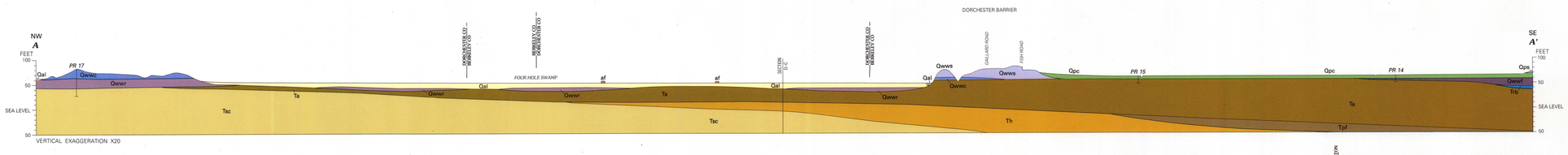
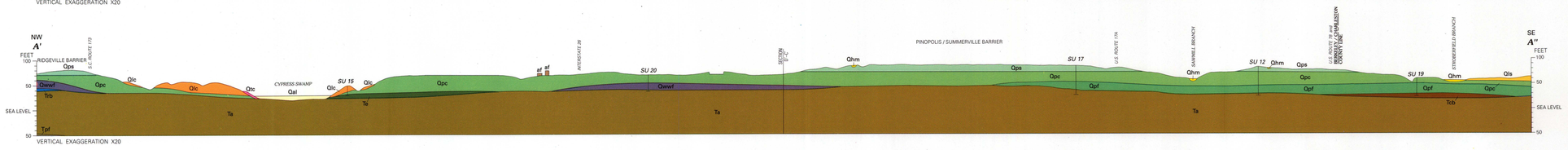
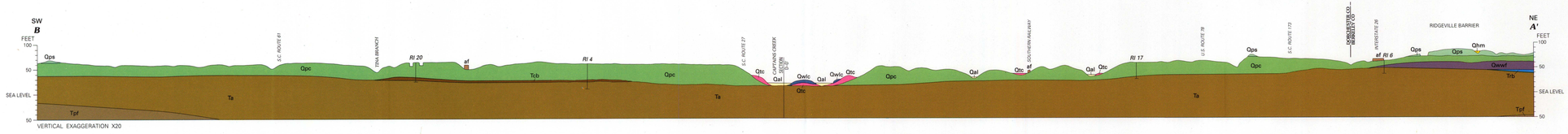
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

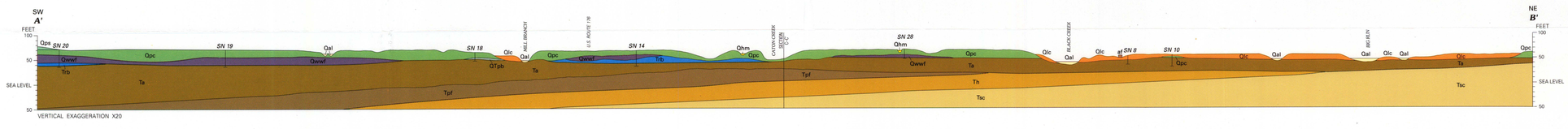
Prepared in cooperation with the
U.S. NUCLEAR REGULATORY COMMISSION

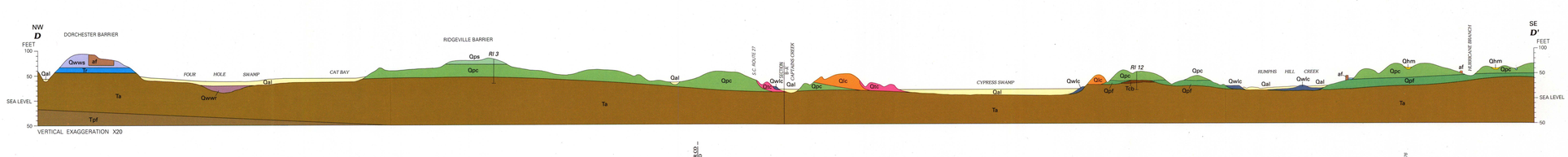
MISCELLANEOUS INVESTIGATIONS SERIES
MAP I–2502 (SHEET 2 OF 2)
Explanatory pamphlet accompanies map

