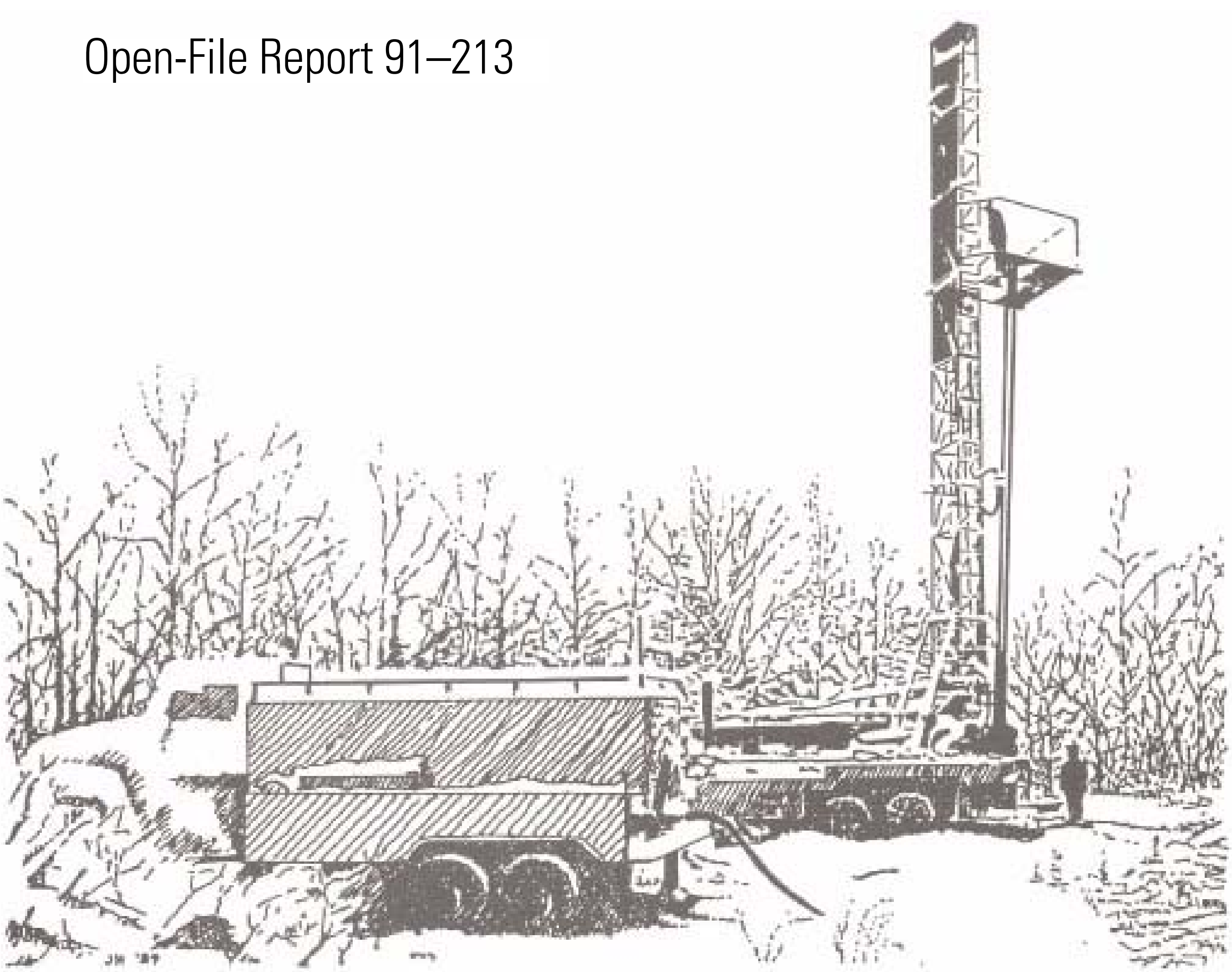
Prepared in cooperation with the
Oklahoma Water Resources Board

Geophysical Logs for Selected Wells in the Picher Field, Northeast Oklahoma and Southeast Kansas

Open-File Report 91–213



Drawing showing cleaning and plugging wells, winter 1984

U.S. Department of the Interior
U.S. Geological Survey

Christenson and others—Geophysical Logs Selected Wells, Picher Field, Northeast Oklahoma and Southeast Kansas—USGS/OFR 91–213

