted, in effect through this manner of compilation, at least some of the judgment on synonyms that was rendered by earlier workers. Neither have I attempted to use the most up-to-date generic names, my method being to leave the status of these as they were found.

New taxonomic treatment would do much to reduce the species list, by perhaps as much as a third, and the stratigraphic and facies data supplied here should be vital to taxonomic revision. Of course, taxonomic revision has been going on, but all of it is not reflected in Appendix 1 because of the manner of compilation. A perhaps extreme example is provided by the pentameracean brachiopods (particularly *Conchidium* and *Pentamerus*). A few newer but here unlisted generic names are also presently needed to encompass the 26 species listings, of which probably more than half should be considered as synonyms. Altogether, Appendix 1 hardly suggests by itself the reliable pentameracean zonation in use for Silurian rocks (1, 25).

Repository

Much of the taxonomic evaluation made by Cumings and Shrock (8), partly as a summary of other work, is based on uncatalogued specimens in the Indiana Geological Survey-Indiana University (IGS-IU) paleontological collections. These collections include types for the well-known graptolite fauna described by Shrock (26) and listed in Appendix 1. Also included is a fossil collection (IGS-IU, InGS4-28) from Huntington and Wabash Counties (W. J. Wayne, unpubl. data, 21) (see Appendix 2). Part of Kindle and Breger's (13) types are in the U.S. National Museum (62258-62369). Busch's (3) collection, made partly in east-central Indiana and northward, is housed at The Ohio State University. Altogether, the species listed in Appendix 1 are fairly well documented for Indiana by reposited specimens, but some of the specimens of record were in private collections, and undoubtedly some of the earliest collections were lost or destroyed.

Acknowledgments

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APPENDIX 1

List of subgeneric taxa of Niagaran (middle Silurian) macrofossils of northern Indiana keyed to stratigraphic and geographic relationships.[1]

Receptaculitids

Receptaculites sp., Sa —35 (IR), LC 190 (RE).

Sponges

Astraeospongia n. sp. Lowenstam, LC 235 (IR).

Conulariids

Conularia niagarensis Hall, Sa —20 (IR).

Stromatactids

Stomatactis sp., Mi-LC 203, 208±, 228±, LC 220, 350 (RE).

Stromatoporoids

Clathrodictyon sp., Lo 100 (IR); Mi 85, LC 190, 220 (RE). *C. fastigiatum* Nicholson, LC 185 (IR). *C. ostiolatum* Nicholson, LC 185 (IR). *C. vesiculosum* Nicholson & Murie, Mi 105, LC 185 (IR); Mi (RE). *C. v. minutum* (Rominger), LC 185 (IR). *Stromatopora* sp., Lo 30 (IR); Mi 130, 140, 175, LC 185 (RE). *S. antiqua* (Nicholson & Murie), Sa —20, —35, Lo 75, LC 185 (IR), Lo 76, Mi 85, 130, LC 190 (RE). *S. constellata* Hall, Sa —20 (IR); Mi 85 (RE).

Tabulate corals

Alveolites sp., LC 185 (IR); Mi 130, LC 190 (RE). *A. louisvillensis* Davis, LC 190 (RE). *A. undosus* Miller, LC 185 (IR). *Coenites* sp., Sa —10, —35, Lo 90, LC 185 (IR); LC 190, 192, 220 (RE). *C. aculeata* (Davis), Lo 75 (IR). *C. laqueata* (Rominger), Sa —30, Lo 75, Mi 105, LC 185 (IR); Lo 76 (RE). *C. macrophora* (Hall), Mi 140 (RE). *C. multipora* (Hall), Mi 130, 140, LC 185 (RE). *C. reticulata* (Hall), Sa —30, —35, LC 185 (IR); Lo 76, Mi 85, 130, LC 185 (RE). *C. striata* (Davis), Sa —30, Lo 75 (IR). *Favosites* sp., Sa —10, —35, Mi 105, LC 180 (IR); Mi 85, 130, 140, 175, LC 185, 210±, 220, 350, 370, 375 (RE). *F. favosus* (Goldfuss), Sa —20, —30, —35?; Lo 75, Mi 105, LC 185 (IR); Lo 76, Mi 85, 130, 140, LC 185, 190, 192, 233±, 425 (RE). *F. forbesi* Edwards & Haime, Sa —10, —30, Lo 75 (IR); LC 350 (RE). *F. forbesi occidentalis* Hall, Sa —35 (IR); LC 185 (RE). *F. hisingeri* (Edwards & Haime), Sa —20, —35, LC 185 (IR); Mi 85, 130, LC 185, 190 (RE). *F. hispidus* Rominger, LC 185 (IR); LC 350 (RE). *F. niagarensis* Hall, Sa —10, —20, —25, —30, —35, Lo 75, LC 185, 240± (IR); Lo 76, Mi 85, 130, 140, LC 185, 190, 191, 192, 220, 320, 425 (RE). *F. occidens* Whitfield, Sa —35 (IR); Mi 85, LC 425 (RE). *Halysites* sp., Mi 85, LC 375 (RE). *H. catenularia* (Linnaeus), Sa —20, —25, —30, —35, —80, Lo 30, 75, Mi 105, LC 185, 233±, 240± (IR); Lo 76, Mi 85, 130, 175, LC 190, 350 (RE). *H. catenularia microporus* (Whitfield), Lo 30 (IR), Mi 85, 130, 175 (RE). *H. labyrinthicus* (Goldfuss), Sa —10, —30, LC 185 (IR); Mi 85; LC 185, 190, 425 (RE). *Romingerella* sp., LC 350 (RE). *Syringopora* sp., LC 185 (IR); Mi 85, LC 192 (RE). *Thecia major* Rominger, Lo 75, LC 185 (IR). *Thecia minor* Rominger, LC 185 (IR); Mi 85, LC 190 (RE).

