patterns, several similarities were noted. For example, in comparing three year old individuals of the two species, two bands were observed to overlap. As noted above, when banding patterns for different age groups are compared, a number of similarities between the bands for the two species are observed. In comparing the three year old gizzard shad esterase banding pattern with the two year old threadfin shad esterase banding pattern, one notes that the gizzard shad bands 1 and 2 overlap the threadfin shad bands 1 and 2. Also, when one compares the two year old gizzard shad esterase banding pattern with the three year old threadfin shad esterase banding pattern, one notes that the gizzard shad bands 3 and 4 overlap the threadfin shad bands 1 and 2. From examination of the electrophoretic banding patterns in this study, the similarities suggest that the two species are closely related on a taxonomic basis.

Additional studies are needed in order to clearly establish the utility of electrophoresis to taxonomically distinguish between these two species. The studies could include the following areas of research: use of different proteins or isozymes, use of cathodal banding patterns (in this study only anodal patterns were examined), use of different buffer systems, and use of two dimensional electrophoresis.

ACKNOWLEDGEMENT

This work was supported in part by the U. S. Fish and Wildlife Service through the Tennessee Cooperative Fishery Research Unit.

A preliminary report of this research was presented at the 85th Annual Meeting of the Tennessee Academy of Science, November 21, 1975.

LITERATURE CITED

Aldridge, E. N. 1954. Some esterases of the rat. Biochem. J. 57:692-702.

Augustinsson, K. B. 1960. Butyryl and propionylcholine-esterases and related types of eserine-sensitive esterases. H. Lardy and K. Myrback (Eds.) *The Enzymes*, Vol. 4, 521 pp.

Avise, J. C. 1974. Systematic value of electrophoretic data. Syst. Zool. 23:465-481.

Bergmann, F., G. Segal, and S. Rimson. 1957. A new type of esterase in hog kidney extract. Biochem. J. 67:481-486.

Cating, J. P. 1953. Determining age of Atlantic shad from their scales. U.S. Fish and Wild. Ser., Fish Bull. No. 85, Vol. 54, pp. 187-199.

Greenbank, J., and D. J. O'Donnell. 1950. Hydraulic presses for making impressions on fish scales. Am. Fisheries Soc. Trans. 78:32-37.

Hazar, G., and M. Elzinger. 1972. Homologous methylated and non-methylated histidine peptides in skeletal and cardia myosins. J. Biol. Chem. 247:745-753.

Holmes, R. S., C. J. Masters, and E. C. Webb. 1968. A comparative study of vertebrate esterase multiplicity. Comp. Biochem. Physiol. 26:837-852.

Lehninger, A. 1973. *Short Course in Biochemistry*. Worth Publishers, New York. 349 pp.

Markert, C. L. 1963. Epigenetic control of specific protein synthesis in differentiating cells. In: Cytodifferentiation and macromolecular synthesis. Twenty-first symposium of the Society for Study of Development and Growth. Michael Locke, Ed. Academic Press Inc., New York, pp. 65-84.

Markert, C. L., and I. Faulhaber. 1965. Lactate dehydrogenase isozyme patterns of fish. J. Exp. Zool. 159:319-332.

Markert, C. L., and F. Moller. 1959. Multiple forms of enzymes: tissue, ontogenetic and species specific patterns Proc. Nat. Acad. Sci. 45:753-763.

Minckley, W. L., and L. A. Krumholz. 1960. Natural hybridization between the clupeid genera *Dorosoma* and *Signalosa*, with a report on the distribution of *S. petenense*. Zoologica 44:171-182.

Pechere, J. F., and P. Pantel. 1974. Evolutionary aspects of the structure of muscular parvalbumins. Syst. Zool. 22:533-548.

Prosser, C. L., Ed. 1973. *Comparative Animal Physiology*. W. B. Saunders Company, Philadelphia, PA 966 pp.

Sarkar, S., F. A. Sreter, and J. Gergely. 1971. Light chains of myosins from white, red, and cardiac muscle. Proc. Nat. Acad. Sci 68:946-950.

Shaklee, J. B., K. L. Kepes, and G. S. Whitt. 1973. Specialized lactate dehydrogenase isozymes: the molecular and genetic basis for the unique eye and liver LDH of teleost fish. J. Exp. Zool. 185:217-240.

Shelton, W. L., and B. G. Grinstead. 1972. Hybridization between *Dorosoma cepedianum* and *D. petenense* in Lake Texoma, Oklahoma. Proc. 26th Ann. Conf. S. E. Assoc. Game and Fish Comm. Knoxville, Tenn.

Smith, M. H., H. O. Hillestad, M. N. Manlove and R. L. Marchinton. 1976 Use of population genetics data for the management of fish and wildlife populations. Trans. 41st N. Amer. Wildl. Nat. Res. Conf. pp. 119-133.

