

Comment on "Greatlakean Substage: A Replacement for Valderan Substage in the Lake Michigan Basin" by E. B. Evenson, W. R. Farrand, D. F. Eschman, D. M. Mickelson, and L. J. Maher

Evenson and others are in part rewriting history in their various papers, including the last cited in the title, on the late Wisconsin stratigraphy of eastern Wisconsin. For the sake of accuracy and completeness, I am compelled to comment on certain points raised in the above paper. These points in turn are predicated in part on earlier studies by Evenson and others which are emphasized throughout this latest paper.

On page 412 appears the statement, "Until the present series of studies by the authors and Lineback *et al.* (1974) all red tills in the area were considered, by most authors, to be age equivalent ("Valderan"), that is, younger than the Two Creeks forest bed, although certain early workers (e.g., Alden, 1918) had recognized some pre-Two-creek red tills." As it stands, the statement is a clear indictment of "most authors" who studied glacial stratigraphy in the field in eastern Wisconsin during that half-century from Alden to Evenson. Few readers would appreciate the fact that the "authors" during that interval consisted mainly of F. T. Thwaites and his students, J. H. Bretz, J. L. Hough, and, in the latter part of the interval, me and my students. Thwaites was a field assistant for Alden during part of his mapping in southeastern Wisconsin. I know from many conversations with Thwaites that he was well aware of Alden's published and unpublished works, including the concept of multiple red tills in eastern Wisconsin. It is true that Thwaites decided to use the red color of the surface soil as a major criterion in distinguishing the Valders till (as he defined it), but he also said that "Drift correlated as of Valders age has been discriminated with certainty only

in the Green Bay Lobe of eastern Wisconsin" (Thwaites, 1946, p. 86). He fully appreciated the problems of correlating the type Valders till with red tills in northern Wisconsin, along Lake Michigan, and in Minnesota, even though he used in his general map the concept of Valders till extending to Milwaukee. Bretz and Hough wrote voluminously on their original field work (which in Wisconsin was limited) and on interpretations of Great Lakes history. Both were concerned especially with lake levels and their relations to various drifts. They both modified extensively the earlier concepts, some of which have been reviewed by Evenson and others and need not be repeated here.

My field studies in Wisconsin started in 1957, especially in western Wisconsin. However, during the summers of 1957 to 1962, inclusive, I traveled all parts of the state supervising student field parties that were locating and evaluating deposits of coarse construction aggregates. I early accepted the multiple age of the red clayey tills of eastern Wisconsin and also disagreed with some of Thwaites' conclusions. I started students on thesis projects related to some of those problems (Piette, 1963; Suttner, 1963). Moreover, I reported that "We now know that not all red clayey tills are Valderan nor are all Valderan drifts red and clayey" (Black and Reed, 1965, p. 70), and, again, "Although the drift was defined as red clay till, it is texturally more complicated (Lee *et al.*, 1962). All such drift is not necessarily Valderan, and other kinds of drift may be Valderan" (Frye *et al.*, 1965, p. 57). Further, "From various mostly unpublished studies by the writer and his stu-

dents, we now know that the red color and high clay content of the Valders drift are not unique. . . . Beneath carbon-14 dated paleosols of Two Creeks age west-southwest of Green Bay . . . is found red clayey till of Cary age that is almost identical in texture and lithology to the Valders and in turn almost identical to still older till nearby (e.g., Piette, 1963). Lithology alone is not everywhere diagnostic of any one of the tills in Wisconsin . . ." (Black, 1966, p. 170). Similar comments were repeated and others were added by Black (1970a, pp. 31–32), e.g., "Locally, red clayey tills separated by radiocarbon-dated Twocreekan soils can only be distinguished by their stratigraphic position." Moreover (pp. 21–22), I also pointed out some differences between the upper and lower tills at the type Two Creeks site. These conclusions on the multiple red tills in eastern Wisconsin were also summarized in Black (1974).

Again on p. 412 of Evenson *et al.* (1976) the following statement appears: "Evenson (1973a, b) and others (Lineback *et al.*, 1974; Farrand, 1970; Farrand *et al.*, 1969) have demonstrated the presence of pre- and post-Twocreekan red tills in the Lake Michigan basin, and Evenson (1973) suggested that the type Valders Till was pre-Twocreekan (Woodfordian) in age." They were not alone, e.g., some of my earlier citations to the pre- and post-Twocreekan red tills are already covered in the preceding paragraph.

