MESOZOIC PALEOSOLS: EXAMPLES FROM THE CHATTahooCHEE RIVER VALLEY

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Introduction

This paper documents the physical characteristics of two Mesozoic fossil soils (paleosols) in the Chattahoochee River Valley and interprets their environmental settings. The older paleosol, a lateritic soil formed on the pre-Upper Cretaceous crystalline rock surface along the Fall Line near Columbus, Georgia, is described and compared with an alluvial flood-plain soil formed within the Upper Cretaceous Tuscaloosa Formation in the vicinity of Phenix City, Alabama (Fig. 1). Although both paleosols formed in poorly drained environments, one shows only incipient soil development, while the other is an extremely well developed soil. These soils formed in quite different geologic settings; nevertheless, both profiles contain evidence of pedogenic processes characteristic of the southeastern Coastal Plain throughout the late Mesozoic and Cenozoic.

Definitions

Paleosols are widespread in the geologic record and have formed in a variety of weathering environments. In general, soil formation (pedogenesis) necessitates both subaerial exposure and a relatively stable ground surface for a considerable period of time. Consequently, paleosols represent a depositional hiatus and may be the only record of certain time intervals. These pedogenic surfaces provide important paleoenvironmental information and, where consistent recognition is possible, can also be used for local and regional stratigraphic correlation (Morrison, 1967).

Fossil soils are recognized by the same criteria as that used for identifying modern soils, principally evidence of physical and pedogenic horizon zonation (Morrison, 1967; Hunt, 1972). Soils or weathering horizons are commonly differentiated by color, biogenic features, soil structure and texture, clay mineralogy, oxide distribution, and concretions. Geochemical, micromorphological, and geomorphic criteria, presented by Loughnan (1969), Brewer (1964), and Daniels and others (1971), respectively, are also useful for the interpretation of fossil soils, but discussion of these criteria is beyond the scope of this study.

Paleosols, like their modern counterparts, develop morphologic characteristics through the complex interaction of physical, biological and chemical systems (see reviews in Fitzpatrick, 1971; Ollier, 1969). Physical processes, such as alternating wetting and drying, cause granular disintegration and exfoliation of bedrock and are important in the initial breakdown of rock fabric. Burrowing organisms, plant roots, and microbial activity significantly modify original textures of rocks and predispose the material to soil development. Also, humic acids, derived from the decay of organic matter, are catalysts in mobilizing and cycling chemical components in the soil. Solution, hydrolysis, and redox reactions are