Utter, F. M., H. O. Hodgins and F. M. Allendorf. 1974. Biochemical genetic studies of fishes: Potentialities and limitations. In: *Biochemical and Biophysical Perspectives in Marine Biology*. D. C. Malins and J. R. Sargent, Eds. Academic Press, New York. pp. 213-238.

Wilson, A. C., N. O. Kaplan, L. Levine, A. Pesce, M. Reichlin, and W. S. Allison. 1964. Evolution of lactate dehydrogenase. Fed. Proc. 23:1258-1266.

JOURNAL OF THE TENNESSEE ACADEMY OF SCIENCE
VOLUME 55, NUMBER 2, APRIL, 1980

LOCALIZED SUBSURFACE MORPHOLOGIC CHANGES IN THE CRAB ORCHARD MOUNTAINS GROUP (PENNSYLVANIAN), SOUTHERN CUMBERLAND PLATEAU WEST OF SEQUATCHIE VALLEY, NORTHWESTERN MT. AIRY QUADRANGLE, TENNESSEE

WARREN DAVENPORT
Independent Coal Consultant
Lookout Mountain, Georgia
and
RICHARD E. BERGENBACK

University of Tennessee at Chattanooga
Chattanooga, Tennessee 37401

ABSTRACT

Localized thickness variation (morphologic change) of stratigraphic units in the Crab Orchard Mountains Group have been noted near the eastern margin of the Southern Cumberland Plateau in Bledsoe County, Tennessee. For example, the Sewanee Coal Seam likely formed as a thick deposit in a local basin in this area.

INTRODUCTION

In Southeastern Tennessee the Cumberland Plateau has been divided into three geomorphic provinces: (1) Walden Ridge (South), situated east of Sequatchie Valley; (2) Sequatchie Valley, and (3) Southern Cumberland Plateau, west of Sequatchie Valley. Figure 1 indicates location of the Mt. Airy quadrangle which spans these three geomorphic areas.

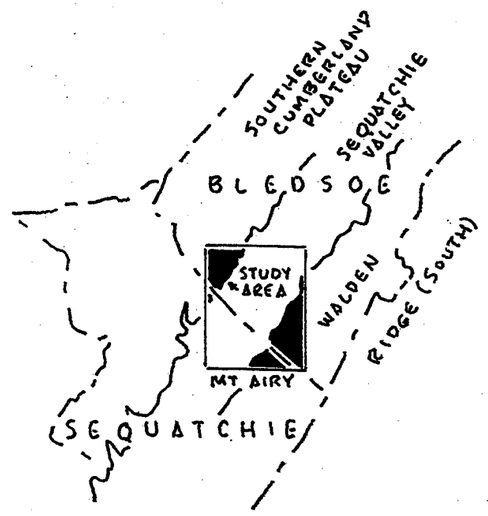

FIG. 1. *Location of study area in Northwestern Mt. Airy Quadrangle, Bledsoe County, Tennessee.*

Cores of the Pennsylvanian Crab Orchard Mountains Group were taken along the eastern margin of the Southern Cumberland Plateau in the northwestern portion of Mt. Airy quadrangle. Figure 2 shows core hole locations.

The purpose of this paper is to document localized subsurface morphologic changes in stratigraphic units of the Pennsylvanian Crab Orchard Mountains Group on the Southern Cumberland Plateau in southeastern Tennessee.

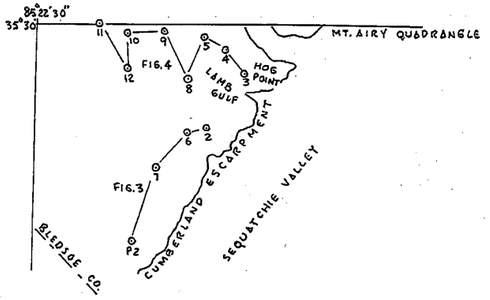

FIG. 2. *Core hole locations in Northwestern Mt. Airy Quadrangle, Tennessee.*

STRATIGRAPHY

C. W. Wilson and others (1956) presented the following stratigraphic subdivision of Pennsylvanian rocks in southern Tennessee:

CRAB ORCHARD MOUNTAINS GROUP	Vandever Formation	Rockcastle Conglomerate
		Vandever Upper Shale
		Vandever Needleseye Sandstone
		Vandever Lower Shale
		Newton Sandstone
		Whitwell Shale
		Sewanee Conglomerate
GIZZARD GROUP		Signal Point Shale
		Warren Point Sandstone
		Raccoon Mountain Formation

STRUCTURE—SOUTHERN CUMBERLAND PLATEAU

In general, the structure of the Southern Cumberland Plateau geomorphic area is that of an asymmetrical syncline with relatively steep dips on the eastern limb and a low dip on the western limb. The northeast-southwest trending synclinal axis is near the eastern erosional edge of the plateau.

