KENTUCKY GEOLOGICAL SURVEY
Donald C. Haney, State Geologist and Director
UNIVERSITY OF KENTUCKY, LEXINGTON

PALEONTOLOGICAL SURVEY OF THE PENNSYLVANIAN ROCKS OF THE EASTERN KENTUCKY COAL FIELD: PART 1, INVERTEBRATES

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Cover Illustration

Worthenia tabulata (Conrad) from the Magoffin Member of the Breathitt Formation, Floyd County, Kentucky.

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PALEONTOLOGICAL SURVEY OF THE PENNSYLVANIAN ROCKS OF THE EASTERN KENTUCKY COAL FIELD: PART 1, INVERTEBRATES

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ABSTRACT

Morse (1931) conducted the last paleontological survey of the Eastern Kentucky Coal Field almost 60 years ago. Substantial new information generated by mapping, as well as sedimentological, stratigraphic, and paleontological studies, now justify a new paleontological survey of these rocks. This survey is a compilation of both the new and old information.

Lithologic analysis reveals at least 41 marine zones in the coal field. Paleontological analysis shows that a variety of faunal communities existed, and many of the marine zones contain abundant and diverse faunal assembleges. However, the biostratigraphic resolution of invertebrate fossils is apparently very poor compared to the lithostratigraphic resolution of the coal-bearing beds.

INTRODUCTION

The last paleontological survey of the Eastern Kentucky Coal Field was conducted by Morse in 1931. A substantial amount of information has been made available since Morse's time. Perhaps most significant is the geologic mapping of Kentucky at a scale of 1:24,000 by the joint U.S. Geological Survey-Kentucky Geological Survey geologic quadrangle mapping program. In addition, new highway construction and coal mining have exposed much rock that would have been otherwise covered. Moreover, numerous paleontological and stratigraphic studies have been conducted since 1931. The present paleontological survey was undertaken to take advantage of this new information.

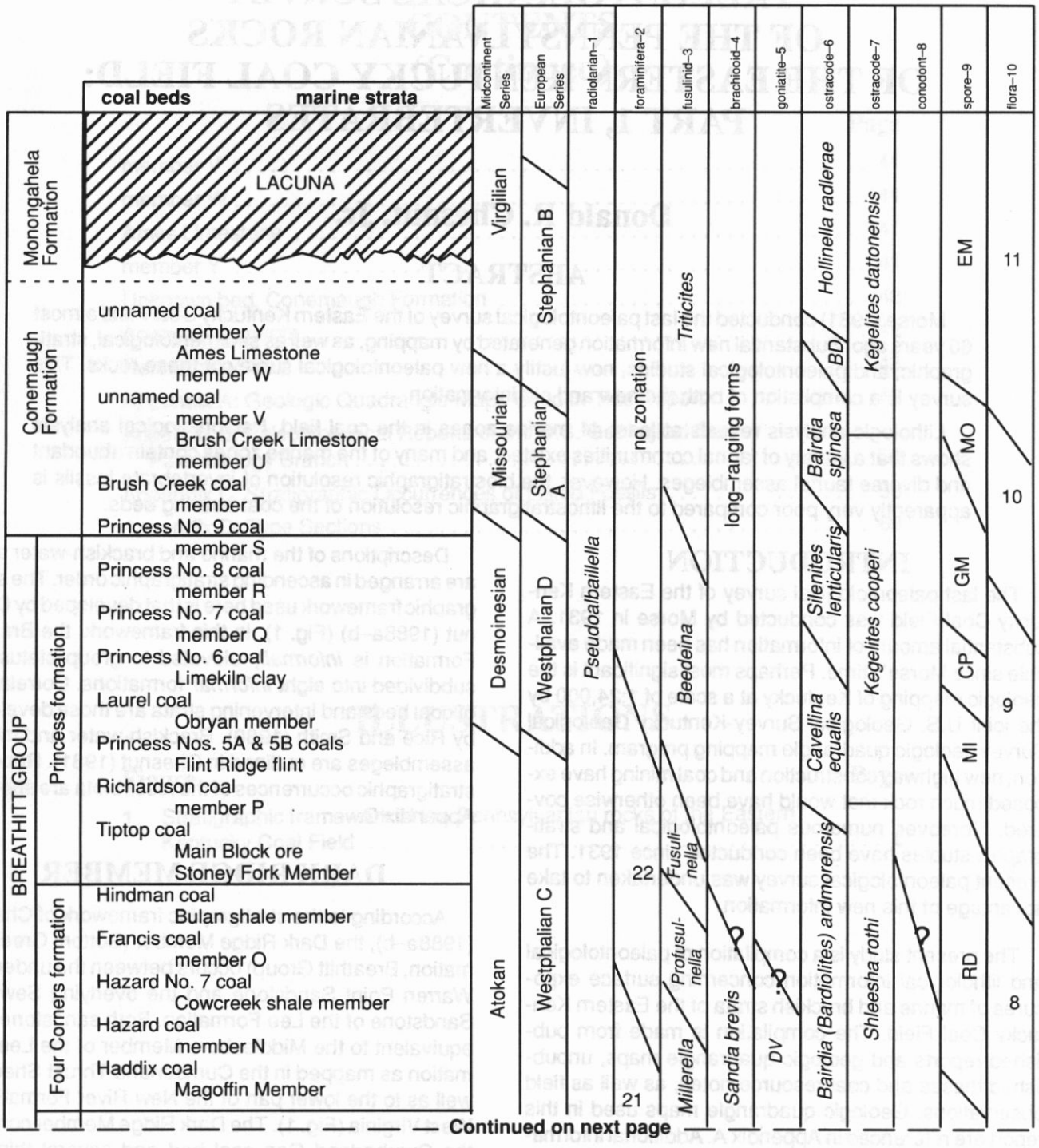
The present study is a compilation of paleontological and lithological information concerning surface exposures of marine and brackish strata of the Eastern Kentucky Coal Field. The compilation is made from published reports and geologic quadrangle maps, unpublished theses and coal resource notes, as well as field observations. Geologic quadrangle maps used in this report are referenced in Appendix A. Additional information was obtained from *preliminary* paleontological reports prepared by the U.S. Geological Survey (the PR–series; *see* Appendix B for a list of unpublished paleontological reports used in this study). Because this paper is a literature survey, taxonomic nomenclature cannot be verified, and many of the genera and species names reported need to be revised to accepted modern usage. Taxonomic verification and revision await future studies.

Descriptions of the marine and brackish-water strata are arranged in ascending stratigraphic order. The stratigraphic framework used here is that developed by Chesnut (1988a–b) (Fig. 1). In this framework, the Breathitt Formation is *informally* elevated to group status and subdivided into eight *informal* formations. Correlations of coal beds and intervening strata are those developed by Rice and Smith (1980). Brackish-water and marine assembleges are outlined in Chesnut (1981). Reported stratigraphic occurrences of the fossil biota are shown in Appendix C.

DARK RIDGE MEMBER

According to the stratigraphic framework of Chesnut (1988a–b), the Dark Ridge Member (Bottom Creek formation, Breathitt Group) occurs between the underlying Warren Point Sandstone and the overlying Sewanee Sandstone of the Lee Formation. Both sandstones are equivalent to the Middlesboro Member of the Lee Formation as mapped in the Cumberland Thrust Sheet, as well as to the lower part of the New River Formation in West Virginia (Fig. 1). The Dark Ridge Member contains the Cumberland Gap coal bed and several thin, unnamed coal beds.

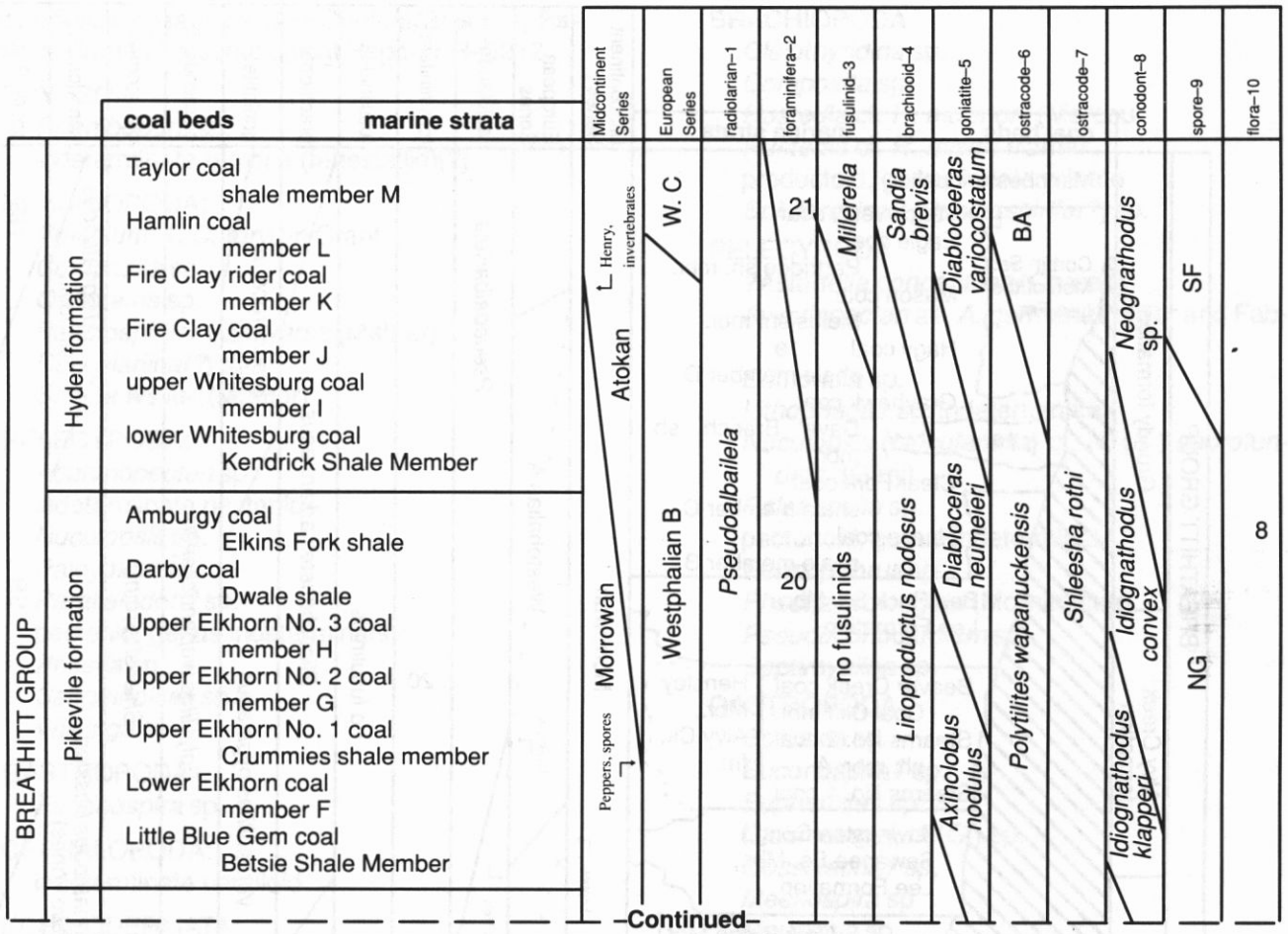
Englund and others (1964) reported calcareous shale at this level in the Middlesboro North Quadrangle. In addition, Charles Rice, T. W. Henry (USGS), and I examined a fossiliferous shale at this level in the pilot tunnel of the Cumberland Gap Tunnel Project in the Middlesboro South Quadrangle in 1988. T. W. Henry re-



Legend

1–Holdsworth and Jones (1980). 2–Mamet (1975); Armstrong and Mamet (1975); Groves (1986). 3–Douglass (1987). 4–Henry and Sutherland (1977). 5–Saunders and others (1977). 6–Cooper (1947). 7–Christopher and others (1990). 8–Lane (1977). 9–Peppers (1988). 10–Read and Mamay (1964). DV—*Diabloceeras varicostatum.* BD—*Bairdiocypris deloi.*

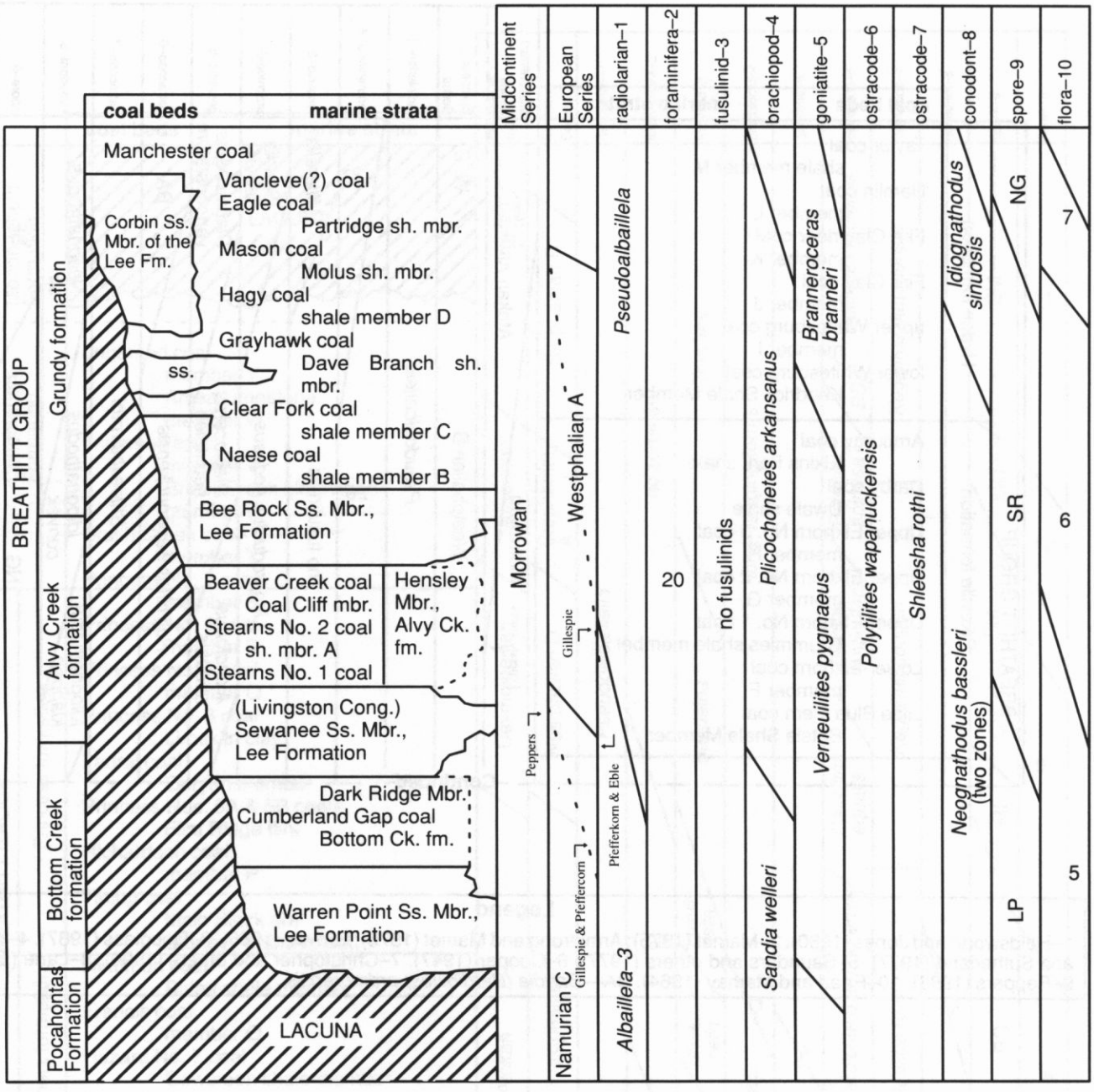
Figure 1. Stratigraphic framework of the Pennsylvanian rocks of the Eastern Kentucky Coal Field, developed by Chesnut (1988a–b), with projected zonation schemes. Continued on following pages.



Legend

1–Holdsworth and Jones (1980). 2–Mamet (1975); Armstrong and Mamet (1975); Groves (1986). 3–Douglass (1987). 4–Henry and Sutherland (1977). 5–Saunders and others (1977). 6–Cooper (1947). 7–Christopher and others (1990). 8–Lane (1977). 9–Peppers (1988). 10–Read and Mamay (1964). BA—*Bairdia (Bardiolites) ardmorensis.*.

Figure 1 (continued). Stratigraphic framework of the Pennsylvanian rocks of the Eastern Kentucky Coal Field, developed by Chesnut (1988a–b), with projected zonation schemes.



Legend

1–Holdsworth and Jones (1980). 2–Mamet (1975); Armstrong and Mamet (1975); Groves (1986). 3–Douglass (1987). 4–Henry and Sutherland (1977). 5–Saunders and others (1977). 6–Cooper (1947). 7–Christopher and others (1990). 8–Lane (1977). 9–Peppers (1988). 10–Read and Mamay (1964).

Figure 1 (continued). Stratigraphic framework of the Pennsylvanian rocks of the Eastern Kentucky Coal Field, developed by Chesnut (1988a–b), with projected zonation schemes.

ported the following fauna in U.S. Geological Survey Paleontology Branch Paleontological Report PR–0212:

BRYOZOA
Rhombopora sp.
indeterminate ramose (fenestellid)[?]

BRACHIOPODA:
Coledium cf. *C. torvum* Grant
Composita sp.
Orthotetes sp.
Punctospirifer transversa (Mather)
Reticulariina(?) sp.
Sandia welleri (Mather)

PELECYPODA:
Acanthopecten sp.
indeterminate pectenid
Nuculopsis sp.
Paleyoldia sp.
Parallelodon? sp.
pectenid, genus indeterminate
Phestia sp.
Sanguinolites sp.
Wilkinga sp.

GASTROPODA
Euconospira sp.

CEPHALOPODA:
indeterminate nautiloid

ECHINODERMATA:
crinoid? columnals

Froelich (1972) reported calcareous shales with marine fossils, including pelecypods and brachiopods, in a lower shale unit of the Middlesboro Member in the Wallins Creek Quadrangle. This unit may be equivalent to the Dark Ridge Member.

COAL CLIFF AND HENSLEY MEMBERS

The Coal Cliff member (Alvy Creek formation, Breathitt Group) is herein informally named for a shale sequence located at Coal Cliff in the Nevelsville Quadrangle. Location information and a measured section for the type locality are provided in Appendix D. The Coal Cliff occurs above the Stearns No. 2 coal bed and below the Rockcastle Sandstone (Bee Rock Sandstone) of the Lee Formation and the level of the Beaver Creek coal bed. Fossils that I collected from the type locality were sent to Charles Rice (USGS) in 1979 and then to the USGS Paleontology and Stratigraphy Branch for identification. The following fauna were identified (PR–0205):

BRACHIOPODA
Cleiothyridina sp.
Composita sp.
Hustedia cf. *H. mormoni* (Marcou)
Hustedia cf. *H. miseri* Mather
productoid, genus indeterminate
Spiriferellina? [Punctospirifer?] sp.

PELECYPODA
?Astartella concentrica (Conrad)
Aviculopecten aff. *A. germanus* Miller and Faber
Edmondia sp.
Lithophaga? sp. indeterminate
Nuculopsis (*Nuculanella*) cf. *N.* (*N.*) *subrotundata* (Girty)
Palaeoneilo sp.
pectenoid, genus indeterminate
Permophorus sp.
Phestia prolongata (Morningstar)
Pseudoconocardium sp.
Septimyalina sp.

GASTROPODA
Borestus sp.
Euconospira? sp.
Euphemites sp.
Glabrocingulum (*G.*) sp.
Gosseletina? sp.
Meekospira sp.
Mourlonia sp.
new genus, aff. *Worthenia* n. sp.
Palaeostylus? [Pseudozygopleura?] sp.
Platyceras sp.
Retispira sp.
Straparollus (*Euomphalus*) sp.
Trepospira (*T.*) *illinoiensis* (Worthen)
gastropod, lirate turbinate, indeterminate

CEPHALOPODA
Ephippioceras ferratum (Cox)
Liroceras sp.
orthoconic nautiloid, genus indeterminate

COELENTERATA
Cladochonus sp.
horn coral

TRILOBITA
Sevillea aff. *S. trinucleata* (Herrick)

OSTRACODA
ostracodes

The Coal Cliff Member is recognized in several places along the western belt of outcrop of Lower Pennsylvanian rocks. Hester and Leung (1978, p. 16–17) reported a black shale with *Lingula* at this level in the Pow-

ersburg Quadrangle. In addition, the following geologic quadrangle maps report potential marine or brackish strata:

Livingston(?): Shale and sandstone containing linguloid brachiopods and worm burrows (stratigraphic level uncertain).

McKee(?): Fragments and molds of marine brachiopods in a 10-inch-thick siltstone below the level of the Tattler coal bed (stratigraphic level uncertain).

I collected a small number of fossils from a marine zone on U.S. Highway 25 near Fort Sequoyah in the Livingston Quadrangle. These fossils (PR–0207) were sent by way of Charles Rice to the Paleontology and Stratigraphy Branch of the U.S. Geological Survey for identification. They listed the following fauna:

BRACHIOPODA
Composita sp. indeterminate
Lingula sp. indeterminate
Oehlertella sp. indeterminate
Pustula n. sp. A

TRACE FOSSILS
Conostichus
other trace fossils

I have also collected pelecypods from canneloid shales (shale member A) in the Stearns No. 1 and $1^1/_2$ coal zones, just above the mid-Carboniferous unconformity, in the Barthell Quadrangle. R. M. C. Eagar (personal commun.) has identified them as the brackish-water pelecypod *Anthraconaia*. The brackish-water shales occur several tens of feet below the level of the Coal Cliff member.

The Coal Cliff member and shale member A are probably laterally equivalent to the Hensley Member (Alvy Creek formation, Breathitt Group), which crops out along Pine and Cumberland Mountains. Examination of geophysical logs in southeastern Kentucky indicates that thick coarsening-upward sequences, typical of most marine zones in eastern Kentucky, are common in the Hensley Member. Further examination of the poorly exposed Hensley will perhaps reveal marine or brackish-water fossils.

SHALE MEMBER B

The informal shale member B (Grundy formation, Breathitt Group), which crops out along Pine Mountain, occurs below the Naese Sandstone. Eagar (1970, 1975) reported the brackish-water pelecypod *Anthraconaia* cf. *A. ohioensis* in the Whitesburg and Roxana Quadrangles.

SHALE MEMBER C

Eagar (1970, 1975) described a shale sequence (herein, member C, Grundy formation, Breathitt Group) overlying the Naese coal bed in the Balkan and Whitesburg Quadrangles. He identified the following brackish-water fauna from these shales (apparently, the Paleontology and Stratigraphy Branch of the U.S. Geological Survey identified Eagar's specimens from this stratum and other strata described in the following sections in PR–0193):

PELECYPODA:
Anthraconaia sp. cf. *A. ohioensis* (Morningstar)
Curvirimula sp. ranging between *C. belgica* (Hind) to *C. trapeziforma* (Dewar)

OSTRACODA:
Carbonita sp.

CRUSTACEA:
Palaeestheria sp. cf. *P. ortoni* (Clarke)

VERTEBRATA:
Drydenius cf. *D. molyneuxi* (Traquair)
Elonicthys aitkeni Traquair (scales)
Elonicthys sp.
Rhizodopsis sp.

The following geologic quadrangle maps report potential marine strata:

Elkhorn City and Harman: Silty shales containing limestone concretions overlying the lower Banner coal; linguloid brachiopods and molluscan shells are associated with the concretions.

Hellier and Clintwood: Silty limestone concretions in shale above Bee Rock Sandstone.

DAVE BRANCH SHALE

The Dave Branch shale (Grundy formation, Breathitt Group) is herein informally named for a shale sequence exposed near Dave Branch at the Laurel River Dam in the Sawyer Quadrangle. A measured section and locality description are given in Appendix D. The Dave Branch shale occurs above the Pine Creek sandstone beds (upper part of the Bee Rock Sandstone) and below the Laurel River Dam sandstone beds (Greb and Chesnut, 1989b). I have discovered a variety of marine trace fossils at the base of this unit at the type locality. These trace fossils include *Zoophycos*, *Rhizocorallium*, and several unidentifed forms.

Greb and Chesnut (1989a, b) have also found productoid and orbiculoid brachiopods from approximately equivalent rocks below the Hazel Patch sandstone in the Billows Quadrangle. In addition, I have found a calcareous sandstone with large spherical calcareous concretions at or near this stratigraphic level in the Whitley City Quadrangle.

Several geologic quadrangle maps record marine strata at this level:

Bangor: Shale with linguloid brachiopods.

Beattyville: Marine fossils in ironstone concretions occurring between the Beattyville and Grayhawk coal beds.

Garrison and Pond Run: Sandstone with worm burrows.

Saxton and Jellico East(?): Some shales locally containing *Lingula* (stratigraphic level uncertain).

Norman C. Hester (unpub. field notes) also reported worm burrows and brachiopods in the Scranton Quadrangle.

A possible correlative of the Dave Branch shale is a shale sequence that crops out along Pine Mountain and in Pike County. Eagar (1970, 1975) published the following list of marine and brackish-water fauna between the Clear Fork and Splitseam coal beds in Balkan, Wallins Creek, and Whitesburg Quadrangles:

BRACHIOPODA
Anthracospirifer sp.
Composita? sp.
Hystriculina? sp.
Juresania sp.
Lingula sp.
Linoproductus nodosus (Newberry)

COELENTERATA
Lophophyllidium? sp.

BRYOZOA
ramose forms
fenestrate forms

PELECYPODA
Anthraconaia? cf. *A. ohioensis* (Morningstar), anthraconautiform
Aviculopecten sp.
Curvirimula sp.
Curvirimula-like sp.
Myalina sp.
Schizodus sp.
Septimyalina? sp.
Wilkingia sp.

OSTRACODA
Geisina arcuata (Bean)
Cypridina[?] sp.

OTHER ARTHROPODS
Palaeestheria sp. cf. *P. ortoni* (Clarke)
phyllocarid carapaces
"*Cyclus*" sp.
xiphosurids cf. *Euproops* sp. cf. *E. danae* (Meek and Worthen)

The following geologic quadrangle maps in Pike County have described marine strata at this level:

Elkhorn City and Harman: Linguloid brachiopods and molluscan shells associated with calcareous concretions in shales above the the Elswick coal bed.

Hellier and Clintwood: Silty, calcareous concretions in shale overlying the Elswick coal bed.

Majestic, Hurley, and Wharncliffe: Fossils, including brachiopods, in shale and sandstone overlying the Elswick coal bed.

Preliminary paleontological reports from the U.S. Geological Survey (PR–0139, –0151, –0192) list the following fauna from strata questionably correlated with this member:

BRACHIOPODA
Antiquatonia morrowensis (Mather), var.
Composita? sp.
Cranaena? sp.
Orbiculoidea? sp.
Linoproductus sp.

GASTROPODA
Platyceras (*Orthonychia*) sp.

OSTRACODA (from thin sections)
geisinidean
kirkbyacean
kloedenellacean
indeterminate forms

FORAMINIFERIDA
Earlandia minuta (Cushman and Waters)
irregularly coiled tubiform

SHALE MEMBER D

A shale sequence overlying the Grayhawk coal bed (and laterally equivalent coal beds) is herein informally called shale member D (Grundy formation, Breathitt Group). The following geologic quadrangle maps report potential marine strata:

Lick Creek: Shale with calcareous concretions indicated above the Splash Dam coal bed.

Majestic, Hurley, and Wharncliffe: Thin, but persistent shale bed with brachiopods about 15 feet above the Splash Dam coal bed.

Manchester: Shale with calcareous concretions indicated above an unnamed coal bed (= Gray Hawk coal bed).

Millard: Canneloid shale containing linguloid brachiopods between the Hagy and Splash Dam coal horizons.

Sturgeon: Shale with iron-rich chert concretions containing fossils, including brachiopods, about 30 feet above the Gray Hawk coal bed.

Norman C. Hester's unpublished field notes for the Scranton Quadrangle indicate a shale at this level that contains linguloid brachiopods and trace fossils.

