correlatives represent fluvial sandbelts oriented parallel to the early Appalachian Mountains. The Breathitt Group represents short alluvial wedges prograding to the Lee sandbelts where the Breathitt rivers became tributaries to the Lee rivers (Fig. 62). The Lee rivers flowed to the southwest to Georgia where they encountered Breathitt-like alluvial wedges and deltas prograding to the north from the Ouachita orogenic belt (in Mississippi, Alabama, and Georgia). The Lee rivers were deflected by these clastic wedges and flowed to the west (Figs. 62). The sediment introduced by the Ouachita clastic wedges was deposited as an oversteepened delta in the Ouachita Trough, a remnant ocean basin (Fig. 62). Flysch (turbidites) and slump blocks were deposited (Jackfork Group) in the deeper parts of the basin. Rivers farther west (represented by the Caseyville etc.) were oriented parallel to the Appalachian trend as well, but may have flowed directly into the Ouachita Trough without major course changes.

CONEMAUGH AND MONONGAHELA FORMATIONS

The Breathitt Group is succeeded by the Conemaugh (Late Pennsylvanian), which consists of thin coals, abundant red beds, and pedogenic flint clays. Its features indicate a higher rate of weathering, either due to climatological changes or to a more upland environment. The occurrence of

several well-developed marine beds in the Conemaugh (Brush Creek and Ames Limestones) seems to preclude an upland interpretation. Other paleobotanical, geochemical, and sedimentological studies also indicate a climatic change for the Conemaugh (several studies are included in the symposium volume edited by Phillips and Cecil, 1985). Marine incursions into the Conemaugh came from the north in Ohio and Pennsylvania, rather than from the west and south during most of the Early and Middle Pennsylvanian (Presley, 1979).

The Monongahela is similar to the Breathitt Group except that the limestones are thicker and more common in the Monongahela, and some are fresh-water limestones (Presley, 1979). Marine incursions come from the north, as during Conemaugh deposition. A return to less weathered conditions may indicate a return to a slightly wetter climate, though not as wet as during Breathitt deposition (climate is discussed in Phillips and Cecil, 1985). The Monongahela represents an assortment of deltaic and related environments.

CONCLUSIONS

As important as the Carboniferous rocks are to the Central Appalachian region, little information on certain aspects of their geology has been available. This dissertation provides information to fill part of this gap.

A stratigraphic and structural framework is developed through the use of the very large stratigraphic data base available from the mineral industry and geological surveys. This data base is used to construct a series of cross sections through the Central Appalachian basin. The conclusions of the study based on the framework are as follows.

(1) Stratigraphic Correlations:--The Mississippian rocks of the Central Appalachian basin are easily integrated into a regional framework (Fig. 11). The rocks of Pennsylvanian age, however, are difficult to correlate regionally because lithologies that comprise the coal-bearing sequence are frequently repeated. The comparison of closely spaced subsurface and surface information in the regional cross sections shows that certain marine-shale members can be recognized over a large area. These members prove to be useful stratigraphic markers for the Breathitt and are used as key stratigraphic beds in the construction of a three-dimensional stratigraphic framework for the basin (Fig. 19, 41). Quartzose sandstone lenses of the Lee Formation are also useful as stratigraphic markers for the Pennsylvanian-age rocks (Fig. 19). Moreover, certain new, informal stratigraphic terms are introduced (Table 1).

(2) Development of Depositional Models:- -The framework is analyzed to determine the validity of existing basin models

and to formulate new models to explain the depositional basin in detail. A commonly used model for Carboniferous sedimentation in the southern Appalachians is that popularized by Ferm and Cavaroc (1969). This model, refered to here as the Lee-Newman Barrier Shoreline model, ascribes the Mississippian marine rocks as time-equivalents of the Pennsylvanian "terrestrial" rocks (Figs. 4, 5, 55).

The long-postulated regional "Mississippian-Pennsylvanian" unconformity between the two systems, however, is an element that contradicts Ferm and Cavaroc's model because the unconformity decouples the two systems. In this dissertation, analysis of the cross sections indicates (a) systematic truncation of units below a possible unconformity surface; (b) topographic relief on this surface: (c) a difference in attitude of rocks above and below the surface: and (d) onlap of overlying strata over the surface. These features support the presence of a regional unconformity. Biostratigraphic analysis of existing data also supports the regional unconformity and demonstrates that the rocks above and below it are of different ages. These relationships are augmented by further analysis which shows that this unconformity was formed during the Early Pennsylvanian, and not at the Mississippian-Pennsylvanian boundary.

(3) Basin Model:--The Central Appalachian Tabular-Erosion model, is herein developed to explain the deposition of the the Carboniferous rocks of the Central Appalachian basin. In this model, the unconformity surface is illustrated by contour maps (Figs. 38, 39). The progressive erosion of mid-Carboniferous rocks below the unconformity toward the edge of the basin is described (Fig. 37), and a sequential overstep on the unconformity of Early Pennsylvanian rocks on older formations toward the basin margin is demonstrated (Fig. 40). Certain significant details are of regional importance.

The analysis of the cross sections reveal that four belt-shaped lenses of quartzose sandstone of the Lee Formation occur within the onlapping Early and Middle Pennsylvanian sequence (Breathitt Group). These sandstone belts, oriented northeast-southwest appear to be largely restricted to the northwestern side of the laterally equivalent coal-bearing clastic wedge of the Breathitt Group (Figs. 45-48). The gradients and measurements of cross beds of the sandstones indicates a dominant paleoflow to the southwest, parallel to the belts. A fluvial model (Fig. 59) is deduced to fit the features recognized in the basin. In this model, the sandbelts represent deposition of a trunk stream flowing to the southwest (Fig. 62), with smaller

tributaries carrying sediment from the Appalachian highlands flowing toward the trunk streams.

(4)Structural Analysis:--A structural framework based on the cross sections as well as a structural contour map of the Fire Clay coal bed shows that the Mississippian and older rocks of the basin dip to the southeast. However, Pennsylvanian rocks occur in a broadly synclinal feature called the Eastern Kentucky Regional Syncline which trends northeast. Contrary to the Mississippian rocks the Pennsylvanian strata southeast of the syncline dip to the northwest. This difference in dip is explained by uplift of the basinal part of the Carboniferous wedge of rocks during the Alleghenian orogeny.

In addition, a newly discovered subsurface fault, the Dorton-Hellier fault, is identified in eastern Kentucky. The displacement of the Early Pennsylvanian unconformity surface and underlying strata indicate a vertical throw of several hundred feet for this normal? fault.

Examination of sediment packages results in information regarding basin development. During the Late Devonian, clastics derived from the northeast filled a basin subsiding to the east. In Early Mississippian times, clastic influx from the northeast continued, however, the basin subsided only slightly to the east. Mid-Mississippian times were characterized by carbonate deposition with very reduced

clastic input; basinal subsidence was minimal. During Late Mississippian times, clastics prograded from the east and basin subsidence to the southeast began. This Late Mississippian trend continued through the end of the Carboniferous and was interupted only once during the Early Pennsylvanian when uplift produced the Early Pennsylvanian unconformity.

Clastic deposition and reduced subsidence during the Late Devonian and Early Mississippian mark the final stages of the Acadian orogeny. Carbonate-platform formation during mid-Mississippian time represents a period of quiescence whereas Late Mississippian and Pennsylvanian clastic progradation and basin subsidence reflect increasing development of the Alleghenian orogeny.

(5) Tectonic Analysis:--A tectonic analysis of the stratigraphic framework indicates that a mid- and late Carboniferous basin developed in three phases: each phase resulted in a northwestward shift of the basin (Fig. 24). The regional unconformity developed between the first two basinal phases. The basins were probably formed as a result of emplacement of thrust loads on the crust. The unconformity, produced between two periods of thrust emplacement, may have been formed by uplift caused by the relaxation of stresses in the crust (Fig. 43).

REFERENCES CITED

Arkle, Thomas, Jr., Beissel, D. R., Larese, R. E., Nuhfer, E. B., Patchen, D. G., Smosna, R. A., Gillespie, W. H., Lund, R., Norton, C. W., and Pfefferkorn, H. W., 1979, The Mississippian and Pennsylvanian (Carboniferous) Systems in the United States--West Virginia and Maryland: U.S. Geological Survey Professional Paper 1110-D, 35 p.

Ausich, W. I., Kammer, T. W., and Lane, N. G., 1979, Fossil communities of the Borden (Mississippian) Delta in Indiana and northern Kentucky: Journal of Paleontology, v. 53, p. 1182-1196.