STRATIGRAPHIC FRAMEWORK

Figures 3 and 4 are panel diagrams, based on core data, which indicate the subsurface stratigraphic framework of the Pennsylvanian Crab Orchard Mountains Group in a local area on the eastern margin of the Southern Cumberland Plateau. Further, it has been noted that the thickest (most complete) stratigraphic section in this geomorphic area is situated over the synclinal axis. Figures 3 and 4 are located in the vicinity of this axis.

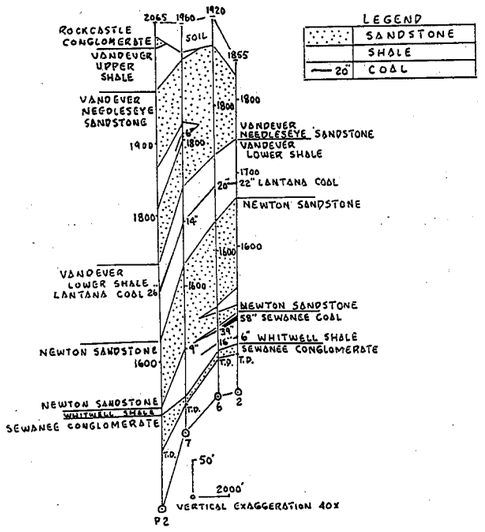

FIG. 3. *Panel diagram showing Pennsylvanian Stratigraphic Framework of Crab Orchard Mountains Group, Bledsoe County, Tennessee.*

In addition, these cores were drilled with the view of determining the thickness of the Sewanee and/or Richland Coal seams in the Whitwell Shale. It is standard drilling practice to penetrate the upper few feet of the Sewanee Conglomerate in order to insure that the entire Whitwell interval has been sampled. The Sewanee Conglomerate is, in general, a silica-cemented sedimentary quartzite and therefore presents drilling problems both with respect to the wearing out of drill bits as well as a significant increase in the time required to drill through this stratigraphic unit.

Rockcastle Conglomerate—uppermost stratigraphic unit in the Crab Orchard Mountains Group and has an erosional upper surface indicated in hole P2 (Fig. 3) and in holes 10 and 11 (Fig. 4).

Vandever Upper Shale—entire thickness is present in

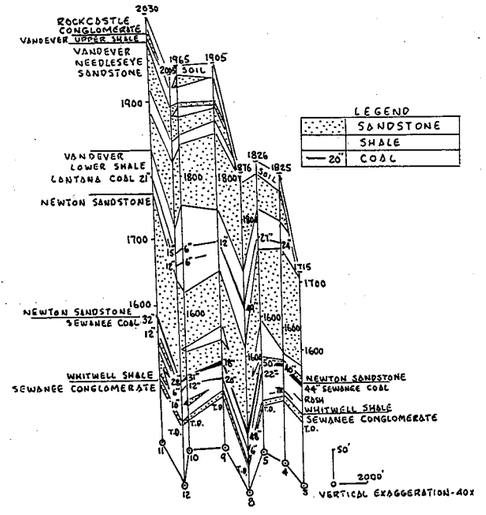

FIG. 4. *Panel diagram showing Pennsylvanian Stratigraphic Framework of Crab Orchard Mountains Group, Bledsoe County, Tennessee.*

hole P2 (Fig. 3) and holes 9, 10, 11 and 12 (Fig. 4) and ranges in thickness from 15 feet in hole 11 to 70 feet in hole P2 which indicates a general thickening of this stratigraphic unit to the south or southeast. No coal was encountered in this unit.

Vandever Needleseye Sandstone—complex stratigraphic unit that consists of thin to thick sandstones and lensing shales. Total thickness is in holes 7 and P2 (Fig. 3) and 9, 10, 11 and 12 (Fig. 4). The range in thickness is from 170 feet in hole 10 to over 270 feet in hole P2. Again, this indicates a thickening to the south or southeast.

Vandever Lower Shale—largely a shale unit with persistent Lantana Coal horizon which ranges in thickness from 6 inches in hole 12 to 49 inches in hole 8. Entire thickness is present in holes 2, 6, 7 and P2 (Fig. 3) and 4, 5, 8, 9, 10, 11 and 12 (Fig. 4), and the range in thickness is from just over 40 feet in hole 4 to 130 feet in holes 8 and P2 which indicates a general thickening to the south.

Newton Sandstone—a thick sandstone unit with shale lenses near the base. The shale is thickest (60 feet) in hole 5 (Fig. 4). The complete thickness of this unit is present in all holes and ranges from 100 feet thick in hole P2 to over 200 feet in hole 2. These observations indicate a thinning to the south.

