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Preliminary contour map on the top of the Eocene Series, Charleston Area, South Carolina

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The distinction between the Eocene and the Oligocene portions of the Cooper Formation is easily made paleontologically using calcareous nannofossils and other taxa (Hazel and others, 1977). Lithologically, the distinction is equally clear. The most important difference is that the Oligocene part of the Cooper always contains visible, dark brown, rounded, sand to pebble size grains of phosphate, whereas visible phosphate is rare to absent in the Eocene part of the Cooper. In general, the Oligocene part of the Cooper Formation is olive green to olive brown, phosphatic, sandy textured, and quartzose. The Eocene part is typically light grayish green, non-phosphatic, clayey textured, and is less quartzose and more calcareous than the Oligocene part. Texturally, the Eocene Cooper is usually a stiff plastic clay, although other lithofacies such as biocalcarenite and soft sandy textured sediment similar to the Oligocene Cooper are also present.

Sloan (1908) first noted the lithologic differences between the Oligocene and Eocene portions of the Cooper Formation and called the Oligocene portion the Ashley Marl and the Eocene portion the Cooper Marl. This distinction was not utilized by later investigators, primarily because of lack of exposures in which both units of the Cooper Formation could be seen. Cooke (1936, p. 88) noted the distinction in a marl pit northwest of Charleston but thought that the lithologic differences were not sufficient to warrant assigning the units to different formations. Cooke was not aware of the difference in age of the units or the duration of the hiatus separating them.

The more phosphatic character of Oligocene Cooper sediments relative to Eocene Cooper is reflected in higher radiation levels of the Oligocene sediments. This characteristic is readily apparent on gamma logs (fig. 2) and has been used in this study to determine the elevation of the top of the Eocene from gamma logs of water wells provided by the South Carolina office of the U.S. Geological Survey Water Resources Division and by the South Carolina Geological Survey.

Figure 1 shows the contoured elevation of the top of the Eocene as defined by 167 data points. The data points, however, are not evenly distributed throughout the area and the contour lines are dashed where control is sparse. In parts of the area, the Oligocene part of the Cooper Formation is not present and Eocene Cooper directly underlies post-Oligocene sediments. These areas are indicated by a stippled pattern.

Although the relief shown on the surface of the Eocene seems somewhat excessive to be the result of submarine scouring, no clearly defined tectonic elements, such as faults, have been proved.

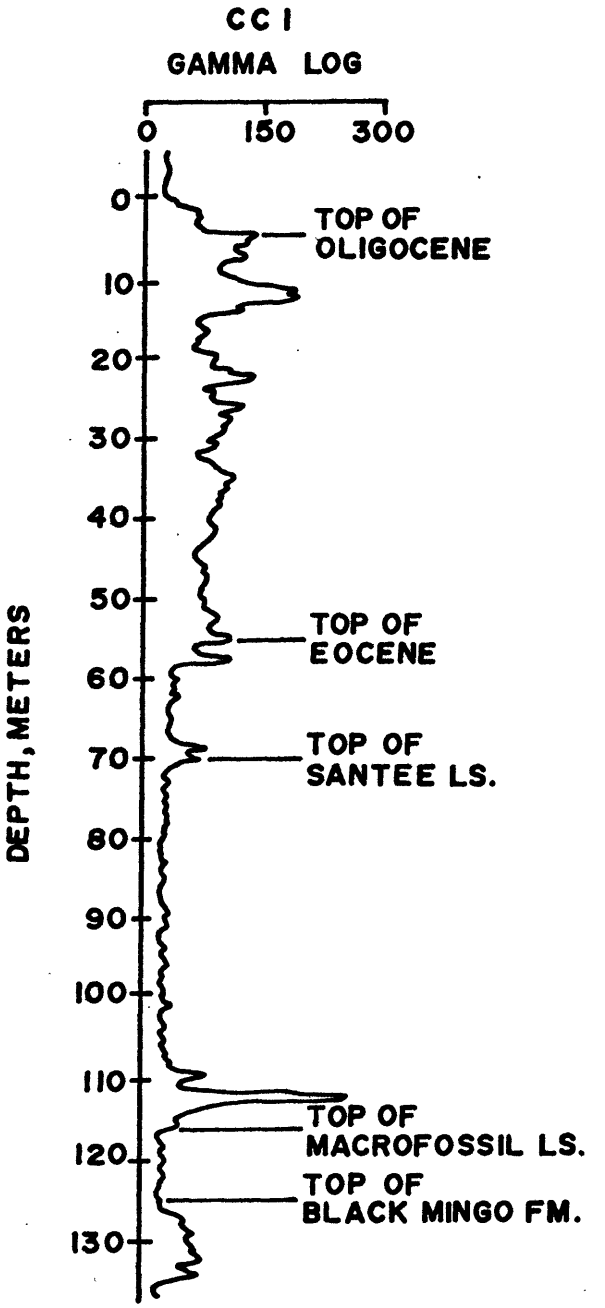

FIGURE 2.-- GAMMA LOG SHOWING HIGHER RADIATION LEVEL OF OLIGOCENE STRATA COMPARED TO EOCENE STRATA.

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