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Prepared by the U.S. Geological Survey in Oklahoma City, Oklahoma

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Conversion Factors and Datum

Multiply	By	To obtain
	Length	
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)

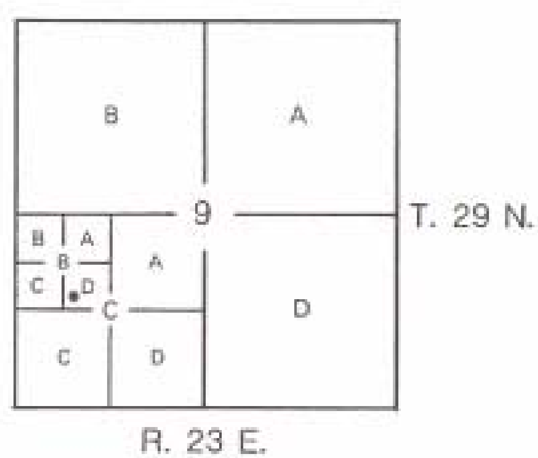
Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

$°F = (1.8 \times °C) + 32$

Sea Level: In this report "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)–a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly call "Mean Sea Level of 1929."

Explanation of the Local Identifier

The location of data-collection sites in this report is illustrated in the diagram below. This method of locating sites is referred to as the "local identifier." The local identifier replaces the standard legal method of locating sites by fractional section, section, township, and range. By the standard legal method, the location of the site indicated by the (●) is described as SE 1/4 NW1/4 SW1/4 sec. 9, T.29 N., R.23 E. The local identifier reverses the order and indicates quarter subdivisions of the section by letters. By this method, the location of the site is given as 29N-23E-09 CBD 1. A sequence number ("1" in this example) is added to provide a unique identifier for each site.



Geophysical Logs for Selected Wells in the Picher Field, Northeast Oklahoma and Southeast Kansas

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Abstract

The Roubidoux aquifer in northeastern Oklahoma is used extensively as a source of water for public supplies, commerce, industry, and rural water districts. The Roubidoux aquifer may be subject to contamination from abandoned lead and zinc mines of the Picher field. Water in flooded underground mines contains large concentrations of iron, zinc, cadmium, and lead. The contaminated water may migrate from the mines to the Roubidoux aquifer through abandoned water wells in the Picher field.

In late 1984, the Oklahoma Water Resources Board began to locate abandoned wells that might be serving as conduits for the migration of contaminants from the abandoned mines. These wells were cleared of debris and plugged. A total of 66 wells had been located, cleared, and plugged by July 1985. In cooperation with the Oklahoma Water Resources Board, the U.S. Geological Survey took advantage of the opportunity to obtain geophysical data in the study area and provide the Oklahoma Water Resources Board with data that might be useful during the well-plugging operation.

Geophysical logs obtained by the U.S. Geological Survey are presented in this report. The geophysical logs include hole diameter, normal, single-point resistance, fluid resistivity, natural-gamma, gamma-gamma, and neutron logs. Depths logged range from 145 to 1,344 feet.

Introduction

The Roubidoux aquifer in northeastern Oklahoma is used extensively as a source of water for public supplies, commerce, industry, and rural water districts. The term "Roubidoux aquifer" is used in this report to describe those geologic units in northeastern Oklahoma in which deep wells are completed, including the Roubidoux Formation and the Cotter, Jefferson City, and Gasconade Dolomites (table 1). There is concern that the Roubidoux aquifer may be subject to contamination from abandoned lead and zinc mines of the Picher field.

The Picher field straddles the Oklahoma-Kansas State line in Ottawa County, Oklahoma, and Cherokee County, Kansas. The mines of the main part of the field are included within an area that is about 9 miles long from east to west and 8 miles wide (McKnight and Fischer, 1970). Large-scale production of lead and zinc from the Picher field began in about 1904 and continued until mid-1958, when all major mining operations ceased. The mines were dewatered during mining operations by extensive pumpage, but later filled with water after mining ceased. By 1979, the majority of the mine workings were completely flooded by ground-water infiltration and surface-water inflow through abandoned mine shafts. Water in the underground mines contains large concentrations of iron, zinc, cadmium, and lead (Parkhurst, 1987). The contaminated water may migrate from the mines to the

Table 1. Generalized geologic section of rocks in northeast Oklahoma and southeast Kansas.