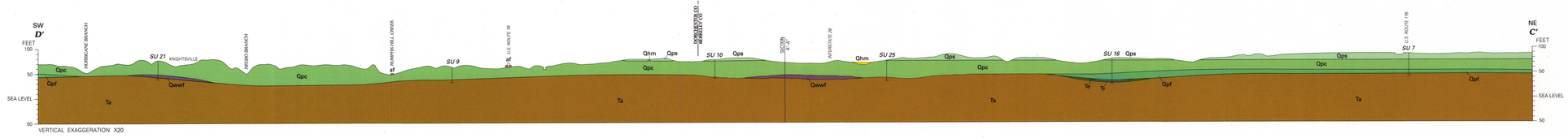


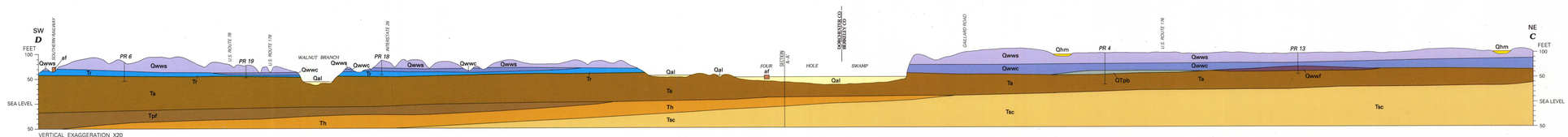


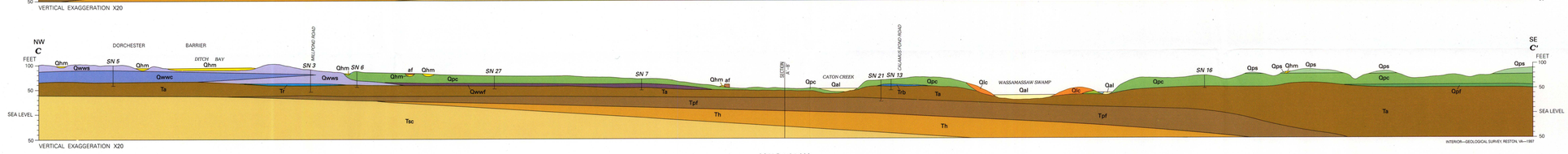












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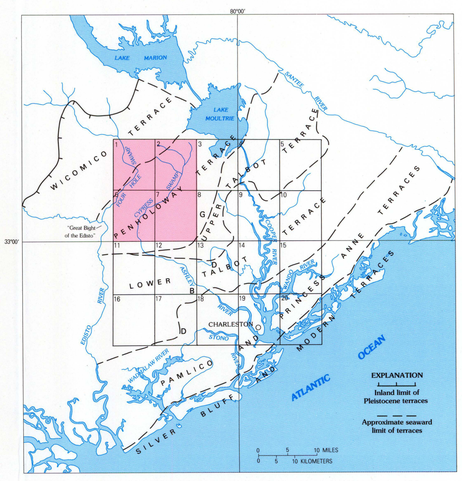


Figure 1.—Map of Pleistocene terraces, estimates of epicenters for earthquake of August 31, 1886, and index of 7.5-minute quadrangles covering the Charleston meizoseismal area. B—Estimate of epicenter (Bollinger, 1977); D—Estimate of two epicenters (Dutton, 1889); G—Estimate of epicenter (Gibbes and others, 1887). Geomorphic terrace nomenclature established by Cooke (1936) and Colquhoun (1974).