Bambach, R. K., Scotese, C. R., Ziegler, A. M., 1980, Before Pangea: The geographies of the Paleozoic world: American Scientist, v. 68, p. 26-28.

Barwis, J. H., and Horne, J. C., 1979, Paleotidal range indicators in the Carboniferous barriers of northeastern Kentucky, in Ferm, J. C., and Horne, J. C., Carboniferous depositional environments in the Appalachian region: Carolina Coal Group, Department of Geology, University of South Carolina, Columbia, South Carolina, p. 460-471.

Bayer, D. E., 1982, Correlation chart of Appalachian coal seams: self published, 1. p.

BeMent, W. O., 1976, Sedimentological aspects of Middle Carboniferous sandstones on the Cumberland overthrust sheet: Ph.D. Dissertation, University of Cincinnati, Cincinnati, Ohio, 182 p.

Bergenback, R. E., and Wilson, R. L., 1961, Early Pennsylvanian sedimentation in southeastern Kentucky and northern Tennessee: American Association of Petroleum Geologists Bulletins, v. 45, p. 501-514.

Blancher, D. W., 1970, Origin of the Hazel Patch Sandstone Member of the Lee Formation of southeast Kentucky: M.S. Thesis, University of Kentucky, Lexington, Kentucky, 57 p.

Branson, C. C., 1962, Pennsylvanian System of central Appalachians, in Branson, C. C., ed., Pennsylvanian System in the United States: a symposium: American

Association of Petroleum Geologists, Special Publication, p. 97-116.

Brown, W. R., and Wixted, J. B., 1979a, Livingston Conglomerate Member of the Lee Formation, in Ettensohn, F. R., and Dever, G. R., Jr., eds., Carboniferous geology from the Appalachian Basin to the Illinois Basin through eastern Ohio and Kentucky: Guidebook and roadlog, Ninth International Congress of Carboniferous Stratigraphy and Geology, Field Trip No. 4, Lexington, Kentucky, University of Kentucky, p. 181-182.

Brown, W. R., and Wixted, J. B., 1979b, The Livingstone Channel and unconformable Mississippian-Pennsylvanian contact, i nEttensohn, F. R.. and Dever, G. R., Jr., eds., Carboniferous geology from the Appalachian Basin to the Illinois Basin through eastern Ohio and Kentucky: Guidebook and roadlog, Ninth International Congress of Carboniferous Stratigraphy and Geology, Field Trip No. 4, Lexington, Kentucky, University of Kentucky, p. 185.

Burger, K., and Damberger, H. H., 1985, Tonsteins in the coalfields of western Europe and North America: Ninth International Congress on Carboniferous Stratigraphy and Geology, May 17-26, 1979, Washington, D.C. and Champaign-Urbana, Compte Rendu, Southern Illinois University Press, Carbondale, v. 4, p. 433-448.

Busch, R. M., and Rollins, H. B.. 1984, Correlation of Carboniferous strata using a hierarchy of transgressive-regressive units: Geology, v. 12, p. 471-474.

Campbell, M. R., 1893, Geology of the Big Stone Gap coal field of Virginia and Kentucky: U.S. Geological Survey, Bulletin 111, 106 p.

Campbell, M. R., 1898, Richmond folio: U.S. Geological Survey, Geological Atlas, Folio 46.

Campbell, M. R., 1899, Standingstone folio: U.S. Geological Survey, Geological Atlas, Folio 53.

Caputo, M. V., and Crowell, J. C., 1985, Migration of glacial centers across Gondwana during Paleozoic Era. Geological Society of America Bulletin, v.96, p.1020-1036.

Chaplin, J. R., 1980, Stratigraphy, trace fossil associations, and depositional environments in the Borden Formation (Mississippian), northeastern Kentucky:

Guidebook and roadlog for Geological Society of Kentucky 1980 Field Conference: Kentucky Geological Survey, ser. 11, 114 p.

Chaplin, J. R., and Mason, C. E., 1979a, Stop 1: Upper part of the Borden Formation and the lower Newman Limestone, in Ettensohn, F. R., and Dever, G. R., Jr., eds., Carboniferous geology from the Appalachian Basin to the Illinois Basin through eastern Ohio and Kentucky: Guidebook and roadlog, Ninth International Congress of Carboniferous Stratigraphy and Geology, Field Trip No. 4, Lexington, Kentucky, University of Kentucky, p. 138-146.

Chaplin, J. R., and Mason, C. E., 1979b, Stop 3: The Devonian-Carboniferous boundary, in Ettensohn, F. R., and Dever, G. R., Jr., eds., Carboniferous geology from the Appalachian Basin to the Illinois Basin through eastern Ohio and Kentucky: Guidebook and roadlog, Ninth International Congress of Carboniferous Stratigraphy and Geology, Field Trip No. 4, Lexington, Kentucky, University of Kentucky, p. 152-162.

Chen, C. S., and Goodell, H. G., 1964, The petrology of Lower Pennsylvanian Sewanee Sandstone, Lookout Mountain, Alabama and Georgia: Journal of Sedimentary Petrology, v. 34, p. 46-72.

Chesnut, D. R., 1980, Echinoderms from the lower part of the Pennington Formation (Chesterian) in south-central Kentucky: M.S. Thesis, University of Kentucky, Lexington, Kentucky, 178 p.

Chesnut, D. R., 1981, Marine zones of the upper Carboniferous of eastern Kentucky; in Cobb, J. C., Chesnut, D. R., Hester, N. C., and Hower, J. C., eds., Coal and coal-bearing rocks of eastern Kentucky: Guidebook and roadlog for Coal Division of Geological Society of America Field Trip 14, Kentucky Geological Survey, ser. 11, p. 57-66.

Chesnut, D. R., 1983, A preliminary study of the Upper Mississippian and Lower Pennsylvanian rocks of eastern Kentucky and nearby areas: Kentucky Geological Survey, ser. 11, Open-File Report, 18 p.

Chesnut, D. R., 1985, Source of the volcanic ash deposit (flint clay) in the Fire Clay coal of the Appalachian Basin: Dixieme Congres International de Stratigraphie

et de Geologie du Carbonifere, Madrid, 1983, Compte Rendu, v. 1, p. 145-154.

Chesnut, D. R., Cobb, J. C., and Kiefer, J. D., In Press, "Four Corners": A three-dimensional panorama of stratigraphy and depositional structures of the Breathitt Formation (Pennsylvanian), Hazard, Kentucky: Geological Society of America Centennial Field Guide--Southeastern Section.

Chesnut, D. R., and Ettensohn, F. R., 1988, Hombergian (Chesterian) echinoderm paleontology and paleoecology, south-central Kentucky. Bulletins of American Paleontologist, v. 95, n. 330, 102 p.

Churnet, H. G., and Bergenback, R. E., 1983, Environment of deposition of part of Lower Pennsylvanian coal-bearing sedimentary rocks in southeastern Tennessee: A case study near the city of Dunlap [abs.]: Geological Society of America, 1983 Annual Meeting, Indianapolis, Indiana, Abstracts with Programs, v. 15, no. 6, p. 738.

Close, J. C., 1985, Lithofacies and environments of the Pennington (Mississippian), Breathitt, and Lee Formations (Pennsylvanian): A stratigraphic section in southcentral Kentucky: M.S. Thesis, Miami University, Oxford, Ohio, 153 p.

Coal Age, 1975, Cross-reference index to seam names: Coal Age, Mid-May Edition, p. 197-228.

Cobb, J. C., Brant, R. A., and Chesnut, D. R., In Press, Coal resources as a tool for basin analysis [abs.]: Geological Society of America, 1986 Annual Meeting, San Antonio, Abstracts with Program.

Cobb, J. C., Chesnut, D. R., Hester, N. C., and Hower, J. C., eds., 1981, Coal and coal-bearing rocks of eastern Kentucky: Guidebook and roadlog for Coal Division of Geological Society of America Field Trip 14, Kentucky Geological Survey, ser. 11, 169 p.

Cobb, J. C., Gastaldo, R. A., and Chesnut, D. R., 1986, Origin of the Middlesboro Member of the Lee Formation (Lower Pennsylvanian) in the central Appalachian Basin and its unique fossil occurrence [abs.]: Abstract of the International Symposium on Coal and Coal-bearing Strata, Royal Holloway and Bedford New College (University of London), 1986, p. 12.