Nontabulate corals

Amplexus sp., Sa —10 (IR); Mi 85, 130, LC 190, 425 (RE). *A. shumardi* (Edwards & Haime), Sa —80, Lo 75, LC 185 (IR); Mi 85, LC 190, 370 (RE). *Arachnophyllum pentagonum* (Goldfuss), Sa —30, LC 185 (IR); Mi 85 (RE). *A. striatum* (D'Orbigny), Sa —30, Lo 75, LC 185 (IR); Mi 85 (RE), *Blothrophyllum* sp., Sa —35 (IR). *Chonophyllum* sp., Sa —35, LC 185 (IR). *Cyathophyllum* sp., Sa —25 (IR). *C* cf. *C. radiculum* Rominger, LC 190 (RE). *Diphyllum caespitosum*, Mi 85 (RE). *Diphyphyllum* sp., LC 185 (IR). *Enteroplasma calicula* (Hall), Mi 205 (IR); LC 191, 192 (RE). *Eridophyllum rugosum* (Edwards & Haime), Mi 105 (IR). *E. sentum* Davis, Mi 85 (RE). *Fletcheria* sp., Mi 85, 130, 140, LC 185 (RE). *F. elegans* (Whiteaves), Mi 85, 130, 140, LC 190, 425 (RE). *F. guelphensis* (Whiteaves), Mi 85, 130, 140, LC 425 (RE). *Favistella* sp., LC 233± (IR). *Heliolites* sp., Lo 30 (IR). *Heliolites elegans* Hall, Lo 76, LC 190 (RE). *H. interstinctus* (Linnaeus), Sa —30, —35, LC 185 (IR); Lo 76, Mi 85, 130, 140, LC 192, 350, 425 (RE). *H. pyriformis* Guettard, Sa —35 (IR). *Lyellia americana* Edwards & Haime, LC 185

(IR); Mi 175 (RE). *Omphyma verrucosa* (Rafinesque & Clifford), Mi 175 (RE). *Plasmopora follis* Edwards & Haime, LC 185 (RE). *Ptychophyllum* sp., LC 350 (RE). *Syringopora* sp., Mi 85, 175 (RE). *S. retiformis* Billings, Mi 85 (RE). *Zaphrentis* sp., Sa —10, —30, —35, —80, Lo 75, 90 (IR); Lo 76, Mi 85, 130, LC 190, 192, 425 (RE). *Z. celator Hall,* LC 240 (IR). *Z. digoniata* Foerste, Sa —35, Lo 30 (IR); Mi 85 (RE). *Z. racinensis* Whitfield, LC 185 (IR). *Z. stokesi* Edwards & Haime, Sa —20 (IR); Mi 85, LC 190 (RE).

Graptolites

Acanthograptus walkeri (Spencer), Lo-Mi 76 (IR). *Callograptus* sp., Mi 210± (IR). *C. niagarensis* Spencer, Lo-Mi 76 (IR). *C. pullchellus* Shrock, Lo-Mi 76 (IR). *C. p. laxus* Shrock, Lo-Mi 76 (IR). *C.* cf. *C. striatus* Gurley, Lo-Mi 76 (IR). *Dendrograptus parallelus* Shrock, Lo-Mi 76 (IR). *D. praegracilis* Spencer, Lo-Mi 76 (IR). *D. ramosus* Spencer, Lo-Mi 76 (IR). *Desmograptus cumingsi* Shrock, Lo-Mi 76, Mi 215 (IR). *D. micronematodes* (Spencer), Lo-Mi 76, Mi 130, 200, 215 (IR). *D. m. magnus* Shrock, Lo-Mi 76 (IR). *Dictyonema* sp., Lo-Mi 76, Mi 130, 200, 215 (IR). *D. crassibasale* Gurley, Lo-Mi 76 (IR). *D. filiramum* Gurley, Lo-Mi 76, Mi 130, 200 (IR). *D. lyriforme* Shrock, Lo-Mi 76 (IR). *D. parallelum* Gurley, Mi 130 (IR). *D. percrassum* Gurley, Lo-Mi 76 (IR). *D. polygonum* Gurley, Lo-Mi 76 (IR). *D. polymorphum* Gurley, Lo-Mi 76, Mi 130 (IR). *D. p. virgatum* Shrock, Lo-Mi 76, Mi 130 (IR). *D. tenellum* Spencer, Lo-Mi 76 (IR). *Diplograptus* sp., Mi 215 (IR). *D. (Glyptograptus) niagarensis* Shrock, Lo-Mi 75 (IR). *Inocaulus ramulosus* Spencer, Mi 130, 215 (IR). *Medusaegraptus mirabilis* Reudemann, Lo-Mi 76 (IR). *Monograptus falciformis* Shrock, Mi 218 (IR). *Thallograptus cervicornis* (Spencer), Lo-Mi 76, Mi 130 (IR). *T. phycoides* (Spencer), Lo-Mi 76 (IR).