MOLUS SHALE MEMBER

A shale sequence overlying the Hagy coal bed is herein informally called the Molus shale member (Grundy formation, Breathitt Group); it is named after Molus, Kentucky (Wallins Creek Quadrangle), where Eagar (1970, 1975) discovered a brackish-water fauna at this level.

Strata previously mapped as the Eagle Shale or Eagle Limestone in Kentucky, which overlie the Hagy rider coal bed, are not laterally equivalent to the Pennsylvanian stratotype for the Eagle Shale (Chesnut, in press a). Instead, these strata are laterally equivalent to the Molus shale. The following geologic quadrangle maps in Pike County, describe marine strata at the level of the Molus:

Elkhorn City and Harman: Shale with calcareous concretions, and articulate and linguloid brachiopods.

Jamboree: Shale with calcareous concretions.

Lick Creek: Shale with calcareous concretions, and marine invertebrate fossils.

Majestic, Hurley, and Wharncliffe: Shale with limestone beds and nodules, fossiliferous sandstone, and marine fossils.

Matewan: Shale with calcareous concretions and marine fossils, including pelecypods, gastropods, and brachiopods.

Eagar (1970, 1975) listed the following fauna:

PELECYPODA:
Anthraconaia sp., anthraconautiform variety
Curvirimula sp.
OSTRACODA:
Carbonita bairdioides, *C.* ex. gr. *altilis-inflata*
Geisina? sp.

Preliminary paleontological reports from the U.S. Geological Survey (PR–0142, –0190) list the following fauna:

BRACHIOPODA
Linoproductus nodosus? (Newberry)
Tornquistia sp.
PELECYPODA
Nucula sp. 1
Nucula sp. 2
Nuculopsis aff. *N. girtyi* Schenck
Wilkingia sp.
GASTROPODA
Bellerophon (*Pharkidonotus*) n. sp.
Glabrocingulum (*G.*)*?* n. sp.
Ianthinopsis sp. indeterminate
Straparollus n. sp. aff. *S.* (*Amphiscapha*) *catilloides* (Conrad)
CEPHALOPODA
Mooreoceras sp.
ECHINODERMATA
Paragassizocrinus kendrickensis Strimple and Knapp
OSTRACODA
Healdia sp.

Marine strata also occur just below the Molus. Marine or brackish-water shale (shale member E) occurring between the level of the Hagy and Hagy rider coal beds was reported in the following geologic quadrangle maps:

Elkhorn City and Harman: Hagy coal overlain by several inches of canneloid shale containing linguloid brachiopods.

Lick Creek: Calcareous shale and siltstone indicated above the Hagy coal bed.

Millard: Shale with calcareous concretions and thin limestone bed; linguloid and articulate brachiopods in canneloid shale at Hagy coal position.

PARTRIDGE SHALE MEMBER

A marine sequence overlying the Mason coal bed and its lateral correlatives is herein informally referred to as

the Partridge shale member (Grundy formation, Breathitt Group). Harned (1979) indicated a marine zone with calcareous shale and calcareous concretions at this level in the Appalachian, Balkan, Evarts, Ewing, Flat Gap, Nolansburg, Pennington Gap, Rose Hill, Varilla, Wallins Creek, and Whitesburg Quadrangles. In addition, the following geologic quadrangle maps provide evidence for potential marine strata at this level:

Beattyville: Thin bed of sandstone about 35 feet below the Manchester coal bed containing small brachiopods and gastropods.

Dorton: Shale with calcareous concretions indicated in the Millard coal zone.

Grayson: Lee sandstone locally cemented by calcite.

Harlan: Shale with marine fossils indicated between unnamed (Mason) and Hance coal zones.

Leighton: Sandstone laterally equivalent but not continuous with the Corbin Sandstone locally bioturbated.

Manchester: Calcareous concretions in sandstone below the Manchester coal bed.

Millard: Linguloid and articulate brachiopods in roof shale of the upper Millard coal bed.

Oldtown: Sand-filled worm burrows in thin-bedded sandstone and siltstone..

Paintsville: Linguloid brachiopods in shale at one locality of Lee sandstone.

Pikeville: Shale containing a few marine invertebrate fossils about 50 feet above the Bingham (Manchester) coal bed.

Portersburg: Sandstone below the Manchester coal bed calcareous when fresh.

West Liberty: *Lingula* in carbonaceous shale below unnamed (Manchester) coal bed; calcareous concretions in the upper part of the Lee Sandstone.

BETSIE SHALE

The Betsie Shale Member (Pikeville formation, Breathitt Group) is a coarsening-upward shale, siltstone, and sandstone sequence overlying the Manchester coal bed and the Corbin Sandstone Member of the Lee Formation (Rice and others, 1987). The Betsie was mapped as the Cannelton Limestone in many quadrangles. A sandstone in the upper part of the Betsie Shale has been mapped informally as the Frozen sandstone.

Evidence for marine or brackish-water strata in the Betsie Shale is found in the following geologic quadrangle maps:

Argillite: Shale and siltstone above unnamed (Manchester) coal bed and Lee Formation locally containing calcareous lenses and marine fossils.

Ault: Thin, ferruginous sandstone bed at unnamed (Manchester) coal horizon containing marine fossils.

Balkan: Shale with linguloid brachiopods.

Barcreek: Shale with limestone bed, and brachiopods.

Belfry: Siltstone with calcareous concretions.

Blaine(?): Shale interlaminated with siltstone and sandstone, commonly burrowed (stratigraphic level uncertain).

Broad Bottom: Calcareous concretions, pelecypods, and linguloid and articulate brachiopods.

Bruin(?): Calcareous sandstone and marine fossils, including brachiopods.

Campton: Shale and calcareous siltstone and sandstone with limestone beds and calcareous concretions; Frozen sandstone locally calcareous; linguloid and articulate brachiopods, crinoids, cephalopods, gastropods, pelecypods, and corals.

Elkhorn City and Harman: Shale with calcareous concretions containing linguloid brachiopods.

Grahn: Thin, calcareous or ferruginous sandstone bed containing marine fossils above the Lee Formation .

Harold: Siltstone with calcareous concretions.

Heidelberg: Sandstone lenses above the Manchester coal bed locally containing siderite concretions that may be burrow fillings.

Hellier and Clintwood: Shale with calcareous concretions containing marine fossils, including corals, and articulate and linguloid brachiopods.

Isonville: Shale overlying unnamed (Manchester) coal bed locally containing a few marine fossils; sandstone beds locally calcareous.

Jackson: Calcareous shale containing fossils overlying the Vancleve (Manchester) coal bed.

Jamboree: Shale with calcareous concretions; Frozen sandstone is calcareous.

Landsaw: Calcareous siltstone and sandstone (Frozen sandstone), and articulate and linguloid brachiopods.

Lee City: Calcareous shale and sandstone.

Lick Creek: Shale with calcareous concretions.

Matewan: Calcareous siltstone, sandstone with calcareous concretion, and marine fossils, including pelecypods, gastropods, and brachiopods.

Maulden: Shale containing marine fossils, including brachiopods.

McDowell: Calcareous concretions.

Meta: Shale with calcareous concretions.

Millard: Calcareous sandstone and siltstone, and shale with calcareous concretions.

Oil Springs: Thin but persistent, locally fossiliferous marine shale unit about 15 feet above the Lee Formation.

Oneida: Shale with linguloid brachiopods.

Paintsville: Carbonaceous and calcareous marker shale bed containing brachiopods, pelecypods, and gastropods above the Lee Formation.

Pennington Gap(?): Calcareous zone (stratigraphic position uncertain).

Pikeville: Calcareous concretions and marine fossils, including linguloid brachiopods, pelecypods, and gastropods.

Quicksand: Shale with calcareous concretions; Frozen sandstone is calcareous.

Sandy Hook: Locally ferruginous or calcareous shale containing marine fossils overlying unnamed (Manchester) coal bed .

Scranton: Shale with trace fossils at this level, according to Norman C. Hester's field notes for this quadrangle.

Sitka: Calcareous concretions.

Soldier(?): Shale and sandstone, and articulate brachiopods (stratigraphic level uncertain).

Tallega: Shale and siltstone containing brachiopods, crinoids, and gastropods.

Tyner(?): Siltstone, sandstone, brachiopods, pelecypods, and trace fossils (stratigraphic position uncertain).

West Liberty: Carbonaceous shale containing *Lingula* above unnamed (Manchester) coal bed.

Williamson: Calcareous shale with calcareous concretions, and linguloid brachiopods and pelecypods.

Wofford: Shale with linguloid brachiopods.

Coskren and Hoge (1978) reported the following fauna in the Campton geologic quadrangle map:

BRACHIOPODA
Leiorhynchoidea sp.
Lingula sp.
Linoproductus? sp.

GASTROPODA
Trepospira (*T.*) *illinoiensis* (Worthen)

CEPHALOPODA
Gastrioceras (*Lissogastrioceras*) aff. *G.* (*L.*) *fittsi* Miller and Owen
Gastrioceras sp.
Metacoceras sp.
Wiedeyoceras sp.

I have recovered abundant *Anthraconaia* (pelecypod) and *Acanthotelson kentuckyensis* Schram and Chesnut in canneloid shales above the River Gem (= Manchester) coal bed in the Winfield Quadrangle. I have also observed abundant trace fossils, including *Zoophycos* and *Lockeia*, and unidentified conchostracan tests in the upper part of the Betsie Shale in the Manchester Quadrangle.

Eagar (1970, 1975) has reported calcareous shales with limestone nodules and beds above the Hance coal zone in the Roxana and Whitesburg Quadrangles. The shales contained corals, linguloid and articulate brachiopods, pelecypods, gastropods, and cephalopods. He listed the following fauna from these shales:

COELENTERATA
Lophophyllidium sp.

BRACHIOPODA
Anthracospirifer aff. *A. opimus* (Hall)
Composita subtilita (Hall)
Composita sp.
chonetids
Juresania sp.
Linoproductus cf. *L. prattenianus* (Norwood and Pratten)
Orbiculoidea cf. *O. missouriensis* Shumard
Orbiculoidea sp. (very low cone)
Tornquistia? sp.

PELECYPODA
Astartella? sp.

Aviculopecten cf. *A. flabellus* (Price)
Aviculopinna? [*Pteronites]* sp.
Dunbarella? sp.
Edmondia? sp.
Palaeoneilo sp.
Permophorus-like pelecypod
Phestia sp.
Posidonia cf. *P. girtyi* (Morningstar)
Promytilus? sp.
Schizodus? sp.
Wilkingia sp.

GASTROPODA
Bellerophon sp.
Glabrocingulum sp.
Shansiella cf. *S. carbonaria* (Norwood and Pratten)
Straparollus (*Amphiscapha*) sp.
Trepospira sp.

CEPHALOPODA
ammonoid cephalopod(?)
Anthracoceras sp. (*A. arcuatilobum* group)
Bitaunioceras? sp.
coiled nautiloid, indeterminate
Gastrioceras aff. *G. subcrenatum* (Frech)
orthoconic nautiloid, indeterminate

Preliminary paleontological reports from the U.S. Geological Survey (PR–0189, –0198, –0202) list the following fauna from strata that questionably belong to the Betsie Shale:

BRACHIOPODA
Leiorhynchoidea sp.
Linoproductus? sp. indeterminate

CEPHALOPODA
Gastrioceras (*Lissogastrioceras* aff. *G.* (*L.*) *fittsi* Miller and Owen
Gastrioceras n. sp.
Metacoceras sp.

SHALE MEMBER F

A shale sequence overlying the Little Blue Gem coal bed and its lateral equivalents is herein informally called shale member F (Pikeville formation, Breathitt Group). The following geologic quadrangle maps contain some evidence for a marine or brackish-water depositional environment for this shale:

Delbarton: Shale with calcareous concretions, and linguloid brachiopods.

Fount: Shale with calcareous concretions.

Heidrick: Shale with calcareous concretions, and brachiopods.

Landsaw: Shale and calcareous siltstone with crinoids and linguloid brachiopods.

Redbush: Shale, siltstone, calcareous sandstone with calcareous concretions, and marine or brackish-water fossils.

Saylersville North: Sandstone containing fossils.

Willard(?): Sandstone with trace fossils (stratigraphic position uncertain).

Eagar (1970, 1975) reported the following fossils from the Roxana and Whitesburg Quadrangles:

BRACHIOPODA
Lingula cf. *L. carbonaria* Shumard
Orbiculoidea sp.

PELECYPODA
Anthraconaia sp. (naiaditiform), brackish-water to restricted-marine pelecypod

A preliminary paleontological report prepared by the U.S. Geological Survey Paleontology and Stratigraphy Branch (PR–0204) lists the following fauna:

BRACHIOPODA
Anthracospirifer tanoensis Sutherland and Harlow
Composita gibbosa? Mather
Composita ovata Mather
Derbyia cf. *D. crassa* (Meek and Worthen)
Derbyia? sp. indeterminate
Desmoinesia cf. *D. nambeensis* Sutherland and Harlow
Echinoconchus sp.
Hustedia miseri Mather
Hustedia miseri Mather?
Juresania sp.
Lingula sp.
Lingula? sp. indeterminate
Linoproductus nodosus Newberry
Linoproductus pumilus Sutherland and Harlow
Neochonetes sp.
Orbiculoidea sp.
productoid, spinose, indeterminate
Retichonetes? sp. indeterminate
Sandia sp.
Spiriferellina [Punctospirifer?] sp.
Trigonoglossa sp.

BRYOZOA
Cystodictya sp.
Prismopora sp.
Rhabdomeson? sp.

rhomboporoid, genus indeterminate
trepostomotous bryozoan
bryozoans, indeterminate

ECHINODERMATA
crinoid columnals

PELECYPODA
Aviculopecten sp. A
Aviculopecten sp. B
Cypricardella? sp. indeterminate
Palaeoneilo? sp. indeterminate
Permophorus? sp. indeterminate
Schizodus sp.
Septimyalina sp.

GASTROPODA
Ianthinopsis sp.
Platyceras sp.
Strophostylus sp.
gastropod, indeterminate

OSTRACODA
ostracodes

TRILOBITA
Ditomopyge conwayense Wheeler
Paladin morrowensis (Mather)

VERTEBRATA
shark dentition

CRUMMIES SHALE MEMBER

The Crummies shale member (Pikeville formation, Breathitt Group) is informally named for a shale sequence overlying the Lower Elkhorn coal bed and laterally equivalent coal beds. The shale is named for strip- and deep-mine highwall exposures that are abundant near Crummies, Kentucky, in the Evarts Quadrangle. The Crummies shale has been mapped as the Campbells Creek Limestone in some areas.

Harned (1979) reported a marine zone composed of calcareous shales with calcareous concretions at this stratigraphic level in the Appalachian, Benham, Keokee, Louellen, Nolansburg, Pennington Gap, Roxana, and Whitesburg Quadrangles.

The following geologic quadrangle maps contain some evidence for marine or brackish-water strata at this level:

Barbourville: Shale with limestone nodules and cone-in-cone structure, and linguloid brachiopods.

Belfry: Shale with linguloid brachiopods.

Blackwater(?): Calcareous sandstone (stratigraphic level uncertain).

Broad Bottom: Shale and sandstone with calcareous concretions.

Cannel City(?): Calcareous siltstone (stratigraphic level uncertain).

Corbin: Shale and siltstone with marine fossils.

Delbarton: Shale with calcareous concretions, and linguloid brachiopods.

Dorton: Shale with calcareous concretions, and calcareous sandstone.

Elkhorn City and Harman: Shale with calcareous concretions.

Evarts and Hubbard Springs: Calcareous shale and, locally, pyritized marine fossils.

Ewing: Shale with calcareous concretions.

Ezel: Shale with linguloid brachiopods.

Fount: Shale with linguloid brachiopods.

Frakes: Shale with linguloid brachiopods.

Haldeman: Calcareous sandstone.

Harlan: Shale and siltstone with calcareous concretions, and fossils.

Harold: Shale with calcareous concretions.

Ivyton: Siltstone and sandstone with limestone beds and calcareous concretions.

Jenkins East(?): Shale and siltstone with calcareous concretions, and calcareous sandstone.

Kite: Shale and siltstone, and marine(?) fossils.

Landsaw: Shale with calcareous concretions.

Lee City: Shale with calcareous concretions.

Lily(?): Shale with linguloid brachiopods and pelecypods (stratigraphic level uncertain).

Mayking: Siltstone with calcareous concretions, and calcareous sandstone.

McDowell: Shale with calcareous concretions.

Martin: Siltstone with calcareous concretions.

Meta: Shale with linguloid brachiopods.

Millard: Calcareous siltstone.

Oil Springs: Shale with calcareous concretions.

Pennington Gap: Calcareous zone.

Pikeville: Shale and sandstone with calcareous concretions.

Rose Hill: Calcareous shale with calcareous concretions, goniatites, gastropods, and other marine fossils.

Quicksand: Shale with calcareous concretions.

Salyersville North: Shale with calcareous concretions.

Sitka: Shale with calcareous concretions.

Tyner(?): Siltstone, sandstone, brachiopods, pelecypods, and trace fossils (stratigraphic position uncertain).

Varilla: Shale with calcareous concretions.

Wallins Creek: Shale and siltstone with calcareous concretions.

Williamson: Calcareous shale with calcareous concretions, and linguloid brachiopods and pelecypods.

Eagar (1970, 1975) described a variety of marine fossils from the Crummies shale in the Roxana and Whitesburg Quadrangles, including:

BRACHIOPODA
Composita sp.
chonetids
Derbyia sp.
Hystriculina? sp.
Juresania sp.
marginigerid aff. *Hystriculina?*
Tornquistia? sp.

PELECYPODA
Aviculopecten sp.
Nuculana? sp.
Palaeoneilo? sp.
pelecypod, indeterminate
Permophorus sp.
Polidevcia? [Phestia] sp. (coarse ribs)
Wilkingia sp.

GASTROPODA
Glabrocingulum sp.
Straparollus (Amphiscapha?) sp.
Trepospira sp.
Worthenia sp.

CEPHALOPODA
goniatite, indeterminate
straight nautiloid, indeterminate

OTHER
Hyolithes sp.

In addition to these occurrences, I have found *Lingula* in a canneloid shale overlying the Blue Gem coal zone (Lower Elkhorn) in the Winfield Quadrangle. In the Evarts Quadrangle I discovered a coal-ball locality at the base of the Crummies shale (Phillips and Chesnut, 1980) and numerous marine fossil localities in the Crummies.

Preliminary paleontological reports from the U.S. Geological Survey (PR–0178, –0197, –0211) list the following fauna:

BRACHIOPODA
Anthracospirifer aff. *A. opimus* (Hall)
Composita sp.
Eolissochonetes sp.
Linoproductus nodosus (Newberry)

GASTROPODA
Bellerophon (B.) sp.
euomphalid, genus indeterminate, possibly *Straparollus (Euomphalus)*
Trepospira cf. *T. depressa* (Cox)

CEPHALOPODA
Metacoceras sp.
Neobistrialites sp.
pseudorthoceratid, probably *Pseudorthoceras*

SHALE MEMBER G

Marine shale and sandstone sequences overlying the Upper Elkhorn No. 1 coal bed and its correlates are herein informally called shale member G (Pikeville formation, Breathitt Group). The following geologic quadrangle maps record evidence for marine strata in this member:

Broad Bottom: Shale with calcareous concretions.

Paintsville: Calcareous sandstone.

Prestonsburg: Shale with calcareous concretions.

SHALE MEMBER H

An unnamed shale sequence above the Upper Elkhorn No. 2 coal bed (and lateral equivalents) is herein informally referred to as shale member H (Pikeville formation, Breathitt Group). Geologic quadrangle maps that provide support for a marine or brackish-water interpretation for this member are:

Ault: Shale with calcareous concretions.

Artemus: Siltstone with limestone nodules and cone-in-cone structure.

Balkan(?): Shale with marine fossils (stratigraphic position uncertain).

Barcreek: Shale with calcareous concretions.

Broad Bottom: Shale with calcareous concretions.

Bruin: Sandstone with calcareous concretions, and fossils.

Cannel City: Shale with calcareous concretions.

Canoe: Shale with limestone.

Corbin(?): Calcareous sandstone about 20 feet above the Moss coal bed (stratigraphic position uncertain).

Dingus: Shale with linguloid brachiopods.

Dorton(?): Calcareous sandstone (stratigraphic position uncertain).

Elkhorn City and Harman: Shale with calcareous concretions.

Ezel: Shale with calcareous concretions.

Fount: Shale with calcareous concretions.

Grayson: Siltstone with calcareous concretions.

Harold: Siltstone and sandstone with calcareous concretions, and trace fossils.

Hazel Green: Shale, siltstone, and sandstone with calcareous concretions.

Heidrick: Shale with calcareous concretions, and gastropods.

Isonville: Shale with calcareous concretions, calcareous sandstone, and fossils.

Lee City: Shale with calcareous concretions, and calcareous shale.

Manchester(?): Sandstone with calcareous concretions about 250 feet above the Manchester coal bed (stratigraphic level uncertain).

Martin: Siltstone with calcareous concretions.

McDowell: Siltstone with calcareous concretions.

Meta: Shale with calcareous concretions.

Millard: Calcareous siltstone.

Pikeville: Shale with calcareous concretions, and linguloid brachiopods.

Prestonsburg(?): Calcareous sandstone (stratigraphic position uncertain).

Rockholds: Shale with calcareous concretions.

Quicksand: Shale with calcareous concretions.

Sandy Hook: Shale and sandstone with calcareous concretions.

Scranton: Shale with gastropods, according to Norman C. Hester's field notes for this quadrangle .

Wayland: Calcareous sandstone and limestone.

West Liberty(?): Shale with calcareous concretions (stratigraphic position uncertain).

Williamson: Calcareous shale and brackish fossils.

DWALE AND ELKINS FORK SHALE MEMBERS

Marine and brackish-water shales within the Upper Elkhorn No. 3 coal zone are informally called the Dwale shale member (Pikeville formation, Breathitt Group). Marine shales overlying the Upper Elkhorn No. $3^1/_2$ (Darby?) coal bed are informally called the Elkins Fork shale (Pikeville formation, Breathitt Group). Because of stratigraphic problems, especially where the Upper Elkhorn No. $3^1/_2$ coal bed is missing, the Dwale and Elkins Fork shales are discussed together in this report.

Harned (1979) indicated marine shales with invertebrate fossils in the Elkins Fork shale in the Eagan, Evarts, Flat Gap, Fork Ridge, Frakes, Kayjay, Keokee, Nolansburg, Pennington Gap, Wallins Creek, and Whitesburg Quadrangles. Numerous geologic quadrangle maps have reported evidence for marine or brackish-water depositional environments for these shale members. They are:

Adams(?): Shale with calcareous concretions (stratigraphic level uncertain).

Artemus: Sandstone with brachiopods and crinoids.

Balkan: Shale with marine fossils.

Barbourville: Sandstone with limestone nodules, and marine fossils.

Barcreek: Shale with calcareous concretions.

Beattyville: Calcareous concretions.

Belfry: Shale with pelecypods, and articulate and linguloid brachiopods.

Benham and Appalachian: Calcareous shale and siltstone, and marine brachiopods.

Big Creek: Siltstone with calcareous concretions.

Blackey: Shale, siltstone, and sandstone with calcareous concretions.

Booneville: Calcareous concretions.

Broad Bottom: Shale and sandstone with calcareous concretions, and invertebrate fossils, including articulate and linguloid brachiopods.

Canoe(?): Invertebrate fossils (stratigraphic level uncertain).

Corbin(?): Calcareous concretions and limestone beds(?) about 110 feet above the Moss coal

bed; fossiliferous(?) (stratigraphic position uncertain).

Creekville: Calcareous concretions.

David: Shale and siltstone with calcareous concretions.

Delbarton: Shale with calcareous concretions, and linguloid brachiopods.

Dingus: Shale with articulate and linguloid brachiopods.

Dorton: Shale with calcareous concretions, calcareous sandstone, and invertebrate fossils, including linguloid brachiopods.

Ezel: Shale with calcareous concretions.

Fount: Shale with calcareous concretions, and fossils.

Frakes: Shale with marine fossils.

Grayson: Shale with linguloid brachiopods.

Handshoe: Calcareous shale with calcareous concretions, and marine invertebrate fossils.

Harlan: Shale, and marine brachiopods and pelecypods.

Harold: Shale, siltstone with calcareous concretions, calcareous sandstone, and fossils, including linguloid brachiopods.

Heidrick: Shale and siltstone with linguloid brachiopods.

Hindman: Shale with marine fossils.

Ivyton: Calcareous concretions and fossils.

Jellico West: Calcareous shale with articulate brachiopods.

Jenkins West(?): Shale and siltstone with calcareous concretions, and calcareous sandstone (stratigraphic level uncertain).

Kayjay: Shale with marine fossils.

Ketchen: Calcareous shale with articulate brachiopods.

Kite: Shale with calcareous concretions, and brachiopods.

Lancer: Siltstone and sandstone with calcareous concretions, and fossils, including linguloid brachiopods.

Landsaw: Shale with calcareous concretions.

Lick Creek: Shale with calcareous concretions, and invertebrate fossils, including marine or brackish forms.

Lily(?): Sandstone with calcareous concretions about 100 feet above the Jellico coal bed (stratigraphic position uncertain).

Louellen: Marine zone, siltstone, and marine brachiopods.

Martin: Shale, siltstone, sandstone with calcareous concretions, and fossils, including linguloid brachiopods.

Matewan: Shale with marine fossils, including linguloid brachiopods.

Maulden(?): Calcareous sandstone.

McDowell: Siltstone and sandstone with calcareous concretions, calcareous siltstone, and marine invertebrates.

Meta: Shale and sandstone with calcareous concretions, and fossils, including articulate and linguloid brachiopods.

Millard: Shale and siltstone with calcareous concretions, and linguloid brachiopods.

Milo and Webb: Shale with limestone nodules and beds.

Offutt: Shale with linguloid brachiopods.

Ogle: Calcareous shale and sandstone, and marine invertebrate fossils.

Paintsville: Calcareous shale, siltstone with calcareous concretions, and articulate brachiopods.

Pikeville: Shale and sandstone with calcareous concretions, and marine invertebrate fossils, including articulate brachiopods.

Pineville: Shale and siltstone with fossils.

Prestonsburg: Shale, siltstone, and sandstone with calcareous concretions.

Quicksand: Shale with calcareous concretions.

Redbush: Siltstone and calcareous sandstone with calcareous concretions.

Roxana: Shale, siltstone, and sandstone with limestone beds, and brackish or marine fossils.

Salyersville North: Shale, siltstone, and sandstone with calcareous concretions.

Salyersville South: Limestone nodules.

Saxton: Shale with calcareous concretions, and brachiopods.

Scalf: Fossils, according to Fount geologic quadrangle map.

Thomas: Shale and sandstone with calcareous concretions, and fossils.

Tilford: Shale and siltstone with calcareous concretions, and fossils.

Varney: Shale with marine or brackish brachiopods and pelecypods.

Vicco: Shale, siltstone, and sandstone with calcareous concretions.

Vox: Calcareous concretions.

Wayland: Limestone beds in Upper Elkhorn No. 3 coal zone; above coal is zone with calcareous concretions containing articulate brachiopods.

West Liberty: Shale with linguloid brachiopods.

Williamson: Calcareous shale.

Morse (1931) listed the following fossils from the Dwale and Elkins Fork shales:

BRACHIOPODA
Lingula carbonaria Shumard
Productus [Linoproductus] cora d'Orbigny
Productus (Marginifera) missouriensis Girty
Productus (Marginifera) [Hystriculina] wabashensis Norwood and Pratten?
Productus [Linoproductus] nodosus Newberry
Productus [Juresania] nebraskensis Owen
Productus [Juresania] symmetricus McChesney

PELECYPODA
Aviculopecten [Streblochondria] herzeri Meek
Myalina swallovi McChesney [*Promytilus pottsvillensis*]

GASTROPODA
Worthenia tabulata Conrad

CEPHALOPODA
Orthoceras[?] sp.