Cobb, J. C., and Smath, R. A., 1981, Geophysical well logging for coal exploration in the Eastern Kentucky Coal Field,in Cobb, J. C., Chesnut, D. R., Hester, N. C., and Hower, J. C., eds., Coal and coal-bearing rocks of eastern Kentucky: Guidebook and roadlog for Coal Division of Geological Society of America Field Trip 14, Kentucky Geological Survey, ser. 11, p. 74-81.

Coleman, J. M., 1988, Dynamic changes and processes in the Mississippi River: Geological Society of America Bulletin, v. 100, p. 999-1015.

Collins, H. R., 1979, The Mississippian and Pennsylvanian (Carboniferous) Systems in the United States--Ohio: U.S. Geological Survey Professional Paper 1110-E, 26 p.

Cook, F. A., 1983, Some consequences of palinspastic reconstruction in the southern Appalachians: Geology, v. 11, p. 86-89.

Coskren, T. D., and Rice, C. L., 1979, Contour map of the base of the Pennsylvanian System, eastern Kentucky: U.S. Geological Survey Miscellaneous Field Studies Map MF-1100, 1:250,000.

Davis, L. E., and Webster, G. D., 1985, Late Mississippian to Early Pennsylvanian conodont biofacies in central Montana: Lethaia, v. 18, p. 67-72.

Dever, G. R., Jr., 1980, Stratigraphic relationships in the lower and middle Newman Limestone (Mississippian), east-central and northeastern Kentucky: Kentucky Geological Survey, ser. 11, Thesis Series 1, 49 p.

Dever, G. R., Jr., Hester, N. C., Ettensohn, F. R., and Moody, J. R., 1979, Stop 3: Newman Limestone (Mississippian) of east-central Kentucky and Lower Pennsylvanian slump structures, in Ettensohn, F. R., and Dever, G. R., Jr., eds., Carboniferous geology from the Appalachian Basin to the Illinois Basin through eastern Ohio and Kentucky: Guidebook and roadlog, Ninth International Congress of Carboniferous Stratigraphy and Geology, Field Trip No. 4, Lexington, Kentucky, University of Kentucky, p. 175-181.

Dever, G. R., Jr., Hoge, H. P., Hester, N. C., and Ettensohn, F. R., eds., 1977, Stratigraphic evidence for late Paleozoic tectonism in northeastern Kentucky: Guidebook and roadlog for field trip held in conjunction with the 5th Annual Meeting of the Eastern Section of

the American Association of Petroleum Geologists and the 1977 Field Conference of the Geological Society of Kentucky: Kentucky Geological Survey, ser. 10, 80 p.

Donaldson, A. C., Renton, J. J., and Presley, M. W., 1985, Pennsylvanian deposystems and paleoclimates of the Appalachians: International Journal of Coal Geology, v. 5, p. 167-193.

Donaldson, A. C., and Shumaker, R. C., 1979, Late Paleozoic molasse of central Appalachians, in Donaldson, A., Presley, M., and Renton, J., eds., Carboniferous coal guidebook: West Virginia Geological and Economic Survey Bulletin B-37-3, p. 1-42.

Dott, R. H., and Batten, R. L., 1981, Evolution of the Earth: New York, McGraw-Hill, 113 p.

Edelman, S. H., Liu Angang, and Hatcher, R. D., ,Jr., 1987, The Brevard Zone in South Carolina and adjacent areas: An Alleghanian orogen-scale dextral shear zone reactivated as a thrust fault: Journal of Geology, v. 95, p. 793-806.

Edmunds, W. E., Berg, T. M., Sevon, W. D., Piotrowski, R. C., Heyman, L., and Rickard, L. V., 1979, The Mississippian and Pennsylvanian (Carboniferous) Systems in the United States--Pennsylvania and New York: U.S. Geological Survey Professional Paper 1110-B, 33 p.

Elliott, W. C., and Aronson, J. L., 1987, Alleghanian episode of K-bentonite illitization in the southern Appalachian Basin: Geology, v. 15, p. 735-739.

Englund, K. J., 1968, Geology and coal resources of the Elk Valley area, Tennessee and Kentucky: U.S. Geological Survey Professional Paper 572, 59 p.

Englund, K. J., 1971, Displacement of the Pocahontas Formation by the Russell Fork fault, southwest Virginia, in Geological Survey Research 1971: U.S. Geological Survey Professional Paper 750-B, p. B13-Bl6.

Englund, K. J., 1979, The Mississippian and Pennsylvanian (Carboniferous) Systems in the United States--Virginia: U.S. Geological Survey Professional Paper 1110-C, 21 p.

Englund, K. J., Arndt, H. H., and Henry, T. W., 1979, Proposed Pennsylvanian System stratotype, Virginia and West Virginia: Guidebook and roadlog, Ninth

International Congress of Carboniferous Stratigraphy and Geology, Field Trip No. 1: Falls Church, Virginia, American Geological Institute, 136 p.

Englund, K. J., Cecil, C. B., Stricker, G. D., 1979, Depositional environments of the Mississippian System and Lower Pennnsylvanian Series in proposed Pennsylvanian System stratotype area, in Englund, K. J., Arndt, H. H., and Henry, T. W., Proposed Pennsylvanian System stratotype, Virginia and West Virginia: Guidebook and roadlog, Ninth International Congress of Carboniferous Stratigraphy and Geology, Field Trip No. 1: Falls Church, Virginia, American Geological Institute, p. 113-114.

Englund, K. J., and DeLaney, A. O., 1966, Intertonguing relations of the Lee Formation in southwestern Virginia: U.S. Geological Survey Professional Paper 550-D, p. D47-D52.

Englund, K. J., Gillespie, W. H., Cecil, C. B., Windolph, J. F., and Crawford, T. J., 1985, Characteristics of the Mississippian-Pennsylvanian boundary and associated coal-bearing rocks in the southern Appalachians: U.S. Geological Survey Open-File Report 85-577, 83 p.

Englund, K. J., Roen, J. B., and DeLaney, A. O., 1964, Geology of the Middlesboro North Quadrangle, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ-300.

Englund, K. J., and Thomas, R. E., 1985, Characteristics of the Mississippian-Pennsylvanian boundary and associated coal-bearing rocks in the central Appalachian Basin, in Englund, K. J., Gillespie, W. H., Cecil, C. B., Windolph, J. F., and Crawford, T. J., eds., Characteristics of the Mississippian-Pennsylvanian boundary and associated coal-bearing rocks in the southern Appalachians: U.S. Geological Survey Open-File Report 85-577, p. 1-7.

Ettensohn, F. R., 1975, Stratigraphy and paleoenvironmental aspects of Upper Mississippian rocks, east-central Kentucky: Ph.D. Dissertation, University of Illinois, Urbana, Illinois, 320 p.

Ettensohn, F. R., 1977, Effects of synsedimentary tectonic activity on the upper Newman Limestone and Pennington Formation, in Dever, G. R., Jr., Hoge, H. P., Hester, N. C., and Ettensohn, F. R., eds., Stratigraphic evidence for late Paleozoic tectonism in northeastern Kentucky:

Guidebook and roadlog for field trip held in conjuction with the 5th Annual Meeting of the Eastern Section of the American Association of Petroleum Geologists and the 1977 field conference of the Geological Society of Kentucky: Kentucky Geological Survey, ser. 10, p. 18-29.

Ettensohn, F. R., 1979a, Depositional framework of the Lower Mississippian subaqueous delta sediments in northeastern Kentucky. in Ettensohn, F. R., and Dever, G. R., Jr., eds., Carboniferous geology from the Appalachian Basin to the Illinois Basin through eastern Ohio and Kentucky: Guidebook and roadlog, Ninth International Congress of Carboniferous Stratigraphy and Geology, Field Trip No. 4, Lexington, Kentucky, University of Kentucky, p.133-136.

Ettensohn, F. R., 1979b, Generalized description of Carboniferous stratigraphy, structure, and depositional environments in east-central Kentucky, in Ettensohn, F. R., and Dever, G. R., Jr., eds., Carboniferous geology from the Appalachian Basin to the Illinois Basin through eastern Ohio and Kentucky: Guidebook and roadlog, Ninth International Congress of Carboniferous Stratigraphy and Geology, Field Trip No. 4, Lexington, Kentucky, University of Kentucky, p. 64-77.

Ettensohn, F. R., 1980, An alternative to the barrier-shoreline model for deposition of Mississippian and Pennsylvanian rocks in northeastern Kentucky: Geological Society of America Bulletin, v. 91, pt. **1**, p. 130-135: pt. 2, p. 934-1056.