INDEX SHOWING QUADRANGLE LOCATIONS

1. Pringletown
2. Summerville N.W.
3. Moncks Corner
4. Cordesville
5. Bethera
6. Ridgeville
7. Summerville
8. Mount Holly
9. Kittredge
10. Huger
11. Clubhouse Crossroads
12. Stallsville
13. Ladson
14. North Charleston
15. Cainhoy
16. Osborn
17. Ravenel
18. Johns Island
19. Charleston
20. Fort Moultrie

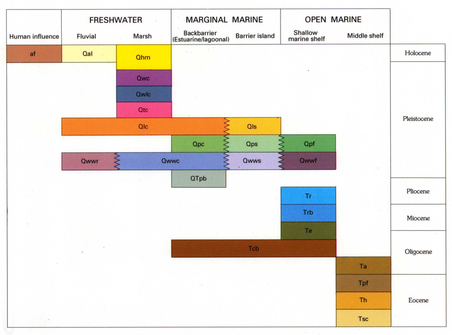
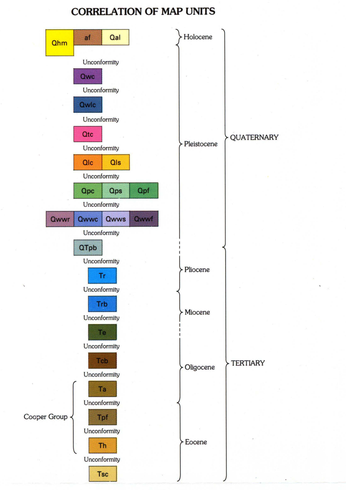


Figure 2.—Depositional environments in which stratigraphic units accumulated.

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

A veneer of loose colluvium, 3–6 ft thick, covers most slopes; this veneer is not mapped. Color designations, in parentheses, are defined in Goddard and others (1948) and are based on naturally moist samples. Ages of deposits are given in years as ka (thousands of years) or Ma (millions of years)

af — **Artificial fill (Holocene)**—Sand or clayey sand of diverse origin, 3–10 ft thick. Used as fill for roads, dams, and other construction. Materials are less than 300 years old

Qal — **Alluvium (Holocene)**—Sand and clayey sand presently prograding along drainage courses, which are commonly veneered by thin muck and peats at their surface

Qhm — **Freshwater swamp deposits (Holocene and upper Pleistocene, 0–70 ka)**—Thin, soft, moderate-brown (5YR 3/4) to black (N 1) mucks and peats, accumulating along impounded stream courses and in ovoid-shaped depressions (poccosins) and "Carolina bays", mostly on the Waccamaw(?) and Penholoway Formations. Deposits located mainly from aerial photographs and topographic base map. Ages range from present to Wisconsinan (modern to at least 34 ka)

Wando Formation (upper Pleistocene, about 70 to 130 ka)

Qwc — Clayey sand and clay facies—Clayey quartz sand, mottled grayish-orange (10YR 7/4) and medium-light-gray (N 6), fine- to medium-grained, and clay, mottled grayish-orange (10YR 7/4) and medium-light-gray (N 6), silty to sandy. Dominant clay mineral is kaolinite, with illite and illite/smectite in variable proportions. Soil profile on this unit is poorly developed; color of B-horizon is grayish-yellow (5Y 8/4) to dark-yellowish-orange (10YR 6/6) and the base of the B-horizon is generally 6 ft deep. Occurs at altitudes below 20 ft. Wood and terrestrial vertebrate fossils indicate deposition predominantly in marsh environments. Unit is 0–15 ft thick

Qwlc — Clayey sand and clay facies—Clayey quartz sand, fine- to medium-grained, and clay, silty to sandy, both mottled grayish-orange (10YR 7/4) and medium-light-gray (N 6). Dominant clay mineral is kaolinite, with illite and illite/smectite in variable proportions. Soil profile on this unit is poorly developed; color of B-horizon is grayish-yellow (5Y 8/4) to dark-yellowish-orange (10YR 6/6), and the base of the B-horizon is commonly 6 ft deep. Occurs at altitudes below 30 ft and usually above 15 ft. Wood and terrestrial vertebrate fossils indicate deposition predominantly in marsh environments. Auger hole *RI 2* includes a typical section. Unit is as much as 10 ft thick