Preliminary paleontological reports from the U.S. Geological Survey (PR–0150, –0190) list the following fauna:

BRACHIOPODA
Anthracospirifer sp.
Antiquatonia aff. *A. coloradoensis* (Girty)
Antiquatonia sp. (small)
Derbyia sp. indeterminate
Desmoinesia sp.
Juresania n. sp.
Linoproductus aff. *L. nodosus* (Newberry)

PELECYPODA
Aviculopecten germanus Miller and Faber
Aviculopecten sp.
nuculoid, undetermined
Parallelodon sp.
Sanquinolites sp.
Schizodus sp. 1
Schizodus sp. 2
?Septimyalina sp.
cf. *Streblochondria hertzeri* (Meek)
aff. *Wilkingia* sp.

GASTROPODA
Bellerophon (Pharkidonotus) sp. indeterminate
pleurotomarioid

OSTRACODA
Pseudobythocypris? sp.
Sansabella sp.
genus indeterminate

KENDRICK SHALE MEMBER

The Kendrick Shale Member (Hyden formation, Breathitt Group) consists of shale overlying the Amburgy and correlative coal beds. The Kendrick has proven to be one of the most important stratigraphic marker members in eastern Kentucky.

The Kendrick Shale has been reported as follows in these geologic quadrangles:

Adams: Shale with calcareous concretions, and fossils.

Artemus: Shale with marine fossils.

Ault: Calcareous sandstone with calcareous concretions.

Balkan: Shale with fossils.

Barbourville: Shale and siltstone, and marine fossils.

Barcreek: Kendrick Shale.

Blackwater(?): Sandstone with calcareous concretions about 220 feet above the Jellico coal bed (stratigraphic level uncertain).

Beattyville: Calcareous sandstone with calcareous concretions.

Belfry: Shale and siltstone with calcareous concretions, and fossils, including cephalopods and articulate and linguloid brachiopods.

Benham and Appalachian: Calcareous shale, brachiopods, and pelecypods.

Big Creek: Shale, siltstone, and sandstone with calcareous concretions, and marine fossils, including brachiopods and gastropods.

Blackey: Shale with calcareous concretions, and marine invertebrate fossils.

Blackwater(?): Sandstone with calcareous concretion about 220 feet above the Jellico coal bed (stratigraphic level uncertain).

Booneville: Shale with calcareous concretions.

Broad Bottom: Shale and sandstone with calcareous concretions, crinoids, corals, and articulate and linguloid brachiopods.

Bruin: Shale and calcareous sandstone with calcareous concretions.

Buckhorn: Shale with brachiopods and gastropods.

Campton: Calcareous sandstone.

Cannel City: Shale and siltstone with calcareous concretions, and fossils.

Canoe: Shale and sandstone with calcareous concretions, cone-in-cone structure, fossils, and trace fossils.

Corbin(?): Calcareous sandstone (stratigraphic position uncertain).

Cowcreek: Shale and sandstone with calcareous concretions, and trace fossils.

Creekville: Shale, siltstone, sandstone, and marine invertebrate fossils.

Cutshin: Shale and siltstone with calcareous concretions, and fossils.

David: Shale, calcareous siltstone and sandstone, and marine fossils.

Delbarton: Shale with calcareous concretions, and marine invertebrate fossils.

Dingus: Kendrick Shale.

Dorton: Shale with calcareous concretions, and invertebrate fossils, including articulate brachiopods, gastropods, and corals.

Elkhorn City and Harman: Kendrick Shale.

Evarts and Hubbard Springs: Shale with marine fossils.

Ewing: Calcareous shale and siltstone with calcareous concretions, and marine fossils.

Ezel: Kendrick Shale.

Fount: Shale, siltstone, and marine fossils, including pelecypods.

Frakes: Shale, siltstone, and marine fossils.

Grahn: Shale and calcareous sandstone.

Grayson: Shale, siltstone with calcareous concretions, and marine fossils.

Haddix: Calcareous shale and siltstone with calcareous concretions, and marine fossils.

Handshoe: Shale, siltstone, and marine fossils.

Harlan: Shale with marine pelecypods and brachiopods.

Harold: Shale, siltstone, calcareous sandstone with limestone nodules, brachiopods, and pelecypods.

Hazard South: Shale with calcareous concretions, and marine fossils.

Hazel Green: Shale and siltstone with calcareous concretions.

Heidrick: Brachiopods, pelecypods, and gastropods.

Hellier and Clintwood: Calcareous shale with calcareous concretions, and marine fossils.

Hindman: Shale with limestone nodules beds, cone-in-cone structure, and marine fossils.

Hoskinston: Kendrick Shale.

Hyden East: Calcareous shale and siltstone with calcareous concretions, and marine fossils.

Hyden West: Shale with calcareous concretions, marine fossils, and trace fossils.

Isonville: Shale and calcareous sandstone with calcareous concretions.

Ivyton: Shale and siltstone with calcareous concretions, and fossils.

Jackson: Calcareous shale with calcareous concretions.

Jamboree: Shale, siltstone, and sandstone with calcareous concretions.

Jenkins East: Shale and siltstone with calcareous concretions, and marine fossils.

Jenkins West: Shale with calcareous concretions, and marine fossils.

Kayjay: Shale and siltstone with pyritized fossils, brachiopods, gastropods, and other fossils (south of Pine Mountain); shale with marine fossils (north of Pine Mountain).

Kermit: Calcareous shale, siltstone, and sandstone, and brachiopods and pelecypods.

Kite: Shale with calcareous concretions, limestone bed, and marine invertebrate fossils.

Krypton: Calcareous shale and siltstone with calcareous concretions.

Lancer: Shale, siltstone, calcareous sandstone with calcareous concretions, and marine fossils.

Landsaw: Shale and siltstone with calcareous concretions, and calcareous sandstone.

Lee City: Calcareous shale with calcareous concretions, and sandstone.

Lenox: Calcareous shale and fossils.

Lick Creek: Shale with calcareous concretions, and marine invertebrate fossils, including pelecypods, gastropods, and linguloid brachiopods.

Load: Siltstone with calcareous concretions, and articulate brachiopods.

Louellen: Calcareous shale and brachiopods (south of Pine Mountain); calcareous shale with marine fossils (north of Pine Mountain).

Louisa: Calcareous concretions and fossils.

Majestic, Hurley, and Wharncliffe: Calcareous shale, siltstone, sandstone with calcareous concretions, brachiopods, and pelecypods.

Martin: Shale, siltstone, sandstone with limestone nodules, brachiopods, and pelecypods.

Matewan: Shale with calcareous concretions, limestone beds, and marine fossils, including brachiopods and pelecypods.

Mayking: Shale and siltstone with calcareous concretions, and brachiopods and pelecypods.

Mazie: Kendrick Shale.

McDowell: Shale, siltstone, and sandstone with calcareous concretions, cone-in-cone structure, and marine fossils.

Meta: Shale, siltstone, and sandstone with calcareous concretions, and fossils, including cephalopods, pelecypods, and articulate and linguloid brachiopods.

Millard: Calcareous shale and siltstone with calcareous concretions, and fossils, including crinoids and articulate and linguloid brachiopods.

Milo and Webb: Shale with calcareous concretions, and articulate and linguloid brachiopods.

Mistletoe: Shale and siltstone with calcareous concretions, and brachiopods and pelecypods.

Naugatuck: Shale and marine invertebrate fossils.

Offutt: Calcareous shale and sandstone, and fossils, including linguloid (and articulate?) brachiopods, pelecypods, and gastropods.

Ogle: Calcareous shale with limestone, and marine fossils, including brachiopods and pelecypods.

Oldtown: Calcareous shale and siltstone, sandstone with calcareous concretions, and articulate brachiopods, gastropods, and pelecypods, including *Bellerophon?*, *Chonetes?*, *Marginifera?*, *Lima?*, and *Nuculana?*.

Oil Springs: Calcareous shale, siltstone, and sandstone with calcareous concretions, and brachiopods.

Olive Hill: Calcareous sandstone, pelecypods, and gastropods.

Oneida: Calcareous siltstone, sandstone, and brachiopods.

Paintsville: Shale, calcareous siltstone, sandstone, brachiopods, pelecypods, and gastropods.

Pennington Gap: Calcareous shale and fossils.

Pikeville: Shale, siltstone, sandstone with calcareous concretions, and marine invertebrate fossils.

Pineville: Shale, siltstone, and fossils.

Portsmouth and Wheelersburg: Shale, calcareous siltstone, limestone, and marine fossils.

Prestonsburg: Shale, siltstone, calcareous sandstone with calcareous concretions, and fossils.

Quicksand: Shale and sandstone with calcareous concretions, and fossils.

Redbush: Siltstone with calcareous concretions.

Richardson: Shale with calcareous concretions.

Roxana: Shale, siltstone, brachiopods, pelecypods, and gastropods.

Rush: Shale with calcareous concretions.

Sandy Hook: Shale, siltstone, and calcareous sandstone with calcareous concretions.

Saylersville North: Shale and siltstone with calcareous concretions, sandstone, and fossils.

Saylersville South: Shale with calcareous concretions, calcareous sandstone, and fossils.

Saxton: Shale with brachiopods.

Scalf: Shale, brachiopods, and pelecypods.

Seitz: Shale with calcareous concretions, and fossils.

Sitka: Shale with calcareous concretions.

Tallega(?): Kendrick Shale?

Thomas: Calcareous shale and sandstone, and marine fossils.

Tilford: Calcareous shale and siltstone with calcareous concretions, and fossils, including cephalopods and gastropods.

Tygarts Valley: Calcareous shale and siltstone, and marine fossils, including articulate(?) and linguloid brachiopods.

Varney: Calcareous shale, siltstone, sandstone, brachiopods, and pelecypods.

Vicco: Shale with calcareous concretions, and marine invertebrate fossils.

Wallins Creek: Calcareous shale with calcareous concretions, brachiopods, pelecypods, and gastropods.

Wayland: Shale, siltstone, sandstone with calcareous concretions, and fossils.

West Liberty: Calcareous sandstone with calcareous concretions, brachiopods, and crinoids.

Wheelwright: Shale, siltstone, and sandstone with calcareous concretions, and marine fossils.

White Oak: Shale and siltstone with calcareous concretions, limestone beds, sandstone, and fossils.

Whitesburg and Flat Gap: Shale and siltstone with calcareous concretions, and marine fossils, including articulate brachiopods.

Williamson: Calcareous shale and sandstone with calcareous concretions, and marine or brackish fossils.

Willard: Shale with calcareous concretions, limestone beds, and brachiopods.

Wrigley: Calcareous sandstone with calcareous concretions(?).

Harned (1979) indicated that the Eagan, Fork Ridge, Frakes, and Keokee Quadrangles contain the Kendrick Shale, in addition to the above quadrangles.

Morse (1931) listed the following fossils from the Kendrick:

BRACHIOPODA

Ambocoelia [Crurithyris] planoconvexa Shumard
Chonetes [Eolissochonetes] glaber Geinitz
Cleiothyridina orbicularis McChesney
Composita subtilita Hall [p. 314-315]
Derbyia crassa Meek and Hayden [p. 308]
Lingula umbonata Cox
Lingulipora kentuckyensis Morse
Lingulipora [Trigonoglossa] nebraskensis Meek
Orbiculoidea [Lindstroemella] patula Girty
Orbiculoidea sp.
Productus [Linoproductus] cora d'Orbigny
Productus [Marginifera] missouriensis Girty
Productus [Juresania] nebraskensis Owen
Productus [Dictyclostus] semireticulatus Martin [p. 311–312]
Productus sp.[?]
Reticularia [Phricodithyris] perplexa McChesney
Spirifer [Neospirifer] cameratus Morton [p. 312]
Spirifer rockymontanus Marcou [T. W. Henry suggested that this is probably *Anthracospirifer gorsei* Mather, which is common in the Kendrick]

BRYOZOA

bryozoa, undetermined

PELECYPODA

Anthraconeilo taffiana Girty *[Palaeoneilo oweni]*
Astartella arcuata Morse
Astartella compacta Girty
Astartella concentrica Conrad
Astartella kentuckyensis Morse
Avicula[?] acosta Cox
Aviculopinna [Pteronites] sp.
Aviculopinna [P.] americana Meek
Deltopecten texanus Girty
Edmondia glabra Meek
Entolium [Pernopecten] aviculatum Swallow
Leda [Phestia] bellistriata Stevens
Leda [Phestia] jillsoni Morse
Lima [Palaeolima] retifera Shumard
Modiola [Modiolus] sp.
Monopteria sp.
Nucula[?] sp.
Nucula [Nuculopsis] anodontoides Meek
Nuculopsis [Nuculopsis] ventricosa Hall
Pinna sp.
Pleurophorus [Permophorus] subcostatus Meek and Worthen
Posidonomya [Posidonia] fracta Meek
Prothyris elegans Meek
Schizodus affinis Herrick
Schizodus alpinus Hall
Solenomya [Solemya] sp.
Yoldia [Paleyoldia] glabra Beede and Rogers

GASTROPODA

Aclisina [*Donaldina*] *stevensana* Meek and Worthen

Bellerophon sp. 1
Bellerophon sp. 2
Bellerophon (Euphemus) [Euphemites] carbonarius Cox [p. 322]
Bellerophon [Pharkidonotus] crassus Meek and Worthen
Bellerophon (Bucanopsis) meekianus Swallow [*Retispira tenuilineata*]
Bellerophon (Patellostium) [Cymatospira] montfortanus Norwood and Pratten
Bulimorphia [Girtyspira] minuta Stevens
Meekospira peracuta Meek and Worthen
Pleurotomaria n. sp.[?]
Schizostoma [Straparollus] catilloides Conrad
Sphaerodoma [Ianthinopsis] brevis White
Sphaerodoma [I.] primigenis Conrad
Trepospira depressa Cox
Worthenia n. sp. 1
Worthenia n. sp. 2
Worthenia tabulata Conrad
Zygopleura [Pseudozygopleura] plebeia Herrick

CEPHALOPODA
Cyrtoceras sp.
Gastrioceras n. spp., three species
Gastrioceras montgomeryense Miller and Gurley
Gastrioceras occidentale Miller and Faber
Metacoceras scuptile Girty
Orthoceras n. spp.[?], two new species
Orthoceras [Mooreoceras] colletti Miller
Orthoceras (Pseudorthoceras) [P.] knoxense McChesney

SCAPHOPODA
Plagioglypta annulistriata Meek and Worthen

COELENTERATA
Lophophyllidium profundum (Milne-Edwards and Haine)

ECHINODERMATA
crinoid plates and stems
Hydreionocrinus [Plaxocrinus] kansasensis (Weller)

TRILOBITA
Phillipsia [Sevillea] trinucleata (Herrick)

Furnish and Knapp (1966) listed several cephalopods from the Kendrick Shale; they are:

Diaboloceras neumeieri Quinn and Carr
Dimorphoceratoides campbellae Furnish and Knapp
Gastrioceras occidentale (Miller and Faber)
Neoicoceras [Gastrioceras] elkhornense (Miller and Gurley), *Beyrichoceratoides [Muensteroceras] lunatus* (Miller and Gurley) [the exact stratigraphic position of this goniatite is unknown but may come from the Kendrick Shale]

Strimple and Knapp (1966) listed several crinoids from the Kendrick, including:

Metacromyocrinus oklahomensis Moore and Plummer
Paragassizocrinus kendrickensis Strimple and Knapp
Paragassizocrinus cf. *P. disculus* Strimple
Paragassizocrinus cf. *P. turris* Strimple [several of the *Paragassizocrinus* species have been synonomized by Ettensohn (1980)]

Summerson and Campbell (1958) reported the following holothurian sclerites from the Kendrick Shale of Kentucky:

Achistrum brownwoodensis? (Croneis)
Achistrum ludwigi (Croneis)
Achistrum monochordata? Hodson, Harris, and Lewison
Achistrum nicholsoni? Etheridge
Etheridgella biconvexa Summerson and Campbell
Petropegia radiata Summerson and Campbell
Petropegia spinosa Summerson and Campbell
Protocaudina kansasensis (Hanna)
Theelia hexacneme Summerson and Campbell
Thuroholia? sp.
Thuroholia croneisi Gutschick
Thuroholia floydensis Summerson and Campbell
Thuroholia gutschicki (Frizzell and Exline)
Thuroholia irregularis Summerson and Campbell
Thuroholia mccormacki (Frizzell and Exline)
Thuroholia wanlessi Summerson and Campbell

Preliminary paleontological reports from the U.S. Geological Survey (PR–0138, –0140, –0150, –0170, –0188, –0190, –0195, –0211) list the following fauna:

BRACHIOPODA
Anthracospirifer sp.
Antiquatonia? cf. *A. morrowensis* (Mather)
Antiquatonia aff. *A. coloradoensis* (Girty)
Composita sp. indeterminate
Derbyia sp. indeterminate
Desmoinesia n. sp.

productoid aff. *Desmoinesia* sp.
Hustedia sp. indeterminate
Juresania cf. *J. nebrascensis* (Owen)
Juresania sp.
?Juresania n. sp.
Linoproductus nodosus (Newberry)
Linoproductus aff. *L. nodosus* (Newberry)
Lissochonetes [Eolissochonetes] sp.
Orbiculoidea sp. indeterminate
Punctospirifer transversus (McChesney)
Rhynchopora sp.
Spirifer sp. (*S. [Anthracospirifer] occiduus* Sadlick group)
Tornquistia? sp.

BRYOZOA
fenestrate

PELECYPODA
Astartella sp. indeterminate
Edmondia sp. indeterminate
myalinid, indeterminate
Myalina? sp. indeterminate
Nucula sp.
Nucula sp. (strong concentric growth lines)
Nuculopsis aff. *N. girtyi* Shenk
Nuculopsis? sp. indeterminate
Parallelodon sp.
Parallelodon? sp.
pectenid, indeterminate
Schizodus sp.
cf. *Schizodus* sp.
Septimyalina sp. indeterminate
Septimyalina n. sp.?
Solemya? sp.
Solenomorpha? sp.
Volsellina sp.
Wilkingia sp. indeterminate
Yoldia [Paleyoldia] sp.

GASTROPODA
Bellerophon cf. *B. (B.) stevensianus* McChesney
Bellerophon (Pharkidonotus) n. sp.
Donaldina sp.
Euphemites cf. *E. multiliratus* Sturgeon
Euphemites n. sp.
Euphemites sp. indeterminate
Fasiculiconcha scalaris (Herrick)
Glabrocingulum (G.)? n. sp.
Glyptotomaria cf. *G. (Dictyotomaria) scitula* (Meek and Worthen)
Ianthinopsis sp.
Knightites (Retispira) sp. indeterminate
Meekospira sp. indeterminate
pleurotomarioid, two genera
Shansiella carbonaria (Norwood and Pratten)
Straparollus (Amphiscapha) sp. indeterminate
Trepospira cf. *T. (T.) illinoisensis* Worthen

CEPHALOPODA
Dimorphoceratoides campbellae Furnish and Knapp?
Gastrioceras occidentale (Miller and Faber)
Gastrioceras occidentale (Miller and Faber)?
Metacoceras sp.
Mooreoceras colletti (Miller)?

SCAPHOPODA
scaphopod?, genus indeterminate

COELENTERATA
Lophophyllidium sp.

ECHINODERMATA
Agassizocrinus sp. *[Paragassizocrinus]*
Paragassizocrinus cf. *P. turris* Strimple
crinoid plates
crinoid stem

OSTRACODA
Bairdia spp.
Bairdiacypris sp.
Bairdiolites ardmorensis (Harlton)
Cavellina sp.
Cavellinella casei Bradfield?
Cavellinella sp.
Geisina jollifiana Cooper
Geisina? sp.
Healdia spp.
Hollinella spp.
Microparaparchites reductospinosus Sohn
Microparaparchites aff. *M. ottervillicus* (Bradfield)
Microparaparchites spp.
Monoceratina ardmorensis (Harlton)
Monoceratina winifrediana Sohn
Monoceratina sp.
Moorites spp.
Nuferella? [Geisina] sp.
Pseudobythocypris pediformis (Knight)
Pseudoparaparchites sp.
Sansabella spp.
Seminolites spp.
Shleesha pinguis (Ulrich and Bassler)
genus indeterminate, bisulcate
genus indeterminate, unisulcate
genus indeterminate, small, smooth

CONODONTA
Cavusgnathus cf. *C. alata* Harris and Hollingsworth
Streptognathodus sp.

fragments

VERTEBRATA

Cooperella sp. [microicthyoliths]

Sohn (1983) reported the following ostracodes from the Kendrick Shale:

OSTRACODA

Bairdiolites astigmaticus Sohn
Cavellinella? pricei Sohn
"Microparaparchites" reductospinosus Sohn
Plavskella englundi Sohn

MARINE MEMBERS I AND J

At least two marine members are associated with the Whitesburg coal zone: informal member I (Hyden formation, Breathitt Group) overlies the Lower Whitesburg coal bed, and informal member J (Hyden formation, Breathitt Group) overlies the Upper Whitesburg coal bed. These marine members are treated together here because of problems in discerning stratigraphic position in some areas. The abundant occurrences of calcareous sandstone at these levels may have been caused by fluid migration from the underlying Kendrick Shale rather than by conditions during deposition of these informal units.

Evidence for marine strata was reported in the following geologic quadrangle maps:

Argillite: Calcareous sandstone.

Big Creek: Shale with linguloid brachiopods.

Blackwater(?): Sandstone with calcareous concretions at two levels that may coincide with strata in the Whitesburg coal zone (at about 290 and about 370 feet above the Jellico coal bed).

Buckhorn: Shale with linguloid brachiopods.

Corbin(?): Calcareous concretions and limestone beds about 250 above the Moss coal bed; fossiliferous(?) (stratigraphic position uncertain).

Creekville: Shale with linguloid brachiopods.

Cutshin(?): Shale and siltstone with calcareous concretions (stratigraphic position uncertain).

Dorton: Calcareous sandstone.

Ewing: Calcareous shale, siltstone with calcareous concretions, and marine fossils.

Fount: Shale with calcareous concretions.

Frakes: Shale with marine fossils.

Grayson(?): Siltstone and sandstone with limestone beds (stratigraphic level uncertain).

Hazard North: Calcareous concretions.

Heidrick: Shale and siltstone with calcareous concretions, and linguloid brachiopods.

Hoskinston: Shale with calcareous concretions, and calcareous sandstone.

Hyden East: Calcareous shale and siltstone with calcareous concretions.

Hyden West: Calcareous shale, siltstone with calcareous concretions, and fossils, including brachiopods.

Inez: Calcareous sandstone.

Isonville: Shale with calcareous concretions and calcareous sandstone.

Ivyton: Shale with linguloid brachiopods.

Kermit: Calcareous sandstone.

Krypton: Shale with calcareous concretions.

Landsaw: Calcareous sandstone.

Leatherwood(?): Calcareous shale and siltstone with calcareous concretions (stratigraphic position uncertain).

Lenox: Calcareous sandstone with calcareous concretions.

Martin: Calcareous sandstone.

Mayking: Shale and siltstone with calcareous concretions, and linguloid brachiopods.

McDowell: Calcareous sandstone.

Millard: Marine shale and sandstone.

Milo and Webb: Shale with calcareous concretions, calcareous sandstone, and articulate and linguloid brachiopods.

Mistletoe: Shale with marine fossils.

Ogle: Shale with calcareous concretions, calcareous sandstone, and marine fossils, including brachiopods and pelecypods.

Offutt: Shale with linguloid brachiopods.

Oil Springs: Shale with linguloid brachiopods.

Oldtown: Calcareous sandstone.

Paintsville: Shale with linguloid brachiopods.

Portsmouth and Wheelersburg: Calcareous sandstone.

Prestonsburg: Calcareous sandstone.

Salyersville South: Limestone beds.

Seitz: Calcareous sandstone.

Thomas: Calcareous sandstone.

Tilford: Shale and siltstone with calcareous concretions.

Vicco: Shale with calcareous concretions.

Wallins Creek: Calcareous shale and linguloid brachiopods.

Wayland: Calcareous sandstone.

White Oak: Shale with calcareous concretions, and fossils.

A preliminary report (PR–0213) from the Paleontology and Stratigraphy Branch of the U.S. Geological Survey lists the following fauna:

BRACHIOPODA
Desmoinesia nambeensis? Sutherland and Harlow
"*Juresania*" sp. indeterminate
Orbiculoidea sp. indeterminate
productoid, large, genus indeterminate
Sandia? sp. indeterminate, possibly *S. welleri* (Mather)
spiriferid, genus indeterminate

ECHINODERMATA
crinoid calyx plates, genus indeterminate
pelmatozoan columnal

SHALE MEMBER K

Some shale beds within and above the Fire Clay coal zone show signs of marine depositional environments. These shale beds are herein informally called shale member K (Hyden formation, Breathitt Group).

The following geologic quadrangle maps reported evidence for a marine or brackish interpretation for these shales:

Barcreek: Shale, calcareous sandstone, and linguloid brachiopods(?).

Benham and Appalachian: Shale, siltstone, and marine fossils.

Big Creek: Shale with calcareous concretions and calcareous sandstone.

Booneville: Calcareous sandstone with calcareous concretions.

Campton: Calcareous sandstone.

Canoe: Calcareous siltstone.

Frakes: Shale and marine fossils.

Grayson(?): Shale, siltstone, sandstone with calcareous concretions, and limestone beds (stratigraphic position uncertain).

Hazard South: Calcareous shale with limestone beds.

Helton: Siltstone with calcareous concretions, cone-in-cone structure, marine zone, brachiopods, and pelecypods.

Hyden West(?): Siltstone with calcareous concretions (stratigraphic level uncertain).

Jackson: Siltstone and calcareous sandstone.

Jenkins West: Shale, siltstone with calcareous concretions, calcareous sandstone, and marine or brackish fossils.

Lee City: Shale with calcareous concretions and calcareous sandstone.

Lenox: Siltstone with calcareous concretions.

Martin: Calcareous sandstone.

Mayking: Shale and siltstone with calcareous concretions, calcareous sandstone, and brachiopods.

McDowell: Calcareous sandstone.

Millard: Calcareous sandstone.

Milo and Webb: Shale, siltstone, calcareous sandstone, and linguloid brachiopods.

Oldtown(?): Calcareous sandstone (stratigraphic position uncertain).

Seitz: Shale with calcareous concretions.

Thomas: Shale, calcareous sandstone, and brackish or marine fossils.

Wallins Creek: Shale and fossils, including nonmarine pelecypods.

Whitesburg and Flat Gap: Shale with marine invertebrate fossils.

Harned indicated marine zones composed of calcareous shales with calcareous concretions in the Eagan, Fork Ridge, Frakes, Harlan, and Kayjay Quadrangles, in addition to these occurrences.

A preliminary paleontological report from the U.S. Geological Survey (PR–0194) lists the following fauna:

PELECYPODA
Anthraconauta sp.

SHALE MEMBER L

A marine or brackish-water shale has also been recognized above the Fire Clay rider coal bed. This shale is informally called shale member L (Hyden formation, Breathitt Group). Problems correlating the Fire Clay Rider and Hamlin coal beds in some areas may cause shale member L to be confused with the shale member overlying the Hamlin coal bed (*see* next section).

The following geologic quadrangle maps provide evidence for marine or brackish-water strata at this position:

Balkan: Shale, marine zone, and fossils.

Barcreek: Shale with calcareous concretions.

Big Creek: Shale with calcareous concretions, and linguloid brachiopods.

Booneville: Calcareous concretions.

Buckhorn: Shale with calcareous concretions, and brachiopods.

Cannel City: Shale with linguloid brachiopods.

Canoe: Shale with linguloid brachiopods.

Carrie: Shale with calcareous concretions, limestone beds, and marine fossils.

Cowcreek: Shale, siltstone, articulate and linguloid brachiopods, and pelecypods.

Creekville: Shale with limestone, and marine fossils.

Cutshin: Shale with calcareous concretions (similar to Magoffin Member), and marine fossils.

Dingus: Shale with articulate and linguloid brachiopods.

Dorton: Shale, siltstone, calcareous sandstone, and fossils.

Fount: Shale (similar to Magoffin Member) and fossils.

Haddix: Shale and siltstone with calcareous concretions.

Handshoe: Calcareous shale and marine fossils.

Harlan: Siltstone, brachiopods, pelecypods, and crinoids.