Bryozoans

Batostomella granulifera (Hall), LC 240 (IR). *Berenicea consimilis* (Lonsdale), LC 240 (IR). *Chilotrypa ostiolota* (Hall), Mi 210± (IR); LC 310 (RE). *C. varia* (Hall), Mi 205, LC 240 (IR). *Fenestella* sp., Sa —10±, —30, 35±, —80±, Lo 75, LC 223 (IR); Mi 130, LC 185, 190, 192, 310, 350 (RE). *F.* cf. *F. clegans,* LC 310 (RE). *F. parvulipora* Hall, LC 240 (IR). *F. prolixa* Hall, Mi 205 (IR). *Fistulipora* sp., LC 220 (RE). *F. neglecta maculata* (Hall), Mi 130, LC 192, 220, 240, 310, 320 (RE). *Lichenalia concentrica* Hall, Lo 75, Mi 200, LC 240 (IR). *Monotrypa* sp., Mi 105 (IR). *M. pediculata* Bassler, Mi 205 (IR). *Pachydictya* sp., Sa —30, —35 (IR). *P. bifurcata* (Hall), Mi 85 (RE). *Pinnatopora* sp., LC 310 (RE). *Polypora* sp., LC 310 (RE). *P.* cf *P. punctostriata* (Hall), LC 310 (RE). *Pseudohornera niagarensis* (Hall), LC 310 (RE). *Demicoscinium acumcum* (Hall), Mi 205 (IR). *S.* cf *S. acmeum* (Hall), LC 310 (RE). *Spatiopora maculata* (Hall), LC 240 (IR). *Stictotrypa? punctipora* (Hall), Mi 205 (IR). *Striatopora? flexuosa* Hall, Mi 205 (IR).

Articulate brachiopods

Anastrophia internascens Hall, Sa —35, LC 300 (IR); Mi 85, 115, LC 220, 310 (RE). *Atrypa calvini* Nettleroth, Mi 115, 130, 175, LC 190, 191, 192, 350 (RE). *A. reticularis* (Hall), Sa —10, —20, —25, —35, —80, Lo 75, Mi 205, 210±, LC 225, 240±, 300 (IR); Mi 85, 130, LC 185, 190, 191, 192, 220, 310, 350, 370 ⊠ (RE). *Bilobites bilobus* (Linnaeus), Mi 205, LC 240± (IR). *Camarotoechia* sp., Sa —25, LC 300 (IR); Mi 115, LC 185, 190, 370 (RE). *C. acinus* (Hall), Sa —10, —35, Lo 75, LC 300 (IR); LC 350 (RE). *C. indianaensis* (Hall), Sa —35, LC 300 (IR); LC 310 (RE). *C. (Stegorhynchus) neglecta* (Hall), Sa —35 (IR); LC 185, 220, 310 (RE). *C. (S.) whitei* (Hall), LC 310 (RE). *Chonetes* sp., Sa —35 (IR); Mi 115 (RE). *Clorinda ventricosa* (Hall), Sa —35 (IR); Mi 130 (RE). *Conchidium* sp., Lo 75, 100 (IR); Mi 130, LC 185, 192, 350, 370, 375, 425 (RE). *C. biloculare* Linnaeus, Mi 85 (RE). *C.* cf. *C. biloculare* Linnaeus, LC 425 (RE). *C. greeni* Hall & Clarke, LC 185 (RE). *C. knighti* Nettleroth, Mi 85 (RE). *C. laqueatum* (Conrad), Sa —30, —35, Lo 30 (IR); Mi 85, 130, LC 185, 190, 192, 350, 375, 425 (RE). *C. littoni* (Hall), Mi 85, 130, LC 190 (RE). *C.* cf. *C. littoni* (Hall), Mi 140, LC 185, 192, 350 (RE). *C. multicostatum* (Hall), Lo 100, LC 185 (IR); Mi 85, 130, LC 185, 190, 191, 192, 425 (RE). *C. nettlerothi* Hall & Clarke, Mi 85 (RE). *C.* n. sp. Busch, Mi 85 (RE). *C. nysius* Hall & Whitfield, Mi 130, LC 190 (RE). *C. occidentale* Hall, Mi 85 (RE). *C. tenuicostatum* (Hall & Whitfield), Mi 85 (RE). *C. trilobatum* Kindle & Breger, Mi 85, LC 185 (RE). *C. unguiformis* Ulrich, LC 370 (RE). *Cyrtia exporrecta* (Wahlenberg), Mi 210±