Ten Mile Hill beds (informal) (middle Pleistocene, about 200 to 240 ka)

Qtc — Clayey sand and clay facies—Clayey quartz sand, typically dark-yellowish-orange (10YR 6/6) and (or) medium-light-gray (N 6), less commonly medium-bluish-gray (5B 5/1) or greenish-gray (5G 6/1), black (N 1) or moderate-reddish-brown (10R 4/6); fine- to medium-grained, poorly sorted; and silty to sandy clay, with same color distribution as the sand or moderate-red (5R 4/6) where deeply weathered. Dominant clay minerals are kaolinite, illite/smectite, and illite in variable proportions. Soil profile moderately well developed; B-horizon is typically dark-yellowish-orange (10YR 6/6) to moderate-reddish-orange (10R 6/6) and 6–10 ft deep. Occurs at altitudes between 15 and 40 ft. Wood and terrestrial vertebrate fossils indicate deposition in swamp to marsh environments. Locally, phosphate- and quartz-pebble lag beds are present at base of unit. Auger hole *RI 16* includes a typical section. Unit is as much as 16 ft thick

Ladson Formation (middle Pleistocene, between 240 and 730 ka)

Qlc — Clayey sand and clay facies—Clayey quartz sand, moderate-reddish-brown (10R 4/6), moderate-red (5R 4/6) and (or) medium-light-gray (N 6), medium-grained, poorly sorted, and silty to sandy clay. Dominant clay minerals are kaolinite, illite/smectite, and illite, in variable proportions. Soil profile is well developed; B-horizon is moderate-reddish-brown (10R 4/6) to dark-reddish-brown (10R 3/4) and 12–16 ft deep. Occurs at altitudes between 35 and 55 ft. Terrestrial vertebrate fossils locally present. Probably accumulated in fluvial, marsh, estuarine, and lagoonal environments. Phosphate-pebble lag beds are present locally at base of unit. Unit is as much as 30 ft thick

Qls — Clean sand facies—Quartz sand, dark-yellowish-orange (10YR 6/6), coarse-grained, poorly sorted; abundant fine-grained, dark, heavy minerals below soil profile; conspicuously crossbedded. Dominant clay minerals are kaolinite and vermiculite, with detrital gibbsite clasts at base. Occurs at altitudes between 50 and 65 ft and only in the far southeastern corner of the map area. Probably deposited as part of a coastal barrier island. Unit is as much as 20 ft thick

Penholoway Formation (lower Pleistocene, between 730 and 970 ka)

Qpc — Clayey sand and clay facies—Clayey to silty sand, sandy to clayey silt, and silty to sandy clay, medium-gray (N 5) to medium-bluish-gray (5B 5/1), weathers to very-light-gray (N 8), commonly well laminated. Dominant clay minerals are kaolinite, illite/smectite, and illite, in variable proportions. Probably accumulated in an open lagoonal environment. Soil profile well developed; B-horizon ranges from moderate-reddish-brown (10R 4/6) to mottled dark-reddish-brown (10R 3/4) and light-gray (N 7) and is 10–15 ft deep. Phosphate- and quartz-pebble lag beds are present locally at base of unit. Auger hole *RI 20* includes a typical section. Unit is as much as 45 ft thick

Qps — Clean sand facies—Quartz sand, moderate-reddish-brown (10R 4/6) to dark-yellowish-orange (10YR 6/6), fine- to medium-grained; abundant very fine grained, dark, heavy minerals below soil profile; conspicuously crossbedded. Probably deposited as coastal barrier islands. Dominant clay minerals are kaolinite and vermiculite, with reworked gibbsite forming detrital clayballs at base. Auger hole *SU 13* includes a typical section. Unit is as much as 12 ft thick