Ettensohn, F. R., 1981, Mississippian-Pennsylvanian boundary in northeastern Kentucky, in Roberts, T. G., ed., Field trip guidebooks, Volume 1--Stratigraphy, sedimentology: Geological Society of America 1981 Annual meeting, Cincinnati, Ohio: Falls Church, Virginia, American Geological Institute, p. 195-257.

Ettensohn, F. R., 1985a, Controls on development of Catskill Delta complex basin facies: Geological Society of America Special Paper 201, p. 65-77.

Ettensohn, F. R., 1985b. The Catskill Delta complex and the Acadian Orogeny: A model: Geological Society of America Special Paper 201, p. 39-49.

Ettensohn, F. R., and Barron, L. S., 1982, A tectonic-climatic approach to the deposition of the Devonian-

Mississippian black-shale sequence of North America: Proceedings, 1982 Eastern Oil Shale Symposium, Kentucky Department of Energy, Lexington, Kentucky, p. 5-37.

Ettensohn, F. R., and Bliefnick, D. M., 1982, Conodonts from a section of upper Newman Limestone and Pennington Formation (middle and upper Chester), northeastern Kentucky: Journal of Paleontology, v. 56, p. 1482-1488.

Ettensohn, F. R., and Chesnut, D. R., 1979a, Stop 1: Upper Mississippian carbonates and the Pennington Formation south of the basement fault zone in east-central Kentucky. in Ettensohn, F. R., and Dever, G. R., Jr., eds., Carboniferous geology from the Appalachian Basin to the Illinois Basin through eastern Ohio and Kentucky: Guidebook and roadlog, Ninth International Congress of Carboniferous Stratigraphy and Geology, Field Trip No. 4, Lexington, Kentucky, University of Kentucky, p. 191-194.

Ettensohn, F. R., and Chesnut, D. R., 1979b, Stop 2: Stratigraphy and depositional environments in the upper Hartselle, Bangor, and Pennington Formations of south-central Kentucky. in Ettensohn, F. R., and Dever, G. R., Jr., eds., Carboniferous geology from the Appalachian Basin to the Illinois Basin through eastern Ohio and Kentucky: Guidebook and roadlog, Ninth International Congress of Carboniferous Stratigraphy and Geology, Field Trip No. 4, Lexington, Kentucky, University of Kentucky, p. 194-201.

Ettensohn, F. R., and Chesnut, D. R., 1985, Depositional environments and stratigraphy of the Pennington Formation (upper Visean-Namurian A), east-central and eastern Kentucky, U.S.A.: Dixieme Congres International de Stratigraphie et de Geologie du Carbonifere, Madrid, 1983, Compte Rendu, v. 3, p. 269-283.

Ettensohn, F. R., and Chesnut, D. R., in press, Nature and probable origin of the Mississippian-Pennsylvanian unconformity in the eastern United States: Eleventh International Congress of Carboniferous Stratigraphy and Geology, Beijing, 1987, Compte Rendu.

Ettensohn, F. R., and Dever, G. R., Jr., 1975, Tectonic control of carbonate sedimentation in the Newman Group (Middle and Late Mississippian), northeastern Kentucky [abs.]: American Association of Petroleum Geologists and Society of Economic Paleontologists and

Mineralogists Annual Meeting, Abstracts with Programs, v. 2, p. 22-23.

Ettensohn, F. R., and Peppers, R. A., 1979, Palynology and biostratigraphy of Pennington shales and coals (Chesterian) at selected sites in northeastern Kentucky: Journal of Paleontology, v. 53, p. 453-474.

Ettensohn, F. R., Rice, C. L., Dever, G. R., and Chesnut, D. R., 1984, Slade and Paragon Formations--New stratigraphic nomenclature for Mississippian rocks along the Cumberland Escarpment in Kentucky: U.S. Geological Survey Bulletin 1605-B, 37 p.

Fairchild, J. E., 1967, Ganges: Collier's Encyclopedia, Crowell Collier and Macmillan, Inc., v. 10, p. 567-568.

Feldman, H. R., 1984, Paleontology and paleoecology of the Somerset Shale Member of the Salem Limestone (Mississippian) in central Kentucky: M.S. Thesis, Indiana University, Bloomington, Indiana, 114 p.

Ferm, J. C., 1971, Carboniferous depositional environments in northeastern Kentucky: in Ferm, J. C., Horne, J. C., Swinchatt, J. P., and Whaley, P. W., eds., Carboniferous depositional environments in northeastern Kentucky: Roadlog for Geological Society of Kentucky 1971 field excursion: Kentucky Geological Survey, ser. 10, p. 1-3.

Ferm, J. C., and Cavaroc, V. V., 1969, A field quide to Allegheny deltaic deposits in the upper Ohio Valley: Pittsburgh, Pennsylvania, Pittsburgh Geological Society, 21 p.

Ferm, J. C., Ehrlich, R., and Neathery, T. L., eds., 1967, A field guide to Carboniferous detrital rocks in northern Alabama: Guidebook and roadlog for Geological Society of America, Coal Division, 1967 Field Trip: University, Alabama, Alabama Geological Society, 101 p.

Ferm, J. C., and Horne, J. C., 1979, Carboniferous depositional environments in the Appalachian region: Carolina Coal Group, Department of Geology, University of South Carolina, Columbia, South Carolina, 760 p.

Ferm, J. C., Horne, J. C., Swinchatt, J. P., and Whaley, P. W., eds., 1971, Carboniferous depositional environments in northeastern Kentucky: Roadlog for Geological Society of Kentucky 1971 field excursion: Kentucky Geological Survey, ser. 10, 30 p.

Ferm, J. C., Milici, R. C., and Eason, J. E., 1972, Carboniferous depositional environments in the Cumberland Plateau of southern Tennessee and northern Alabama: Guidebook and roadlog for Geological Society of America, Southeastern Section, Field Trip: Tennessee Division of Geology, 32 p.

Ferm, J. C., and Weisenfluh, G. A., 1979, Warrior and Anthracite Basins, in Ferm, J. C., and Horne, J. C., eds., Carboniferous depositional environments in the Appalachian region: Carolina Coal Group, Department of Geology, University of South Carolina, Columbia, South Carolina, p. 517.

Fisher, M. P., 1981, Sedimentology and stratigraphy of the Pennington Formation, Upper Mississippian, in south-central Kentucky: M.S. Thesis, University of Cincinnati, Cincinnati, Ohio, 234 p.

Gallagher, D.(?) E., 1949(?), Coal correlation sheet: The Cleveland, (Ohio?), The M. A. Hanna Company, 1 sheet.

Galloway, W. E., and Hobday, D. K., 1983, Terrigenous clastic depositional systems: Applications to petroleum, coal, and uranium exploration: New York, Springer-Verlag, 423 p.

Gardner, T. W., 1983, Paleohydrology and paleomorphology of a Carboniferous, meandering, fluvial sandstone: Journal of Sedimentary Petrology, v. 53, p. 991-1005.

Garrison, R. K., 1977, Paleoenvironmental analysis of the Lost Creek Limestone and associated facies: Marine and nonmarine: M.S. Thesis, University of Cincinnati, Cincinnati, Ohio, 338 p.

Gillespie, W. H., Crawford, T. J., and Rheams, L. J.. 1985, Biostratigraphic significance of compression-impression plant fossils near the Mississippian-Pennsylvanian boundary in the southern Appalachians, in Englund, K. J., Gillespie, W. H., Cecil, C. B., Windolph, J. F., and Crawford, T. J., eds., Characteristics of the Mississippian-Pennsylvanian boundary and associated coal-bearing rocks in the southern Appalachians: U.S. Geological Survey Open-File Report 85-577, p.11-18.

Gillespie, W. H., and Pfefferkorn, H. W., 1979, Distribution of commonly occurring plant megafossils in the proposed Pennsylvanian System stratotype, in Englund, K. J., Arndt, H. H., and Henry, T. W., eds., Proposed Pennsylvanian System stratotype, Virginia and West Virginia: Guidebook and roadlog, Ninth International Congress of Carboniferous Stratigraphy and Geology, Field Trip No. 1: Falls Church, Virginia, American Geological Institute, p. 87-96.

Goodwin, P. W., and Anderson, E. J., 1985, Punctuated aggradational cycles: A general hypothesis of episodic stratigraphic accumulation: Journal of Geology, v. 93, p. 515-533.

Gopinath, T. R., 1972, Upper Caseyville (Lower Pennsylvanian) deltaic sedimentation: Jackson, Union, and Johnson Counties, Illinois: M.S. Thesis, Southern Illinois University, Carbondale, Illinois, 84 p.