Harold: Shale, calcareous sandstone, and marine fossils, including linguloid brachiopods.

Hindman: Calcareous shale and marine fossils.

Hoskinston: Calcareous shale with calcareous concretions, calcareous sandstone, and marine fossils.

Hyden East: Calcareous sandstone.

Hyden West: Shale with calcareous concretions, calcareous sandstone, and invertebrate fossils.

Inez: Siltstone and calcareous sandstone.

Ivyton(?): Shale and siltstone with calcareous concretions, calcareous sandstone, and fossils (stratigraphic position uncertain).

Jenkins East(?): Siltstone with calcareous concretions, and marine fossils (stratigraphic level uncertain).

Kermit: Calcareous sandstone.

Krypton: Shale with calcareous concretions.

Lancer: Shale, calcareous sandstone, and brachiopods, including linguloids.

Lee City: Shale with calcareous concretions and calcareous sandstone (stratigraphic level uncertain).

Louellen: Shale, siltstone, and marine fossils.

Martin: Shale, calcareous sandstone, and marine invertebrate fossils, including linguloid brachiopods.

Milo and Webb: Shale, siltstone, and linguloid brachiopods.

Mistletoe: Shale with linguloid brachiopods.

Noble: Shale with limestone, and fossils, including linguloid brachiopods.

Ogle: Shale and marine fossils, including brachiopods and pelecypods.

Pineville: Shale and fossils.

Prestonsburg: Calcareous sandstone.

Salyersville South(?): Shale and fossils (stratigraphic level uncertain).

Saxton: Siltstone with calcareous concretions.

Tilford: Shale and siltstone with lenses of silty limestone (calcareous concretions?).

Tiptop: Shale with articulate brachiopods(?).

Varney(?): Calcareous sandstone (stratigraphic level uncertain).

Vest: Brachiopods.

Wallins Creek: Siltstone, sandstone, brachiopods, and pelecypods.

Wayland: Shale with fossils.

Whitesburg and Flat Gap: Siltstone with calcareous concretions, and marine fossils.

In addition to these occurrences, Harned (1979) reported calcareous marine shale with calcareous concretions and limestone beds and fossils in the Appalachian, Benham, Eagan, Fork Ridge, Flat Gap, Frakes, Kayjay, Louellen, and Whitesburg Quadrangles.

SHALE MEMBER M

Marine or brackish-water strata overlying the Hamlin coal bed (main bed) are herein informally called shale

member M (Hyden formation, Breathitt Group). This shale unit may be confused with the underlying shale member L (described above).

Harned (1979) reported calcareous marine shales above the Hamlin coal correlates in the Evarts, Harlan, Louellen, Pennington Gap, and Wallins Creek Quadrangles.

Possible marine strata at this level have been recognized on the following geologic quadrangle maps:

Canoe: Shale with limestone beds, and articulate brachiopods.

Cutshin: Shale and siltstone with calcareous concretions, limestone beds, coal balls, calcareous sandstone, and marine invertebrate fossils, including crinoids.

Guage: Shale and siltstone with calcareous concretions.

Hazard South: Calcareous shale.

Hindman: Calcareous shale, siltstone, and marine fossils.

Hoskinston: Calcareous sandstone.

Hyden East: Calcareous shale, siltstone with calcareous concretions, and calcareous sandstone.

Hyden West: Shale with limestone, coal balls, and marine fossils, including crinoids.

Isonville: Calcareous concretions and marine zone (this marine zone may merge with the Magoffin Member in this quadrangle).

Leatherwood: Calcareous shale, siltstone with calcareous concretions, and calcareous sandstone.

McDowell: Calcareous sandstone.

Millard: Calcareous sandstone.

Noble: Limestone beds and fossils.

Prestonsburg(?): Calcareous sandstone (stratigraphic level uncertain).

Quicksand: Calcareous concretions.

Tilford: Shale, siltstone with calcareous concretions, and fossils, including brachiopods.

Tiptop: Linguloid brachiopods.

Vicco: Calcareous shale and siltstone with calcareous concretions.

Wayland: Shale and fossils.

A preliminary paleontological report prepared by the U.S. Geological Survey Paleontology and Stratigraphy Branch (PR–0208) reports the following brackish- or fresh-water fauna:

PELECYPODA
Anthraconauta

ANNELIDA
spirorbid worm tubes on some of the pelecypods

MAGOFFIN MEMBER

The Magoffin Member (Four Corners formation, Breathitt Group) is the most widely recognized marine marker unit in the Eastern Kentucky Coal Field. It overlies the Taylor coal zone and its lateral equivalents.

The Magoffin Member has been recognized on the following geologic quadrangle maps:

Adams: Calcareous shale, calcareous sandstone, limestone, brachiopods, and crinoids.

Argillite: Shale, siltstone, sandstone, and marine fossils.

Artemus: Calcareous shale, limestone beds and nodules, and fossils.

Ault: Calcareous shale, limestone, brachiopods, pelecypods, corals, and crinoids.

Balkan: Calcareous shale, marine zone, and fossils.

Barbourville: Shale, limestone nodules, and marine fossils.

Barcreek: Shale, siltstone, sandstone, brachiopods, and other fossils.

Beattyville: Shale, siltstone, brachiopods, gastropods, and crinoids.

Belfry: Shale with calcareous concretions, siltstone, sandstone, articulate and linguloid brachiopods, pelecypods, gastropods, and cephalopods.

Benham and Appalachian: Calcareous shale with calcareous concretions, limestone beds, and marine fossils.

Beverly: Calcareous shale with calcareous concretions, siltstone, brachiopods, and other fossils.

Big Creek: Calcareous shale with calcareous concretions, sandstone, brachiopods, and gastropods.

Blackey: Siltstone, calcareous shale with calcareous concretions, limestone beds, and marine invertebrate fossils.

Blaine: Calcareous sandstone, limestone, brachiopods, and crinoids.

Bledsoe: Calcareous shale, limestone, marine zone, and fossils.

Booneville: Shale, siltstone, sandstone, brachiopods, gastropods, and crinoids.

Broad Bottom: Calcareous siltstone, shale with calcareous concretions, sandstone, articulate and linguloid brachiopods, and crinoids.

Bruin: Sandstone, calcareous concretions, and fossils.

Buckhorn: Shale, siltstone, limestone beds and nodules, and fossils, including brachiopods.

Campton: Shale, siltstone, sandstone, brachiopods, crinoids, and trace fossils.

Cannel City: Calcareous siltstone, shale with calcareous concretions, calcareous sandstone, limestone beds, brachiopods, crinoids, and trace fossils.

Canoe: Shale, siltstone, calcareous sandstone, limestone beds, and marine invertebrate fossils, including brachiopods, cephalopods, crinoids, and other fossils.

Carrie: Calcareous shale, siltstone with calcareous concretions, calcareous sandstone, limestone, and marine fossils.

Cowcreek: Shale, sandstone, and articulate brachiopods.

Creekville: Calcareous shale with calcareous concretions, sandstone, and marine invertebrate fossils.

Cutshin: Siltstone and shale with calcareous concretions, sandstone, and marine invertebrate fossils, including crinoids and other fossils.

David: Calcareous shale with calcareous concretions, calcareous sandstone, limestone beds, brachiopods, pelecypods, cephalopods, bryozoans, and crinoids.

Delbarton: Shale with calcareous concretions, sandstone, and marine or brackish fossils.

Dingus: Siltstone and calcareous shale with calcareous concretions, calcareous sandstone, limestone, and marine fossils.

Dorton: Calcareous shale and siltstone with calcareous concretions, and marine invertebrate fossils.

Evarts and Hubbard Springs: Calcareous shale, limestone beds, and marine fossils.

Ewing: Calcareous shale and marine fossils.

Ezel: Calcareous shale, limestone, articulate brachiopods, bryozoans, pelecypods, gastropods, corals, and other fossils.

Fallsburg and Prichard(?): Sandstone and fossils (stratigraphic level uncertain).

Fount: Shale, siltstone, sandstone, brachiopods, gastropods, and crinoids.

Frakes: Shale, limestone beds and nodules, and marine fossils.

Grayson: Siltstone, calcareous sandstone, limestone, articulate brachiopods, bryzoans, pelecypods, and crinoids.

Grahn(?): Calcareous sandstone (stratigraphic position uncertain).

Greenup and Ironton: Sandstone and invertebrate fossils.

Guage: Calcareous shale with calcareous concretions, limestone beds, brachiopods, and crinoids.

Haddix: Calcareous shale and siltstone with calcareous concretions, limestone, and marine fossils.

Handshoe: Calcareous shale and siltstone with calcareous concretions, calcareous sandstone, limestone beds, and fossils.

Harlan: Calcareous shale, limestone, and fossils.

Harold: Calcareous shale with calcareous concretions, limestone beds, brachiopods, and pelecypods.

Hazard North: Calcareous shale and siltstone with calcareous concretions, limestone beds, and marine fossils.

Hazard South: Calcareous siltstone and shale with calcareous concretions, calcareous sandstone, and marine fossils.

Hazel Green: Siltstone, calcareous shale with calcareous concretions, limestone beds, and fossils.

Hellier and Clintwood: Shale and marine invertebrate fossils.

Helton: Calcareous shale, siltstone, limestone beds and nodules, and marine fossils.

Hindman: Calcareous shale with calcareous concretions and sandstone.

Hoskinston: Calcareous siltstone and shale with calcareous concretions, calcareous sandstone, limestone beds, cone-in-cone structures, and marine fossils, including brachiopods, pelecypods, crinoids, and other fossils.

Hyden East: Siltstone and calcareous shale with calcareous concretions, calcareous sandstone, limestone beds, and marine invertebrate fossils, including crinoids.

Hyden West: Siltstone and shale with calcareous concretions, sandstone, brachiopods, pelecypods, crinoids, and other fossils.

Inez: Calcareous shale with calcareous concretions, limestone beds, brachiopods, bryozoans, gastropods, crinoids, and other fossils.

Isonville: Calcareous shale with calcareous concretions, sandstone, brachiopods, pelecypods, corals, crinoids, and trace fossils.

Ivyton: Siltstone and shale with calcareous concretions, sandstone, and marine fossils.

Jackson: Calcareous siltstone with calcareous concretions, and fossils.

Jamboree: Calcareous shale with calcareous concretions, and marine and brackish fossils.

Jellico West: Shale and limestone.

Jenkins East: Shale, siltstone, calcareous sandstone, and marine fossils.

Jenkins West: Shale with calcareous concretions, and marine fossils.

Kayjay: Shale, siltstone, articulate brachiopods, gastropods, pelecypods, and other fossils (south of Pine Mountain); siltstone and shale with calcareous concretions, calcareous sandstone, and marine fossils (north of Pine Mountain).

Keokee: Calcareous sandstone, limestone, and fossils.

Kermit: Calcareous shale with calcareous concretions, siltstone, brachiopods (including linguloids), pelecypods, crinoids, and trace fossils.

Ketchen: Shale, limestone, and fossils.

Kite: Shale with calcareous concretions, calcareous sandstone, and marine invertebrate fossils.

Krypton: Calcareous shale and siltstone with calcareous concretions, limestone beds, sandstone, and marine fossils, including crinoids.

Lancer: Calcareous shale with calcareous concretions, siltstone, sandstone, limestone beds, and marine invertebrate fossils.

Landsaw: Calcareous siltstone and shale with calcareous concretions, calcareous sandstone, articulate brachiopods, pelecypods, gastropods, and crinoids.

Leatherwood: Calcareous shale with calcareous concretions, calcareous sandstone, limestone beds, and marine fossils, including crinoids.

Lee City: Calcareous shale with calcareous concretions, calcareous sandstone, brachiopods (including articulates), and crinoids.

Lenox: Calcareous siltstone and shale with calcareous concretions, and marine fossils, including brachiopods, pelecypods, and crinoids.

Lick Creek: Shale with calcareous concretions and fossils.

Load: Siltstone, sandstone, fossiliferous siderite, and marine fossils.

Louellen: Calcareous shale with calcareous concretions, and marine fossils (south of Pine Mountain); calcareous shale, siltstone, limestone nodules, and marine fossils (north of Pine Mountain).

Louisa: Shale, siltstone, sandstone, limestone, and fossils.

Martin: Shale with calcareous concretions, siltstone, limestone beds, and fossils.

Matewan: Shale with calcareous concretions, siltstone, sandstone, and marine and brackish fossils.

Mayking: Siltstone and shale with calcareous concretions, calcareous sandstone, brachiopods, pelecypods, and gastropods.

Mazie: Shale, siltstone, calcareous sandstone, and fossils.

McDowell: Siltstone and sandstone with calcareous concretions, and marine fossils.

Meta: Calcareous shale with calcareous concretions, sandstone, pelecypods, gastropods, cephalopods, and articulate and linguloid brachiopods.

Millard: Calcareous shale and siltstone, and linguloid brachiopods.

Milo and Webb: Calcareous shale with calcareous concretions, limestone beds, cone-in-cone structure, sandstone, articulate and linguloid brachiopods, gastropods, cephalopods, crinoids, corals, and trace fossils.

Mistletoe: Siltstone and shale with calcareous concretions, brachiopods (including articulates), pelecypods, gastropods, and crinoids.

Naugatuck: Shale, sandstone, and marine fossils.

Noble: Shale with calcareous concretions, siltstone, limestone beds, and marine fossils.

Nolansburg: Shale, limestone beds, and marine fossils, including crinoids.

Offutt: Calcareous shale with calcareous concretions, limestone beds, brachiopods, bryozoans, pelecypods, gastropods, cephalopods, and crinoids.

Ogle: Siltstone and shale with calcareous concretions, sandstone, limestone, and marine fossils, including brachiopods, pelecypods, and crinoids.

Oil Springs: Calcareous shale with calcareous concretions, calcareous sandstone, limestone beds, brachiopods, bryozoans, pelecypods, gastropods, and crinoids.

Oldtown: Siltstone, calcareous sandstone, limestone, fossiliferous siderite, articulate and linguloid brachiopods, and crinoids.

Oneida: Shale, siltstone, brachiopods, gastropods, and crinoids.

Paintsville: Calcareous shale with calcareous concretions, calcareous sandstone, limestone beds, brachiopods, bryozoans, pelecypods, gastropods, and crinoids.

Pennington Gap: Calcareous sandstone and siltstone, limestone beds, and fossils.

Pikeville: Calcareous shale with calcareous concretions, siltstone, sandstone, and marine invertebrate fossils.

Pineville: Calcareous shale and fossils.

Portsmouth and Wheelersburg: Sandstone, limestone, and marine fossils, including brachiopods.

Prestonsburg: Calcareous shale with calcareous concretions, sandstone, limestone beds, and fossils.

Quicksand: Shale with calcareous concretions, sandstone, and fossils.

Redbush: Siltstone, sandstone, limestone, and marine fossils.

Richardson: Shale and fossils.

Roxana: Siltstone and shale with calcareous concretions, sandstone, limestone beds, and fossils, including brachiopods, pelecypods, gastropods, and crinoids.

Rush: Calcareous sandstone and marine fossils.

Salyersville North: Calcareous siltstone and shale with calcareous concretions, sandstone, and fossils.

Salyersville South: Calcareous siltstone and shale with calcareous concretions, sandstone, limestone, brachiopods, pelecypods, gastropods, and crinoids.

Sandy Hook: Calcareous shale with calcareous concretions, calcareous sandstone, limestone beds, brachiopods, pelecypods, corals, crinoids, and trace fossils.

Saxton: Shale and marine fossils, including brachiopods, cephalopods, and fecal pellets.

Scalf: Calcareous shale and marine fossils.

Seitz: Calcareous siltstone and shale with calcareous concretions, calcareous sandstone, limestone beds, brachiopods, pelecypods, gastropods, and crinoids.

Sitka: Shale, calcareous sandstone, and marine fossils.

Tallega: Shale, limestone, brachiopods, and gastropods.

Thomas: Calcareous shale with calcareous concretions, siltstone, calcareous sandstone, limestone beds, and brackish or marine fossils.

Tilford: Calcareous siltstone and shale with calcareous concretions, limestone beds, brachiopods, and crinoids.

Tiptop: Shale with calcareous concretions, limestone beds, brachiopods, pelecypods, gastropods, cephalopods, and crinoids.

Tygarts Valley(?): Calcareous sandstone (stratigraphic level uncertain).

Varney: Calcareous shale with calcareous concretions, brachiopods, pelecypods, crinoids, and trace fossils.

Vest: Calcareous shale, siltstone, calcareous sandstone, limestone beds, and fossils.

Vicco: Calcareous siltstone and shale with calcareous concretions, limestone nodules, and marine invertebrate fossils.

Wallins Creek: Shale with calcareous concretions, limestone nodules and beds, and fossils (south

of Pine Mountain); shale, limestone beds and nodules, marine zone, brachiopods, pelecypods, and gastropods (north of Pine Mountain).

Wayland: Shale with calcareous concretions, siltstone, calcareous sandstone, and marine invertebrate fossils.

Webbville: Sandstone and fossils.

West Liberty: Calcareous shale with calcareous concretions, sandstone, limestone, brachiopods, pelecypods, crinoids, and trace fossils.

Wheelwright: Siltstone, sandstone, calcareous shale with calcareous concretions, and marine fossils, including articulate brachiopods.

White Oak: Calcareous siltstone and shale with calcareous concretions, calcareous sandstone, limestone beds, brachiopods, crinoids, and trace fossils.

Whitesburg and Flat Gap: Shale with calcareous concretions, and marine invertebrate fossils (south of Pine Mountain); siltstone, sandstone, and marine fossils (north of Pine Mountain).

Willard: Shale, calcareous sandstone, fossiliferous siderite, limestone, glauconite, brachiopods, and crinoids.

Williamson: Calcareous shale with calcareous concretions, calcareous sandstone, and marine or brackish fossils.

Wrigley: Calcareous shale, limestone, and fossils.

In addition to these occurrences, Harned (1979) recognized the Magoffin marine zone in the Eagan, Fork Ridge, and Frakes Quadrangles.

Morse (1931) listed the following fossils from the Magoffin:

BRACHIOPODS
- *Ambocoelia [Crurithyris] planoconvexa* Shumard
- *Chonetes [Neochonetes] granulifer* Owen
- *Cleiothyridina orbicularis* McChesney [p. 315]
- *Composita subtilita* Hall
- *Derbya crassa* Meek and Hayden
- *Derbya robusta* Hall?
- *Orbiculoidea* sp.
- *Productus [Linoproductus] cora* d'Orbigny
- *Productus [Desmoinesia] missouriensis* Girty
- *Productus [Juresania] nebraskensis* Owen [p. 310–311]
- *Productus [Dictyclostus] semireticulatus* Martin
- *Reticularia [Phricodithyris] perplexa* (McChesney)
- *Spirifer [Anthracospirifer] opimus* Hall
- *Spirifer rockymontanus* Marcou

ECHINODERMATA
- crinoid stems and plates

PELECYPODA
- *Astartella concentrica* Conrad?
- *Aviculopinna [Pteronites] americana* Meek [p. 316–317]
- *Edmondia ovata* Meek and Worthen
- *Leda [Phestia?]* sp.
- *Leda [Phestia] bellistriata* (Stevens) [p. 315–316]
- *Nuculopsis ventricosa* Hall
- *Schizodus alpinus* Hall [p. 317]
- *Allerisma [Wilkingia] terminale* (Hall) [p. 318]

GASTROPODA
- *Bellerophon (Euphemus) [Euphemites] carbonarius* Cox
- *Bellerophon (Bucanopsis) [Retispira] meekianus* Swallow [p. 323]
- *Bellerophon [Pharkidonotus] crassus* (Meek and Worthen) [p. 322]
- *Schizostoma [Straparollus] catilloides* (Conrad)
- *Trepospira depressa* Cox [p. 321–322]
- *Worthenia tabulata* Conrad [p. 321]

CEPHALOPODA
- *Gastrioceras montgomeryense* Miller and Gurley [p. 326–327]
- *Orthoceras (Pseudorthoceras) [P.] knoxense* McChesney [p. 326]

Strimple and Knapp (1966) described the crinoid *Diphuicrinus patina* Strimple and Knapp from the Magoffin Member.

Dennis (1975) listed the following fossils from the Magoffin:

FORAMINIFERIDA
- *Serpulopsis?* sp.

CONULARIDA
- *Paraconularia* sp.

BRYOZOA
- encrusting bryozoan
- fenestellid bryozoan
- rhabdomesid bryozoan

BRACHIOPODA
- *Anthracospirifer* cf. *A. matheri* (Dunbar and Condra)
- *Beecheria* sp.

Cleiothyridina cf. *C. pecosii* (Marcou)
Composita subtilita (Hall)
Crurithyris cf. *C. planoconvexa* (Shumard)
Crania modesta White and St. John
Derbya crassa (Meek and Hayden)
Desmoinesia cf. *D. missouriensis* (Girty)
Eolissochonetes sp.
Hustedia cf. *H. "mormoni"* (Marcou)
Juresania? sp.
Lindstroemella patula (Girty)
Lingula cf. *L. carbonaria* Shumard
Linoproductus sp.
Plicochonetes sp.
Pulchratia sp.
Punctospirifer kentuckyensis (Shumard)
Sandia sp.
Schizophoria cf. *S. resupinoides* (Cox)
Trigonoglossa nebrascensis (Meek)

SCAPHOPODA
ribbed scaphopod
smooth scaphopod

PELECYPODA
Acanthopecten? sp
Astartella cf. *A. concentrica* (Conrad)
Cypricardinia? carbonaria Meek
Dunbarella sp.
Grammatodon cf. *G. carbonaria* (Cox)
Lima [Palaeolima] retifera Shumard
Limapecten cf. *L. morsei* Newell
Nuculopsis girtyi Shenck
Nuculopsis sp.
Paleyoldia cf. *P. glabra* (Beede and Rogers)
pelecypod, genus and species indeterminate
Permophorus? sp.
Phestia cf. *P. bellistriata* (Stevens)
Phestia sp.
Posidonia sp.
Posidoniella sp.
Promytilus cf. *P. vetulus* Newell
Prothyris sp.
Pteronites sp.
Schizodus sp., large species
Schizodus sp., small species
Septimyalina sp.
Solemya sp.
Wilkingia terminale (Hall)
Wilkingia sp.

GASTROPODA
Bellerophon cf. *B. (Pharkidonotus) percarinatus* (Conrad)
Euphemites cf. *E. nodocarinatus* (Hall)
Glabrocingulum cf. *G. (G.) grayvillense* (Norwood and Pratten)
Ianthinopsis cf. *I. paludinaeformis* (Hall)
Ianthinopsis cf. *I. regularis* (Cox)
Knightites (Cymatospira) montfortianus (Norwood and Pratten)
Orthonema? sp.
Shansiella carbonaria (Norwood and Pratten)
Straparollus cf. *S. (Amphiscapha) catilloides* (Conrad)
Trepospira (T.) illinoiensis (Worthen)
Worthenia tabulata (Conrad)

CEPHALOPODA
Gastrioceras occidentale (Miller and Faber)
Metacoceras? sp.
nautiloid, genus and species indeterminate
Pseudoparalegoceras compressum (Hyatt)
Pseudorthoceras knoxense (McChesney)

ECHINODERMATA
crinoid and plates, genus and species indeterminate
echinoid plates and spines
Diphuicrinus patina Strimple and Knapp
Paragassizocrinus cf. *P. diculus* Strimple

TRACE FOSSILS
burrow structures
crawling traces
Zoophycos sp.

Preliminary paleontological reports (PR–0136, –0137, –0149, –0150, –0159, –0168, –0169, –0176, –0183, –0184, –0185, –0187, –0195, –0196, –0206) from the U.S. Geological Survey Paleontology and Stratigraphy Branch list the following fauna:

BRACHIOPODA
Anthracospirifer cf. *A. occidentalis* (Girty)
Anthracospirifer matheri? (Dunbar and Condra)
Antiquatonia? portlockiana (Norwood and Pratten)
Antiquatonia? sp. indeterminate
Cleiothyridina? sp.
Composita subtilita? (Hall)
Composita sp.
Crania modesta White and St. John
Derbyia sp. cf. *D. deercreekensis* Dunbar and Condra
Derbyia cf. *D. cymbula* Hall and Clarke
Derbyia cf. *D. plattsmouthensis* Dunbar and Condra
Derbyia? sp. indeterminate
echinoconchid
Hustedia sp.

Juresania sp.
linoproductid
margini ferid, indeterminate
Orbiculoidea missouriensis (Shumard)
Orbiculoidea sp.
Neochonetes? sp.
Punctospirifer sp.
Schizophoria oklahomae? Dunbar and Condra
Schizophoria? sp.
Tesuguea sp.

BRYOZOA
fenestella sp.
Polypora? sp.
rhomboporoid
stenoporid

ECHINODERMATA
crinoid debris
crinoid spine

PELECYPODA
Astartella concentrica (Conrad)
Astartella cf. *A. concentrica* (Conrad)
Astartella sp.
Edmondia? sp.
Leptodesma sp.
Myalina spp.
myalinid, indeterminate
Nuculoidea sp.
Nuculopsis ventricosa (Hall)
Nuculopsis sp.
?Nuculopsis sp.
?Parallelodon
?Pernopecten sp.
Phestia sp. indeterminate
Polidevcia [Phestia] bellistriata (Stevens)
Polidevcia [Phestia] sp.
Posidonia cf. *P. girtyi* Morningstar
Posidonia sp. indeterminate
Schizodus sp.
Septimyalina sp.
Wilkingia sp.

GASTROPODA
Euphemites sp.
Euphemites enodus Sturgeon
Glabrocingulum (G.) grayvillense (Norwood and Pratten)
Ianthinopsis spp.
Knightites (Retispira) cf. *K. (R.) tenuilineata* (Gurley)
Knightites cf. *K. (Cymatospira) montfortianus* (Norwood and Pratten)
Meekospira peracuta (Meek and Worthen)
Paleostylus (Pseudozygopleura)? sp. indeterminate
Phymatopleura aff. *P. nodosa* (Girty)
Straparollus aff. *S. (Amphiscapha) reedsi* (Knight)
Trepospira cf. *T. (Trepospira) illinoisensis* (Worthen)
Worthenia tabulata (Conrad)

CEPHALOPODA
Gastrioceras sp.
Metacoceras? sp.
Mooreoceras sp.
Pseudoparalegoceras (Phaneroceras) compressum (Hyatt)
Temnocheilus sp.

OSTRACODA
Amphissites girtyi Knight
Aurikirkbya sp.
Bairdia sp.
Bairdiacypris? sp.
Cavellinella? pricei Sohn
Coryellites? sp.
Fabalicypris sp.
Geisina jolliffina Cooper
Geisina? sp.
Microparaparchites sp.
Monoceratina ardmorensis (Harlton)
Monoceratina sp.
Paraparchites? sp.
Pseudobythocypris pediformis (Knight)
Pseudobythocypris? sp.
genus and species indeterminate, small, smooth, elongated.

OTHER CRUSTACEA
barnacle borings in myalinid

FORAMINIFERIDA
Millerella sp.

CONODONTA
Cavusgnathus sp.
Gnathodus n. sp.
Hindeodella sp.
Idiognathodus sp.
Ligonodina? sp.
fragments

Sohn (1983) reported the following ostracode fauna from the Magoffin Member:

OSTRACODA
Amphissites (Amphikegelites) henryi Sohn
Aurikirkbya ex gr. *A. triseriata* Shaver
Healdia ehlersi Bradfield
Kirkbya magna Roth

"Microparaparchites" reductospinosus Sohn
Monoceratina winifrediana Sohn
Monoceratina aff. *M. macoupeni* Scott and Borger
Plavskella englundi Sohn
Pseudobythocypris pediformis (Knight)

MARINE MEMBER N

Possible marine strata are associated with and overlie the Haddix coal zone in some areas. These strata are herein informally called marine member N (Four Corners formation, Breathitt Group). The calcareous sandstones of this member may have been caused by fluid migration from the underlying Magoffin Member.

Possible evidence for marine strata in member N has been reported in the following quadrangle maps:

Carrie: Sandstone and glauconite.

Harold: Calcareous sandstone.

Hoskinston: Calcareous siltstone and shale.