Evenson *et al.* (1976) in Fig. 2 and in various places in the text emphasize a Cary–Port Huron interstade as being much more significant than the Twocreekan interstade. I agree. However, they cite as evidence of retreat of the ice only the bryophyte bed in the northern part of southern Michigan, which is dated about 13,000 years old. Black and Rubin (1967–1968) and Black (1970a, b, 1976) reviewed the significance of many radiocarbon dates of similar age from Wisconsin and upper Michigan. About 13,000 years ago spruce was present from southern Wisconsin to northern Wisconsin and, possibly, western upper Michigan. However, no sub-

sequent ice advance covered the dated material in Wisconsin. Figure 1 shows the distribution of Shorewood and Manitowoc tills in Lake Michigan, which Lineback *et al.* (1974) correlate with readvances of ice in pre-Twocreekan time. Interestingly the ice, as interpreted, advanced furthest south on the Wisconsin side of the lake, ignoring the topography of the lake floor, and extended well up on land. If these are the equivalent of the Port Huron advances, which were so much greater than the post-Twocreekan, why did they not bury some of that 13,000-year-old wood? Considering the large number of organic remains from about 11,850 years ago, equal to the type Twocreekan deposit, that are found under the post-Twocreekan ice advance (Black, 1970a, 1976; Black and Rubin, 1967–1968), it seems strange that not one deposit approximating 13,000 years old has been found under the late-Woodfordian tills in Wisconsin. Certainly it is not creditable to argue that all the spruce of that age was destroyed under the pre-Twocreekan ice advances when spruce only about 1100 years younger survived under the post-Twocreekan ice advance. I am convinced that differences in late Wisconsinan history exist between northern Wisconsin and upper Michigan, on one hand, and lower Michigan, on the other (Black, 1970b, 1976).

In the discussion of the Twocreekan deglaciation and its significance Evenson *et al.* (1976, pp. 416–417) cite mainly their recent references in Michigan. Black (1966, 1976) and Black and Rubin (1967–1968) earlier pointed out for Wisconsin that organic matter and weathering breaks of Twocreekan age between tills have been found no farther north latitudinally than about 40 km from the type Twocreekan site. Moreover, in consideration of the length of time represented by the Twocreekan interstade, Black and Rubin (1967–1968, pp. 111–112) point out that "The general range of Twocreekan time from 11,000 to 12,500 years proposed by Frye and Willman (1960) is distinctly longer than the interval represented at Two Creeks.

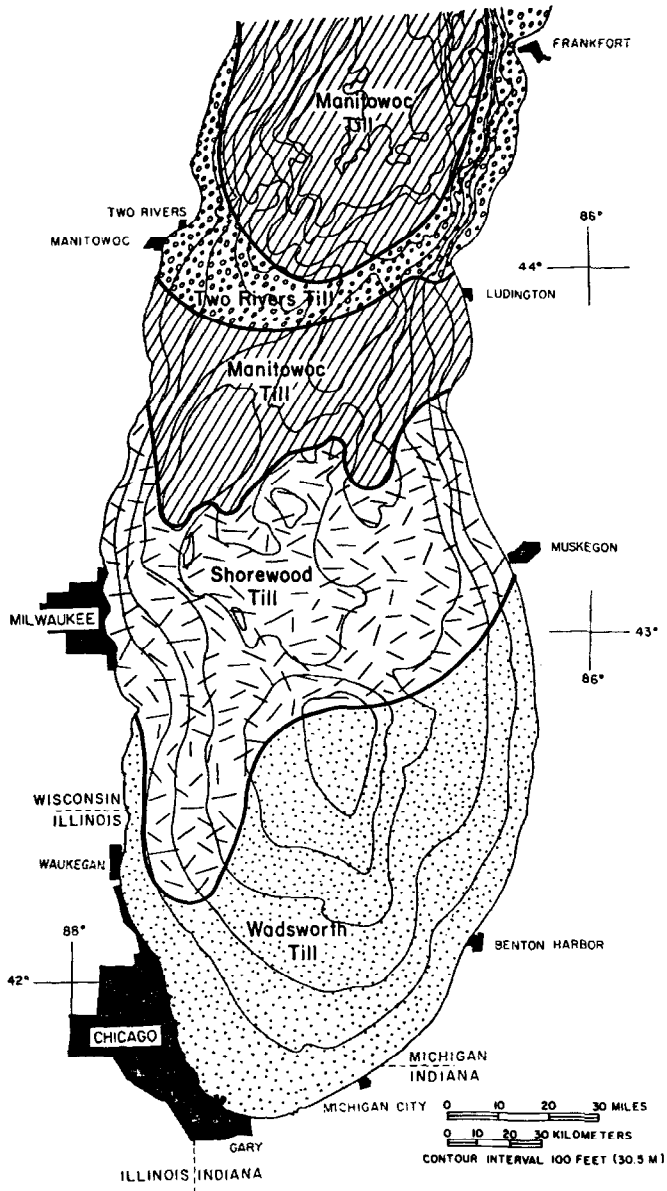


FIG. 1. Distribution of glacial till units under Lake Michigan. From Lineback *et al.* (1974, Fig. 5).

