WATER-RESOURCES INVESTIGATIONS
[redacted]REPORT 85-4109

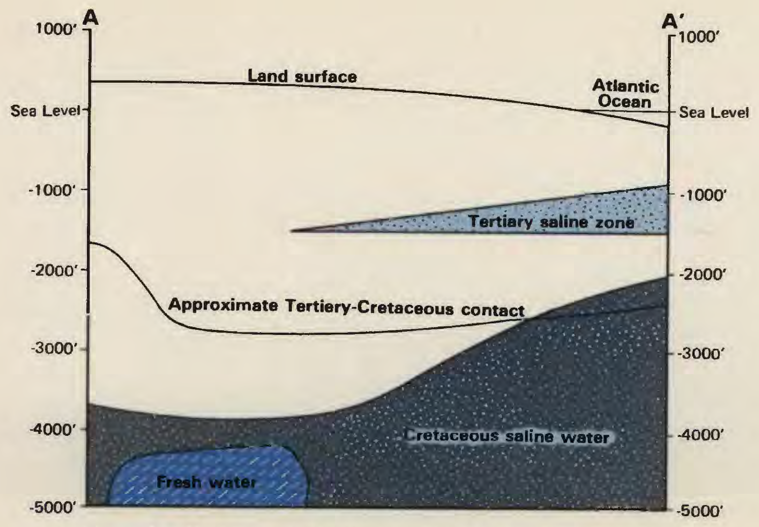

Figure 1.—Conceptualized cross section A-A' showing locations of freshwater and saline water zones.

INTRODUCTION

The extent and altitude of saline water,which contains more than 10,000 milligrams per liter (mg/L) dissolved solids as sodium chloride, in sediments in the Coastal Plain of the southeastern United States is shown on the accompanying map. The map illustrates the estimated area and altitude of the dynamic fresh ground-water system in these sediments and aids in establishing downgradient boundary conditions for a digital model of a regional ground-water flow system. Ground water that contains less than 10,000 mg/L dissolved solids is considered a usable resource and, according to the Safe Drinking Water Act (Public Law 93-523), must be protected from contamination or degradation. This report was prepared as part of the Southeastern Coastal Plain Regional Aquifer-System Analysis.

DISTRIBUTION AND ALTITUDE OF SALINE WATER AND FRESHWATER

Chemical data from seven test wells in lower Tertiary sediments (R. E. Faye, written commun., 1984) in southern Georgia and coastal areas of South Carolina indicate that a relatively shallow zone of saline water extends inland and overlies the fresher waters in the deeper sediments. Data from seven wells in Thomas, Ware, and Chatham Counties, Ga., and in Beaufort County, S. C., (see map) approximate the altitude of the top of this particular saline zone. The overlying lower Tertiary sediments that contain the saline water are of relatively low permeability (J. A. Miller, personal commun., 1984). The presence of saline water in this lower Tertiary interval indicates low circulation rates of freshwater and therefore incomplete flushing of this saltwater-bearing zone.

Saline waters in Georgia are contained primarily in Cretaceous sediments (R. A. Renken,personal commun., 1985). Freshwater-bearing zones underlie the saline zone in southern Georgia. These areas are shown by the textured pattern on the map.

Additional data are required to accurately establish the downdip limits of freshwater in various zones of the sediments in these particular areas. A conceptual section (fig. 1) indicates the approximate vertical distribution of freshwater and saline water along cross section A-A'.

DATA ANALYSIS

Data for this map are from previous studies (Geological Survey of Alabama, 1981; Brown and others, 1979; P. W. Bush, written commun., 1982; Epsman and others, 1981; Gandl, 1982; Meisler, 1981). Calibrated geophysical well logs in Mississippi, Alabama, Georgia, North Carolina, and South Carolina provided data from more than 450 control points. Calculations of dissolved solids as sodium chloride were made using the methods of Turcan (1966) and Brown (1971). Datum of the measurements is the National Geodetic Vertical Datum of 1929. Each map contour line represents the altitude of the top of the sediment that contains water with greater than 10,000 mg/L dissolved solids (as sodium chloride). Each sediment deposit indicated by a contour line is at least 20 ft thick. The approximate updip geologic limit of saline water in the Cretaceous aquifers, shown on the map, was determined by using subsurface structure contour information that describes the contact between Coastal Plain sediments and basement rocks (R. L. Wait, personal commun., 1984).

Most of the Cretaceous sedimentary aquifers in South Carolina contain freshwater. The freshwater-saltwater interface apparently lies eastward, offshore, but few data are available to support this. The altitude at the top of the saline water is therefore inferred in this area and contours are dashed on the map. Data were available for the upper saline zone in the Beaufort County area and the contours for the upper saline zone are extended into South Carolina.

An offshore core hole (6004B, about 60 miles southeast of Charleston) drilled by the Atlantic Margin Coring Project (Hathaway and others, 1976) shows that the top of Upper Cretaceous sediments is about 1,580 feet below sea level and contains pore waters that have dissolved solids (35,000 to 40,000 mg/L) near seawater concentrations. Although this core hole does not fully penetrate the sediments, measurements from it indicate that fresh ground water may not extend further east of this location.

Equal values of the altitude of saline water and basement rock-coastal plain sediment contact approximate the updip limit (intersection of two planes in space is a line). Water greater than 10,000 mg/L dissolved solids is presumed to be absent above this line. The updip limit of saline water in the lower Tertiary sediments is not defined because no data were available.

Much of the disruption in continuity of the contoured surface of the saline water as shown may be attributed to varying hydraulic characteristics of sediments or to subsurface structural features. Mississippi and Alabama generally contain a gradually deepening saltwater zone landward with several "mounds" of saline water. The "mound" near Jackson, Miss., reflects the Jackson dome. This subsurface structural dome explains the presence of saline water at shallower depths. The crescent-shaped mound that extends eastward from Perry County, Miss., to Clarke County, Ala., may be due to area salt domes, permeability differences, stratigraphic controls, or subsurface structural features. The slight mound in Mississippi that trends northwest-southeast from Tallahatchie County to Newton County, Miss., and the area near Mobile, Ala., may result from significant salinity differences in adjacent aquifers; however, further study and additional data are needed to completely validate this interpretation.

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FACTORS FOR CONVERTING INCH-POUND UNITS TO INTERNATIONAL SYSTEM OF UNITS(SI)

Multiply inch-pound units	By	To obtain SI units
feet(ft)	0.3048	meters(m)
miles(mi)	1.609	kilometers (km)

DISTRIBUTION AND ALTITUDE OF THE TOP OF SALINE GROUND WATER IN THE SOUTHEASTERN COASTAL PLAIN

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1986