[Modified from Christenson, Parkhurst, and Fairchild, 1990. Thickness: All geologic units are absent at the outcrop of the Precambrian Spavinaw Granite in Mayes County, northeast Oklahoma.]

System	Geologic unit	Thickness (feet)	Lithologic description
Pennsylvanian	Pennsylvanian rocks undivided	0-230	Shale, siltstone, sandstone, limestone, and a few thin coal seams.
Mississippian	Mississippian rocks undivided	0-175	Limestone, shale, siltstone, and sandstone.
	Boone Formation	0-370	Chert and fine- to coarse-grained gray, light gray, and bluish limestone.
	Northview Shale	0-30	Greenish-black or dull-blue shale.
	Compton Limestone		Gray, nodular, shaly limestone.
Devonian and Mississippian	Chattanooga Shale	0-80	Black, carbonaceous, fissile shale.
Ordovician	Ordovician rocks undivided	0-550	Finely crystalline dolomite, with some thin shale beds and some sand stringers; found in a few wells in the southern part of the study unit.
	Cotter Dolomite	0-840	Light buff to brown cherty dolomite with several sandy and argillaceous zones; Swan Creek sandstone identified in some wells is sandstone or sandy dolomite at the base.
	Swan Creek sandstone		
	Jefferson City Dolomite		Light buff, gray and dark brown very cherty dolomite.
	Roubidoux Formation	0-300	Light-colored, cherty dolomite with 2 or 3 layers of sandstone 15 to 20 feet thick.
	Gasconade Dolomite	0-350	Light-colored, medium to coarsely crystalline, cherty dolomite; Gunter Sandstone Member is sandstone or sandy dolomite at the base.
	Gunter Ss. Member		
Cambrian	Eminence-Potosi Dolomites	0-370	Dark brown and light-colored cherty dolomite
	Bonneterre Formation	0-180	Dolomite with chert, pyrite, oolites, and glauconite; with sand decreasing progressively upward from the base of the formation.
	Lamotte Sandstone	0-80	Medium- to coarse-grained sandstone, shale, and siltstone.
Precambrian	Precambrian basement	?	Volcanic rocks and granite.

Roubidoux aquifer through abandoned water wells in the mining district. Wells were drilled to the Roubidoux aquifer to supply water for milling operations and communities overlying the Picher field.

The Tar Creek area within the Picher field was ranked by the Environmental Protection Agency first on a listing of 114 hazardous-waste sites in the Nation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Sites on the list of the hazardous-waste sites are known as “Superfund” sites. Investigative work began on the Tar Creek site in 1982.

In late 1984 the Oklahoma Water Resources Board attempted to locate and plug all abandoned wells within the Picher field that might be serving as conduits for the migration of contaminants from the abandoned mines. A total of 66 wells had been cleaned and plugged by July 1985.

Purpose and Scope

This project took advantage of the opportunity provided by the Oklahoma Water Resources Board’s well-plugging operation to obtain geophysical data on the study area and provide the Oklahoma Water Resources Board with data that might be useful during the well-plugging operation. The specific objectives of the study were to: (1) Obtain a suite of geophysical logs for each abandoned well before plugging; (2) recondition selected abandoned wells in order to construct a production well and several observation wells for the purpose of conducting an aquifer test; (3) perform aquifer tests to determine hydraulic properties and leakage characteristics of the Roubidoux; and (4) collect water samples for chemical and isotope analyses to determine the geochemical evolution and age of water in the Roubidoux aquifer.

Attempts at converting old production wells into monitoring wells were unsuccessful. Many of the old wells could not be cleared to the Roubidoux aquifer, and the wells that could be cleared were not located in positions that were suitable for an aquifer test. The planned aquifer tests and sampling of wells could not be done.

Of the 66 wells that were cleaned and plugged, 27 wells in northeastern Oklahoma and 19 wells in southeastern Kansas were logged by the U.S. Geological Survey (fig. 1 and table 2). Depths logged range from 145 to 1,344 feet. A computer program available through the U.S. Geological Survey was utilized to plot the digitized geophysical logs in report-ready format. This report presents those logs (fig. 2, at back of report).

Acknowledgments

The cooperation and assistance extended by members of the Oklahoma Water Resources Board is gratefully acknowledged. In particular, John Mott provided information regarding the locations of the wells for which geophysical logs are presented in this report.