Inez: Calcareous sandstone.

Ivyton: Calcareous sandstone.

Kite: Calcareous sandstone.

Lancer: Calcareous sandstone.

Lenox: Shale with calcareous concretions.

Martin: Calcareous sandstone.

Milo and Webb: Shale and invertebrate fossils, including linguloid brachiopods.

Prestonsburg: Calcareous sandstone.

Thomas(?): Calcareous sandstone (stratigraphic level uncertain).

Varney: Calcareous sandstone.

White Oak: Calcareous sandstone.

Ross Overby (personal commun., 1980) reported calcareous shale and limestone with articulate brachiopods and crinoids above the Haddix coal bed in the Scalf Quadrangle.

I have found *Anthraconaia*-type brackish-water pelecypods, as well as fish plates, and brackish- or fresh-water xenacanthid shark teeth in the Haddix coal zone in the Hazard North Quadrangle (Cobb and others, 1981).

COWCREEK MEMBER

A marine zone overlying the Hazard coal zone (Hazard rider coal bed) is herein informally called the Cowcreek member (Four Corners formation, Breathitt Group); it is named for marine strata cropping out in the Cowcreek Quadrangle.

Geologic quadrangle maps that report evidence for marine or brackish conditions for the Cowcreek member are:

Booneville: Siltstone, brachiopods, and crinoids.

Buckhorn: Shale, marine zone, and linguloid brachiopods.

Cannel City: Limestone and fossils.

Canoe: Calcareous sandstone, limestone with cone-in-cone structure, and brachiopods.

Cowcreek: Calcareous siltstone with calcareous concretions, calcareous sandstone, limestone, and articulate brachiopods.

Creekville: Shale, limestone, marine zone, and fossils.

Dingus: Sandstone and fossils.

Guage: Sandstone and limestone.

Harold: Calcareous sandstone.

Hindman(?): Calcareous shale and sandstone (stratigraphic level uncertain).

Hyden West: Shale and marine fossils.

Ivyton: Calcareous sandstone.

Jamboree: Calcareous sandstone.

Kite: Calcareous sandstone.

Lancer: Calcareous sandstone.

Martin: Calcareous sandstone.

McDowell: Calcareous sandstone.

Meta: Shale, calcareous sandstone, and fossils.

Mistletoe: Calcareous siltstone and brachiopods, including linguloids.

Oneida: Calcareous siltstone with calcareous concretions, and marine fossils, including brachiopods and crinoids.

Prestonsburg: Calcareous sandstone.

Salyersville South: Calcareous sandstone.

Sandy Hook(?): Shale and marine fossils (stratigraphic level uncertain)

Seitz: Calcareous sandstone.

Tiptop: Siltstone and shale with calcareous concretions.

Varney: Calcareous sandstone.

Vest: Shale, limestone beds, and marine fossils.

Wayland: Calcareous sandstone.

West Liberty: Shale and marine fossils, including brachiopods.

Wheelwright(?): Calcareous sandstone (stratigraphic level uncertain).

White Oak: Calcareous concretions.

Wrigley(?): Shale and sandstone with calcareous concretions (stratigraphic level uncertain).

Preliminary paleontological reports from the U.S. Geological Survey (PR–0162, –0164, –0210) list the following fauna from the Cowcreek:

BRACHIOPODA
Anthracospirifer chavezae Sutherland and Harlow
Antiquatonia? sp. indeterminate
Buxtonia n. sp. B (of Sutherland and Harlow, 1973)?
Composita sp.
Derbyia crassa Meek and Hayden?
Eolissochonetes? sp.
Linoproductus planiventralis Hoare
Orbiculoidea sp.
Orbiculoidea?
Neochonetes? sp. indeterminate
Sandia? sp.

BRYOZOA
encrusting form
rhomboporid

PELECYPODA
Aviculopecten cf. *A. germanus* Miller and Faber
Aviculopecten sp. A
Aviculopecten? sp.
Paleyoldia?
Permophorus? two sp.?
Posidonia? sp.
Sanquinolites? sp. indeterminate
Septimyalina sp.
Septimyalina? sp.
Wilkingia sp.
pelecypod indeterminate

GASTROPODA
bellerophontacean?

ECHINODERMATA
pelmatozoan stem

CONULARIDA
Paraconularia?

FORAMINIFERIDA
endothyrids
Millerella sp.
Tetrataxis sp.
tolypamminids

MARINE MEMBER O

Possible marine or brackish-water strata have been identified in or overlying the Hazard No. 7 coal zone and its lateral equivalents. This member is herein informally called marine member O (Four Corners formation, Breathitt Group).

The following geologic quadrangle maps report evidence for marine strata in member O:

Cannel City: shale, siltstone, limestone, articulate brachiopods, and crinoids; fossils listed are *Kozlowskia* cf. *K. haydenensis* (Girty) and *Neospirifer* cf. *N. cameratus* (Morton).

Creekville: Shale, limestone, and marine fossils.

Harold: Calcareous sandstone.

Hoskinston: Sandstone and trace fossils.

Inez: Calcareous sandstone.

Ivyton: Siltstone with calcareous concretions, calcareous sandstone, and dwarf marine invertebrate fossils.

Lenox: Siltstone and shale with calcareous concretions, sandstone, and marine fossils, including brachiopods.

Martin: Calcareous sandstone.

Milo and Webb: Calcareous sandstone.

Prestonsburg: Siltstone with calcareous concretions, and cone-in-cone structures.

Salyersville North: Calcareous shale, brachiopods, and pelecypods.

Varney: Calcareous sandstone.

White Oak: Shale, limestone, brachiopods, and crinoids.

A preliminary paleontological report prepared by the U.S. Geological Survey Paleontology and Stratigraphy Branch (PR–0201) cites the following fauna:

BRACHIOPODA
Composita sp. indeterminate
Crurithyris planoconvexa (Shumard)
Derbyia? sp. indeterminate
Desmoinesia? sp.
Kozlowskia cf. *K. haydenensis* (Girty)
Krotovia sp.
Orbiculoidea sp. indeterminate
Neospirifer cf. *N. cameratus* (Morton)
Phricodothyris perplexa (McChesney)?
productoid, two genera, indeterminate
Punctospirifer kentuckensis (Shumard)
Schizophoria sp. indeterminate

terebratuloid, genus indeterminate

GASTROPODA
Ianthinopsis? sp. indeterminate

ECHINODERMATA
crinoid columnals

BULAN SHALE MEMBER

Marine or brackish-water strata associated with or overlying the Francis coal zone (and equivalents) are herein informally referred to as the Bulan shale member (Four Corners formation, Breathitt Group); the member is named for outcrops on Kentucky Highway 80 near Bulan in the Hazard North Quadrangle.

Following is a list of geologic quadrangle maps that have reported marine or brackish-water strata at this level:

Buckhorn: Shale and marine fossils, including linguloid brachiopods and pelecypods.

Carrie: Shale and linguloid brachiopods.

David: Shale, brachiopods, pelecypods, and gastropods.

Dingus(?): Shale and brachiopods (stratigraphic level uncertain).

Harold: Calcareous sandstone.

Hazard North: Shale, limestone, and marine fossils.

Hazard South: Shale, siltstone, limestone, and marine fossils.

Hindman: Siltstone and shale with calcareous concretions, calcareous sandstone, and limestone.

Inez: Calcareous sandstone.

Lancer: Calcareous sandstone.

Lenox(?): Siltstone, sandstone, and calcareous concretions (stratigraphic level uncertain).

Martin: Calcareous sandstone.

Milo and Webb: Calcareous sandstone.

Prestonsburg: Calcareous sandstone.

Thomas: Calcareous zone and calcareous sandstone.

Vest: Shale and invertebrate fossils.

Vicco(?): Shale and invertebrate fossils (stratigraphic level uncertain).

Willard: Calcareous sandstone.

A preliminary paleontological reports prepared by the U.S. Geological Survey Paleontology Branch (PR–0209) reports the following fauna:

BRACHIOPODA
Lingula carbonaria Shumard
Orbiculoidea sp.

STONEY FORK MEMBER

The Stoney Fork Member (Princess formation, Breathitt Group) is a widely recognized marine unit in the Eastern Kentucky Coal Field. The Stoney Fork was mapped as the Lost Creek Limestone in many quadrangles. Geologic quadrangle maps recording Stoney Fork (Lost Creek) strata are:

Balkan: Calcareous shale, limestone nodules, marine zone, and marine fossils.

Beverly: Limestone, brachiopods, pelecypods, crinoids, and other fossils.

Big Creek: Shale with calcareous concretions, limestone, brachiopods, pelecypods, crinoids, and other fossils.

Blackey: Calcareous shale, marine zone, limestone, and marine fossils.

Bledsoe: Calcareous shale with calcareous concretions, limestone, marine zone, and marine fossils(?).

Broad Bottom: Shale with calcareous concretions, sandstone, and linguloid brachiopods.

Buckhorn: Shale, marine zone, limestone, brachiopods, and pelecypods.

Canoe: Shale, limestone, brachiopods, and pelecypods.

Carrie: Shale, limestone, and marine fossils.

Cowcreek: Shale, limestone, chert, marine zone, and marine fossils.

Creekville: Shale with calcareous concretions(?), limestone, and fossils.

Cutshin: Shale with calcareous concretions, limestone beds, and marine fossils, including brachiopods, other fossils, and trace fossils.

Guage(?): Calcareous zone (stratigraphic level uncertain).

Haddix: Limestone, brachiopods, and bryozoans.

Handshoe: Calcareous shale, limestone, and marine fossils.

Hazard North: Shale, siltstone, and marine fossils.

Hazard South: Calcareous shale and siltstone, and marine invertebrate fossils.

Helton: Calcareous shale with calcareous concretions, limestone, brachiopods, pelecypods, gastropods, and crinoids.

Hindman: Calcareous shale, limestone, and marine fossils.

Hoskinston: Shale, limestone, brachiopods, gastropods, crinoids, and other fossils.

Hyden East: Shale and marine fossils.

Hyden West: Calcareous shale, siltstone, limestone, and marine fossils, including brachiopods, pelecypods, crinoids, and other fossils.

Ivyton: Siltstone, calcareous sandstone, and marine invertebrate fossils, including linguloid brachiopods.

Leatherwood: Shale, limestone beds, and marine fossils.

Louellen(?): Shale and marine fossils (stratigraphic position uncertain).

Noble: Shale, limestone, and marine fossils.

Nolansburg: Shale and fossils.

Oil Springs: Siltstone, calcareous sandstone, and limestone.

Prestonsburg: Calcareous sandstone.

Tiptop: Shale and marine fossils.

Vest: Calcareous shale, limestone beds, and marine fossils, including gastropods and pelecypods.

Vicco: Shale, limestone, and invertebrate fossils.

Wallins Creek(?): Calcareous shale and siltstone, brachiopods, pelecypods, and gastropods.

Morse (1931) listed the following fossils from the Stoney Fork (Lost Creek Limestone) Member:

BRACHIOPODS
Chonetes [Neochonetes] granulifer Owen
Composita subtilita Hall
Derbya crassa Meek and Hayden
Productus sp.[?]
Spirifer sp.[?]
Spiriferina [Punctospirifer] kentuckyensis Shumard

BRYOZOA
fenestellid bryozoan

Ping (1978) listed the following microfossils from the Stoney Fork:

FORAMINIFERIDA
Bradyina sp.
Climacammina sp.
encrusting forms
endothyrids
fusulinids
Fusulinella sp.
Millerella sp.
Monotaxipoides sp.
Profusulinella kentuckyensis Thompson and Riggs
Tetrataxis sp.
textularids

OSTRACODA
Amphisites sp.
Aurikirkbya sp.
Bairdia sp.
Fabalicypris sp.
Healdia sp.
Hollinella sp.
Monoceratina sp.
Moorites sp.
Orthobairdia sp.
Pseudoparaparchites sp.
Sansabella sp.

Garrison (1977) listed the following fossils from the Stoney Fork:

BRACHIOPODA
Anthracospirifer sp.
brachiopod, genus and species indeterminate
Composita spp.
Crurithyris sp.
Derbya crassa Meek and Hayden
Desmoinesia muricatina var. *missouriensis* (Girty)
Dictyoclostus semireticulatus (Martin)
Linoproductus sp.
Neochonetes granulifer (Owen)
Punctospirifer kentuckyensis (Shumard)
Pustula sp.

BRYOZOA
fistuliporid bryozoan
Rhabdomeson? sp.

PELECYPODA
Astartella sp.
myalinid
Nuculopsis sp.
Paleoyoldia sp.
pectenid, genus unknown

Phestia sp.

GASTROPODA
Euphemites sp.
Iathinopsis sp.
Meekospira sp.
microgastropods, indeterminate
Shansiella sp.
Straparollus sp.
Trepospira sp.
Worthenia sp.

CEPHALOPODA
nautiloid, unidentified
orthocerid nautiloids

COELENTERATA
unidentified horn coral

ECHINODERMATA
crinoid columnals or plates

TRILOBITA
unidentified trilobite

OSTRACODA
Amphissites rothi Bradfield
Amphissites dattonensis Harlton
Aurikirkbya triseriata Shaver
Aurikirkbya sp. B
Bairdia spp.
Cavellina sp.
Fabalicypris sp.
Healdia spp.
Hollinella sp. A
hollinacean genus
Kirkbya jolliffana Bradfield
kirkbyacean genus 1
kirkbyacean genus 2
Monoceratina spp.
Moorites spp.
Orthobairdia spp.
Paraparchites sp.
Pseudoparaparchites spp.
Sansabella spp.
small indeterminate ostracodes

FORAMINIFERIDA
Bradyina sp.
Calcitornella sp.
Climacacammina sp.
Endothyra spp.
fischerinid, indeterminate
Fusulinella sp.
Millerella sp.
Monotaxonoides sp.
Paleospiroplectammina? sp.
Tetrataxis sp.
Tuberitina sp.

CONODONTA
Hindeodella spp.
Idiognathodus delicatus Gunnell
Neognathodus sp.
unidentified fragments

VERTEBRATA
"platform ray teeth"

PLANTAE (ALGAE)
Anthracoporella? sp.
indeterminate genus cf. *Ivanovia* sp.

Preliminary paleontological reports from the U.S. Geological Survey (PR–0145, –0146, –0147, –0153, –0167, –0181, –0182) list the following fauna:

BRACHIOPODA
Chonetes [Neochonetes] granulifer Owen
Composita sp. indeterminate
Derbyia crassa (Meek and Hayden)
Desmoinesea aff. *D. ingrata* (Girty)
dictyoclostid, small
inarticulate, indeterminate
Juresania sp. indeterminate
Linoproductus prattenianus (Norwood and Pratten)
Linoproductus sp. indeterminate
Orbiculoidea sp. indeterminate
Pugilis sp. indeterminate
Spirifer [Anthracospirifer] occiduus Sadlick
Spirifer cf. *S. [Anthracospirifer] occiduus* Sadlick
?Spirifer sp. indeterminate
Spiriferina [Punctospirifer?] sp.

PELECYPODA
Acanthopecten sp. indeterminate
Astartella? sp. indeterminate
Aviculopecten germanus Miller and Faber
?lucinoid
Nuculopsis? sp. indeterminate
Permophorus? sp. indeterminate
Phestia? sp. indeterminate
Polidevcia [Phestia] bellistriata (Stevens)
Schizodus sp.
Wilkingia cf. *W. terminale* (Hall)

GASTROPODA
Bellerophon (Pharkidonotus) sp. indeterminate
Ianthinopsis sp. indeterminate
Shansiella? sp. indeterminate

ECHINODERMATA
crinoid stems

OSTRACODA
Amphissites spp.

Aurikirkbya triseriata Shaver
Aurikirkbya sp.
Bairdia spp.
Discoidella sp. (not an ostracode)
Fabalicypris sp.
Healdia spp.
healdiid, genus undetermined
Hollinella sp.
Kegelites spp.
Kirkbya sp.
Kirkbyella sp.
Microcheilinella sp.
Microcheilinella? sp.
Microparaparchites sp.
Monoceratina sp.
Moorites sp.
Orthobairdia sp.
Orthobairdia? sp.
Pseudobythocypris? sp.
Sansabella spp.
Silenites? sp.
Youngiella sp.
Youngiella? sp.
genera indeterminate

FORAMINIFERIDA
Bradyina sp.
Climacammina sp.
endothyrids undetermined
Fusulinella spp.
?Fusulinella sp.
fusulinid, small, undetermined
Millerella sp.
Profusulinella aff. *P. kentuckyensis* Thompson and Riggs
?Profusulinella sp.
Tetrataxis sp.

CONODONTA
Idiognathodus sp. A
Hindeodella sp.
fragments

Sohn (1983) reported the following ostracodes from the Stoney Fork:

OSTRACODA
Amphissites (Amphikegelites) henryi Sohn
Aurikirkbya ex gr. *A. triseriata* Shaver
Bairdiacypris cf. *B. rectiformis* (Shaver)
Bairdiacypris spp.
bairdiidae spp. undetermined
Healdia ehlersi Bradfield
Healdia spp.
Kegelites spp.
Kirkbya magna Roth
kirkbyidae indeterminate
Kirkbyella (Berdanella) ricei Sohn
"Microparaparchites" reductospinosus Sohn
Monoceratina winifredeana Sohn
Moorites spp.
Orthobairdia oklahomaensis (Harlton)
Plavskella englundi Sohn
Pseudobythocypris pediformis (Knight)
Pseudoparaparchites spp.
Sansabella stewartae Marple

MAIN BLOCK ORE BEDS

The Main Block Ore beds (Princess formation, Breathitt Group) occur near the stratigraphic level of the Stoney Fork Member. William Outerbridge (USGS, personal commun.) suggested that both units are the same; however, Charles Rice (USGS, personal commun.) indicated that they are not equivalent strata.

Geologic quadrangle maps that report marine strata for the Main Block Ore beds are:

Argillite: Calcareous sandstone and marine fossils.

Ashland and Catlettsburg: Calcareous sandstone.

Oldtown: Calcareous siltstone, calcareous sandstone, limestone with cone-in-cone structure, and fossils.

Portsmouth and Wheelersburg: Siltstone, sandstone, and marine fossils, including brachiopods and crinoids.

Rush: Calcareous zone and marine fossils.

Tygarts Valley: Calcareous siltstone.

MEMBER P

Marine or brackish-water strata overlying the Tiptop and laterally equivalent coal beds are herein informally called member P (Princess formation, Breathitt Group). Geologic quadrangle maps reporting potentially marine strata at this level are:

Argillite: Calcareous sandstone.

Ashland and Catlettsburg: Calcareous sandstone.

Broad Bottom(?): Shale with calcareous concretions, sandstone, and linguloid brachiopods (stratigraphic level uncertain).

Harold: Shale, calcareous sandstone, brachiopods, and other fossils.

Inez: Siltstone and shale with calcareous concretions.

Kermit: Shale, calcareous sandstone, and trace fossils.

Martin: Calcareous sandstone.

Milo and Webb: Calcareous sandstone.

Prestonsburg: Calcareous sandstone.

Salyersville South: Calcareous sandstone.

Thomas: Calcareous sandstone.

Varney: Shale, calcareous sandstone, and trace fossils.

KILGORE-FLINT RIDGE FLINT

The Kilgore flint and the Flint Ridge flint are approximately at the same stratigraphic level, overlying the Richardson coal bed; they are treated together here as the Flint Ridge flint (Princess formation, Breathitt Group), which has priority.

The following geologic quadrangle maps record possible marine or brackish-water strata at this level:

Argillite: Silicified siltstone and marine fossils.

Ashland and Catlettsburg: Silicified siltstone and marine fossils.

Greenup and Ironton: Calcareous sandstone.

Guage: Siltstone, sandstone, chert, and pelecypods.

Helton: Chert.

Lancer (?): Calcareous sandstone (stratigraphic level uncertain).

Milo and Webb(?): Calcareous sandstone (stratigraphic level uncertain).

Noble: Sandstone, limestone, chert, and marine fossils, including brachiopods.

Quicksand: Calcareous sandstone, limestone, chert, and fossils.

Richardson(?): Flint clay (stratigraphic level uncertain).

Rush(?): Silicified and calcareous siltstone, and marine fossils (stratigraphic level uncertain).

Salyersville South: Calcareous shale with calcareous concretions, limestone beds, and marine fossils.

Tiptop: Shale, chert, and spiculite.

Vest: Chert.

Morse (1931) listed the following fossils from the Flint Ridge Flint:

BRACHIOPODA
Orbiculoidea convexa Shumard
Productus [Juresania] nebraskensis Owen
Spirifer [Anthracospirifer] rockymontanus Marcou

BRYOZOA
fenestellid

PELECYPODA
Allerisma [Wilkingia] terminale Hall
Lima [Palaeolima] retifera Shumard?
Pseudomonotis kansasensis Beede?

GASTROPODA
Bellerophon (Bucanopsis) meekianus Swallow?
[Retispira tenuilineatus]

ECHINODERMATA
crinoid stems

Preliminary paleontological reports from the U.S. Geological Survey (PR–0166, –0176, –0180, –0199, –0200) list the following fauna from the Flint Ridge flint or strata questionably equivalent to it:

BRACHIOPODA
Anthracospirifer aff. *A. occiduus* (Sadlick)
Antiquatonia cf. *A. coloradoensis* (Girty)
Chonetes [Neochonetes] granulifer Owen
chonetid, genus indeterminate
Composita ovata Mather?
Derbyia crassa (Meek and Hayden)
Derbyia cf. *D. crassa* (Meek and Hayden)
Derbyia? sp. indeterminate
Desmoinsea aff. *D. ingrata* (Girty)
Echinaria cf. *E. knighti* (Dunbar and Condra)
Eolissochonetes sp.
Juresania nebrascensis (Owen), var.?
Juresania sp.
Kozlowskia haydenensis (Girty)
Orbiculoidea sp.
productiod, indeterminate
Schizophoria? sp. indeterminate

BRYOZOA
Fenestella sp.
Polypora? sp.
Prismopora sp.
Rhombopora lepidodendroides Meek
Rhombopora lepidodendroides Meek?

PELECYPODA
Aviculopecten sp.

CONODONTA
Hindeodella sp.
Idiognathodus sp. A

Idiognathodus sp. B
"Lonchodus" sp.
Polygnathus sp.
fragments of bar-type

OBRYAN LIMESTONE

According to Rice and others (1979), the Vanport Limestone as mapped in Kentucky (Vanport of Phalen, 1912) is not stratigraphically equivalent to the Vanport of Ohio. Rice and others (1991) are renaming the Vanport Limestone in Kentucky the Obryan Limestone. The Obryan Limestone (Princess formation, Breathitt Group) overlies the Princess Nos. 5A and 5B coal beds.

Evidence for marine strata has been found in the following geologic quadrangle maps:

Adams: Limestone and brachiopods.

Ashland and Catlettsburg: Limestone and fossils.

Blaine: Sandstone, calcareous concretions, limestone, and fossils, including brachiopods and crinoids.

Fallsburg and Prichard: Sandstone, limestone, and fossils.

Grayson: Limestone, limonite, and fossils.

Greenup and Ironton: Limestone and fossils.

Isonville: Limestone and fossils.

Lenox: Limestone.

Mazie: Calcareous concretions, limestone, and fossils.

Milo and Webb: Limestone nodules.

Rush: Shale, marine zone, limestone, and cone-in-cone structure.

Webbville: Limestone and fossils.

Willard: Limestone and marine fossils.

A preliminary paleontological report from the U.S. Geological Survey (PR–0157) lists the following fauna:

FORAMINIFERIDA
Beedeina sp.

LIMEKILN CLAY BED

Clay and limestone overlying the Laurel coal bed are herein informally called the Limekiln clay bed (Princess formation, Breathitt Group). The following geologic quadrangle map reports marine strata from this bed:

Dingus: Shale, limestone, brachiopods, and pelecypods.

A preliminary paleontological report prepared by the U.S. Geological Survey Paleontology and Stratigraphy Branch (PR–0203) lists the following fauna from strata questionably equivalent to this bed:

BRACHIOPODA
Cleiothyridina pecosi? (Marcou)
Orbiculoidea sp. indeterminate

BRYOZOA
Prismopora sp.

MEMBER Q

Limestone beds overlying the Princess No. 6 coal bed, herein informally called member Q (Princess formation, Breathitt Group), have been reported in the following geologic quadrangle maps:

Grayson: Limestone.

Rush: Limestone, calcareous concretions, and trace fossils.

Webbville: Limestone.

MEMBER R

Marine strata overlying the Princess No.7 coal bed are herein informally referred to as member R (Princess formation, Breathitt Group). Marine strata at this level have been reported in the following geologic quadrangle maps:

Adams: Limestone (fresh-water?).

Argillite: Siltstone with calcareous concretions, and trace fossils.

Ashland and Catlettsburg: Calcareous siltstone and calcareous concretions.

Boltsfork and Burnaugh: Calcareous shale.

Fallsburg and Prichard: Limestone.

Grayson: Calcareous siltstone.

Greenup and Ironton: Siltstone with calcareous concretions.

Mazie: Siltstone and shale with calcareous concretions, limestone, chert, and fossils.

Rush: Limestone and trace fossils.

Webbville: Limestone.

Willard: Limestone, cone-in-cone structure, limestone nodules, brachiopods, pelecypods, and gastropods.

MEMBER S

Possible marine strata (herein informally called member S, Princess formation, Breathitt Group) overlying the Princess No. 8 coal bed have been found in several quadrangles. The following geologic quadrangle maps contain evidence for marine or brackish-water conditions in this member:

Ashland and Catlettsburg: Calcareous shale and calcareous sandstone.

Boltsfork and Burnaugh: Shale, calcareous siltstone and sandstone, and limestone.

Fallsburg and Prichard: Limestone.

Louisa: Calcareous siltstone.

Rush: Limestone and trace fossils.

Webbville: Calcareous shale and limestone.

MEMBER T

Strata with possible marine affinities that are associated with or overlie the Princess No. 9 coal zone are informally designated member T (Conemaugh Formation). The following geologic quadrangle maps report possible marine rocks at this level:

Adams: Calcareous siltstone and limestone (fresh-water?).

Blaine: Calcareous siltstone and calcareous sandstone.

Fallsburg and Prichard: Calcareous siltstone, calcareous sandstone, and limestone.

Louisa: Shale, limestone (fresh-water?), and fossils.

Rush: Calcareous sandstone, and limestone (fresh-water?).

Webbville: Calcareous sandstone, limestone (fresh-water?), and fossils.

MEMBER U

Member U (Conemaugh Formation) is herein informally used for possible marine strata underlying the Brush Creek Limestone. Evidence for this member has been reported in the following geologic quadrangle maps:

Ashland and Catlettsburg: Calcareous shale with calcareous concretions, calcareous sandstone, and invertebrate fossils, including brachiopods.

Boltsfork and Burnaugh: Calcareous shale, calcareous sandstone, and invertebrate fossils.

Fallsburg and Prichard: Calcareous shale.

Grayson: Calcareous siltstone and shale.

BRUSH CREEK LIMESTONE

The Brush Creek Limestone (Conemaugh Formation) has been recognized in the following geologic quadrangle maps:

Adams: Calcareous siltstone and shale, limestone, brachiopods, pelecypods, bryozoans, and crinoids.

Argillite: Calcareous sandstone, limestone nodules, and calcareous concretions.

Ashland and Catlettsburg: Limestone and fossils.

Blaine: Limestone, brachiopods, pelecypods, bryozoans, and crinoids.

Boltsfork and Burnaugh: Shale, siltstone, limestone, chert, brachiopods, and crinoids.

Grayson: Limestone, articulate brachiopods, and crinoids.

Greenup and Ironton: Calcareous shale.

Fallsburg and Prichard: Siltstone, calcareous sandstone, limestone, and fossils.

Louisa: Calcareous siltstone and shale, limestone nodules, marine and nonmarine fossils, brackish pelecypods, bryozoans, crinoids, and other fossils.

Rush: Calcareous shale, limestone nodules, and marine fossils, including articulate brachiopods, crinoids, and other fossils.

Webbville: Calcareous shale, limestone, chert, limestone nodules, and fossils.