Gordon, M., Jr., and Henry, T. W., 1981, Late Mississippian and Early Pennsylvanian invertebrate faunas, east-central Appalachians--A preliminary report. K. J., and Henry, T. W., eds., Mississippian-in Englund, Pennsylvanian boundary in the central part of the Appalachian Basin, Part 1; southwestern Virginia and southern West Virginia: Guidebook and roadlog for Geological Society of America Field Trip No. 4. Falls Church, Virginia, American Geological Institute, p.165-171.

Gordon, M., Jr., and Mason, C. E., 1983, Progradation of the Borden Formation in Kentucky, U.S.A., demonstrated by successive Early Mississippian (Osagean) ammonoid faunas: Dixieme Congres International de Stratigraphie et de Geologic du Carbonifere, Madrid, 1983, Compte Rendu, v. 1, p. 191-198.

Graham, S. A., Dickinson, W. R., and Ingersoll. R. V.. 1975, Himalayan-Bengal model for flysch dispersal in the Appalachian-Ouachita system. Geological Society of America Bulletin, v. 86, p. 273-286.

Green, R. D., 1982, Depositional environment as interpreted from primary sedimentary structures and other related evidence for the Rockcastle Sandstone Member of the Lee Formation (Lower Pennsylvanian) in southwest eastern Kentucky: M.S. Thesis, Eastern Kentucky University, Richmond, Kentucky, not numbered.

Gutschick, R. C., and Sandberg, C. A., 1983, Mississippian continental margins of the conterminous United States: Society of Economic Paleontologists and Mineralogists Special Publication 33, p. 79-96.

Haney, D. C., 1979, The Mississippian-Pennsylvanian systemic boundary in eastern Kentucky: Southeastern Geology, v. 21, 1, p. 53-62.

Haney, D. C., Cobb, J. C., Chesnut, D. R., and Currens, J. C., 1985, Structural controls on environments of deposition, coal quality, and resources in the Appalachian Basin in Kentucky: Dixieme Congres International de Stratigraphie et de Geologie du Carbonifere, Madrid, 1983, Compte Rendu, v. 2, p. 69-78.

Hansen, M. C., 1984, Middle Carboniferous depositional events: the Sharon Sandstone, a basal Pennsylvanian quartzarenite in the north-central Appalachian Basin: Appalachian Basin Industrial Associates, Spring Meeting, Program, v. 6, p. 148-173.

Haq, B. U., and Boersma, A., 1978, Introduction to marine micropaleontology: New York, Elsevier, 376 p.

Harland, W. B., Cox, A. V., Llewellyn, P. G., Picton, C. A. G., Smith, A. G., and Walters, R., 1982, A geological time scale: Cambridge, Cambridge University Press, 128 p.

Harned, G. W., 1979, Correlation of the coals of the Cumberland Overthrust Sheet of Kentucky and parts of southwestern Virginia: Kentucky Geological Survey, ser. 11, Open-File Report, 66 p.

Heckel, P. H., 1986, Sea-level curve for Pennsylvanian eustatic marine transgressive-regressive depositional cycles along midcontinent outcrop belt, North America: Geology, v. 14, p. 330-334.

Henderson, S. W., and Frey, R. W., 1986, Taphonomic redistribution of mollusk shells in a tidal inlet channel, Sapelo Island, Georgia: Palaios, v. 1, p. 3-16.

Henry, T. W., and Gordon, M., Jr., 1979, Late Devonian through Early Permian(?) invertebrate faunas in proposed Pennsylvanian System stratotype area. in Englund, K. J., Arndt, H. H., and Henry, T. W., eds., Proposed Pennsylvanian System stratotype, Virginia and West

Virginia: Guidebook and roadlog, Ninth International Congress of Carboniferous Stratigraphy and Geology, Field Trip No. 1: Falls Church, Virginia, American Geological Institute, p. 97-103.

Hester, N. C., 1981, Stop 12: Cold Cave Cut, in Cobb, J. C., Chesnut, D. R., Hester, N. C., and Hower, J. C., eds., Coal and coal-bearing rocks of eastern Kentucky: Guidebook and roadlog for Coal Division of Geological Society of America Field Trip 14, Kentucky Geological Survey, ser. 11, p. 45-47.

Hester, N. C., and Taylor, F., 1977, Corbin Sandstone Member of the Lee Formation, in Dever, G. R., Jr., Hoge, H. P., Hester, N. C., and Ettensohn, F. R., eds., Stratigraphic evidence for late Paleozoic tectonism in northeastern Kentucky: Guidebook and roadlog for field trip held in conjunction with the 5th Annual Meeting of the Eastern Section of the American Association of Petroleum Geologists and the 1977 field conference of the Geological Society of Kentucky: Kentucky Geological Survey, ser. 10, p. 35-38.

Hester, N. C., and Taylor, F., 1981, Origin of the Corbin Sandstone Member of the Pennsylvanian Lee Formation, in Cobb, J. C., Chesnut, D. R., Hester, N. C., and Hower, J. C., eds., Coal and coal-bearing rocks of eastern Kentucky: Guidebook and roadlog for Coal Division of Geological Society of America Field Trip 14, Kentucky Geological Survey, ser. 11, p. 127-130.

Hines, R. A., and Thomas, W. A., 1984, Facies within clastic wedges: Appalachian Basin Industrial Associates, Spring Meeting, Program, v. 6, p. 127-147.

Hobday, D. K., 1969, Upper Carboniferous shoreline systems in northern Alabama: Ph.D. Dissertation, Louisiana State University, Baton Rouge, Louisiana, 75 p.

Hobday, D. K., 1974, Beach and barrier island facies in the upper Carboniferous of northern Alabama, in Briggs, G., ed., Carboniferous of the southeastern United States: Geological Society of America Special Paper 148, p. 209-224.

Hobday, D. K., 1979, Beach- and barrier-island facies in the upper Carboniferous of northern Alabama, in Ferm, J. C., and Horne, J. C., eds., Carboniferous depositional environments in the Appalachian region: Carolina Coal

Group, Department of Geology, University of South Carolina, Columbia, South Carolina, p. 371-385.

Hobday, D. K., and Horne, J. C., 1979, Tidally influenced barrier island and estuarine sedimentation in the upper Carboniferous of southern West Virginia, in Ferm, J. C., and Horne, J. C., eds., Carboniferous depositional environments in the Appalachian region: Carolina Coal Group, Department of Geology, University of South Carolina, Columbia, South Carolina, p. 436-459.

Horne, J. C., 1979, The effects of Carboniferous shoreline geometry on paleocurrent distribution, in Ferm, J. C., and Horne, J. C., eds., Carboniferous depositional environments in the Appalachian region: Carolina Coal Group, Department of Geology, University of South Carolina, Columbia, South Carolina, p. 509-516.

Horne, J. C., and Ferm, J. C., 1970, Facies relationships of the Mississippian-Pennsylvanian contact in northeastern Kentucky [abs.]: Geological Society of America, Southeastern Section, 1970 Meeting, Lexington, Kentucky, Abstracts with Program, v. 2, no. 3, p. 217.

Horne, J. C., Ferm, J. C., and Baganz, B. P., 1976, Sedimentary responses to penecontemporaneous tectonics in the Carboniferous of eastern Kentucky [abs.]: Geological Society of America, Northeastern-Southeastern Section, 1976 Meeting, Arlington, Virginia, Abstracts with Program, v. 8, no. 2, p. 198-199.

Horne, J. C., Ferm, J. C., Hobday, D. K., Saxena, R. S., and Robinson, L. D., 1976, A field guide to Carboniferous littoral deposits in the Warrior Basin: Guidebook and roadlog for Society of Economic Paleontologists and Mineralogists and the American Association of Petroleum Geologists Annual Field Trip, New Orleans, Louisiana, 81 p.

Horne, J. C., Ferm, J. C., and Swinchatt, J. P., 1974, Depositional model for the Mississippian-Pennsylvanian boundary in northeastern Kentucky, in Briggs, G., ed., Carboniferous of the southeastern United States: Geological Society of America Special Paper 148, p. 97-115.

Horne, J. C., Ferm, J. C., and Swinchatt, J. P., 1979, Depositional model for the Mississippian-Pennsylvanian boundary in northeastern Kentucky, in Ferm, J. C., and Horne, J. C., Carboniferous depositional environments in

the Appalachian region: Carolina Coal Group, Department of Geology, University of South Carolina, Columbia, South Carolina, p. 386-403.