Qpf — Fossiliferous sand facies—Quartz sand, medium-gray (N 5) to medium-bluish-gray (5B 5/1) or greenish-gray (5G 6/1), fine- to medium-grained, phosphatic, bioturbated. Dominant clay minerals are kaolinite, illite/smectite, and illite in decreasing order of abundance. Unweathered beds contain a moderately diverse molluscan fossil fauna, so this unit probably formed as a shallow-marine-shelf deposit. Basal contact usually marked by a 1- to 3-in.-thick layer of coarse-grained sand, quartz pebbles, black phosphate pebbles, and worn and rounded bones and teeth. Auger hole *SU 13* includes a typical section. Unit is as much as 22 ft thick

Waccamaw(?) Formation (lower Pleistocene, between 1.4 and 1.6 Ma)

Qwwr — Pebbly, coarse sand facies—Gravel to feldspathic pebbly quartz sand, coarse-grained, medium-gray (N 5), very poorly sorted, subrounded to subangular. Present only near Four Hole Swamp and beneath the swamp deposits veneering the bottom of Four Hole Swamp. Probably represents the relict bed load of a prehistoric channel of the Santee River. Auger hole *PR 17* includes a typical section. Unit is as much as 25 ft thick

Qwws — Clean sand facies—Quartz sand, moderate-reddish-brown (10R 4/6) to dark-yellowish-orange (10R 6/6), fine- to coarse-grained; abundant very fine grained heavy minerals below soil profile; conspicuously crossbedded. Probably deposited as coastal barrier islands. Dominant clay minerals are kaolinite, vermiculite, and gibbsite. Auger holes *PR 4*, *PR 6*, and *SN 2* include typical sections. Unit is as much as 30 ft thick

Qwwf — Fossiliferous sand facies—Sand, medium-gray (N 5) to light-gray (N 7), fine- to medium-grained, calcareous to very calcareous, phosphatic, bioturbated. Dominant clay minerals are kaolinite, illite/smectite, and illite, in decreasing order of abundance. Unweathered beds contain a diverse molluscan fossil fauna, so this unit probably formed as a shallow-marine-shelf deposit. Basal contact usually marked by a layer 1–3 in. thick of coarse-grained sand, black phosphate pebbles, and worn and rounded bones and teeth. Auger holes *SU 20* and *SN 12* include typical sections. Unit is as much as 20 ft thick

QTpb — **Pringletown beds (informal) (upper Pliocene or lower Pleistocene, between 1.5 and 3 Ma)**—Clayey sand, silty to sandy clay, and sand, fine- to medium-grained, dark-bluish-gray (5B 3/1) to dark-gray (N 3), dense; clay-rich beds sticky; interbeds present of peat, dark-brownish-gray (5YR 3/1). Locally contains quartz and phosphate pebbles. Probably deposited in estuarine to lagoonal environments. Present only in subsurface (see cross sections *A'–B'* and *D–C*). Auger holes *PR 4* and *SN 2* include typical sections. Unit is as much as 10 ft thick

Tr — **Raysor Formation (upper Pliocene, about 3.1 Ma)**—Sand, quartzose and phosphatic, medium-dark-gray (N 4), grayish-brown (5YR 3/2), dark-olive-green (5GY 2/2) or black (N 1), fine- to medium-grained, sparsely shelly. Basal contact commonly marked by a thin layer, 1–2 in. thick, of black, rounded phosphate pebbles 1–2 in. in diameter. Auger holes *PR 6*, *SN 2*, and *SU 16* include typical sections. Unit is as much as 14 ft thick

Trb — **Rudd Branch beds (informal) (upper or middle Miocene, about 11–12 Ma)**—Quartz-phosphate sand, dusky-green (5G 3/2) to grayish-olive-green (5GY 3/2), fine-grained, silty. Basal contact with underlying Ashley Formation (**Ta**) typically marked by sparse, subrounded phosphate pebbles. Badly decomposed remnants of aragonitic shells locally abundant. Unit not known from outcrop but present in the subsurface of Summerville Northwest quadrangle (section *A'–B'*). Auger hole *SN 14* includes typical section. Unit is as much as 10 ft thick