Whitwell Shale—unit thickness is present in all holes. Thickness of the Whitwell ranges from over 100 feet in hole 11 to over 10 feet in hole P2 which suggests a southward thinning. Holes 10 and 11 show sandstone lenses in the Whitwell. There may be as many as four coal horizons in the Whitwell, but the seam of major interest is the Sewanee Coal situated at the top of the Whitwell just below the Newton Sandstone. The thickness of the Sewanee Coal ranges from 9 inches in hole 7 to 78 inches in hole 9.

Sewanee Conglomerate—only the upper few feet of the Sewanee Conglomerate is present in all holes.

CONCLUSIONS

It has been noted that stratigraphic units in the Crab Orchard Mountains Group near the eastern margin of the Southern Cumberland Plateau in Bledsoe County, Tennessee show a relatively large thickness variation (morphologic change) over a small area. Vandever stratigraphic units thicken southward; whereas, the Newton Sandstone and Whitwell Shale thin to the south. The Sewanee Coal Seam occurs in the Whitwell as a locally thick seam which likely formed in a small depositional basin that thinned to the south.

LITERATURE CITED

Wilson, C. W., Jr., Jewell, J. W., and Luther, E. T., 1956. Pennsylvanian geology of the cumberland plateau: Tennessee Division Geology Folio, 21 p.

JOURNAL OF THE TENNESSEE ACADEMY OF SCIENCE
VOLUME 55, NUMBER 2, APRIL, 1980

SUBSURFACE STRATIGRAPHIC FRAMEWORK OF CRAB ORCHARD MOUNTAIN AND GIZZARD GROUPS (PENNSYLVANIAN) ON WALDEN RIDGE (SOUTH) IN BLEDSOE, HAMILTON AND RHEA COUNTIES, WEST OF GRAYSVILLE, TENNESSEE

RICHARD KETELLE AND RANDALL WILSON
Hensley-Schmidt, Consulting Engineers
Chattanooga, Tennessee 37401
and
RICHARD E. BERGENBACK
University of Tennessee at Chattanooga
Chattanooga, Tennessee 37401

ABSTRACT

A number of bore holes in Pennsylvanian rocks on Walden Ridge South west of Graysville, Tennessee, enabled development of a localized, subsurface stratigraphic framework with marked thickness variation of stratigraphic units, as well as, an east-west geologic cross-section indicating the asymmetric synclinal nature of this part of the Cumberland Plateau.

INTRODUCTION

Recently obtained bore hole (air rotary) and core hole data from Walden Ridge South in Bledsoe, Hamilton and Rhea Counties west of Graysville, Tennessee, have enabled establishment of a subsurface stratigraphic framework for the lower Pennsylvanian Crab Orchard Mountain and Gizzard Groups.

STRATIGRAPHY

C. W. Wilson and others (1956) presented the following stratigraphic subdivision of Pennsylvanian rocks in southern Tennessee:

Crab Orchard Mountain	Vandever Formation	Rockcastle Conglomerate
		Upper Shale
		Needleseye Sandstone
		Lower Shale
		Newton Sandstone
		Whitwell Shale
		Sewanee Conglomerate
Gizzard Group		Signal Point Shale
		Warren Point Sandstone
		Raccoon Mountain Formation

STRATIGRAPHIC FRAMEWORK

Figure 1 indicates the geographic location of the Brayton and Graysville quadrangles on Walden Ridge South in Bledsoe, Hamilton and Rhea Counties, Tennessee. Bore hole and core hole locations, indicated on Figure 2, are situated in northwestern Hamilton County.

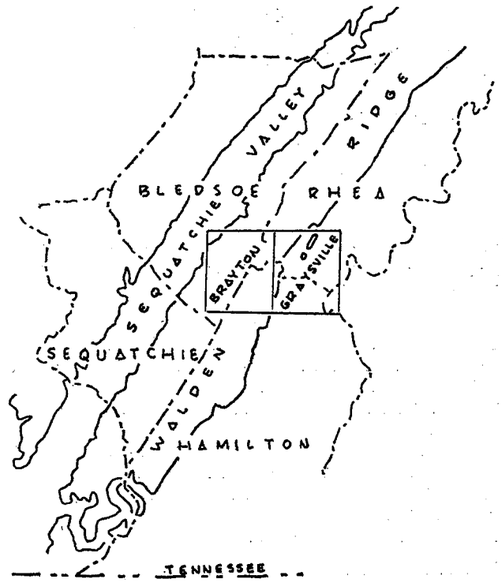

FIG. 1. *Location of Brayton and Graysville Quadrangles on Walden Ridge (South), Tennessee.*