(IR); LC 375 (RE). *C. exporrecta myrtia* (Billings), Lo 75 (IR); LC 190, 350, 375 (RE). *Dalmanella elegantula* (Dalman), Sa —35, Lo 30, 75, Mi 210±, LC 300 (IR); Mi 140, LC 170, 190, 191, 192, 220, 350, 370 (RE). *Gypidula (Sieberella) galeata* (Dalman), LC 191, 220, 320, 350, 370 (RE). *G. (S.) nucleus* (Hall & Whitfield), Mi 115, LC 350 (RE). *Leptaena rhomboidalis* (Wilckens), Sa —10, —25, —30, —35, —80, Lo 75, Mi 215, LC 225, 240 (IR); Mi 115, 140, LC 190, 191, 192, 220, 310, 350 (RE). *Meristina* sp., Mi 140 (RE). *M. maria* (Hall), Sa —10, —30, —35, Lo 30, LC 185 (IR); Mi 115, LC 190, 191, 220, 240±, 350 (RE). *M.* cf. *M. princeps* (Hall), LC 350 (RE). *M. rectirostris* Hall, LC 220, 370 (RE). *Nucleospira pisiformis* Hall, LC 300 (IR); Mi 115, 140, LC 191, 192, 220 (RE). *Orthis benedicti* Miller, LC 240 (IR). *O. flabellites* Foerste, Mi 115, LC 190, 220, 320, 370 (RE). *O. subnodosa*, LC 370 (RE). *Pentamerus* sp., LC 190 (RE). *P.* n. sp. Cumings, LC 310 (RE). *P. oblongus* Sowerby, Sa —10, —20, —25, —30, —35, —80, Lo 30, 75, 90 (IR); Lo 76, Mi 130, 140, LC 185 (RE). *P. o. compressus* Kindle & Breger, LC 375 (RE). *P. o. cylindricus* (Hall & Whitfield), Sa —35, Lo 75 (IR); LC 375 (RE). *P. ovalis* Hall, Lo 30 (IR). *P. pergibbosus* Hall & Whitfield, Sa —35, Lo 30 (IR); Mi 140 (RE). *Pholidostropia niagarensis* Kindle & Breger, LC 370 (RE). *Plectambonites* cf. *P. siriceus* (Sowerby), LC 192 (RE). *Rhipidomella circulus* Hall, LC 350 (RE). *R. hybrida* (Sowerby), Sa —10±, —30, —35±, —80±, Lo 75, Mi 205, LC 300 (IR); Mi 115, 130, LC 192, 240, 310, 370, 375, 425 (RE). *Rhynchotreta cuneata* (Hall), LC 240±, 350 (RE). *Schizophoria* sp., Lo 30 (IR). *Schizotreta tenuilamellata* (Hall), Lo 75 (IR). *Schuchertella* sp., Sa —35 (IR); *S. subplana* (Conrad), Sa —10, LC 223 (IR); Lo 76, Mi 115, LC 190, 191, 220, 310, 350, 375 (RE). *S. radiatus*, Lo 75, 90, Mi 200 (IR); LC 220 (RE). *S. tenuis* (Hall), LC 220 (RE). *Spirifer (Delthyris) crispus* (Hisinger), LC 240, 300 (IR); Mi 140, LC 190, 191, 192, 310, 350 (RE). *S. (D.) c. simplex* (Hall), Sa —10, LC 300 (IR); Mi 115, LC 192, 310, 350, 370 (RE). *S. (Eospirifer) eudora* (Hall), Sa —10, —30 (IR); LC 320, 350 (RE). *S. (E.) nobilis* (Barrande), Mi 115, LC 190, 191, 192, 350 (RE). *S. (E.) radiatus* (Sowerby), Sa —10, —35, —80, LC 185 (IR); Mi 85, 115, LC 185, 191, 192, 320, 350, 370, 375 (RE). *S.* cf. *S. radiatus* (Sowerby), LC 191 (RE). *S. foggi* Nettleroth, LC 190, 192, 350 (RE). *Stropheodonta* sp., LC 191, 310 (RE). *S. (Brachyprion) profunda* Hall, Sa —10, —20, —30, —35, Lo 30, 90 (IR). *S.* cf. *S. corrugata* (Conrad), LC 350 (RE). *Stricklandinia* sp., LC 190 (RE). *S. gaspiensis* (Billings), Mi 85, LC 192 (RE). *Strophonella* sp., LC 192, 320 (RE). *S. semifasciata* (Hall), Lo 30 (IR); LC 190, 310 (RE). *S. striata* (Hall), Sa —10, —35, Lo 75, Mi 200, 205 (IR); Mi 140, LC 190, 191, 192, 220, 310, 320, 350 (RE). *S. williamsi* Kindle & Breger, Mi 115, LC 192, 350, 375 (RE). *Trematospira* sp., LC 310 (RE). *Trematospira* cf. *T. camura* (Hall), LC 310 (RE). *Uncinulus stricklandi* (Sowerby), Sa —35, Lo 90 (IR). *Whitfieldella* sp., Sa —25, —30 (IR); Mi 130 (RE). *W.* cf. *W. marylandica* Prouty, LC 190 (RE). *W. nitida* (Hall), Sa —10, —35, Lo 90, Mi 215, LC 185, 240 (IR); LC 190, 310, 350, 370, 425 (RE). *W. n. oblata* (Hall), Sa —35 (IR). *Wilsonia saffordi* Hall, LC 350 (RE). *Wilsonia* cf. *W. saffordi*, LC 310 (RE).

Inarticulate brachiopods

Crania sp., Mi 115 (RE). *Dinobolus conradi* (Hall), LC 185 (RE). *Monomorella* sp., LC 375 (RE). *M. noveboracum* Clarke & Reudemann, LC 185 (RE). *Trimerella* sp., LC 375 (RE).

Pelecypods

Ambonychia sp., Mi 215 (IR). *Amphicoelia leidyi* Hall, Sa —35 (IR); LC 350 (RE). *A. neglecta* (McChesney), LC 220 (RE). *Anodontopsis wabashensis* Kindle & Breger, LC 220 (RE). *Clidophorus consuitus* Ulrich, Sa —35 (IR). *Conocardium multistriatum* Kindle & Breger, LC 350 (RE). *C. oweni* Kindle & Breger, LC 192, 370 (RE). *Cypricardinia* sp., Mi 115 (RE). *C. undulostriata* (Hall), Sa —10 (IR). *C.* cf. *C. undulostriata* (Hall), LC 300 (IR). *Leiopteria subplana* (Hall), LC 310 (RE). *Megalomus canadensis* Hall, LC 425 (RE). *Mytilarca* sp., Sa —35 (IR). *M. acutirostra* (Hall), LC 240 (IR). *M. sigilla* Hall, Sa —35 (IR). *Paleopinna* sp., LC 220 (RE). *Plethomytilus cuneatus* Kindle & Breger, Sa —35 (IR); LC 350 (RE). *Pterinea* sp., Sa —30, —35 (IR); LC 375 (RE). *P. emacerata* (Conrad), LC 310 (RE). *Streptomytilus wabashensis* Kindle & Breger, Mi 210± (IR); LC 220 (RE).