Te — **Edisto Formation (lower Miocene and (or) upper Oligocene, about 24 Ma)**—Calcareous sand to quartzose calcarenite, light-olive-gray (5Y 6/1), greenish-gray (5GY 6/1), moderate-blue-green (5BG 4/6) or moderate-brown (5YR 4/4), mostly fine-grained, phosphatic. Base of unit locally contains sparse black phosphate pebbles 1–2 in. in diameter. Foraminifera abundant, and bryozoan and pelecypod shell fragments locally abundant. Auger holes *RI 16* and *SU 22* include typical sections. Unit is as much as 20 ft thick

Tcb — **Chandler Bridge Formation (upper Oligocene, about 28 Ma)**—Quartz-phosphate sand, fine-grained, greenish-gray (5GY 6/1), dark-greenish-gray (5GY 4/1) or greenish-black (5GY 2/1), and clay, dark-yellowish-brown (10YR 4/2), silty. Dominant clay mineral is illite/smectite, with lesser amounts of illite and kaolinite; sepiolite occurs in the basal few inches. Basal contact with the underlying Ashley Formation (**Ta**) is marked by a burrowed, gently rolling unconformity. Vertebrate remains are abundant. Auger holes *RI 20* and *SU 19* include typical sections. Unit is as much as 10 ft thick

Cooper Group (Oligocene and Eocene)

Ta — **Ashley Formation (upper Oligocene, about 30 Ma)**—Calcarenite, light-olive-brown (5Y 5/6), fine-grained, phosphatic, massive. Dominant clay mineral is illite/smectite, with lesser amounts of sepiolite and attapulgite. Base of unit contains densely packed phosphate-pebble bed (1–4 in. thick), with pebbles modally 1–2 in. in diameter. Sparsely macrofossiliferous but sand-size Foraminifera tests are abundant. Auger holes *SN 2*, *RI 15*, and *PR 21* include typical sections. Unit is as much as 125 ft thick

Tpf — **Parkers Ferry Formation (upper Eocene, about 38 Ma)**—Calcilutite to very fine grained calcarenite, light-blue-green (5BG 6/6) or grayish-blue-green (5BG 5/4) to moderate-yellowish-green (10GY 6/4), stiff to plastic, dense, sticky. Dominant clay mineral is illite/smectite, with lesser amounts of clinoptilolite. Basal 1–2 ft of unit commonly black (N 1) and composed mostly of phosphate and glauconite sand. Contains numerous short (0.25–0.50 in.) echinoid spines. Auger holes *RI 15* and *SN 2* include typical sections. Unit is as much as 70 ft thick. Shown in all cross sections except *D'–C'*

Th — **Harleyville Formation (upper Eocene, about 39–40 Ma)**—Calcarenite, very fine grained, light-greenish-gray (5GY 8/1) to olive-gray (5Y 4/1) or brownish-gray (5YR 4/1), interlayered with thin (0.5–2.5 in.) indurated strata. Dominant clay mineral is illite/smectite, with lesser amounts of clinoptilolite. Basal 1–2 ft of unit commonly black (N 1) and composed mostly of phosphate and glauconite sand. Auger holes *PR 21* and *RI 15* include typical sections. Unit in this area has been penetrated to a thickness of 20 ft; its full thickness is unknown. Shown only in cross sections *A–A'*, *A'–B'*, *C–C'*, and *D–C*

Tsc — **Cross Member of the Santee Limestone (middle Eocene, about 44 Ma)**—Calcarenite, very fine grained, yellowish-gray (5Y 8/1) to light-gray (N 7), friable but tough; some beds firmly cemented. Macrofossil fragments locally abundant. Small amounts (1–5 percent) of glauconite and phosphate commonly present. Unit in the map area has been penetrated to a depth of 40 ft; its full thickness is unknown. Shown only in cross sections *A–A'*, *A'–B'*, *C–C'*, and *D–C*

EXPLANATION OF MAP SYMBOLS

Contact—Located by noting changes in slope and by projecting drill-hole data to surface

50 / 40 — **Structure contour**—Shows base of Quaternary units. Contour interval 10 ft. Datum is mean sea level