There, only an incipient soil profile was formed under trees of which the oldest by tree-ring count was only 142 years. . . . Destruction of the Twocreekan forests by rising lake waters and by Valderan ice at about 11,850 radiocarbon years ago should mark the close of Twocreekan time rather than the 11,000 years proposed." Evenson *et al.* (1976, p. 418) have reached a similar interpretation.

Since probably all Wisconsin, except possibly the extreme northeastern part, was ice free from 13,000 to 11,850 years ago (Black, 1970b, 1976; Black and Rubin, 1967–1968), the question of the time of inception of the Twocreekan interval seems arbitrary. At the type locality and most nearby *in situ* localities only a few centuries are represented by the organic horizon and soil (Black, 1970a). I have never had a quarrel with the concept

of a short-lived Twocreekan interstade (as represented by the type locality).

On page 417 of Evenson *et al.* (1976), they say, with reference to the post-Twocreekan advance, that "The ice position within the lake basin is modified slightly from Lineback *et al.* (1974) on the basis of the work of Evenson (1973a)." When those original papers are examined, it seems that the reasons for the change are principally to support their side of the debate, because, as presented, the evidence is contrary. The change is not slight, but major. Lineback *et al.* (1974, Fig. 2) show thick till on bedrock well south of Manitowoc, (Fig. 4) sample locations of Two Rivers Till in the lake and more significantly on land south of Manitowoc, and (Fig. 5, reproduced here as Fig. 1) a reconstruction of the deployment of Two Rivers Till that clearly encompasses the lowland between Two Rivers and Manitowoc that Evenson *et al.* (1976) claim had not been covered by the post-Twocreekan ice advance that left the Two Rivers Till. Thus, as presented, the findings of Lineback *et al.* (1974) support the earlier concept and not that of Evenson *et al.* (1976). They have pulled the Two Rivers Till border about 15 km north and east across the lowland between Two Rivers and Manitowoc to the Two Rivers moraine in their "slight modification." No specific justification is made for discarding the sample location of Two Rivers Till south of Manitowoc. If the work of Lineback *et al.* (1974) can be modified so easily, I would have to question whether it can be used to support the conclusions of Evenson *et al.* (1976).

On p. 418 of Evenson *et al.* (1976) appears the anachronistic statement ". . . we have shown that there are pre- and post-Twocreekan red tills over the Two Creeks forest bed."

Although Evenson *et al.* (1976) (and their earlier references) have amassed abundant evidence pointing toward the till at Valders being pre-Twocreekan, some problems remain in the interpretation. I have already pointed out above the problem of lack of any

organic matter under the till of supposed Port Huron equivalent. Since such organic matter is widespread in Wisconsin outside that border and the Cary-Port Huron interstade brought major retreat and subsequent readvance, it should be present locally.

Black (1974) asked why the post-Twocreekan ice in the massive Lake Michigan Lobe terminated 25 miles north of, and many hundred feet lower than, ice of the much smaller Green Bay Lobe. This seems pertinent as all pre-Twocreekan advances so far as we know went much farther south in the lake basin than in the Green Bay lowland.

Evenson *et al.* (1976, p. 415) ask which of the two pre-Twocreekan red tills in Lake Michigan basin is correlative with the type Valders Till. However, Mickelson and Evenson (1975) correlate the till at Valders with the Green Bay Lobe, in spite of the fact that the associated striae indicate ice flowed from the east. They present three possible explanations for this for which no proof is available. I find it difficult to accept the concepts that the red till at Valders is not associated with the west-flowing ice that left the last striae and that the striae do not record the latest ice flow in the area. The red till at Valders is thin and seemingly unbroken by any hiatus that could represent yet another ice advance. However, I have not gone through the section minutely with detailed laboratory tests.

Evenson *et al.* (1976, and earlier papers) have done a service in calling attention to possible and probable changes that need to be made in the late Wisconsin history of events in the Lake Michigan area. I suspect that my reaction has been "wait and see" because of their incomplete literature citation and because their ideas and interpretation have come and gone at times with too little or no justification (recorded) from field data.