Gastropods

Bellerophon shelbiensis Clarke & Reudemann, Mi 85, LC 350, 425 (RE). *Bucania* sp., LC 350 (RE). *Coelocaulus* sp., LC 185 (RE). *C. bivattatus* (Hall), LC 185 (IR); LC 185 (RE). *C. macrospira* (Hall), Sa —35 (IR). *Cyclonema cancellata* Hall, LC 350, 370 (RE). *Diaphorostoma* sp., Mi 115 (RE). *D. niagarense* (Hall), Sa —35, Lo 75, Mi 210±, LC 225 (IR); LC 192, 220, 350, 370, 425 (RE). *Eotomaria* sp., Mi 200, 215 (IR). *E. galtensis* (Billings), Mi 85, 130 (RE). *E. laphami* (Whitfield), Mi 210± (IR); LC 375 (RE). *Euomphalopterus alatus limatoideus* Kindle & Breger, LC 350, 370, 375 (RE). *Hormotoma* sp., Mi 210±, 215 (IR); LC 425 (RE). *Liospira perlata* (Hall), LC 185 (RE). *Lophospira* sp., LC 185, 425 (RE). *Loxonema? leda* Hall, Mi 210± (IR). *Platyceras* sp., LC 192 (RE). *P. niagarense* (Hall), Sa —80 (IR); Mi 85 (RE). *Pleurotomaria* sp., Sa —20 (IR); LC 375 (RE). *P. axion* Hall, LC 185 (RE). *P. eloroidea* Kindle & Breger, Mi 85, 130, 175, LC 185, 375 (RE). *P, hoyi* Hall, LC 375 (RE). *P.? idia* Hall, Mi 85, LC 185 (RE). *Poleumita* sp., Sa —30, LC 185 (IR); LC 190, 350, 375, 425 (RE). *P. crenulata* (Whiteaves), Mi 130 (RE). *P. huntingtonensis* (Kindle & Breger), Sa —10 (IR); LC 185 (RE). *P. h. alternata* (Kindle & Breger), LC 185 (RE). *P. opercula* (Kindle & Breger), Mi 130 (RE). *P. plana* (Kindle & Breger), LC 350 (RE). *P. scamnata* Clarke & Reudemann, Sa —30, —35 (IR); Mi 130, 175 (RE). *Schizolopha* sp., LC 375 (RE). *Straparollus* sp., Mi 215 (IR). *S. mopsus* Hall, Mi 85, 140 (RE). *S. niagarensis* Hall & Whitfield, Mi 85 (RE). *Strophostylus cancellatus*, Sa —35 (IR); Mi 175 (RE). *S. cyclostomus?* (Hall), Mi 130 (RE). *S. elevatus* Hall, LC 185 (RE). *Subulites terebriformis* (Hall), Sa —35 (IR). *Tremanotus alpheus* (Hall), Sa —35, Lo 30 (IR); Mi 85 (RE). *T. chicagoensis* McChesney, Lo 30 (IR); Mi 85, 130, LC 185, 375 (RE). *Trochonema pauper* (Hall), LC 185 (RE). *Turritoma laphami* (Hall), Sa —35 (IR); LC 185, 375 (RE).