Updip limit of Ashley Formation beneath Pleistocene cover—Ticks point downdip

58 *PR 15* — **Drill hole**—Quadrangle abbreviations: *PR*, Pringletown; *RI*, Ridgeville; *SU*, Summerville; *SN*, Summerville Northwest. Value indicates elevation in feet above sea level of the base of the Pleistocene. See Weems and others (1987) for logs. Symbols designate beds penetrated:

- Chandler Bridge Formation
- Edisto Formation
- Rudd Branch beds
- Raysor Formation
- Pringletown beds
- Outliers of Waccamaw(?) Formation
- Outliers of Penholoway Formation

SN 35 — **Location of selected outcrop (*SN 35*)**—See Weems and others (1987) for logs

Location of epicenter of small earthquake occurring between March 1973 and December 1992—Numbers represent date of events (year-month-day) listed in Tarr and Rhea (1983) and Talwani and others (1992, 1993), and depth (miles)

Structure contour (in miles) demarcating average depth to foci of small earthquakes in Summerville area (possible fault plane)

Cave (one occurrence, in the Pringletown quadrangle)

Sand pit and (or) clay pit

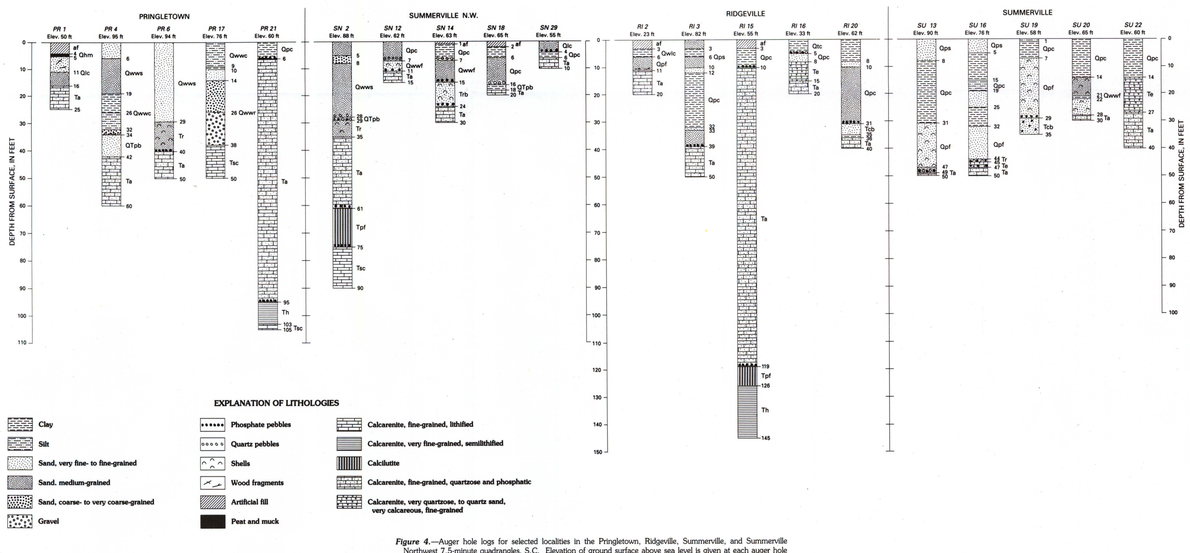


Figure 4.—Auger hole logs for selected localities in the Pringletown, Ridgeville, Summerville, and Summerville Northwest 7.5-minute quadrangles, S.C. Elevation of ground surface above sea level is given at each auger hole site. Geologic units are labelled; see description of map units above.