Horne, J. C., and Levy, R. A., 1979, The Baileysville Justice area, in Ferm, J. C., and Horne, J. C., Carboniferous depositional environments in the Appalachian region: Carolina Coal Group, Department of Geology, University of South Carolina, Columbia, South Carolina, p. 671-691.

Horne, J. C., Swinchatt, J. P., and Ferm, J. C., 1971, Lee-Newman barrier shoreline model, in Ferm, J. C., Horne, J. C., Swinchatt, J. P., and Whaley, P. W., eds., Carboniferous depositional environments in northeastern Kentucky: Roadlog for Geological Society of Kentucky, 1971 Field Excursion: Kentucky Geological Survey, ser. 10, p. 5-9.

Horowitz, A. S., Mamet, B. L., Neves, R., Potter, P. E., and Rexroad, C. B., 1979, Carboniferous paleontological zonation and intercontinental correlation of the Fowler No. 1 Traders Core, Scott County, Tennessee, U.S.A.: Southeastern Geology, v. 20, p. 205-228.

Howard, R. H., 1979, The Mississippian-Pennsylvanian unconformity in the Illinois Basin--Old and new thinking, in Palmer, J. E., and Dutcher, R. R. eds., Depositional and structural history of the Pennsylvanian System of the Illinois Basin, part 2: Invited papers: Ninth International Congress of Carboniferous Stratigraphy and Geology, Field Trip No. 9: Illinois State Geological Survey, p. 34-43.

Huddle, J. W., Lyons, E. J., Smith, H. L., Ferm, J. C., 1963, Coal reserves of eastern Kentucky: U. S. Geological Survey Bulletin 1120, 247 p.

Imbrie, J., and Imbrie, J. Z., 1980, Modeling the climatic response to orbital variations: Science, v. 207, p. 943-953.

Jackson, S. R., 1984, Depositional environment of the Lower Pennsylvanian Rockcastle Conglomerate, Northern Cumberland Plateau, Tennessee: M.S. Thesis, Vanderbilt University, Nashville, Tennessee, 148 p.

Jackson, S. R., and Miller, M. F., 1984, Depositional environments of the Lower Pennsylvanian Rockcastle Conglomerate, Northern Cumberland Plateau, Tennessee:

Geological Society of America, Southeastern and North-Central Sections, 1984 Meeting, Lexington, Kentucky, Abstracts with Programs, v. 16, p. 148.

Johnsson, M. J., Stallard, R. F., and Meade, R. H., 1988, First-cycle quartz arenites in the Orinoco River basin, Venequela and Colombia: Journal of Geology, v. 96, no. 3, p. 263-277.

Jones, M. L., 1972, Littoral paleocurrents in Gizzard and Crab Orchard Mountains Groups, southern Cumberland Plateau and Walden Ridge, Tennessee, in Ferm, J. C., Milici, R. C., and Eason, J. E., eds., Carboniferous depositional environments in the Cumberland Plateau of southern Tennessee and northern Alabama: Guidebook and roadlog for Geological Society of America, Southeastern Section, 1972 field trip: Tennessee Division of Geology, p. 24-26.

Kamm, M. W., and Heald, M. T., 1983, Petrology and diagenesis of the Ravencliff sandstone in West Virginia: Southeastern Geology, v. 24, p. 1-12.

Kammer, T. W., Brett, C. E., Boardman, D. R., and Mapes, R. H., 1986, Ecologic stability of the dysaerobic biofacies during the Late Paleozoic: Lethaia, v. 19, p. 109-121.

Kammer, T. W., Cox, K. D., 1985, Paleoecology of a delta slope community from the Lower Mississippian Borden Formation in central Kentucky: Southeastern Geology, v. 26, p. 39-46.

Kepferle, R. C., 1977, Stratigraphy, petrology, and depositional environment of the Kenwood Siltstone Member, Borden Formation (Mississippian), Kentucky and Indiana: U.S. Geological Survey Professional Paper 1007, 49 p.

Koeninger, C. A., 1978, Regional facies of the Caseyville Formation (Lower Pennsylvanian), south-central Illinois: M.S. Thesis, Southern Illinois University, Carbondale, Illinois, 124 p.

Koeninger, C. A., and Mansfield, C. F., 1979, Earliest Pennsylvanian depositional environments in central southern Illinois, in Palmer, J. E., and Dutcher, R. R. eds., Depositional and structural history of the Pennsylvanian System of the Illinois Basin, part 2: Invited papers: Ninth International Congress of

Carboniferous Stratigraphy and Geology, Field Trip No. 9: Illinois State Geological Survey, p. 76-81.

Kosanke, R. M., 1982, Mississippian-Pennsylvanian boundary in the United States based on palynomorphs, in Ramsbottom, W. H. C.. Saunders, W. B., and Owens, B.. eds., Biostratigraphic data for a mid-Carboniferous boundary: Subcommission on Carboniferous Stratigraphy, Leeds, England, p. 27-35.

Kosanke, R. M., 1984, Palynology of selected coal beds in the proposed Pennsylvanian System stratotype in West Virginia. U.S. Geological Survey Professional Paper 1318, 44 p.

Laskowski, T. E., Fluegeman, R. H., and Grant, N. K., 1980, Rb-Sr glauconite systematics and the uplift of the Cincinnati Arch: Geology, v. 8, p. 368-370.

Lee, K. D., 1980, Subsurface structure of the Eastern Kentucky Gas Field: Morgantown, West Virginia, West Virginia University, Department of Geology, U.S. D.O.E. Contract No. DE-AC21-76ET12138, 56 p.

Lewis, R. Q., and Potter, P. E., 1978, Surface rocks in the western Lake Cumberland area, Clinton, Russell, and Wayne counties, Kentucky: Guidebook and roadlog for Geological Society of Kentucky 1978 Field Conference: Kentucky Geological Survey, ser. 11, 41 p.

MacQuown, W. C., and Perkins, J. H., 1982, Stratigraphy and petrology of petroleum-producing Waulsortian-type carbonate mounds in Fort Payne Formation (Lower Mississippian) of north-central Tennessee: American Association of Petroleum Geologists Bulletin, v. 66, p. 1055-1075.

McFarlan, A. C., 1943, Geology of Kentucky: Lexington, Kentucky, University of Kentucky, 531 p.

McPherson, J. G., Shanmugam, G., and Moiola, R. J., 1986, Fan deltas and braid deltas: Conceptual problems: American Association of Petroleum Geologists Bulletin, v. 70, p. 619.

Mason, C. E., and Chaplin, J. R., 1979, Stop 2: Nancy and Cowbell Members of the Borden Formation, in Ettensohn, F. R., and Dever, G. R., eds., Carboniferous Geology from the Appalachian Basin to the Illinois Basin through eastern Ohio and Kentucky: Guidebook and roadlog, Ninth

International Congress of Carboniferous Stratigraphy and Geology, Field Trip No. 4, Lexington, Kentucky, University of Kentucky, p. 147-152.

Meckel, L. D., 1967, Origin of the Pottsville Conglomerates (Pennsylvanian) in the central Appalachians: Geological Society of America Bulletin, v. 78, p. 223-257.

Meissner, C. R., Jr., 1978, Geologic map of the Duty Quadrangle, Dickenson, Russell, and Buchanan Counties, Virginia: U.S. Geological Survey Geologic Quadrangle Map GQ-1458.

Meissner, C. R., Jr., and Miller, R. L., 1981, Geologic map of the Honaker Quadrangle, Russell, Tazewell, and Buchanan Counties, Virginia: U.S. Geological Survey Geologic Quadrangle Map GQ-1542.

Merrill, G. K., 1973a, Carboniferous conodonts from northeastern Kentucky: Journal of Paleontology, v. 47, no. 6, p. 1122-1125.

Merrill, G. K., 1973b, Pennsylvanian conodont paleoecology: Geological Society of America, Special Paper 141, p. 239-274.

Metzger, W. J., 1965, Pennsylvanian stratigraphy of the Warrior Basin, Alabama: Alabama Geological Survey Circular 30, 80 p.

Milici, R. C., 1979, Stratigraphy and depositional environments of Upper Mississippian and Lower Pennsylvanian rocks in the southern Cumberland Plateau of Tennessee, in Ferm, J. C., and Horne, J. C., eds., Carboniferous depositional environments in the Appalachian region: Carolina Coal Group, Department of Geology, University of South Carolina, Columbia, South Carolina, p. 404-421.

