DISCUSSIONS.

PLEISTOCENE STRANDLINES: A REJOINDER

In a paper published recently, I reviewed the literature on the Pleistocene marine and fluvial deposits and land forms of the Atlantic Coastal Plain, and drew several inferences, one of which was that the hypothesis of C. Wythe Cooke, that seven former marine strandlines are recognizable on the Coastal Plain, is not demonstrated. On the other hand I offered evidence that seems to me unequivocal, based on my own reconnaissance field study, that two of the seven strandlines recognized by Cooke—those at about 100 feet and about 25 feet, respectively—are clearly evidenced by the distinct, though discontinuous and inconspicuous, Surry and Suffolk scarps first recognized and named by Wentworth. Further, I presented evidence that in Georgia the sea reached at least as high as 160 feet above present sealevel.

Under the title Two Shore Lines or Seven? Cooke discusses my paper briefly and raises the points that demand reply. As the Surry and Suffolk scarps seem to me to prove strandlines at two of Cooke's seven altitudes, we are in agreement on these two shores (although the evidence published by me in support of them appears to me to be far stronger than any evidence of the same strandlines published by Cooke). Consequently the differences between us concern the five remaining altitudes (270, 215, 170, 70, and 42 feet) at which Cooke states he can recognize strandlines,—strandlines that I regard as not demonstrated.

Two quotations from my paper (p. 777) make clear my present position on this question:

"It is not intended to imply that the Surry scarp necessarily marks the upper limit of Pleistocene marine submergence on the Coastal Plain."

"As the sea receded from the Surry scarp, the shoreline must have occupied successively all positions east of the scarp, and the waves must have cut scarps here and there at lower elevations. But no conspicuous discontinuity in the emergence can be inferred unless strandline features occurring consistently at one level, throughout a considerable range of latitude, can be demonstrated."

Thus I have not denied that sealevel stood, nor even that it paused appreciably, at altitudes other than those clearly marked by the Surry and Suffolk scarps. But I repeat that before we

can accept the inference that the sealevel stood at some particular altitude for a long time, we must be given adequate descriptions of geomorphic and stratigraphic features that demonstrate a former shoreline at the altitude specified.

I stated in my former paper that I did not regard such demonstration as having been made, and in my opinion Cooke’s discussion of that paper fails to accomplish such demonstration. In reply to my implied request for evidence supporting the five strandlines he recognizes, he cites (1) a section exposing black carbonaceous sand, which he interprets as a tidal-marsh deposit, and (2) certain topographic features in the same district (two quadrangles in South Carolina) including a spit, two scarps, and a flat, both (1) and (2) occurring at an altitude of 70 feet. If carbonaceous deposits contain the remains of plants identified as types ecologically confined to the zone between high and low tide, we are justified in inferring that their altitude closely approximates that of a former sealevel; and we then have precisely one of the kinds of evidence that I tried unsuccessfully to find in my reconnaissance work, but that ought to come to light as detailed study of the Coastal Plain progresses. However, the mere fact that a sediment is carbonaceous does not eliminate the possibility that its carbon content originated as freshwater plant matter at any altitude above sealevel. The scarps cited may indeed record a former shoreline, but evidence of their linear continuity must be offered before the possibility can be eliminated that they are merely nips cut by the receding sea only at the locality where they occur. The spit, as noted below, is not a sufficiently accurate indicator of a former sealevel to support an inferred former shoreline unless it is merely one of a variety of features occurring within a narrow vertical range.

In summary, the small amount of specific evidence adduced by Cooke in reply to my paper serves merely to emphasize the doubt with which I must regard the reality of the strandlines—other than those at 100 feet and 25 feet—that he visualizes.