Additional recent information on the Two Creeks vegetation comes from Miller (1976) who interprets the vegetation during Two Creeks at a site near Green Bay to be an

open, more or less dry *Picea glauca* woodland with rich fens and dry sites. He concludes that today 95% of the Twocreekan moss flora is still present in the area or nearby.

## REFERENCES

- Black, R. F. (1966). Valdres glaciation in Wisconsin and Upper Michigan—A progress report. In "Great Lakes Research Conference, 9th, Chicago, 1966, Proceedings," Publ. No. 15, pp. 169–175. University of Michigan, Great Lakes Research Division, Ann Arbor, Mich.
- Black, R. F. (1970a). "Glacial Geology of Two Creeks Forest Bed, Valderan Type Locality, and Northern Kettle Moraine State Forest." Wisconsin Geological and Natural History Survey Information Circular 13.
- Black, R. F. (1970b). Chronology and Climate of Wisconsin and Upper Michigan—14,000 to 9,000 radiocarbon years ago. *American Quaternary Association Abstracts*, 12.
- Black, R. F. (1974). Late Pleistocene shorelines and stratigraphic Relations in the Lake Michigan basin: Discussion. *Geological Society of America Bulletin* 85, 659–670.
- Black, R. F. (1976). Quaternary Geology of Wisconsin and contiguous Upper Michigan. In "Quaternary Stratigraphy of North America" (W. C. Mahaney, Ed.), pp. 93–117. Dowden, Hutchinson, and Ross, Stroudsburg, Pa.
- Black, R. F., and Reed, E. C. (1965). "Guidebook for Field Conference C, Upper Mississippi Valley" (C. B. Schultz and H. T. U. Smith, Eds.), *International Association for Quaternary Research*, VIIth Congress. The Nebraska Academy of Sciences, Lincoln, Neb.
- Black, R. F., and Rubin, M. (1967–1968). Radiocarbon dates of Wisconsin. *Wisconsin Academy of Science, Arts and Letters* 56, 99–115.
- Evenson, E. B., Farrand, W. R., Eschman, D. F., Mickelson, D. M., and Maher, L. J. (1976). "Great-lakean Substage: A Replacement for Valderan Substage in the Lake Michigan basin." *Quaternary Research* 6, 411–424.
- Frye, J. C., and Willman, H. B. (1960). "Classification of the Wisconsinan Stage in the Lake Michigan Glacial Lobe." Illinois Geological Survey Circular 285.
- Frye, J. C., Willman, H. B., and Black, R. F. (1965). Outline of glacial geology of Illinois and Wisconsin. In "The Quaternary of the United States" (H. E. Wright, Jr., and D. G. Frey, Eds.), pp. 43–61. Princeton University Press, Princeton, N. J.
- Lineback, J. A., Gross, D. L., and Meyer, R. P. (1974). "Glacial Till under Lake Michigan." Illinois Geological Survey Environmental Geology Note 69.
- Mickelson, D. M., and Evenson, E. B. (1975). Pre-Twocreekan age of the type Valdres till, Wisconsin. *Geology* 3, 587–590.
- Miller, N. G. (1976). Studies of North American Quaternary bryophyte subfossils. 1. A new moss assemblage from the Two Creeks forest bed of Wisconsin. In "Occasional Papers of the Farlow Herbarium of Harvard University" (Reed C. Rollins and Kathryn Ruby, Eds.), No. 9, pp. 21–42. Cambridge, Mass.
- Piette, C. R. (1963). "Geology of Duck Creek Ridges, East-Central Wisconsin." Master's Thesis, The University of Wisconsin.
- Suttner, L. J., (1963). "Geology of Brillion Ridge, East-Central Wisconsin." Master's Thesis, The University of Wisconsin.
- Thwaites, F. T. (1946). "Outline of Glacial Geology." Lithoprinted by the author. 129 pp. Madison, Wis.

ROBERT F. BLACK

*Department of Geology and Geophysics  
The University of Connecticut  
Storrs, Connecticut 06268*

## Reply to Comments by P. F. Karrow and R. F. Black

It is encouraging to see that our article on the late Wisconsinan stratigraphy of the Lake Michigan Basin has been thought provoking, and we wish to thank Karrow and Black for their comments and we welcome the opportunity to discuss their replies.

Karrow's comments on our paper are, by his own definition (pers. commun., 1977) "mainly a voicing of opinions," and we

share many of his feelings. While revising the nomenclature of this key area, we were besieged by many of the feelings that are expressed so succinctly by Karrow, and in many cases we originally entertained the same solutions. In our section on "Interpretation and Revision of Nomenclature" (pp. 417–420), we discussed some of the points raised by Karrow and presented our reasoning behind the final selections.