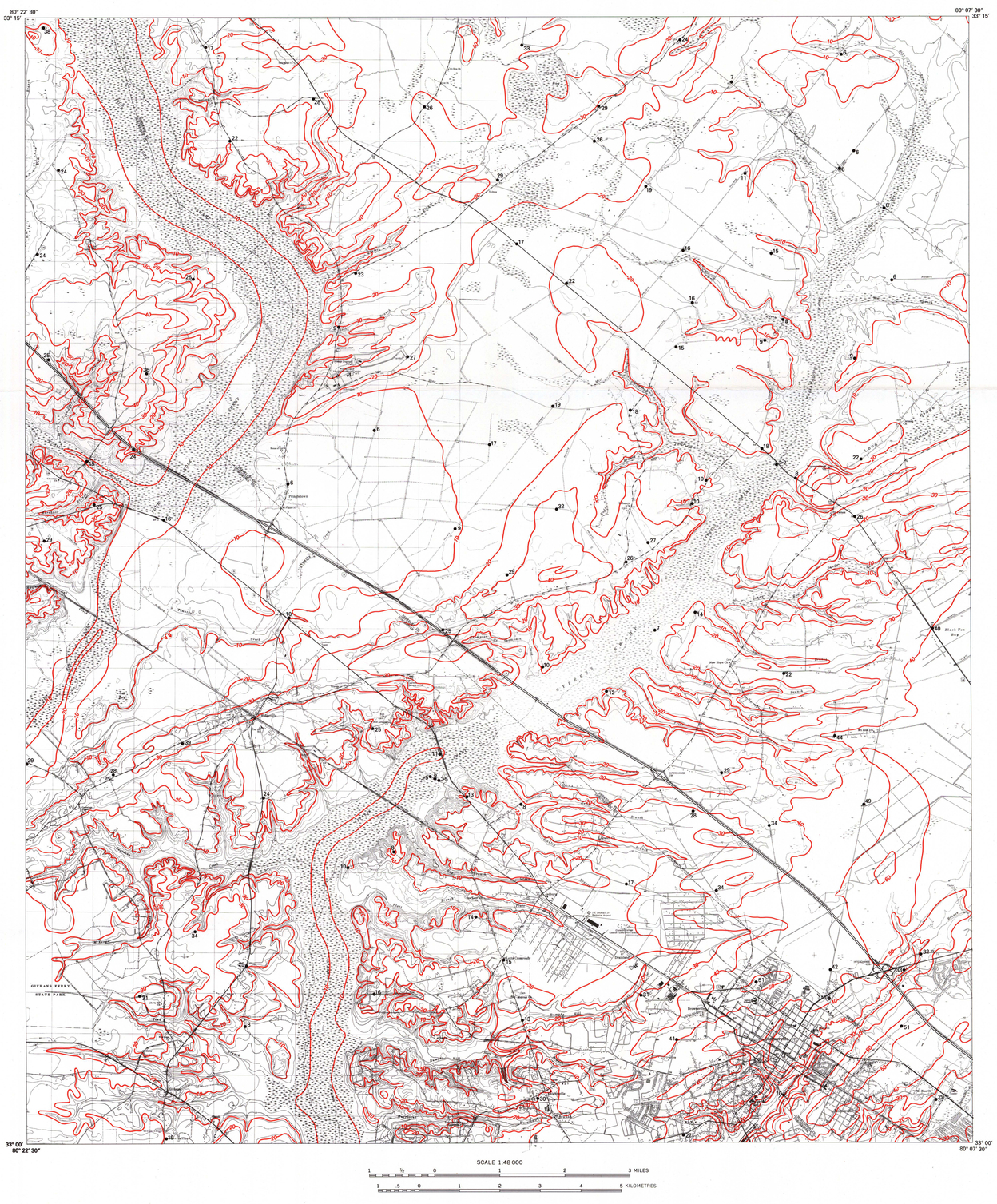


Figure 3.—Isopach map showing thickness of poorly consolidated Quaternary deposits. Isopach contours are shown in red; contour interval 10 ft. Thicknesses at drill-hole localities (solid black dots) are in feet; values were taken from Weems and others (1987).

GEOLOGY OF THE PRINGLETOWN, RIDGEVILLE, SUMMERVILLE, AND SUMMERVILLE NORTHWEST 7.5-MINUTE QUADRANGLES, BERKELEY, CHARLESTON, AND DORCHESTER COUNTIES, SOUTH CAROLINA

By
Robert E. Weems, Earl M. Lemon, Jr., and M. Sandra Nelson
1997