Cephalopods

Actinoceras sp., LC 190 (RE). *Ascoceras newberryi* Billings, LC 375 (RE). *A. wabashense* Newell, LC 375 (RE). *Bickmorites bickmoreanus* (Whitfield), Sa —35, LC 210±, 240 (IR); LC 185, 350 (RE). *Cycloceras amycus* (Hall), Lo 30 (IR). *Cyclostomiceras orodes*, Sa —35 (IR). *Cyrtoceras gorbyi* Kindle & Breger, LC 185 (RE). *Cyrtorizoceras dardanum* (Hall), Mi 205 (IR). *Dawsonoceras americanum* (Foord), LC 310 (RE). *D. annulatum* (Sowerby), Sa —30, —35, Lo 30, 75, LC 185 (IR); Mi 85, LC 185, 310, 375 (RE). *Discoceras* n. sp. Phinney, Mi 205 (IR). *D. graftonense* (Meek & Worthen), LC 240 (IR). *D. marshi* (Hall), LC 223, 240 (IR); Mi 85, LC 425 (RE). *D.* cf. *D. marshi* (Hall), LC 310 (RE). *Gomphoceras lineare* Newell, LC 240 (IR). *G. projectum* Newell, LC 375 (RE). *G. scrinium* Hall, LC 350 (RE). *S. subgracile* Billings, Mi 205 (IR). *G. wabashense* Newell, LC 223, 240 (IR); Mi 85, LC 375 (RE). *Hexameroceras* sp., Mi 175 (RE). *H. cacabiforme* Newell, LC 240 (IR); LC 375, 425 (RE). *H. delphicolum* Newell, LC 185, 375 (RE). *H. hertzeri* (Hall & Whitfield), Mi 85, LC 185 (RE). *Kionoceras* sp., LC 190 (RE). *K. cancellatum* (Hall), Lo 75, Mi 200, LC 240 (IR); Mi 85, LC 185, 190, 192, 310, 370, 375, 425 (RE). *K. darwini* Billings, Mi 140, 170 (RE). *K. delphiense* Kindle & Breger, LC 375 (RE). *K. strix* (Hall & Whitfield), Mi 205, LC 240 (IR). *Lechritochoceras desplainense* (McChesney), Mi 85 (RE). *Mandaloceras scrinium* (Hall), Mi 85 (RE). *M. subgracile* (Billings), Mi 85 (RE). *Orthoceras* sp., Sa —10, —20, —30, —35, Lo 30, 75, 90 (IR); LC 350, 425 (RE). *O. alienum* Hall, LC 233± (IR). *O. obstructum* Newell, LC 240 (IR). *O. rigidum* Hall, LC 240 (IR). *O. simulator* Hall, Sa —30, —35, Lo 30, 75 (IR); Mi 85 (RE). *O. unionense* Worthen, LC 240 (IR). *Pentameroceras cumingsi* Flower [= *P. mirium* (Barrande)], LC 250, 375 (RE). *Phragmoceras* sp., Lo 75 (IR); LC 425 (RE). *P. angustum* (Newell), LC 240 (IR); Lo 76 (RE). *P. ellipticum* Hall & Whitfield, Mi 205 (IR); Mi 85, LC 185 (RE). *P. nestor* Hall, Mi 205, LC 240 (IR); LC 425 (RE). *P. parvum* Hall & Whitfield, Sa —35, LC 240 (IR); LC 185 (RE). *Protokionoceras* sp., Lo 75 (IR). *P. crebescens* (Hall), Mi 205, LC 225, 240 (IR); Lo 76, Mi 85 (RE). *P. medullare* (Hall), Lo 75, Mi 120, 210± (IR); LC 185, 375 (RE). *P. trisutum* (Clarke & Reudemann), Mi 210± (IR); Mi 85, 130 (RE). *Protophragmoceras hercules carollensis* Kindle & Breger, LC 375 (RE). *Spyroceras* sp., Mi 215 (IR). *Trimoceras gilberti* Kindle & Breger, LC 223 (IR); LC 185, 375 (RE). *Trochoceras* sp., Sa —20 (IR). *T.* cf. *T. costatum* Hall, Mi 210± (IR). *T. desplainense* McChesney, LC 240 (IR). *T.* cf. *T. desplainense* McChesney, LC 185 (RE). *Trocholites* n. sp. Busch, Mi 130 (RE).

Crinoids

Crinoid sp. Kindle & Breger, Cumings, LC 190 (RE). Crinoid sp. Kindle & Breger, Cumings, LC 190 (RE). *Eucalyptocrinites crassus* Hall, Sa —20 (IR); LC 192, 320 (RE). *Gissocrinus quadratus*, LC 220 (RE). *Gissocrinus* cf. *G. quadratus*, LC 235 (IR). *Pisocrinus* sp., LC 235, 240± (IR); LC 190 (RE); *Pisocrinus baccula*, LC 235 (IR). *P. benedicti* Miller, Mi 205, LC 240± (IR); LC 190 (RE). *P. campana* Miller, LC 240± (IR); LC 220, 310 (RE). *P. gemmiformis* Miller, LC 235, 240± (IR); *P. gorbyi*, Mi 205, LC 235, 240± (IR). *P. quinquelobus*, LC 235 (IR).

Cystoids

Caryocrinites ornatus Say, LC 320 (RE).

Trilobites

Bumastus sp., LC 185 (RE). *B. armatus* (Hall), Lo 76, LC 350 (RE). *B. cuniculus* (Hall), Mi 175 (RE). *B. insignis* (Hall), Lo 75 (IR); Lo 76, Mi 85, 140, 175, LC 191, 192, 350, 370, 375 (RE). *B. ioxus* (Hall), Sa —35 (IR); Mi 115, 170, LC 190, 191, 192, 310 (RE). *B. niagarensis* (Whitfield), Lo 76 (RE). *Calymene niagarensis* Hall, Sa —80, Lo 75, Mi 205, LC 240± (IR); Mi 130, LC 190, 220, 320 (RE). *C.* cf. *C. vodgesi* Foerste, Mi 130, LC 185, 190, 208±, 220, 350 (RE). *Ceratocephala goniata* Warder, Mi 115 (RE). *Cheirurus niagarensis* (Hall), LC 205 (IR); Lo 76, Mi 85, 130, LC 192, 205, 350 (RE). *Dalmanites* sp., Sa —10 (IR); LC 320 (RE). *D. vigilans* Hall, Lo 76, Mi 120, 210± (IR); Mi 115, 130, LC 191, 220 (RE). *Encrinurus* sp., Mi 130, 175, LC 220, 350 (RE). *E. indianaensis* Kindle & Breger, Sa —80, Lo 76, LC 225 (IR); Mi 130, 140, LC 185, 190, 191, 192, 310, 370, 375 (RE). *E. ornatus* Hall & Whitfield, Mi 140 (RE). *B.* cf. *B. insignis* (Hall), LC 190 (RE). *Illaenus* sp., LC 310 (RE). *Odontopleura* sp., LC 185 (IR). *O. ortoni* (Foerste), Mi 115, LC 350 (RE). *Phacops pulchellus* Foerste, Sa —30 (IR); LC 192, 350 (RE). *P.* cf. *P. pulchellus* Foerste, Mi 120 (IR); Mi 115, LC 191, 192, 350 (RE). *Proteus* sp., Lo 75, LC 225 (IR). *Sphaerexochus romingeri* Hall, Mi 130, 140, LC 191, 192, 220, 240, 350, 370, 375 (RE).