Milici, R. C., Briggs, Garret, Knox, L. M., Sitterly, P. D., and Statler, A. T., 1979, The Mississippian and Pennsylvanian (Carboniferous) Systems in the United States--Tennessee: U.S. Geological Survey Professional Paper 1110-G, 38 p.

Miller, A. M., 1919, The geology of Kentucky: Department of Geology and Forestry of Kentucky, Series 5, Bulletin 2, 392 p.

Miller, M. F., and Jackson, S. R., 1984, Biogenic structures as salinity indicators: Lower Pennsylvanian coal-bearing sequences, northern Cumberland Plateau, Tennessee [abs.]: Geological Society of America, Southeastern and North-Central Section, 1984 Meeting, Lexington, Kentucky, Abstracts with Program, v. 16, no. 3, p. 180.

Miller, M. F., and Knox, L. W., 1985, Biogenic structures and depositional environments of a Lower Pennsylvanian coal-bearing sequence, northern Cumberland Plateau, Tennessee, U.S.A.: Society of Economic Paleontologists and Mineralogists Special Publication 35, p. 67-97.

Miller, M. S., 1974, Stratigraphy and coal beds of Upper Mississippian and Lower Pennsylvanian rocks in southwestern Virginia: Virginia Division of Mineral Resources Bulletin 84, 211 p.

Miller, R. L., and Meissner, C.R., 1977, Geologic map of the Big A Mountain Quadrangle, Buchanan and Russell Counties, Virginia: U.S. Geological Survey Geologic Quardrangle Map GQ-1350.

Mitchell, M. L., Morris, M. S., Polzin, J. K., Nolde, J. E., and Grantham, J. H., 1982, Stratigraphic cross sections for the Upper Mississippian-Middle Pennsylvanian units of Buchanan and Dickenson Counties, southwest Virginia: Virginia Division of Mineral Resources Publication 42, 3 p. 4 sheets.

Mitchum, R. M., 1954, Pottsville strata (Pennsylvanian) of part of the central Appalachian coal field: Ph.D. Dissertation, Northwestern University, Evanston, Illinois, 348 p.

Outerbridge, W. F.,1983, The Logan Plateau, a new physiographic region of the Appalachian plateaus [abs.]: Geological Society of America 1983 Annual Meeting, Indianapolis, Abstracts with Program, v. 15, no. 6, p. 656.

Patchen, D. G., Avary, K. L., and Erwin, R. B., coordinators, 1984, Correlation of stratigraphic units in North America--Southern Appalachian region correlation chart: American Association of Petroleum Geologists Correlation Chart Series, 1 sheet.

Pfefferkorn, H. W., and Gillespie, W. H., 1981, Biostratigraphic significance of plant megafossils near

the Mississippian-Pennsylvanian boundary in southern West Virginia and southwestern Virginia, in Englund, K. J., and Henry, T. W., eds., Mississippian-Pennsylvanian Boundary in the central part of the Appalachian Basin: Part 1: Southwestern Virginia-southern West Virginia: Guidebook and roadlog for Geological Society of America Annual Meeting, 1981, Cincinnati, Field Trip No. 4, Falls Church, Virginia, American Geological Institute, p. 159-164.

Phillips, T. L., and Cecil, C. B., 1985, Paleoclimatic controls on coal resources of the Pennsylvanian System of North America: International Journal of Coal Geology, v. 5, 230 p.

Phillips, T. L., and Peppers, R. A., 1984, Changing patterns of Pennsylvanian coal-swamp vegetation and implications of climatic control on coal occurrence: International Journal of Coal Geology, v. 3, no. 3, p. 205-255.

Phillips, T. L., Peppers, R. A., and Dimichele, W. A., 1985, Stratigraphic and interregional changes in Pennsylvanian coal-swamp vegetation: Environmental inferences: International Journal of Coal Geology, v. 5, p. 43-109.

Ping, R. G., 1978, Stratigraphy and structural relationships of the Stoney Fork Member of the Breathitt Fsrmation in southeastern Kentucky: M.S. Thesis, University of Kentucky, Lexington, Kentucky, 125 p.

Pocahontas Land Corporation, 1971, Correlation chart of Appalachian coal seams, in Keystone Coal Industry Manual, Supplements 1-4: New York, McGraw-Hill, 4 sheets.

Potter, P. E., and Siever, R., 1956a, Cross-bedding, [Pt.] 1 of Sources of basal Pennsylvanian sediments in the Eastern Interior Basin: Journal of Geology, v. 64, no. 5, p. 225-244.

Potter, P. E., and Siever, R., 1956b, Some methodological implications, [Pt.] 3 of Sources of basal Pennsylvanian sediments in the Eastern Interior Basin: Journal of Geology, v. 64, No. 5, p. 447-455.

Pratt, T. L., Costain, J. K., Coruh, C., Glover, L., 111, and Robinson, E. S., 1985, Geophysical evidence for an allochthonous Alleghanian(?) granitoid beneath the basement surface of the Coastal Plain near Lumberton,

North Carolina: Geological Society of America Bulletin, v. 96, p. 1070-1076.

Presley, M. W., 1979, Facies and depositional systems of Upper Mississippian and Pennsylvanian strata in the Central Appalachians, in Donaldson, A. C., Presley, M. W., and Renton, J. J., eds., Carboniferous coal guidebook: West Virginia Geological and Economic Survey, Bulletin B-37-1, p. 1-50.

Pryor, W. A., and Potter, P. E., 1979, Sedimentology of a paleovalley fill: Pennsylvanian Kyrock Sandstone in Edmonson and Hart Counties, Kentucky, in Palmer, J. E., and Dutcher, R. R. eds., Depositional and structural history of the Pennsylvanian System of the Illinois Basin, part 2: Invited papers: Ninth International Congress of Carboniferous Stratigraphy and Geology, Field Trip No. 9: Illinois State Geological Survey, p. 49-62.

Quinlan, G. M., and Beaumont, C., 1984, Appalachian thrusting, lithospheric flexure, and the Paleozoic stratigraphy of the Eastern Interior of North America: Canadian Journal of Earth Sciences, v. 21, p. 973-996.

Rahmani, R. A., and Flores, R. M., eds., 1984, Sedimentology of coal and coal-bearing sequences: International Association of Sedimentologists Special Publication 7, 412 p.

Rast, Nicholas, 1983, Variscan Orogeny, in Hancock, P. L., ed., The Variscan fold belt in the British Isles: Adam Hilger Ltd., Bristol, England, p. 1-19.

Rast, Nicholas, 1984, Alleghanian deformation as a sediment-generating event in the southern Appalachians [abs.]: Geological Society of America, Southeastern and North-Central Meeting, 1984, Lexington, Kentucky, Abstracts with Programs, v. 16, no. 3, p. 188.

Reineck, H. E., and Singh, I. B., 1980, Depositional sedimentary environments with reference to terrigenous clastics. Springer-Verlag, New York, 549 p.

Rexroad, C. B., and Clarke, C. E., 1960, Conodonts from the Glen Dean Formation of Kentucky and equivalent formations of Virginia and West Virginia: Journal of Paleontology, v. 34, p. 1202-1206.

Rice, C. L., 1984, Sandstone units of the Lee Formation and related strata in eastern Kentucky: U.S. Geological Survey Professional Paper 1151-G, 53 p.

Rice, C. L., 1985, Terrestrial versus marine depositional model--A new assessment of subsurface Lower Pennsylvanian rocks of southwestern Virginia: Geology, v. 13, p. 786-789.

Rice, C. L., Kehn, T. M., and Douglass, R. C., 1979, Pennsylvanian correlations between the Eastern Interior and Appalachian Basins, in Palmer, J. E., and Dutcher, R. R. eds., Depositional and structural history of the Pennsylvanian System of the Illinois Basin, part 2: Invited papers: Ninth International Congress of Carboniferous Stratigraphy and Geology, Field Trip No. 9: Illinois State Geological Survey, p. 103-105.

Rice, C. L., Sable, E. G., Dever, G. R., Jr., and Kehn, T. M., 1979, The Mississippian and Pennsylvanian (Carboniferous) Systems in the United States--Kentucky: U.S. Geological Survey Professional Paper 1110-F, 32 p.

Rice, C. L., and Smith, J. H., 1980, Correlation of coal beds, coal zones, and key stratigraphic units in the Pennsylvanian rocks of eastern Kentucky: U.S. Geological Survey Miscellaneous Field Studies Map MF-1188, 1 sheet.

Ross, C. A., and Ross, J. R. P., 1985, Late Paleozoic depositional sequences are synchronous and worldwide: Geology, v. 13, p. 194-197.