Willard: Calcareous shale, limestone, chert, brachiopods, and crinoids.

A preliminary paleontological report from the U.S. Geological Survey (PR–0143) lists the following fauna as being questionably from the Brush Creek Limestone:

OSTRACODA
Cavellina sp.
Hollinella sp.
Sansabella sp.
Shleesha sp.

The following fauna were reported in other preliminary paleontological reports from the U.S. Geological Survey (PR–0160, –0191):

PELECYPODA
nuculoid
nuculoid cf. *Polidevcia [Phestia]*
pectenoid
?Polidevcia [Phestia] sp. indeterminate

GASTROPODA
Glabrocingulum sp.
Knightites (Retispira) tenuilineatus (Gurley)

FORAMINIFERIDA
Triticites sp. aff. *T. Ohioensis*

MEMBER V

Member V (Conemaugh Formation) is the name herein informally assigned to possible marine strata overlying the Brush Creek Limestone. The following geologic quadrangle maps record evidence for member V:

Adams: Calcareous zone.

Boltsfork and Burnaugh: Calcareous siltstone with calcareous concretions, and calcareous sandstone.

Fallsburg and Prichard: Calcareous shale and siltstone, limestone nodules, brachiopods, crinoids, and other fossils.

Louisa: Calcareous siltstone.

MEMBER W

Possible marine or brackish-water strata below the Ames Limestone are herein informally designated as member W (Conemaugh Formation). Geologic quadrangle maps reporting this member are:

Ashland and Catlettsburg(?): Calcareous shale and limestone (stratigraphic position uncertain).

Boltsfork and Burnaugh: Siltstone and limestone.

Fallsburg and Prichard: Calcareous shale, limestone, and limestone nodules.

Rush: Shale, limestone, and limestone nodules (nonmarine?).

Webbville: Calcareous shale and siltstone, limestone, and limestone nodules (nonmarine?).

AMES LIMESTONE

The Ames Limestone (Conemaugh Formation) is the stratigraphically highest mapped marine zone in the Eastern Kentucky Coal Field. The Ames is recognized in the following geologic quadrangle maps:

Ashland and Catlettsburg(?): Shale, limestone, and fossils (stratigraphic level uncertain).

Boltsfork and Burnaugh: Calcareous siltstone, limestone, brachiopods, and crinoids.

Fallsburg and Prichard: Calcareous shale and siltstone, limestone, limestone nodules, brachiopods, and crinoids.

Louisa: Calcareous shale and siltstone, limestone, limestone nodules, and fresh- or brackish-water fossils.

Rush: Shale, limestone, and fossils, including articulate brachiopods.

Webbville: Calcareous shale and siltstone, limestone, limestone nodules, articulate brachiopods, and crinoids.

A preliminary paleontological report from the U.S. Geological Survey (PR–0175) lists the following fauna:

BRACHIOPODA
Antiquatonia portlockiana (Norwood and Pratten)
Composita subtilita (Hall)?
?Derbia paucicostata Sturgeon and Hoare
Echinaria moorei (Dunbar and Condra)?
Echinaria sp. indeterminate
Juresania nebrascensis (Owen)
?Juresania nebrascensis (Owen)
Linoproductus sp. indeterminate
Meekella striatocostata (Cox)
Neochonetes semiacanthus (Linz)
Neospirifer dunbari King
Punctospirifer kentuckensis amesi (Sturgeon and Hoare)

BRYOZOA
Polypora sp.
trepostomatous genus, indeterminate

MEMBER Y

Member Y (Conemaugh Formation?) herein represents possible marine or brackish-water strata above the Ames Limestone. Strata of member Y have been reported in the following geologic quadrangle maps:

Ashland and Catlettsburg: Shale with calcareous concretions.

Boltsfork and Burnaugh: Calcareous siltstone, limestone, and fossils.

Fallsburg and Prichard: Calcareous shale, siltstone, and sandstone.

Louisa: Shale, calcareous siltstone, and limestone nodules.

Rush: Limestone and limestone nodules (nonmarine?).

Webbville: Calcareous shale and siltstone, and limestone (nonmarine?).

A preliminary paleontological report from the U.S. Geological Survey (PR–0143) lists the following fauna:

OSTRACODA
Whipplella sp.

UNKNOWN BED CONEMAUGH FORMATION

The following fauna are reported (PR–0174) from *unidentified strata within the Conemaugh Formation* (probably Brush Creek or Ames Limestones):

BRACHIOPODA
Chonetinella plebeia (Dunbar and Condra)?
Composita? sp. indeterminate
Crurithyris planiconvexa (Shumard)
Derbyia crassa (Meek and Hayden)
Hystriculina wabashensis (Norwood and Pratten)?
Juresania nebrascensis (Owen)
Linoproductus cf. *L. prattenianus* (Norwood and Pratten)
Neochonetes granulifer (Owen)
Neospirifer dunbari King

BRYOZOA
fenestrates, possibly *Septopora* sp.
rhomboporoids

PELECYPODA
Aviculopecten occidentalis (Shumard)
Aviculopinna [Pteronites] sp. indeterminate
Edmondia sp.
Edmondia aspinwallensis Meek
Lima [Palaeolima] retifera Shumard
Nuculopsis anodontoides (Meek)
Nuculopsis (Nuculanella) sp.
Permophorus oblongus Meek
Permophorus? sp.
Pernopecten prosseri (Mark)?
Schizodus sp. indeterminate
Streblopteria orbiculus (Stevens)?

GASTROPODA
Bellerophon (Pharkidonotus) percarinatus Conrad
bellerophontacean, indeterminate genus
Euphemites sp.
Glabrocingulum (G.) grayvillense (Norwood and Pratten)
Ianthinopsis? sp. indeterminate
Meekospira sp.
Retispira cf. *R. tenuilineata* (Gurley)

CEPHALOPODA
Metacoceras sp.
Neoaganides? sp.
Pseudorthoceras knoxense (McChesney)

ECHINODERMATA
crinoid spine

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APPENDIX A:
Geologic Quadrangle Maps Used in This Report

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Puffett, W. P., 1965b, Geology of the Vicco Quadrangle, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–418.

Rice, C. L., 1963, Geology of the Thomas Quadrangle, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–227.

Rice, C. L., 1964, Geology of the Lancer Quadrangle, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–347.

Rice, C. L., 1965, Geologic map of the Harold Quadrangle, Floyd County, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–441.

Rice, C. L., 1966, Geologic map of the Martin Quadrangle, Floyd County, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–563.

Rice, C. L., 1967, Geologic map of the Prestonsburg Quadrangle, Floyd and Johnson Counties, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–641.

Rice, C. L., 1968a, Geologic map of the McDowell Quadrangle, Floyd and Pike Counties, Kentucky: U.S.

Geological Survey Geologic Quadrangle Map GQ–732.

Rice, C. L., 1968b, Geologic map of the Redbush Quadrangle, eastern Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–708.

Rice, C. L., 1969, Geologic map of the Ivyton Quadrangle, eastern Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–801

Rice, C. L., 1973, Geologic map of the Jenkins West Quadrangle, Kentucky-Virginia: U.S. Geological Survey Geologic Quadrangle Map GQ–1126.

Rice, C. L., 1976, Geologic map of the Mayking Quadrangle, Letcher and Knott Counties, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–1309.

Rice, C. L., and Lee, K. Y., 1978, Geologic map of the Oneida Quadrangle, Clay and Owsley Counties, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–1470.

Rice, C. L., and Maughan, E. K., 1978, Geologic map of the Kayjay Quadrangle and part of the Fork Ridge Quadrangle, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–1505.

Rice, C. L., and Newell, W. L., 1975, Geologic map of the Saxton Quadrangle and part of the Jellico East Quadrangle, Whitley County, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–1264.

Rice, C. L., Ping, R. G., and Barr, J. L., 1977, Geologic map of the Belfry Quadrangle, Pike County, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–1369.

Rice, C. L., and Wolcott, D. E., 1973, Geologic map of the Whitesburg Quadrangle and part of the Flat Gap Quadrangle, Kentucky and Virginia: U.S. Geological Survey Geologic Quadrangle Map GQ–1119.

Rice, D. D., 1974, Geologic map of the Artemus Quadrangle, Bell and Knox Counties, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–1207.

Rice, D. D., 1975, Geologic map of the Helton Quadrangle, southeastern Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–1227.

Sable, E. G., 1978a, Geologic map of the Cannel City Quadrangle, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–1498.

Sable, E. G., 1978b, Geologic map of the White Oak Quadrangle, Magoffin and Morgan Counties, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–1480.

Sanchez, J. D., Alvord, D. C., and Hayes, P. T., 1978, Geologic map of the Richardson Quadrangle, Lawrence and Johnson Counties, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–1460.

Seiders, V. M., 1964, Geology of the Hazard North Quadrangle, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–344.

Seiders, V. M., 1965, Geology of the Carrie Quadrangle, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–422.

Sharps, J. A., 1966, Geologic map of the Load Quadrangle, Greenup County, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–519.

Sharps, J. A., 1967, Geologic map of the Fallsburg Quadrangle, Kentucky-West Virginia, and the Prichard Quadrangle in Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–584.

Sheppard, R. A., 1964a, Geology of the Portsmouth Quadrangle, Kentucky-Ohio and parts of the Wheelersburg and New Boston Quadrangles, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–312.

Sheppard, R. A., 1964b, Geology of the Tygarts Valley Quadrangle, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–289.

Sheppard, R. A., and Ferm, J. C., 1962, Geology of the Argillite Quadrangle, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–175.

Smith, J. H., 1967a, Geologic map of the Rockholds Quadrangle, Whitley and Knox Counties, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–677.

Smith, J. H., 1967b, Geologic map of the Wofford Quadrangle, Whitley County, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–617.

Snyder, G. L., 1963, Geology of the Tyner Quadrangle, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–247.

Spencer, F. D., 1964, Geology of the Boltsfork Quadrangle and part of the Burnaugh Quadrangle, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–316.

Spengler, R. W., 1977, Geologic map of the Salyersville South Quadrangle, Magoffin and Breathitt Counties, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–1373.

Spengler, R. W., 1978, Geologic map of the Seitz Quadrangle, eastern Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–1435.

Stager, H. K., 1963, Geology of the Lily Quadrangle, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–218.

Stager, H. K., 1964, Geology of the Blackwater Quadrangle, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–304.

Taylor, A. R., 1978a, Geologic map of the Barcreek Quadrangle, Clay County, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–1485.

Taylor, A. R., 1978b, Geologic map of the Hoskinston Quadrangle, Leslie County, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–1456.

Tazelaar, J. F., and Newell, W. L., 1974, Geologic map of the Evarts Quadrangle and part of the Hubbard Springs Quadrangle, southeastern Kentucky and Virginia: U.S. Geological Survey Geologic Quadrangle Map GQ–914.

Trent, V. A., 1965, Geology of the Matewan Quadrangle, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–373.

Trimble, D., and Smith, J. H., 1978, Geologic map of the Heidrick Quadrangle, Knox and Laurel Counties, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–1501.

Volckman, R. P., and Leo, G. W., 1978, Geologic map of the Mistletoe Quadrangle, southeastern Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–1474.

Waldrop, H. S., 1976, Geologic map of the Blackey Quadrangle, Letcher and Knott Counties, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–1322.

Ward, D. E., 1978, Geologic map of the Adams Quadrangle, Lawrence County, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–1489.

Weir, G. W., 1978a, Geologic map of the Booneville Quadrangle, Owsley and Lee Counties, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–1479.

Weir, G. W., 1978b, Geologic map of the Sturgeon Quadrangle, east-central Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–1455.

Weir, G. W., and Eggleton, R. E., 1978, Geologic map of the Beattyville Quadrangle, Lee and Owsley Counties, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–1483.

Weir, G. W., and Mumma, M. D., 1973, Geologic map of the McKee Quadrangle, Jackson and Owsley Counties, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–1125.

Weis, P. L., 1975, Geologic map of the Scalf Quadrangle, southeastern Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–1267.

Weis, P. L., and Rice, C. L., 1976, Geologic map of the Beverly Quadrangle, southeastern Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–1310.

Whittington, C. L., and Ferm, J. C., 1965, Geology of the Oldtown Quadrangle, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–353.

Whittington, C. L., and Ferm, J. C., 1967, Geologic map of the Grayson Quadrangle, Carter County, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–640.

Wolcott, D. E., 1974, Geologic map of part of the Jenkins East Quadrangle, Pike and Letcher Counties, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–1210.

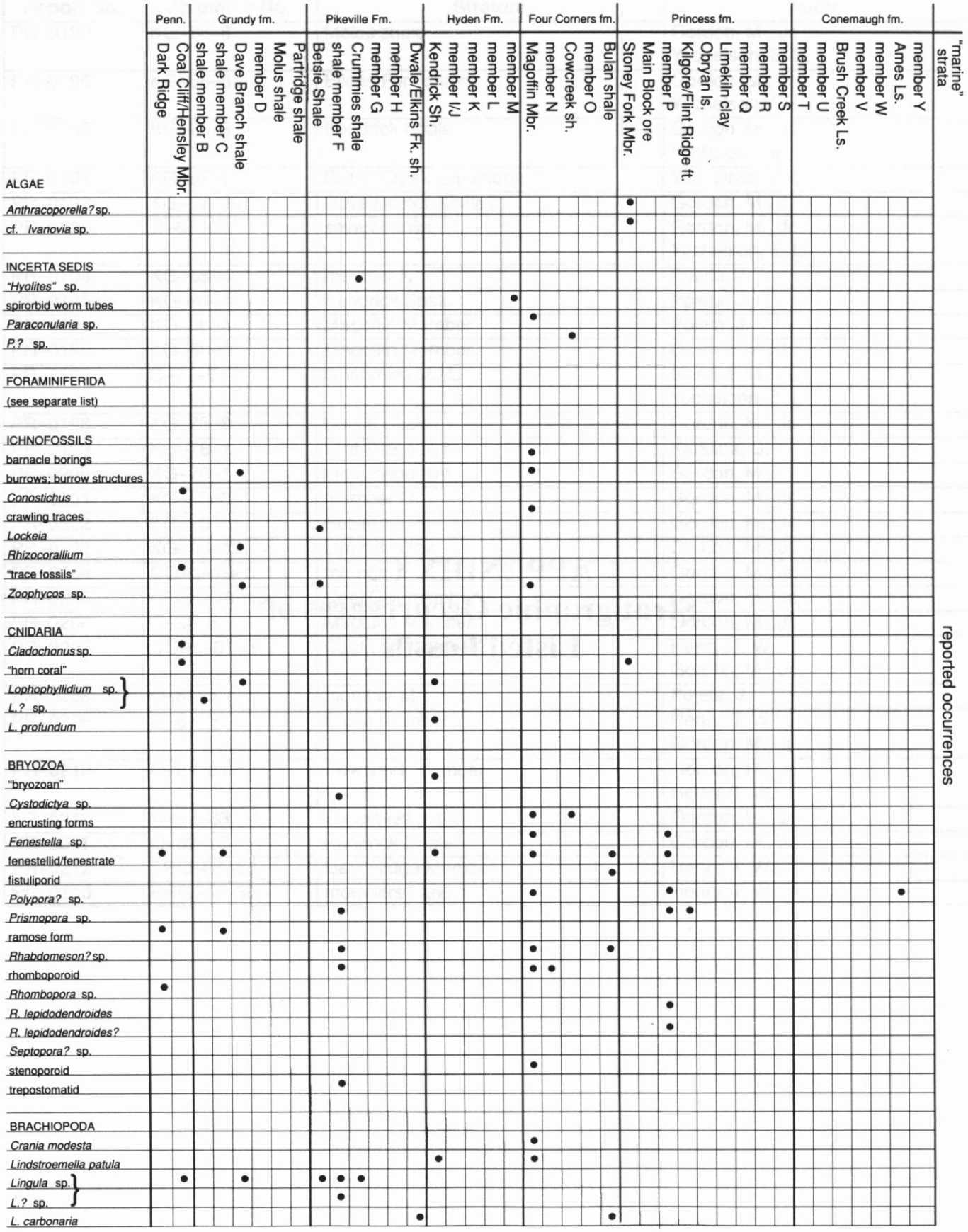
Wolcott, D. E., and Jenkins, E. C., 1966, Geologic map of the Meta Quadrangle, Pike County, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ–497.

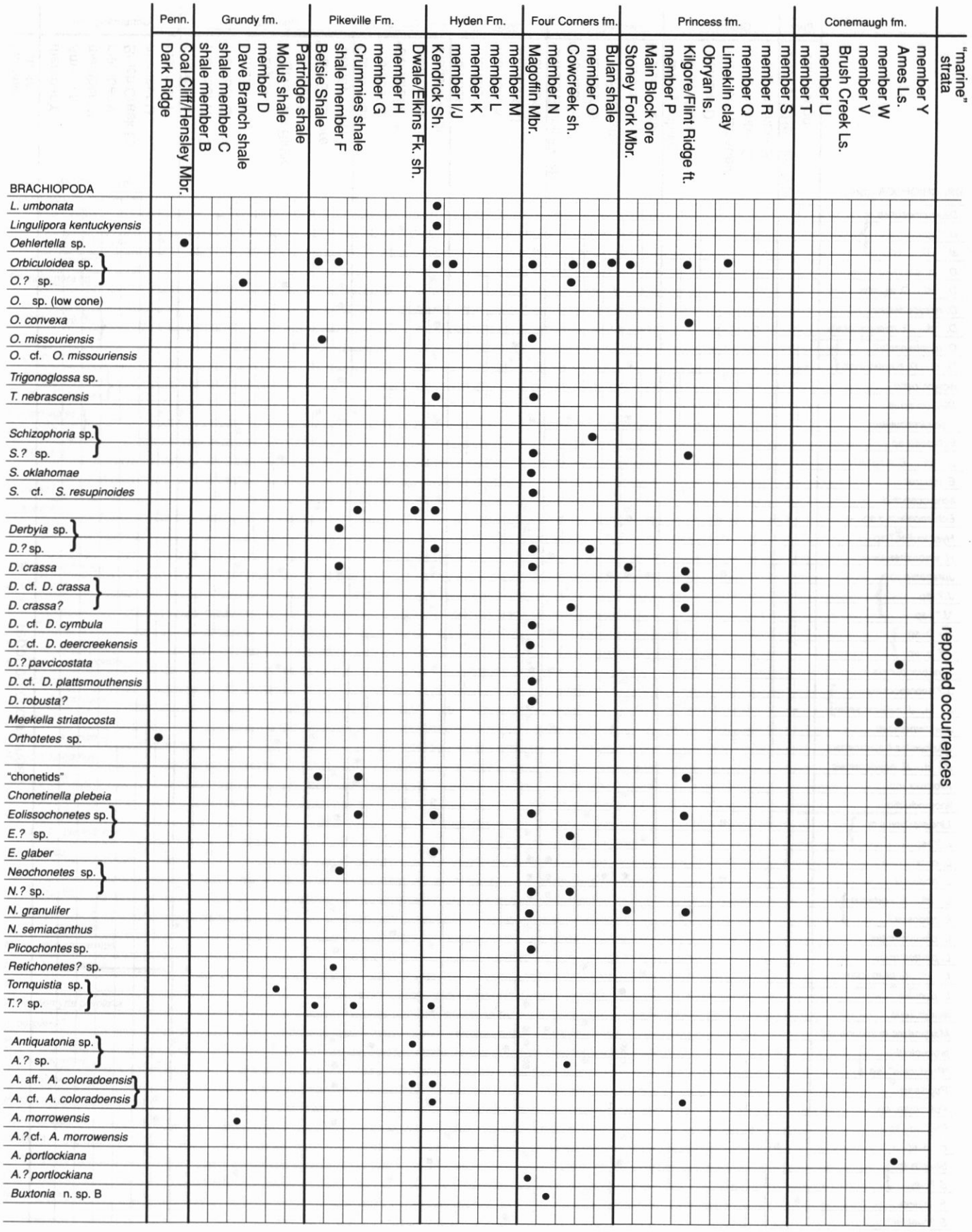
APPENDIX B:
Paleontological Reports of the U.S. Geological Survey Paleontology Branch

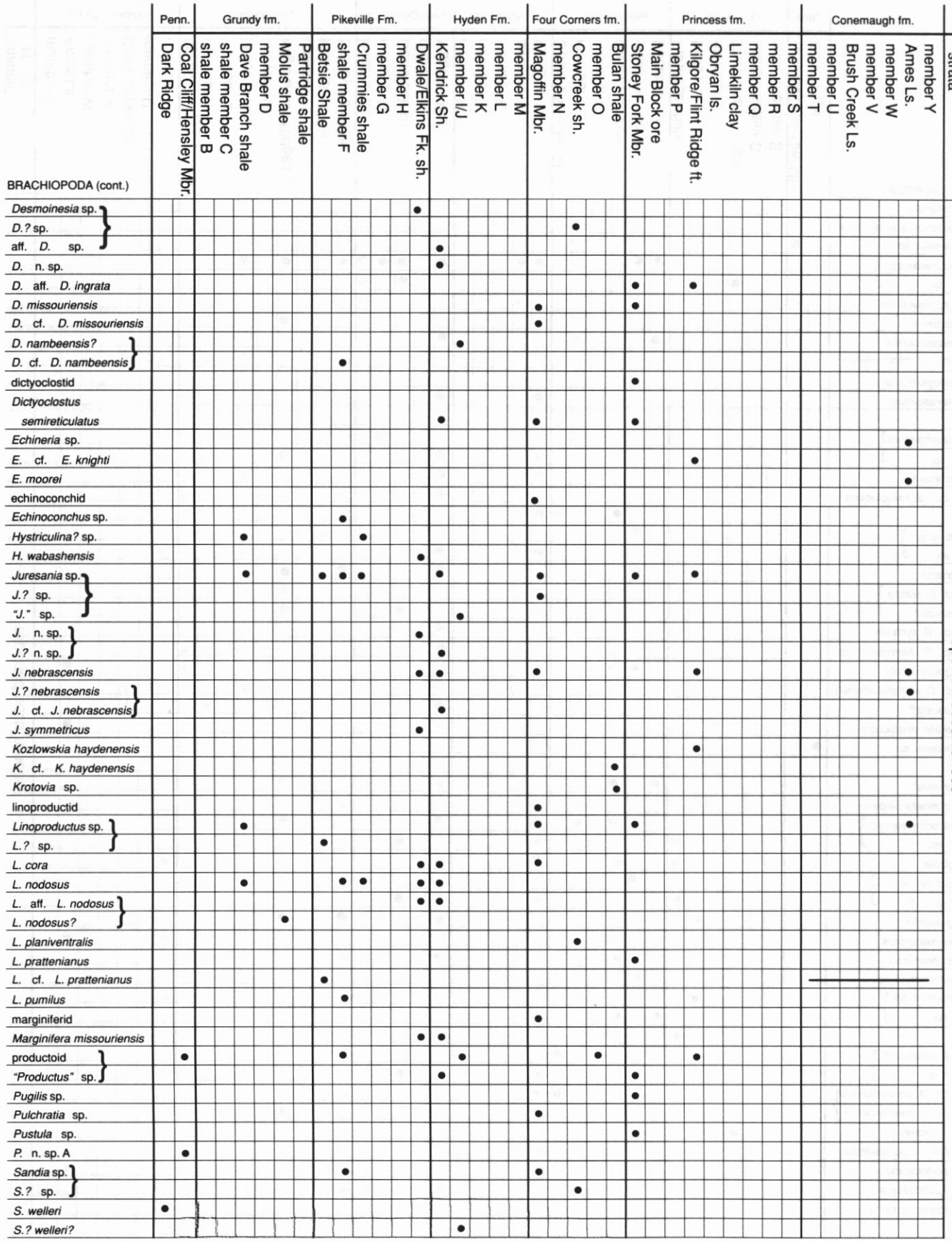
Report No.	Shipment No.	Stratum	Author
PR–0136	KG–64–3	Magoffin Member	Sohn, I. G.
PR–0137	KG–64–4	Magoffin Member	Sohn, I. G.
PR–0138	KG–64–6	Kendrick Shale	Sohn, I. G.
PR–0139	KG–62–11	Dave Branch shale	Sohn, I. G.
PR–0140	KG–64–23	Kendrick Shale	Sohn, I. G.
PR–0142	KG–66–8	Molus shale	Sohn, I. G.
PR–0143	KG–67–2	Brush Creek limestone?	Sohn, I. G.
PR–0143	KG–67–2	member Y	Sohn, I. G.
PR–0145	KG–75–2	Stoney Fork Member	Sohn, I. G.
PR–0146	KG–75–5	Stoney Fork Member	Sohn, I. G.
PR–0147	KG–75–5 supp.	Stoney Fork Member	Sohn, I. G.
PR–0149	KG–78–6(B)	Magoffin Member	Sohn, I. G.
PR–0150	COAL–84–5	Elkins Fork shale	Sohn, I. G.
PR–0150	COAL–84–5	Kendrick Shale	Sohn, I. G.
PR–0150	COAL–84–5	Magoffin Member	Sohn, I. G.
PR–0151	KG–62–11	Dave Branch shale	Henbest, L. G.
PR–0153	KG–75–2	Stoney Fork Member	Douglass, R. C.
PR–0157	KG–76–5	Obryan member	Douglass, R. C.
PR–0159	KG–78–6	Magoffin Member	Douglass, R. C.
PR–0160	KG–78–7	Brush Creek limestone	Douglass, R. C.
PR–0162	KG–78–10	Cowcreek member	Douglass, R. C.
PR–0164	O–80–80	Cowcreek member	Douglass, R. C.
PR–0166	KG–63–11	Flint Ridge flint	Huddle, J. W.
PR–0167	KG–63–14	Stoney Fork Member	Huddle, J. W.
PR–0168	KG–64–3	Magoffin Member	Huddle, J. W.
PR–0169	KG–64–4	Magoffin Member	Huddle, J. W.
PR–0170	KG–64–23	Kendrick Shale	Huddle, J. W.
PR–0175	KG–62–3	Ames Limestone	Gordon, M., Jr.
PR–0176	KG–62–4	Magoffin Member	Gordon, M., Jr.
PR–0176	KG–62–4	Flint Ridge flint	Gordon, M., Jr.
PR–0177	KG–62–8	Molus shale?	Pojeta, J.
PR–0178	KG–62–8	Crummies shale	Gordon, M., Jr.
PR–0180	KG–63–11	Flint Ridge flint	Gordon, M., Jr., Yochelson, E. L.
PR–0181	KG–63–14	Stoney Fork Member	Gordon, M., Jr. Yochelson, E. L.
PR–0182	KG–63–15	Stoney Fork Member	Yochelson, E. L. Gordon, M., Jr.
PR–0183	KG–64–3	Magoffin Member	Pojeta, J.
PR–0184	KG–64–3	Magoffin Member	Grant, R. E. Gordon, M., Jr.
PR–0185	KG–64–3	Magoffin Member	Duncan, H.
PR–0187	KG–64–4	Magoffin Member	Gordon, M., Jr. Yochelson, E. L.
PR–0188	KG–64–6	Kendrick Shale	Gordon, M., Jr. Yochelson, E. L.
PR–0189	KG–65–40	Betsie Shale?	Gordon, M., Jr.