Certain specific misunderstandings, if not misrepresentations, of points in my paper must be mentioned:

1. It is not true, as Cooke implies, that I regard high sea cliffs “as the sole usable criterion for the recognition of abandoned shore lines.” There are no high sea cliffs on the Coastal Plain. The Surry and Suffolk scarps (I pointed out on page 774 of my paper that the term “scarp” is somewhat misleading) are inconspicuous breaks in slope, commonly 15 to 20 feet high, with slope angles of only one to 21½ degrees. This condition is met with along the present shore at many places other than at Myrtle Beach, South Carolina—where there is a real cliff—and consists merely of a nip, commonly in a continuous row of shore dunes. The “scarps” at the
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Surry and Suffolk levels are discontinuous, like the nips along the present shore, as is shown on my map, Fig. 1.

2. Cooke states that features such as tidal flats, wave-cut shelves, and steep shores, occurring within estuaries, are better adapted for the determination of former sealevels than are features facing the open sea. I doubt the truth of this unsupported assertion, but I would welcome discussion of it. If estuarine features have a special significance, as indeed they may have, this significance should be fully discussed, with descriptions and locations, by those who already apprehend it.

3. Cooke implies that I consider all the emerged marine bars on the Coastal Plain to be offshore bars. This is not the case, nor do I find in my paper any statement that supports this implication. I consider marine bars to include wave- and current-built bars of several types, some of which, on a basis of surface form alone, are indistinguishable from each other.

Whatever kinds of bars are present on the Coastal Plain seems to me to be of little significance for the present purpose, because as far as I am aware, a marine bar of any kind may occur with its top above, at, or below sealevel, or in all three relations along various parts of its length. Therefore (as Cooke seems to agree) it is doubtful whether, after complete emergence, the altitude at which the sealevel stood at the time of bar building could be inferred within satisfactory limits.

It should be noted that the bars under discussion occur at elevations lower than the highest marine limits recognized in my paper. Consequently their presence does not indicate that the sea stood higher than the minimum upper limits I have recognized.

4. Cooke's statement that I imply he has not done enough field work requires amplification: Cooke has done a great deal of field work on the Coastal Plain—far more than I have done—and, as stated in my paper (pp. 766, 767) I consider the published results of his stratigraphic studies, and of some of his geomorphic studies, to be excellent, sound, and helpful contributions. It is only fair to me to point out, however, that according to his own statement3 much of the work leading to his shoreline conclusions was based on examination of topographic maps. This seems to me an inadequate basis for the fixing of former sealevels, especially in a province where the field evidence is at best obscure.

Cooke implies that it is unnecessary for him to publish the evidence on which he bases the correlations I have questioned,


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because this evidence is available on topographic maps. On the contrary, I believe that because of the scattered, elusive, and not uncommonly equivocal character of the field data, the necessity for full description and interpretation of the evidence is compelling, so that geologists unfamiliar with the Coastal Plain will be in a position to assess any proposed correlations with an adequate background of fact. At present they have only his assertion that the evidence exists. His published maps have the disadvantage that they fail to distinguish between fact and interpretation; they show the inferred shorelines as possessing unbroken continuity, whereas even the most distinct and reliable features are in reality very discontinuous. The map in my paper (Fig. 1) shows fact only. No attempt is made to interpolate between the localities at which the scarp remnants are clearly present.

In conclusion, I wish to make it clear that I do not actively oppose the hypothesis that more than two abandoned shorelines are recorded on the Coastal Plain. On the contrary I see no reason why more detailed study should not reveal evidence of other shorelines, although such evidence will be less clear and less easily followed than that of the Surry and Suffolk scarps. Cooke and I already agree on two; let us examine the evidence and see whether we can not agree on more than two. I ask him specifically to describe the features by which he recognizes the five additional strandlines, even if he should describe them no more fully than I have described the Surry and Suffolk features. Even this much would add greatly to our knowledge. I am certain that at least all glacial geologists will welcome the publication of any evidence from which they can draw satisfactory inferences as to the Quaternary shifting of sealevels, as a basis for checking the waxing and waning of Quaternary glaciers.

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