[1] Interrelationships of stratigraphic units are shown in Figure 2. Abbreviations: Sa, Salamonie Dolomite; Lo, Louisville Limestone; Mi, Mississinewa Shale Member of Wabash Formation; LC, Liston Creek Limestone Member of Wabash Formation. Figures following the stratigraphic designations refer to approximate distance above the base of Waldron Formation; also, they are keyed to geographic position through Appendix 2. Abbreviations (IR) and (RE) following stratigraphic designations refer to interreef or nonreef (IR) and reef (RE) facies, respectively.

APPENDIX 2

Collection sites, stratigraphic levels, and literature sources for subgeneric taxa of Niagaran (middle Silurian) macrofossils of northern Indiana.[1]

Adams County

30[2]; Linn Grove, Meshberger Bros. quarry, SE ¼, Sec. 33, T 26 N, R 13 E; L Lo Ir[3]; 30; B[4]. 32; New Corydon northwest, Smith & Baker abandoned quarry, SW ¼, Sec. 32, T 25 N, R 15 E; U Sa Ir; —25; B, C, C&S. 31; New Corydon west, J. W. Karsch quarry, SW ¼ SW ¼, Sec. 31, T 25 N, R 15 E; U Sa Ir; —30; B, C, C&S.

Allen County

24; May Stone & Sand, Inc., Ardmore Quarry, C N ½, Sec. 29, T 30 N, R 12 E; U Lo Ir; 100; Sh(a), Sh & O.

Carroll County

4; Camden southeast and Little Deer Creek, NW ¼ NW ¼, Sec. 30, T 25 N, R 1 E; U Wa Re; 370; C&S, K&B. 3; Delphi, Secs. 19, 20, 29 and 30, T 25 N, R 2 W; U Wa Re; 375; C&S, F, K&B, Sa, T&C.

Cass County

2; Georgetown east, reef, Sec. 36, T 27 N, R 1 W; M Wa Re; 350; C&S, K&B, L(b).

Delaware County

43; Muncie City, Sec. 10?, T 20 N, R 10 E; L Mi Ir or U Lo Ir; 90; C&S. 42; Muncie southwest, Muncie Stone Co. or J & K Stone Co. quarry, C, Sec. 20, T 20 N, R 10 E; U Lo Ir; 75; C&S. 41; Yorktown northeast, abandoned quarries, NW ¼ SW ¼, Sec. 14, T 20 N, R 9 E; At Lo-Mi boundary in Mi Ir; 76; C&S.

Grant County

34; Marion, in or near, T 24 and 25 N, R 8 E; U Mi Ir; 205; C&S, K&B.

Hamilton County

39; Fall Creek north side, formerly Helm's Mill, Secs. 5 and 6, T 17 N, R 6 E, Sec. 32, T 18 N, R 6 E; L LC? Re; 170; K&B. 36; Fishersburg southwest, abandoned quarries, E ½, Sec. 29, T 19 N, R 6 E; L LC Re; 191; K&B. 35; White River at Riverwood, formerly Connors Mill, E ½ NW ¼, Sec. 16, T 19 N, R 5 E; L LC Re; 192; C&S, K&B.

Huntington County

20; Huntington County west-central, four locations, T 28 N, R 8 E; L LC Ir, 233±, Sh(a); L LC Re, 233±, Sh (a). 22; Huntington east[5], abandoned quarries and river channel, Secs. 7, 8, 18, T 28 N, R 10 E, and Secs. 12, 13, T 28 N, R 9 E; L LC Ir; 185; C, C&S, K&B. 21; Huntington, Erie Stone Co. quarry, SE ¼, Sec. 12, T 28 N, R 9 E; L LC Ir, 180, C&S, Sa; L LC Re, 180, C&S, Sa. 25; Lancaster south, abandoned quarry, SE ¼ SE ¼, Sec. 33, T 27 N, R 9 E; U Mi Re; 175; B. 23; Little Wabash River, Secs. 7, 8, 18, T 28 N, R 10 E; L LC Ir, 185, C&S; L LC Re, 185, C&S. 27; Markle south, abandoned quarry, Wildcat Reserve 37, T 27 N, R 10 E; M Mi Re; 130; B, C&S. 26; Warren west, abandoned quarry, W ½ SE ¼, Sec. 19, T 26 N, R 10 E; M Mi Re; 140; B.

Jay County

33; Jay City, Sec. 5, T 24 N, R 15 E; U Sa Ir; —20; C&S.

Madison County

38; Anderson west, 1 mile, NE ¼ SE¼, Sec. 10?, T 19 N, R 7 E; Mi Ir?; 120; K&B. 37; Lapel, Martin Marietta Central Division quarry, C N ½, Sec. 28, T 19 N, R 6 E; L LC Re; 190; C. 40; Pendleton, Fall Creek, Sec. 20, T 18 N, R 7 E; Mi Re; 115; K&B.