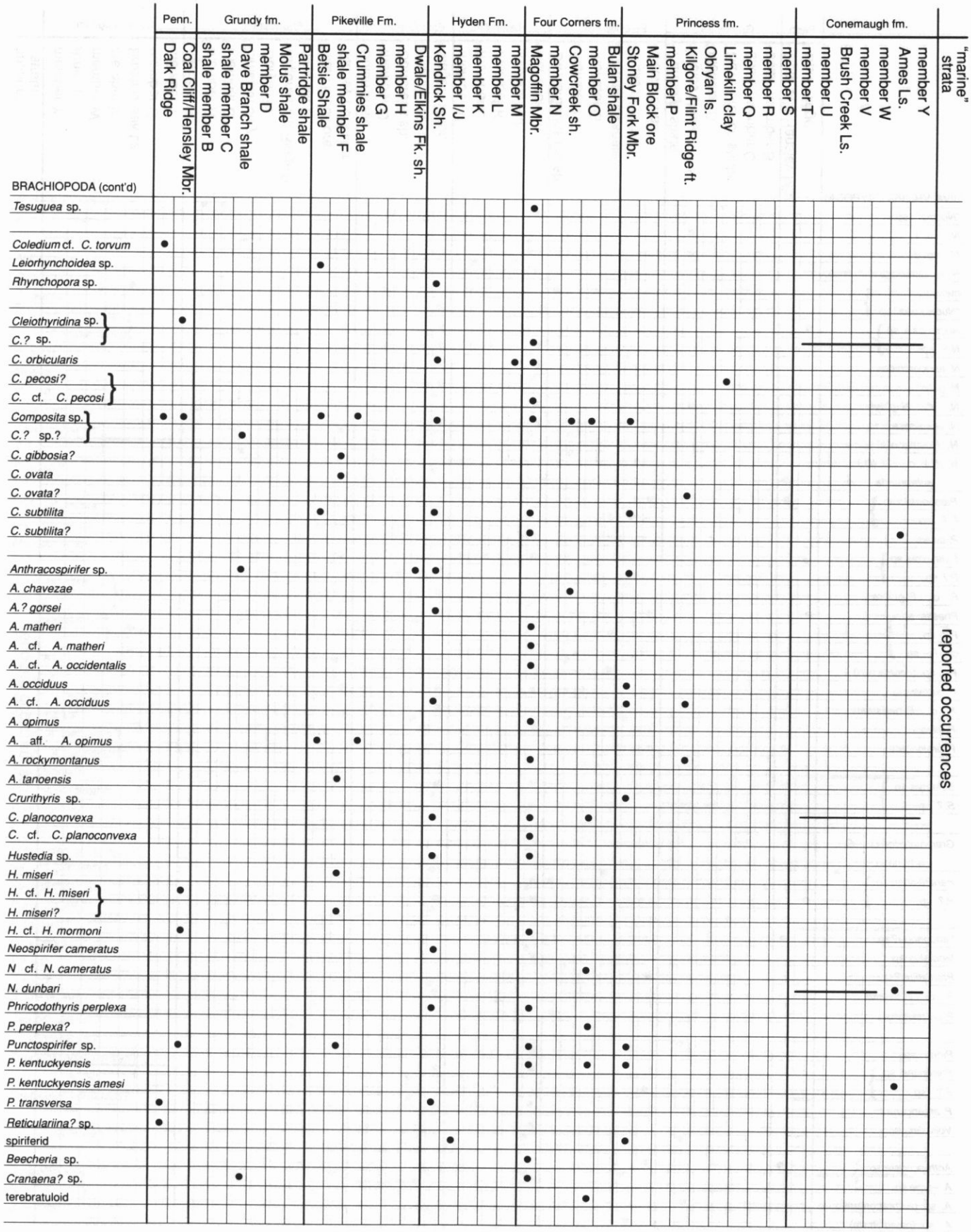
Report No.	Shipment No.	Stratum	Author
PR–0190	KG–66–8	Molus shale	Gordon, M., Jr. Yochelson, E. L.
PR–0190	KG–66–8	Elkins Fork shale	Gordon, M., Jr. Yochelson, E. L
PR–0190	KG–66–8	Kendrick Shale	Gordon, M., Jr. Yochelson, E. L.
PR–0191	KG–67–2	Brush Creek Limestone	Yochelson, E. L.
PR–0192	KG–67–19	Dave Branch shale?	Gordon, M., Jr.
PR–0193	O–67–60	several units	Gordon, M., Jr. Yochelson, E. L.
PR–0194	KG–68–4	member K	Pojeta, J.
PR–0195	KG–68–4	Kendrick Shale	Pojeta, J.
PR–0195	KG–68–4	Magoffin Member	Pojeta, J.
PR–0196	KG–68–4	Magoffin Member	Gordon, M., Jr.
PR–0197	C–71–5	Crummies shale	Gordon, M., Jr. Yochelson, E. L
PR–0198	KG–75–8	Betsie Shale	Gordon, M., Jr.
PR–0199	KG–76–1	Flint Ridge flint	Karklins, O.
PR–0200	KG–76–1	Flint Ridge flint	Gordon, M., Jr.
PR–0201	KG–76–3	member O	Gordon, M., Jr.
PR–0202	KG–76–11	Betsie Shale	Gordon, M., Jr.
PR–0203	KG–76–12	Limekiln clay	Gordon, M., Jr.
PR–0204	COAL–79–8	member F	Gordon, M., Jr.
PR–0205	COAL–79–13	Coal Cliff member	Gordon, M., Jr.
PR–0206	O–80–5	Magoffin Member	Gordon, M., Jr.
PR–0207	COAL–81–3	Coal Cliff member?	Henry, T. W. Gordon, M., Jr.
PR–0208	O–81–5	member M	Pojeta, J.
PR–0209	O–81–5	Bulan member	Henry, T. W. Gordon, M., Jr.
PR–0210	O–81–21	Cowcreek member	Gordon, M., Jr. Henry, T. W.
PR–0211	O–82–63	Crummies shale	Gordon, M., Jr.
PR–0211	O–82–63	Kendrick Shale	Gordon, M., Jr.
PR–0212	ERG–88–20	Dark Ridge Member	Henry, T. W.
PR–0213	ERG–88–3D	members I and J	Henry, T. W.

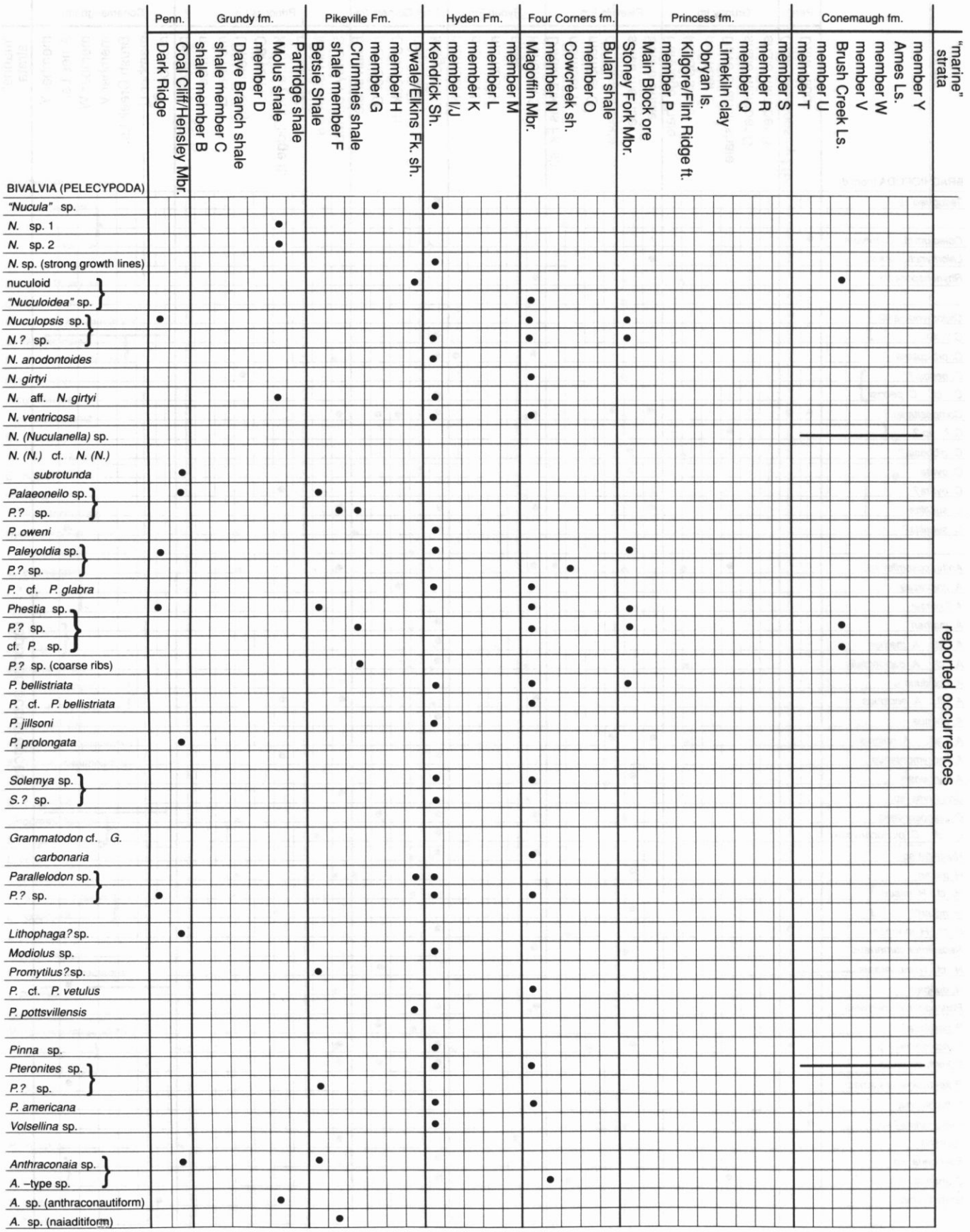
APPENDIX C:
Stratigraphic Occurrences of Listed Fossils

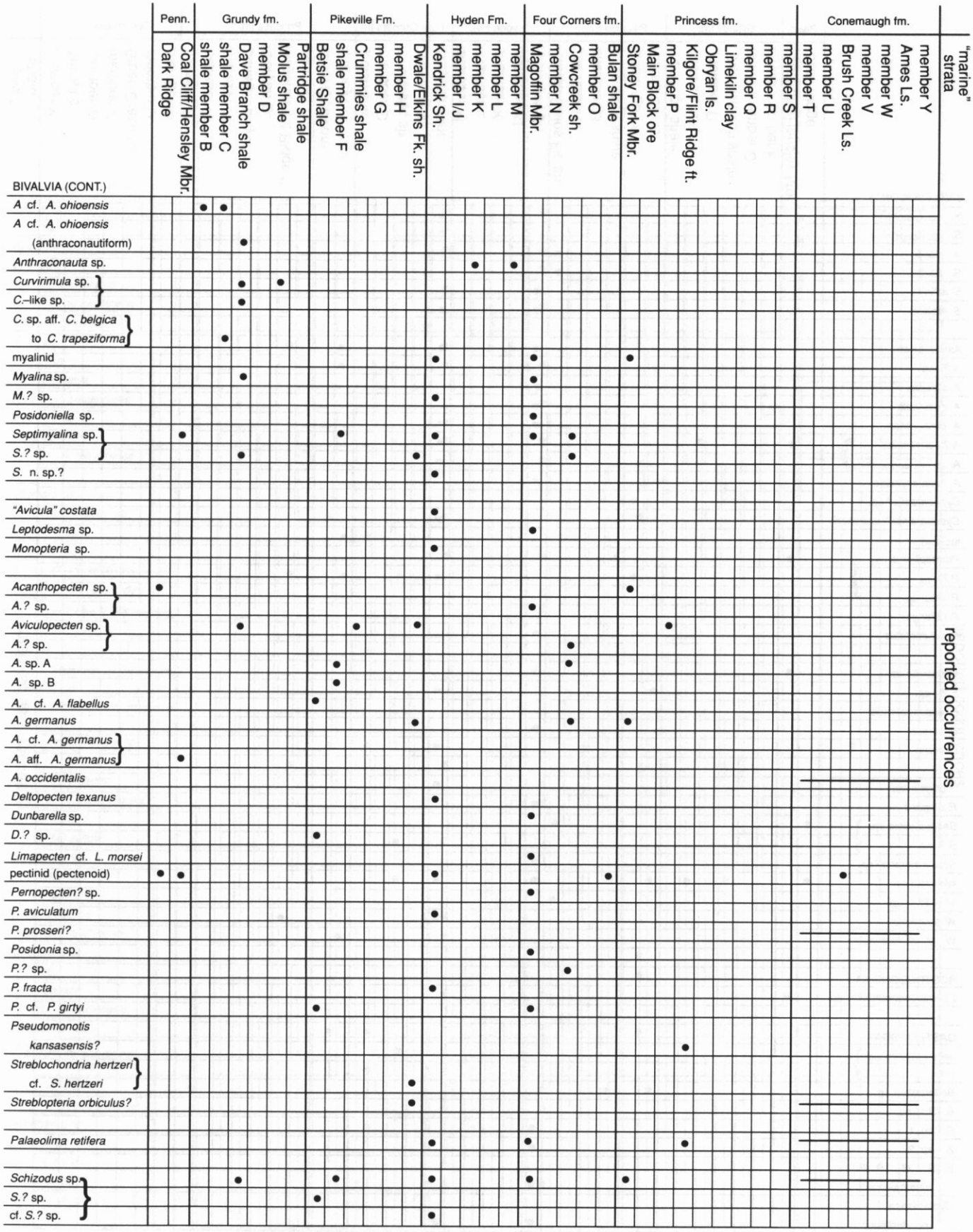

Penn.
Grundy fm.
Pikeville Fm.
Hyden Fm.
Four Corners fm.
Princess fm.
Conemaugh fm.
"marine" strata
ALGAE
Dark Ridge
Coal Cliff/Hensley Mbr.
shale member B
shale member C
Dave Branch shale member D
Molus shale
Partridge shale
Betsie Shale
shale member F
Crummies shale member G
member H
Dwale/Elkins Fk. sh.
Kendrick Sh.
member I/J
member K
member L
member M
Magoffin Mbr.
member N
Cowcreek sh.
member O
Bulan shale
Stoney Fork Mbr.
Main Block ore
member P
Kilgore/Flint Ridge ft.
Obryan ls.
Limekiln clay
member Q
member R
member S
member T
Brush Creek Ls.
member U
member V
Ames Ls.
member W
member Y
Anthracoporella? sp.
cf. Ivanovia sp.
INCERTA SEDIS
"Hyolites" sp.
spirorbid worm tubes
Paraconularia sp.
P.? sp.
FORAMINIFERIDA
(see separate list)
ICHNOFOSSILS
barnacle borings
burrows; burrow structures
Conostichus
crawling traces
Lockeia
Rhizocorallium
"trace fossils"
Zoophycos sp.
CNIDARIA
Cladochonus sp.
"horn coral"
Lophophyllidium sp.
L.? sp.
L. profundum
BRYOZOA
"bryozoan"
Cystodictya sp.
encrusting forms
Fenestella sp.
fenestellid/fenestrate
fistuliporid
Polypora? sp.
Prismopora sp.
ramose form
Rhabdomeson? sp.
rhomboporoid
Rhombopora sp.
R. lepidodendroides
R. lepidodendroides?
Septopora? sp.
stenoporoid
trepostomatid
BRACHIOPODA
Crania modesta
Lindstroemella patula
Lingula sp.
L.? sp.
L. carbonaria
reported occurrences

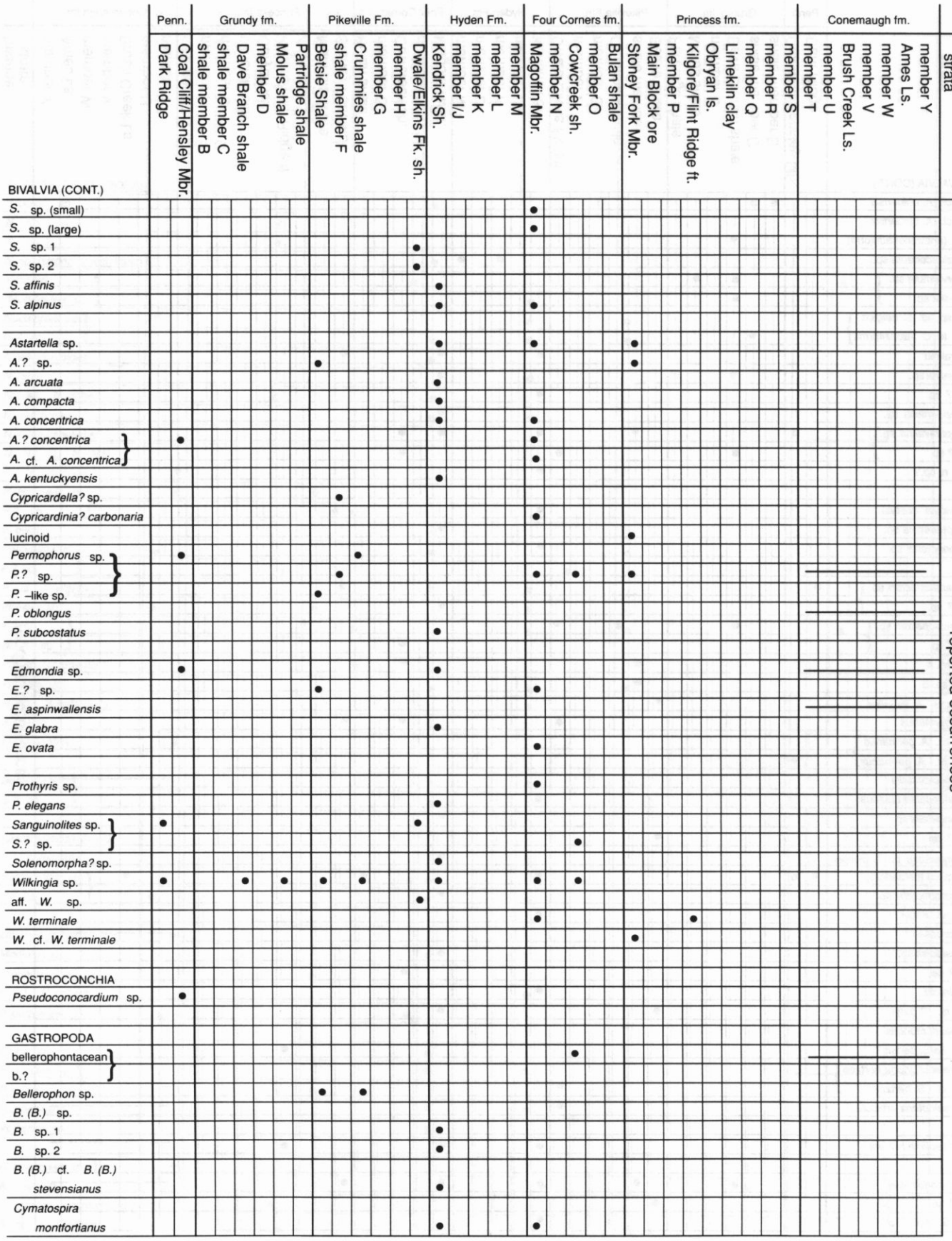

Penn.
Grundy fm.
Pikeville Fm.
Hyden Fm.
Four Corners fm.
Princess fm.
Conemaugh fm.
"marine" strata
reported occurrences
BRACHIOPODA
L. umbonata
Lingulipora kentuckyensis
Oehlertella sp.
Orbiculoidea sp.
O.? sp.
O. sp. (low cone)
O. convexa
O. missouriensis
O. cf. O. missouriensis
Trigonoglossa sp.
T. nebrascensis
Schizophoria sp.
S.? sp.
S. oklahomae
S. cf. S. resupinoides
Derbyia sp.
D.? sp.
D. crassa
D. cf. D. crassa
D. crassa?
D. cf. D. cymbula
D. cf. D. deercreekensis
D.? pavcicostata
D. cf. D. plattsmouthensis
D. robusta?
Meekella striatocosta
Orthotetes sp.
"chonetids"
Chonetinella plebeia
Eolissochonetes sp.
E.? sp.
E. glaber
Neochonetes sp.
N.? sp.
N. granulifer
N. semiacanthus
Plicochontes sp.
Retichonetes? sp.
Tornquistia sp.
T.? sp.
Antiquatonia sp.
A.? sp.
A. aff. A. coloradoensis
A. cf. A. coloradoensis
A. morrowensis
A.? cf. A. morrowensis
A. portlockiana
A.? portlockiana
Buxtonia n. sp. B
Dark Ridge
Coal Cliff/Hensley Mbr.
shale member B
Dave Branch shale
shale member C
member D
Molus shale
Partridge shale
Betsie Shale
shale member F
Crummies shale
member G
member H
Dwale/Elkins Fk. sh.
Kendrick Sh.
member I/J
member K
member L
member M
Magoffin Mbr.
member N
Cowcreek sh.
member O
Bulan shale
Stoney Fork Mbr.
Main Block ore
member P
Kilgore/Flint Ridge ft.
Obryan ls.
Limekiln clay
member Q
member R
member S
member T
member U
Brush Creek Ls.
member V
member W
Ames Ls.
member Y

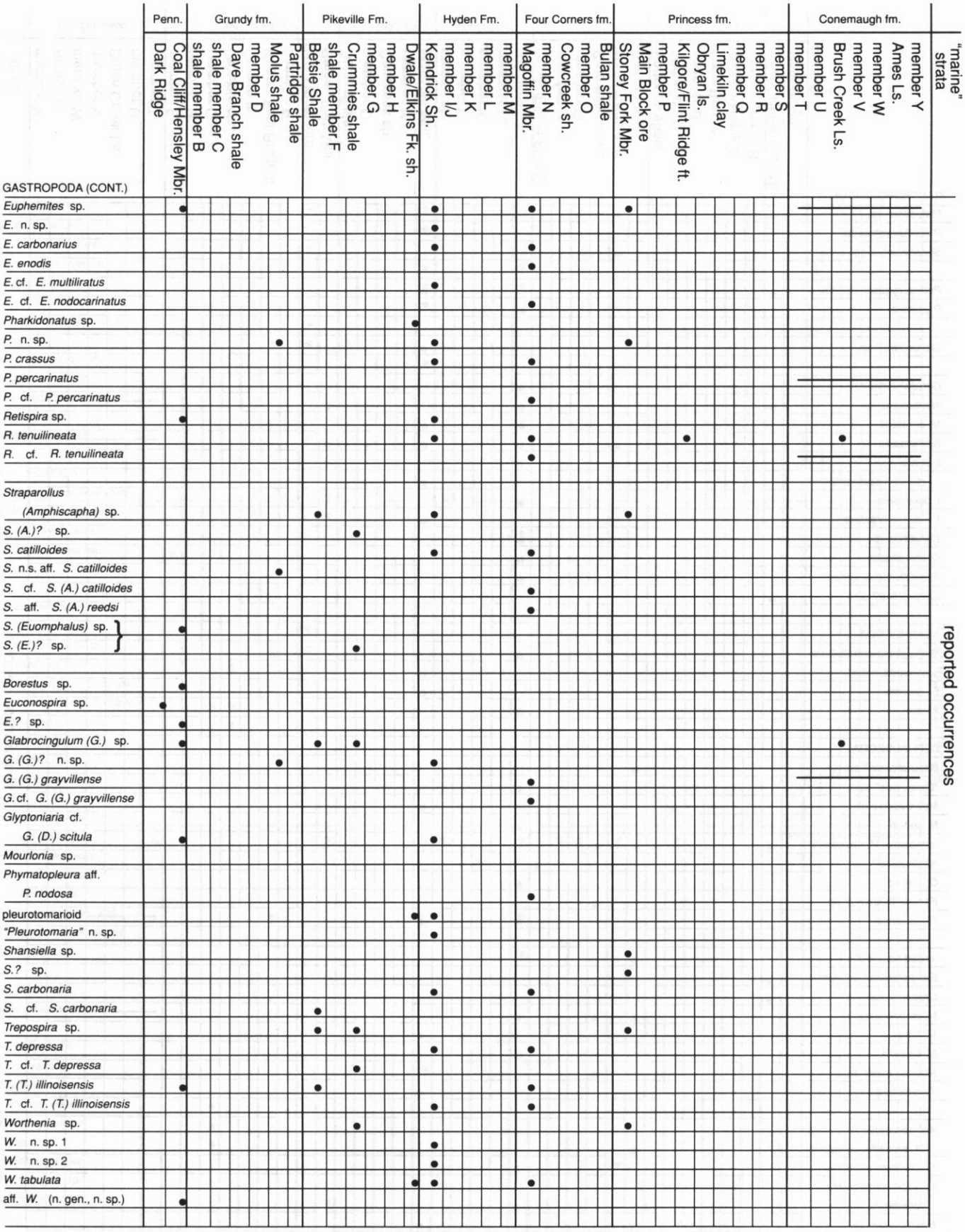

Penn.
Grundy fm.
Pikeville Fm.
Hyden Fm.
Four Corners fm.
Princess fm.
Conemaugh fm.
"marine" strata
Dark Ridge
Coal Cliff/Hensley Mbr.
shale member B
shale member C
Dave Branch shale member D
Molus shale
Partridge shale
Betsie Shale
shale member F
Crummies shale member G
member H
Dwale/Elkins Fk. sh.
Kendrick Sh.
member I/J
member K
member L
member M
Magoffin Mbr.
member N
Cowcreek sh.
member O
Bulan shale
Stoney Fork Mbr.
Main Block ore
member P
Kilgore/Flint Ridge ft.
Obryan ls.
Limekiln clay
member Q
member R
member S
member T
member U
Brush Creek Ls.
member V
member W
Ames Ls.
member Y
reported occurrences
BRACHIOPODA (cont.)
Desmoinesia sp.
D.? sp.
aff. D. sp.
D. n. sp.
D. aff. D. ingrata
D. missouriensis
D. cf. D. missouriensis
D. nambeensis?
D. cf. D. nambeensis
dictyoclostid
Dictyoclostus semireticulatus
Echineria sp.
E. cf. E. knighti
E. moorei
echinoconchid
Echinoconchus sp.
Hystriculina? sp.
H. wabashensis
Juresania sp.
J.? sp.
"J." sp.
J. n. sp.
J.? n. sp.
J. nebrascensis
J.? nebrascensis
J. cf. J. nebrascensis
J. symmetricus
Kozlowskia haydenensis
K. cf. K. haydenensis
Krotovia sp.
linoproductid
Linoproductus sp.
L.? sp.
L. cora
L. nodosus
L. aff. L. nodosus
L. nodosus?
L. planiventralis
L. prattenianus
L. cf. L. prattenianus
L. pumilus
marginiferid
Marginifera missouriensis
productoid
"Productus" sp.
Pugilis sp.
Pulchratia sp.
Pustula sp.
P. n. sp. A
Sandia sp.
S.? sp.
S. welleri
S.? welleri?