Saunders, W. B., Manger, W. L., and Gordon, M., Jr., 1977, Upper Mississippian and Lower and Middle Pennsylvanian ammonoid biostratigraphy of northern Arkansas, in Sutherland, P. K., and Manger, W. L., eds., Upper Chesterian-Morrowan stratigraphy and the Mississippian-Pennsylvanian boundary in northeastern Oklahoma and northwestern Arkansas, Oklahoma Geological Survey Guidebook 18, p. 117-137.

Saunders, W. B., and Ramsbottom, W. H. C., 1986, The mid-Carboniferous eustatic event: Geology, v. 14, p. 208-212.

Schalla, R. A., 1984, Deltaic deposits of the Upper Mississippian Ravencliff Member of the Hinton Formation, southern West Virginia: Southeastern Geology, v. 25, p. 1-12.

Schlee, J., 1963, Early Pennsylvanian currents in the southern Appalachian Mountains: Geological Society of America Bulletin, v. 74, p. 1439-1451.

Scotese, C. R., Bambach, R. K., Barton, C., Van der Voo, R., and Ziegler, A. M., 1979, Paleozoic base maps: Journal of Geology, v. 87, p. 217-277.

Secor, D. T., Jr., Snoke, A. W., and Dallmeyer, R. D., 1986, Character of the Alleghanian orogeny in the southern Appalachians: Part 111. Regional tectonic relations: Geological Society of America Bulletin, v. 97, p. 1345-1353.

Sergeant, R. E., 1979, Stratigraphic correlations of selected Alleghenian coals of the Princess District, Kentucky: M.S. Thesis, Eastern Kentucky University, Richmond, Kentucky, 103 p.

Shaver, R. H., coordinator, 1984, Correlation of stratigraphic units in North America--Midwestern Basin and Arches Region correlation chart: American Association of Petroleum Geologists Correlation Chart Series, 1 sheet.

Sinha, A. K., and Zietz, I., 1982, Geophysical and geochemical evidence for a Hercynian magmatic arc, Maryland to Georgia: Geology, v. 10, p. 593-596.

Smith, J. H., 1976, Geologic map of the Nevelsville Quadrangle, south-central Kentucky: U.S. Geological Survey Geologic Quadrangle, Map GQ-1326.

Smith, N. D., and Smith, D. G., 1984, William River: An outstanding example of channel widening and braiding caused by bed-load addition: Geology, v. 12, p. 78-82.

Stearns, R. G., 1954, The Cumberland Plateau Overthrust and geology of the Crab Orchard Mountains area, Tennessee: Tennessee Division of Geology Bulletin 60, 47 p.

Stearns, R. G., and Mitchum, R. M., Jr., 1962, Pennsylvanian rocks of southern Appalachians, in Branson, C. C., ed., Pennsylvanian System in the United States, a symposium: American Association of Petroleum Geologists, Special Publication, p. 74-96.

Stevenson, J. J., 1881, A geological reconnaissance of parts of Lee, Wise, Scott and Washington counties, Virginia:

American Philosophical Society, Proceedings, v. 19, p. 219-262.

Sutton, E. M., 1981, Deep exploration in eastern Kentucky by the SCLAW Group during the early Seventies: Kentucky Oil and Gas Association. Proceedings of Annual Meeting, June 6-7, 1974, Kentucky Geological Survey Special Publication 3, p. 31-44.

Swingle, G. D., 1960, Geologic map of the Lake City Quadrangle, Tennessee: Tennessee Division of Geology, Geologic Map 137-NW.

Tankard, A. J., 1986, Depositional response to foreland deformation in the Carboniferous of eastern Kentucky: American Association of Petroleum Geologists Bulletin, v. 70, p. 853-868.

Upshaw, C. F., 1967, Pennsylvanian palynology and age relationships in the Warrior Basin, Alabama, in Ferm, J. C., Ehrlich, R., and Neathery, T. L., eds., A field guide to Carboniferous detrital rocks in northern Alabama: Guidebook and roadlog for Coal Division of Geological Society of America Field Trip: Tennessee Division of Geology Report of Investigation 33, p. 16-20.

Vail, P. R., 1959, Stratigraphy and lithofacies of Upper Mississippian rocks in the Cumberland Plateau: Ph.D. Dissertation, Northwestern University, Evansville, Illinois, 143 p.

Vauchez, A., 1987, Brevard fault zone, southern Appalachians: A medium-angle, dextral, Alleghanian shear zone: Geology, v. 15, p. 669-672.

Veevers, J. J., and Powell, C. M., 1987, Late Paleozoic glacial episodes in Gondwanaland reflected in transgressive-regressive depositional sequences in Euramerica: Geological Society of America Bulletin, v. 98, pp. 475-487.

Vugrinovich, R., 1984, Lithostratigraphy and depositional environments of the Pennsylvanian rocks and the Baysport Formation of the Michigan Basin: Michigan Geological Survey Report of Investigation 27, 33 p.

Wagner, R. H., 1982, Floral changes near the Mississippian-Pennsylvanian boundary: an appraisal, in Ramsbottom, W. H. C., Saunders, W. B., and Owens, B., eds.,

Biostratigraphic data for a mid-Carboniferous boundary: Subcommission on Carboniferous Stratigraphy, Leeds, England, p. 120-127.

Wanless, H. R.. 1939, Pennsylvanian correlations in the Eastern Interior and Appalachian Coal Fields: Geological Society of America Special Paper 17,.130 p.

Wanless, H. R., 1946, Pennsylvanian geology of a part of the Southern Appalachian Coal Field: Geological Society of America Memoir 13, 162 p.

Wanless, H. R., 1962, Pennsylvanian rocks of Eastern Interior Basin, in Branson, C. C., ed., Pennsylvanian System in the United States, a symposium: American Association of Petroleum Geologists, p. 97-116.

Wanless, H. R., 1969, Marine and non-marine facies of the Upper Carboniferous of North America: Sixieme Congres International de Stratigraphie et de Geologie du Carbonifere, Sheffield, 1967, Compte Rendu, v. 1, p. 293-336.

Ward, C. R., ed., 1984, Coal geology and coal technology: Victoria, Australia, Blackwell Scientific Publications, 345 p.

Wardlaw, B. R., 1983, Late Mississippian-Early Pennsylvanian (Namurian) conodont biostratigraphy of the northern Rocky Mountains: Dixieme Congres International de Stratigraphie et de Geologie du Carbonifere, Madrid, Compte Rendu, v. 4, p. 391-401.

Wei Jiayong, Xiao Weimin, Wang Hongdi, Dong Wenlan, Feng Rulin, Wu Xianghe, and Zheng Shufang, 1987, Carboniferous and Permian stratigraphy in Guizhou: Eleventh International Congress of Carboniferous Stratigraphy and Geology, Beijing, Guidebook for Excursion 5, p. 1-69.

Weisenfluh, G. A., 1979, The Warrior Basin, in Ferm, J. C., and Horne, J. C., eds., Carboniferous depositional environments in the Appalachian region: Carolina Coal Group, Department of Geology, University of South Carolina, Columbia, South Carolina, p. 518-529.

Wentworth, C. K., 1921, Russell Fork fault, in The geology and coal resources of Dickinson County, Virginia: Virginia Geological Survey Bulletin 21, p. 53-67.

Wilpolt, R. H., and Marden, D. W., 1959, Geology and oil and gas possibilities of Upper Mississippian rocks of southwestern West Virginia and eastern Kentucky: U.S. Geological Survey Bulletin 1072-K, p. 583-653.

Wilson, C. W., and Stearns, R. S., 1960, Pennsylvanian marine cyclothems in Tennessee: Geological Society of America Bulletin, v. 71, p. 1451-1466.

Wixted, J. B., 1977, Sedimentary aspects of the Livingston Conglomerate, southeastern Kentucky: M.S. Thesis, University of Kentucky, Lexington, Kentucky, 63 p.

Woodward, H. P., 1961, Preliminary subsurface study of southeastern Appalachian Interior Plateau: American Association of Petroleum Geologists Bulletin, v. 45, p. 1634-1655.

Xu Huilong, Sun Weihan, Hou Jihui, Pan Suixian, Liu Yu, Zhao Xiuhu, Liu Lujun, and Rui Lin, 1987, Carboniferous and Permian stratigraphy in Shanxi: Eleventh International Congress of Carboniferous Stratigraphy and Geology, Beijing, Guidebook for Excursion 1, p. 1-64.