Miami County

8; Mississinewa River at Cliffs of the Seven Double Pillars, S part Reserve 10, T 26 N, R 5 E; LC Ir; 225; C&S. 9; Peoria southeast, Mississinewa Reservoir, Secs. 10 or 11, T 26 N, R 5 E; L LC Re; 240; C&S. 7; Peru city, vicinity Mount Hope Cemetery, Sec. 28, T 27 N, R 4 E; LC Re; 320; C&S. 5; Peru northwest, SW ¼, Sec. 20, T 27 N, R 4 E; LC Re; 310; C. 6; Peru southwest, north side Wabash River opposite mouth of Little Pipe Creek, S ½, Sec. 32, T 27 N, R 4 E; LC Ir; 300; C&S.

Randolph County

44; Fairview southeast, quarry, NW ¼ SW ¼, Sec. 11, T 21 N, R 12 E; U Sa Ir; —10; C&S. 46; Maxville, abandoned quarries, Sec. 20, T 20 N, R 13 E; M? Sa Ir; —80; C&S. 45; Ridgeville east, abandoned quarry, NW ¼ SW ¼, Sec. 7, T 21 N, R 14 E; U? Sa Ir; —35; B, C&S.

Wabash County

15; General county, mostly? T 27 N, R 6 E; LC Ir and other recks?; 240±; C&S, L(a). 18; Hanging Rock, W ½ SE ¼, Sec. 35, T 28 N, R 7 E; U Mi and L LC Re; 208±; T&C. 17; Lagro, general vicinity, south-central part of T 28 N, R 7 E; U Mi Ir; 200; C&S, K&B; U Mi-L LC Re; 203; T&C. 16; Matlock Cemetery, NE ¼ NE ¼, Sec. 24, T 27 N, R 6 E; U Mi and L LC? Re; 228±; T&C. 10; Red Bridge, Mississinewa Reservoir, S ½ Reserve 26, T 26 N, R 6 E; L LC Ir; 223; C&S; U Mi Ir; 218; C&S. 14; South Wabash Reef, NE ¼ Reserve 18, T 27 N, R 6 E; U Mi-L LC Re; 230; L(a). 11; Wabash city in or near Sec. 10, T 27 N, R 6 E; L LC Ir; 215; C&S; U Mi Ir; 215; C&S. 19; Wabash County east-central, 13 locations, T 27 and 28 N, R 7 and 8 E; U Mi Ir; 210±; Sh(a); L LC Ir; 210±; Sh(a); L LC Re, 210±; Sh(a). 12; Wabash Reef, C SE ¼ SE ¼, Sec. 11, T 27 N, R 6 E; U Mi-L LC Re; 220; C&S, K&B, L (b), T&C. 13; Wabash south, State Highway 15 road cut?, N ½ Reserve 18, T 27 N, R 6 E; L LC Ir; 235; L(a).

Wells County

29; Bluffton north, Erie Stone Co. quarry, W ½ NW ¼, Sec. 28, T 27 N, R 12 E; L Mi Re; 85; B, C&S, T&C. 28; Rockford, abandoned quarry, E ½, Sec. 29, T 27 N, R 11 E; L Mi or U Lo Ir; 105; C&S.

White County

1; Monon south, Monon Crushed Stone Co. quarry, NE ¼, Sec. 28, T 28 N, R 4 W; U Wa Re; 425; C&S, K&B, Sh&O.

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[1] Sequence is as follows: county, map no., site; location, stratigraphic unit; Waldron datum; literature source, respectively.

[2] Map numbers are shown in Figure 1.

[3] Interrelationships of stratigraphic units are shown in Figure 2. Abbreviations: L, lower; M, middle; U, upper; Sa, Salamonie Dolomite; Lo, Louisville Limestone; Mi, Mississinewa Shale Member of Wabash Formation; LC, Liston Creek Limestone Member of Wabash Formation; Wa, Wabash Formation undifferentiated; Ir, interreef or nonreef; Re, reef or reef flank; Waldron-datum figures give approximate feet above base of Waldron Formation for collection sites, those figures preceded by a minus sign being estimated feet below the now-eroded Waldron at those locations; because of regional differences in deposition and because most figures are estimated, the Waldron-datum figures are not all indicative of the exact order of superposition among the faunas.

[4] Literature source abbreviations: B, Busch (3); C, Cumings (6); C&S, Cumings and Shrock (8); F, Flower (10); K&B, Kindle and Breger (13); L(a), Lowenstam (14); L(b), Lowenstam (15); P&S, Pinsak and Shaver (19); Sa, Sangree (20); Sh(a), Shaver (21); Sh(b), Shaver (22); Sh&O, Shaver and others (25); and T&C, Textoris and Carozzi (27). Several older references to the fossils and their localities have not been included, the intent here being to give the major and(or) latest sources for all subgeneric taxa of record. Example: Cumings and Shrock and Kindle and Breger are listed as major sources of fossil information for Delphi, but neither pair were the first to record taxa of record. Example: Cumings and Shrock and Kindle and Breger are listed as major sources of fossil information for Delphi, but neither pair were the first to record taxa at that place; Lowenstam is added because a single taxon would not have been documented otherwise.

[5] It is not clear from Cumings and Shrock (8) that some of the Liston Creek interreef coral species listed in their table came from a location 1½ miles southwest of Huntington (NE ¼, Sec. 28, T 28 N, R 9 E). Page 105 of the R. R. Shrock field notebook (deposited in the Department of Geology, Indiana University), however, refers to a fine collection of Liston Creek corals from the southwest Huntington location. Thus, it seems very probable that the coral list for location 22 is a composite for the Huntington area.