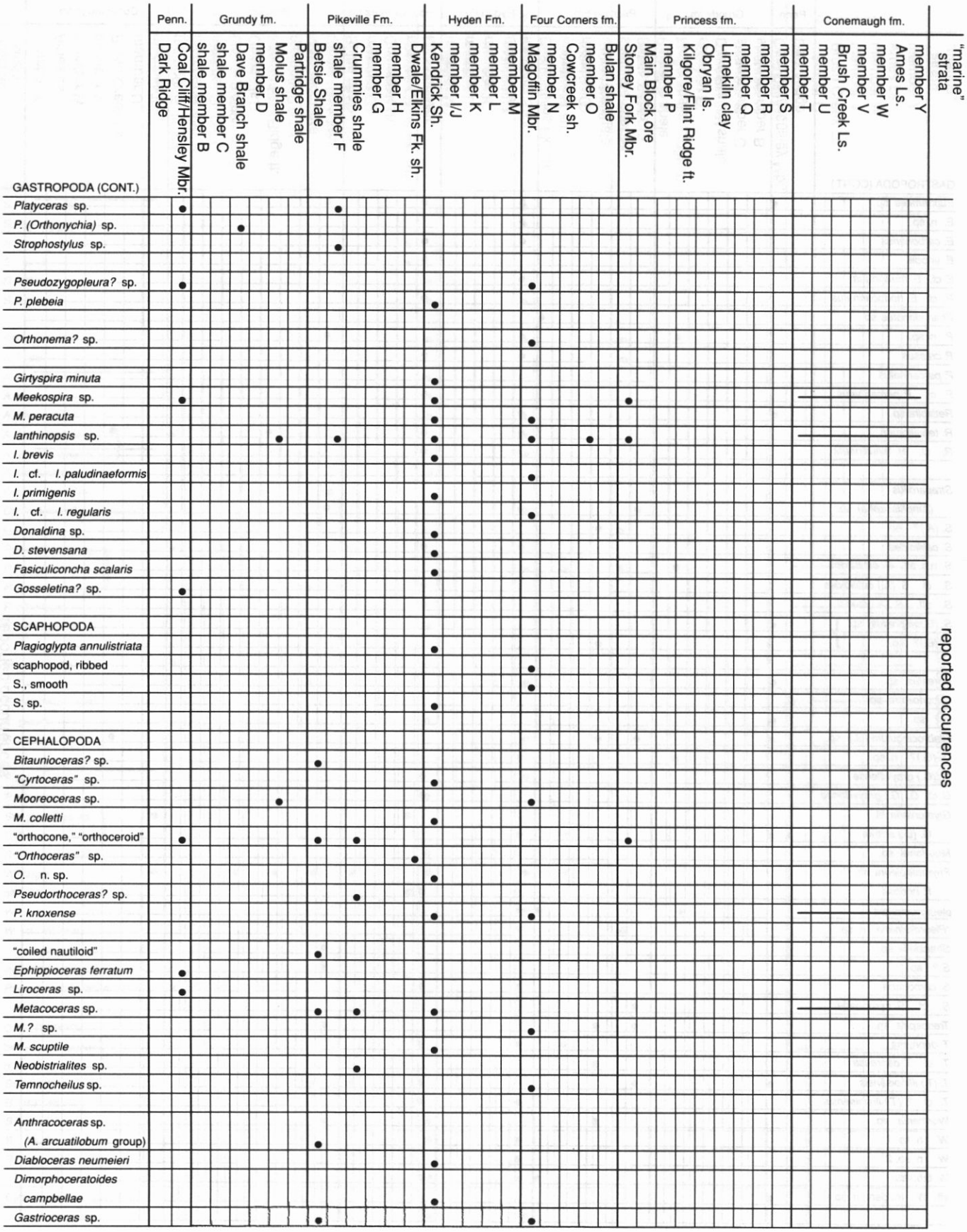

Penn.
Grundy fm.
Pikeville Fm.
Hyden Fm.
Four Corners fm.
Princess fm.
Conemaugh fm.
"marine" strata
BRACHIOPODA (cont'd)
Dark Ridge
Coal Cliff/Hensley Mbr.
shale member B
shale member C
Dave Branch shale
member D
Molus shale
Partridge shale
Betsie Shale
shale member F
Crummies shale
member G
member H
Dwale/Elkins Fk. sh.
Kendrick Sh.
member I/J
member K
member L
member M
Magoffin Mbr.
member N
Cowcreek sh.
member O
Bulan shale
Stoney Fork Mbr.
Main Block ore
member P
Kilgore/Flint Ridge ft.
Obryan ls.
Limekiln clay
member Q
member R
member S
member T
member U
Brush Creek Ls.
member V
member W
Ames Ls.
member Y
Tesuguea sp.
Coledium cf. C. torvum
Leiorhynchoidea sp.
Rhynchopora sp.
Cleiothyridina sp.
C.? sp.
C. orbicularis
C. pecosi?
C. cf. C. pecosi
Composita sp.
C.? sp.?
C. gibbosia?
C. ovata
C. ovata?
C. subtilita
C. subtilita?
Anthracospirifer sp.
A. chavezae
A.? gorsei
A. matheri
A. cf. A. matheri
A. cf. A. occidentalis
A. occiduus
A. cf. A. occiduus
A. opimus
A. aff. A. opimus
A. rockymontanus
A. tanoensis
Crurithyris sp.
C. planoconvexa
C. cf. C. planoconvexa
Hustedia sp.
H. miseri
H. cf. H. miseri
H. miseri?
H. cf. H. mormoni
Neospirifer cameratus
N cf. N. cameratus
N. dunbari
Phricodothyris perplexa
P. perplexa?
Punctospirifer sp.
P. kentuckyensis
P. kentuckyensis amesi
P. transversa
Reticulariina? sp.
spiriferid
Beecheria sp.
Cranaena? sp.
terebratuloid
reported occurrences

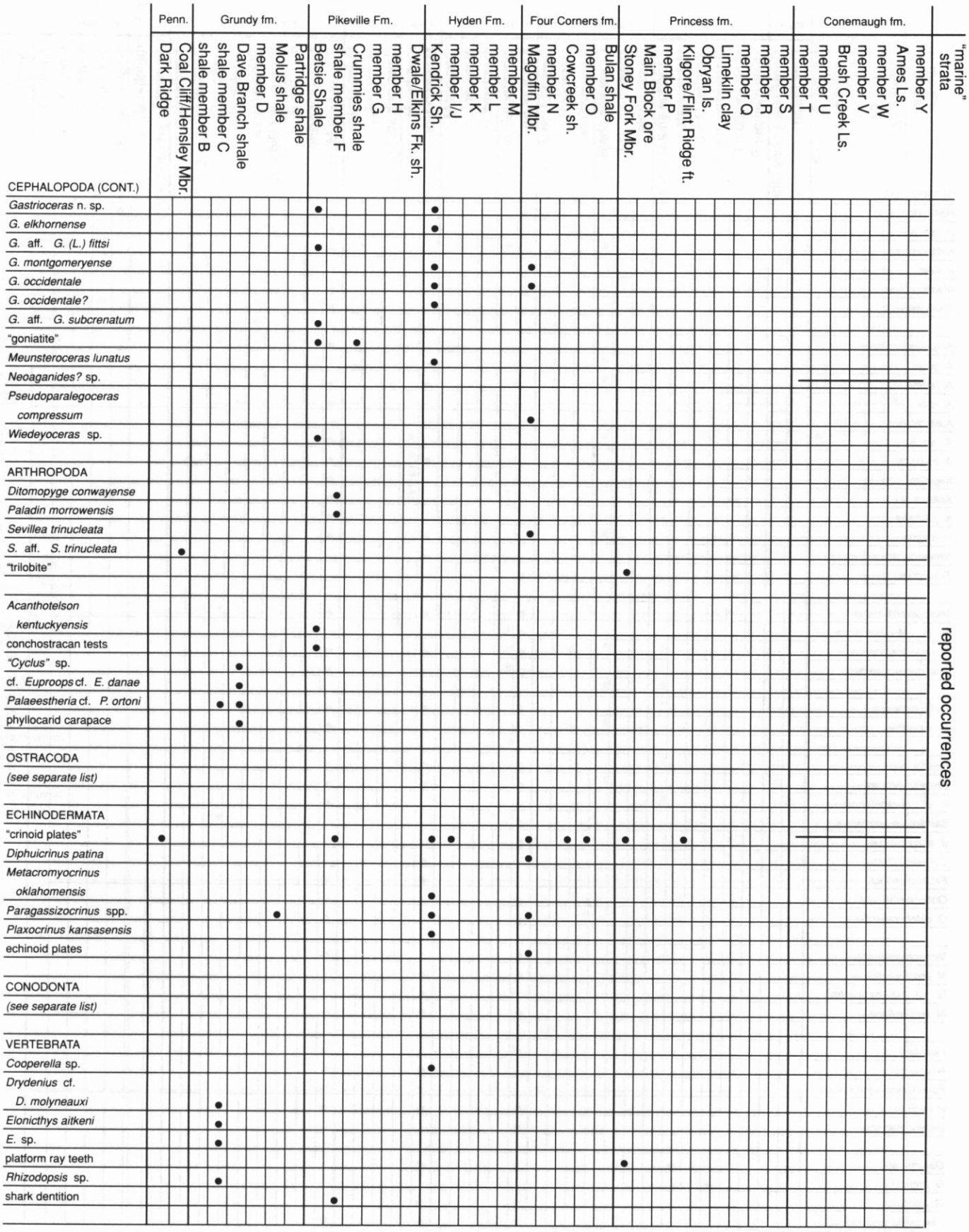

Penn.
Grundy fm.
Pikeville Fm.
Hyden Fm.
Four Corners fm.
Princess fm.
Conemaugh fm.
"marine" strata
Dark Ridge
Coal Cliff/Hensley Mbr.
shale member B
shale member C
Dave Branch shale
member D
Molus shale
Partridge shale
Betsie Shale
shale member F
Crummies shale
member G
member H
Dwale/Elkins Fk. sh.
Kendrick Sh.
member I/J
member K
member L
member M
Magoffin Mbr.
member N
Cowcreek sh.
member O
Bulan shale
Stoney Fork Mbr.
Main Block ore
member P
Kilgore/Flint Ridge ft.
Obryan ls.
Limekiln clay
member Q
member R
member S
member T
member U
Brush Creek Ls.
member V
member W
Ames Ls.
member Y
reported occurrences
BIVALVIA (PELECYPODA)
"Nucula" sp.
N. sp. 1
N. sp. 2
N. sp. (strong growth lines)
nuculoid
"Nuculoidea" sp.
Nuculopsis sp.
N.? sp.
N. anodontoides
N. girtyi
N. aff. N. girtyi
N. ventricosa
N. (Nuculanella) sp.
N. (N.) cf. N. (N.) subrotunda
Palaeoneilo sp.
P.? sp.
P. oweni
Paleyoldia sp.
P.? sp.
P. cf. P. glabra
Phestia sp.
P.? sp.
cf. P. sp.
P.? sp. (coarse ribs)
P. bellistriata
P. cf. P. bellistriata
P. jillsoni
P. prolongata
Solemya sp.
S.? sp.
Grammatodon cf. G. carbonaria
Parallelodon sp.
P.? sp.
Lithophaga? sp.
Modiolus sp.
Promytilus? sp.
P. cf. P. vetulus
P. pottsvillensis
Pinna sp.
Pteronites sp.
P.? sp.
P. americana
Volsellina sp.
Anthraconaia sp.
A. –type sp.
A. sp. (anthraconautiform)
A. sp. (naiaditiform)


Penn.
Grundy fm.
Pikeville Fm.
Hyden Fm.
Four Corners fm.
Princess fm.
Conemaugh fm.
"marine" strata
Dark Ridge
Coal Cliff/Hensley Mbr.
shale member B
shale member C
Dave Branch shale
member D
Molus shale
Partridge shale
Betsie Shale
shale member F
Crummies shale
member G
member H
Dwale/Elkins Fk. sh.
Kendrick Sh.
member I/J
member K
member L
member M
Magoffin Mbr.
member N
Cowcreek sh.
member O
Bulan shale
Stoney Fork Mbr.
Main Block ore
member P
Kilgore/Flint Ridge ft.
Obryan ls.
Limekiln clay
member Q
member R
member S
member T
member U
Brush Creek Ls.
member V
member W
Ames Ls.
member Y
BIVALVIA (CONT.)
A cf. A. ohioensis
A cf. A. ohioensis (anthraconautiform)
Anthraconauta sp.
Curvirimula sp.
C.-like sp.
C. sp. aff. C. belgica to C. trapeziforma
myalinid
Myalina sp.
M.? sp.
Posidoniella sp.
Septimyalina sp.
S.? sp.
S. n. sp.?
"Avicula" costata
Leptodesma sp.
Monopteria sp.
Acanthopecten sp.
A.? sp.
Aviculopecten sp.
A.? sp.
A. sp. A
A. sp. B
A. cf. A. flabellus
A. germanus
A. cf. A. germanus
A. aff. A. germanus
A. occidentalis
Deltopecten texanus
Dunbarella sp.
D.? sp.
Limapecten cf. L. morsei
pectinid (pectenoid)
Pernopecten? sp.
P. aviculatum
P. prosseri?
Posidonia sp.
P.? sp.
P. fracta
P. cf. P. girtyi
Pseudomonotis kansasensis?
Streblochondria hertzeri cf. S. hertzeri
Streblopteria orbiculus?
Palaeolima retifera
Schizodus sp.
S.? sp.
cf. S.? sp.
reported occurrences


Penn.
Grundy fm.
Pikeville Fm.
Hyden Fm.
Four Corners fm.
Princess fm.
Conemaugh fm.
"marine" strata
Dark Ridge
Coal Cliff/Hensley Mbr.
shale member B
shale member C
Dave Branch shale member D
Molus shale
Partridge shale
Betsie Shale
shale member F
Crummies shale member G
member H
Dwale/Elkins Fk. sh.
Kendrick Sh.
member I/J
member K
member L
member M
Magoffin Mbr.
member N
Cowcreek sh. member O
Bulan shale
Stoney Fork Mbr.
Main Block ore
member P
Kilgore/Flint Ridge ft.
Obryan ls.
Limekiln clay
member Q
member R
member S
member T
member U
Brush Creek Ls.
member V
member W
Ames Ls.
member Y
reported occurrences
BIVALVIA (CONT.)
S. sp. (small)
S. sp. (large)
S. sp. 1
S. sp. 2
S. affinis
S. alpinus
Astartella sp.
A.? sp.
A. arcuata
A. compacta
A. concentrica
A.? concentrica
A. cf. A. concentrica
A. kentuckyensis
Cypricardella? sp.
Cypricardinia? carbonaria
lucinoid
Permophorus sp.
P.? sp.
P. –like sp.
P. oblongus
P. subcostatus
Edmondia sp.
E.? sp.
E. aspinwallensis
E. glabra
E. ovata
Prothyris sp.
P. elegans
Sanguinolites sp.
S.? sp.
Solenomorpha? sp.
Wilkingia sp.
aff. W. sp.
W. terminale
W. cf. W. terminale
ROSTROCONCHIA
Pseudoconocardium sp.
GASTROPODA
bellerophontacean b.?
Bellerophon sp.
B. (B.) sp.
B. sp. 1
B. sp. 2
B. (B.) cf. B. (B.) stevensianus
Cymatospira montfortianus


Penn.
Grundy fm.
Pikeville Fm.
Hyden Fm.
Four Corners fm.
Princess fm.
Conemaugh fm.
"marine" strata
Dark Ridge
Coal Cliff/Hensley Mbr.
shale member B
shale member C
Dave Branch shale
member D
Molus shale
Partridge shale
Betsie Shale
shale member F
Crummies shale
member G
member H
Dwale/Elkins Fk. sh.
Kendrick Sh.
member I/J
member K
member L
member M
Magoffin Mbr.
member N
Cowcreek sh.
member O
Bulan shale
Stoney Fork Mbr.
Main Block ore
member P
Kilgore/Flint Ridge ft.
Obryan ls.
Limekiln clay
member Q
member R
member S
member T
member U
Brush Creek Ls.
member V
member W
Ames Ls.
member Y
GASTROPODA (CONT.)
Euphemites sp.
E. n. sp.
E. carbonarius
E. enodis
E. cf. E. multiliratus
E. cf. E. nodocarinatus
Pharkidonatus sp.
P. n. sp.
P. crassus
P. percarinatus
P. cf. P. percarinatus
Retispira sp.
R. tenuilineata
R. cf. R. tenuilineata
Straparollus (Amphiscapha) sp.
S. (A.)? sp.
S. catilloides
S. n.s. aff. S. catilloides
S. cf. S. (A.) catilloides
S. aff. S. (A.) reedsi
S. (Euomphalus) sp.
S. (E.)? sp.
Borestus sp.
Euconospira sp.
E.? sp.
Glabrocingulum (G.) sp.
G. (G.)? n. sp.
G. (G.) grayvillense
G. cf. G. (G.) grayvillense
Glyptoniaria cf. G. (D.) scitula
Mourlonia sp.
Phymatopleura aff. P. nodosa
pleurotomarioid
"Pleurotomaria" n. sp.
Shansiella sp.
S.? sp.
S. carbonaria
S. cf. S. carbonaria
Trepospira sp.
T. depressa
T. cf. T. depressa
T. (T.) illinoisensis
T. cf. T. (T.) illinoisensis
Worthenia sp.
W. n. sp. 1
W. n. sp. 2
W. tabulata
aff. W. (n. gen., n. sp.)
reported occurrences


Penn.
Grundy fm.
Pikeville Fm.
Hyden Fm.
Four Corners fm.
Princess fm.
Conemaugh fm.
"marine" strata
Dark Ridge
Coal Cliff/Hensley Mbr.
shale member B
shale member C
Dave Branch shale
member D
Molus shale
Partridge shale
Betsie Shale
shale member F
Crummies shale
member G
member H
Dwale/Elkins Fk. sh.
Kendrick Sh.
member I/J
member K
member L
member M
Magoffin Mbr.
Cowcreek sh.
member N
member O
Bulan shale
Stoney Fork Mbr.
Main Block ore
member P
Kilgore/Flint Ridge ft.
Obryan ls.
Limekiln clay
member Q
member R
member S
member T
member U
Brush Creek Ls.
member V
member W
Ames Ls.
member Y
reported occurrences
GASTROPODA (CONT.)
Platyceras sp.
P. (Orthonychia) sp.
Strophostylus sp.
Pseudozygopleura? sp.
P. plebeia
Orthonema? sp.
Girtyspira minuta
Meekospira sp.
M. peracuta
Ianthinopsis sp.
I. brevis
I. cf. I. paludinaeformis
I. primigenis
I. cf. I. regularis
Donaldina sp.
D. stevensana
Fasiculiconcha scalaris
Gosseletina? sp.
SCAPHOPODA
Plagioglypta annulistriata
scaphopod, ribbed
S., smooth
S. sp.
CEPHALOPODA
Bitauniocerас? sp.
"Cyrtoceras" sp.
Mooreoceras sp.
M. colletti
"orthocone," "orthoceroid"
"Orthoceras" sp.
O. n. sp.
Pseudorthoceras? sp.
P. knoxense
"coiled nautiloid"
Ephippioceras ferratum
Liroceras sp.
Metacoceras sp.
M.? sp.
M. scuptile
Neobistrialites sp.
Temnocheilus sp.
Anthracoceras sp.
(A. arcuatilobum group)
Diabloceras neumeieri
Dimorphoceratoides campbellae
Gastrioceras sp.


Penn.
Grundy fm.
Pikeville Fm.
Hyden Fm.
Four Corners fm.
Princess fm.
Conemaugh fm.
"marine" strata
Dark Ridge
Coal Cliff/Hensley Mbr.
shale member B
shale member C
Dave Branch shale
member D
Molus shale
Partridge shale
Betsie Shale
shale member F
Crummies shale
member G
member H
Dwale/Elkins Fk. sh.
Kendrick Sh.
member I/J
member K
member L
member M
Magoffin Mbr.
member N
Cowcreek sh.
member O
Bulan shale
Stoney Fork Mbr.
Main Block ore
member P
Kilgore/Flint Ridge ft.
Obryan ls.
Limekiln clay
member Q
member R
member S
member T
member U
Brush Creek Ls.
member V
member W
Ames Ls.
member Y
CEPHALOPODA (CONT.)
Gastrioceras n. sp.
G. elkhornense
G. aff. G. (L.) fittsi
G. montgomeryense
G. occidentale
G. occidentale?
G. aff. G. subcrenatum
"goniatite"
Meunsteroceras lunatus
Neoaganides? sp.
Pseudoparalegoceras compressum
Wiedeyoceras sp.
ARTHROPODA
Ditomopyge conwayense
Paladin morrowensis
Sevillea trinucleata
S. aff. S. trinucleata
"trilobite"
Acanthotelson kentuckyensis
conchostracan tests
"Cyclus" sp.
cf. Euproops cf. E. danae
Palaeestheria cf. P. ortoni
phyllocarid carapace
OSTRACODA
(see separate list)
ECHINODERMATA
"crinoid plates"
Diphuicrinus patina
Metacromyocrinus oklahomensis
Paragassizocrinus spp.
Plaxocrinus kansasensis
echinoid plates
CONODONTA
(see separate list)
VERTEBRATA
Cooperella sp.
Drydenius cf. D. molyneauxi
Elonicthys aitkeni
E. sp.
platform ray teeth
Rhizodopsis sp.
shark dentition
reported occurrences

OSTRACODA	Penn.		Grundy fm.								Pikeville Fm.								Hyden Fm.								Four Corners fm.								Princess fm.										Conemaugh fm.										"marine" strata
	Dark Ridge	Coal Cliff/Hensley Mbr.	shale member B	shale member C	Dave Branch shale	member D	Molus shale	Partridge shale	Betsie Shale	shale member F	Crummies shale	member G	member H	Dwale/Elkins Fk. sh.	Kendrick Sh.	member I/J	member K	member L	member M	Magoffin Mbr.	member N	Cowcreek sh.	member O	Bulan shale	Stoney Fork Mbr.	Main Block ore	member P	Kilgore/Flint Ridge ft.	Obryan ls.	Limekiln clay	member Q	member R	member S	member T	member U	Brush Creek Ls.	member V	member W	Ames Ls.	member Y	
Hollinella spp.															•																					•														
H. sp. A																									•																								
Kirkbyella sp.																									•																								
K. ricei																									•																								
Moorites spp.															•										•																								
Youngiella sp.																									•																								
Amphissites dattonensis																									•																								
A. girtyi																				•																														
A. henryi																				•					•																								
A. rothi																									•																								
Aurikirkbya sp.																				•																														
A. sp. B																									•																								
A. triseriata																				•					•																								
Kegelites spp.																									•																								
Kirkbya sp.																									•																								
K. jolliffana																									•																								
K. magna																				•					•																								
Shleesha sp.																																				•												
S. pinguis															•																																		
Microparchites spp.															•					•					•																								
M. cf. *M. ottervillicus*															•																																		
M. reductospinosus															•					•					•																								
Pseudoparaparchites spp.															•										•																								
Sansabella spp.															•					•					•																								
S. stewartae																									•																								
Bairdia spp.															•					•					•																								
Bairdiacypris sp.															•					•					•																								
B. cf. *B. rectiformis*															•										•																								
Bairdiolites ardmorensis															•																																		
B. astigmaticus															•																																		
Coryellites? sp.																				•																														
Fabelicypris sp.																				•					•																								
Orthobairdia spp.																									•																								
O. oklahomaensis																									•																								
Monoceratina spp.															•					•					•																								
M. ardmorensis															•					•																														
M. aff. *M. macoupeni*																				•																														
M. winifrediana															•					•					•																								
Healdia spp.							•								•										•																								
H. ehlersi																				•					•																								
Pseudobythocypris spp.														•						•					•																								
P. pediformis															•					•					•																								
Seminolites spp.															•																																		
Geisina sp.							•								•					•																														
G. arcuata					•																																												
G. jolliffiana															•					•																														
Plauskella englundi															•					•					•																								

reported occurrences

OSTRACODA (CONT.)	Penn.		Grundy fm.							Pikeville Fm.							Hyden Fm.							Four Corners fm.							Princess fm.										Conemaugh fm.										"marine" strata
	Dark Ridge	Coal Cliff/Hensley Mbr.	shale member B	shale member C	Dave Branch shale member D	Molus shale	Partridge shale	Betsie Shale	shale member F	Crummies shale member G	member H	Dwale/Elkins Fk. sh.	Kendrick Sh.	member I/J	member K	member L	member M	Magoffin Mbr.	member N	Cowcreek sh.	member O	Bulan shale	Stoney Fork Mbr.	Main Block ore	member P	Kilgore/Flint Ridge ft.	Obryan ls.	Limekiln clay	member Q	member R	member S	member T	Brush Creek Ls.	member U	member V	member W	Ames Ls.	member Y										
Paraparchites spp.																		•					•																									
Carbonita spp.			•																																													
C. ex. gr. *altilis–inflata*						•																																										
C. bairdiodes						•																																										
"Cypridina" sp.					•																																											
Microcheilinella sp.																							•																									
Silenites sp.																							•																									
Whipplella sp.																																																•
Cavellina sp.													•										•																									
Cavellinella sp.													•																																			
C. casei													•																																			
C. pricei													•					•																															
Discoidella sp.																							•																									
CONODONTA																																																
Cavusgnathus sp.																		•																														
C. cf. *C. alata*					•																																										
Gnathodus n. sp.																		•																														
Hindeodella sp.																		•					•			•																					
Idiognathodus sp.																		•																														
I. sp. A																							•			•																					
I. sp. B																										•																					
I. delicatus																							•																									
Ligonodina? sp.																		•																														
"Lonchodus" sp.																										•																					
Neognathodus sp.																							•																									
Polygnathus sp.																										•																					
Streptognathodus sp.					•																																										

reported occurrences

FORAMINIFERA	Penn.		Grundy fm.							Pikeville Fm.							Hyden Fm.							Four Corners fm.							Princess fm.										Conemaugh fm.										"marine" strata
	Coal Cliff/Hensley Mbr.	Dark Ridge	Partridge shale	Molus shale member D	Dave Branch shale member C	shale member B	Dwale/Elkins Fk. sh.	member H	member G	Crummies shale member F	Betsie Shale	Kendrick Sh.	member I/J	member K	member L	member M	Bulan shale	member O	Cowcreek sh. member N	Magoffin Mbr.	Stoney Fork Mbr.	Main Block ore member P	Kilgore/Flint Ridge ft.	Obryan ls.	Limekiln clay member Q	member R	member S	member T	member U	Brush Creek Ls. member V	member W	Ames Ls. member Y																
tolypamminid																		●																																
Paleospiroplectammina? sp.																					●																														
Earlandia minuta					●																																													
Bradyina sp.																					●																														
endothyrid																		●																																
Endothyra spp.																					●																														
Monotaxonoides sp.																					●																														
Tetrataxis sp.																		●			●																														
Tubertina sp.																					●																														
"Beedeina" sp.																							●																										
Fusulinella sp.																					●																														
Millerella spp.																		●		●	●																														
Profusulinella? sp.																					●																														
P. aff. *P. kentuckyensis*																					●																														
Triticites aff. *T. ohioensis*																																																	
Calcitornella sp.																					●																														
fisheriid																					●																														
irregularly coiled tubiform					●																																													

reported occurrences

APPENDIX D:
Type Sections

COAL CLIFF MEMBER

The type section for the Coal Cliff member is a strip mine highwall located near Coal Cliff, Nevelsville Quadrangle, Wayne County, Kentucky. Carter coordinate location is 8-D-59, 4500 FSL X 100 FEL. The section was measured by D. R. Chesnut, Jr., in 1979.

Unit	Description	Thickness (feet)
Rockcastle Sandstone member, Lee Formation (informal)		
1.	Sandstone, quartzose, massive, cliff-forming, crossbedded	60+
Disconformity		
Coal Cliff Member, Alvy Creek formation		
2.	Silty shale and siltstone; silty shale is fissile, with abundant siderite nodules and layers, abundant marine fossils and burrows in places, including brachiopods, pelecypods, gastropods, cephalopods, and trilobites; grades laterally into siltstone; siltstone is laminated, with no fossils or nodules observed.	approx. 60–70
Disconformity		
1.	Sandstone, calcareous; transported marine fossil debris includes crinoid columnals, brachiopods, etc.; thinly bedded, tangential crossbeds, top truncated; stringers of coal from underlying coal bed interfinger with some of the crossbeds (stringers were part of the peat mat that was apparently eroded by a tidal or storm channel).	0–8
Stearns No. 2 coal bed		
2.	Coal, banded, clarain, with pyrite nodules up to 2 inches thick; sandstone balls and wedges appear in coal near overlying crossbeds.	4.07
1.	Canneloid shale ("bone"), fissile, with scattered pyrite nodules.	0.3+

DAVE BRANCH SHALE MEMBER

The type section for the Dave Branch shale is a spillway cut at the Laurel River Dam, near Dave Branch, Sawyer Quadrangle, Whitley County, Kentucky. Carter Coordinate location is 12-F-63, 3300 FSL X 400 FEL. The section was measured by S. F. Greb and D. R. Chesnut, Jr,. in 1988; it is also described in Greb and Chesnut (1989b).

Unit	Description	Thickness (feet)
Laurel River Dam sandstone (informal)		
1.	Sandstone (S1 of Greb and Chesnut, 1989b), with thin shale beds; sandstone is fine-grained; basal beds contain transported fossil plant limbs and shale(?).	33–40
Disconformity		
Dave Branch shale member, Grundy formation (informal)		
1.	Shale, silty, dark-gray, carbonaceous, fissile, with scattered siderite nodules and thin beds; contains *Orbiculoidea, Lingula,* conodonts; basal bed is thin siderite layer.	30–36
Pine Creek sandstone(?) (informal), Lee Formation		
1.	Sandstone, quartzose, massive, cliff-forming, crossbedded; upper beds are trough crossbedded; upper surface is covered with abundant marine trace fossils, including *Zoophycos, Rhizocorallium,* and *Planolites*, as well as other unidentified types (the trace-fossil zone is apparently related to overlying shale, because none of the other surfaces of the sandstone contain trace fossils).	55