Explanation of Information Appearing on Well Logs

The set of logs run by the Geological Survey on any given well depended on the condition of the well. On some wells, only the hole diameter (caliper log) of the well bore could be run safely. On other wells, a partial set of logs was run for the full depth of the hole, but deterioration of the bore prevented other logging tools from reaching the full depth of the bore hole.

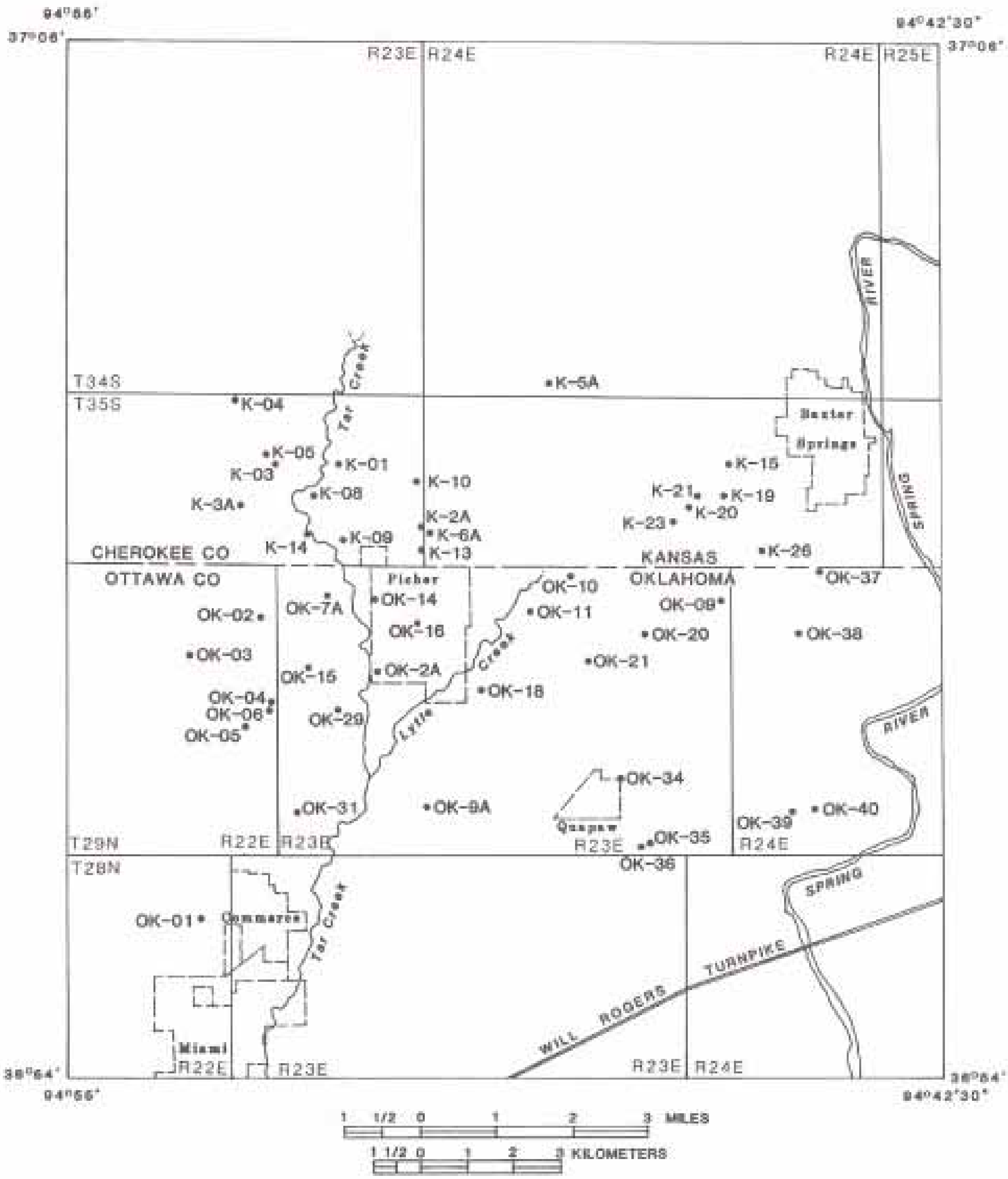

Figure 1. Location of wells for which geophysical logs were collected.

Table 2. Geophysical logs of selected wells in northeast Oklahoma and southeast Kansas.

[Logs available: C, hole diameter; S, 16-inch normal; L, 64-inch normal; P, single point; F, fluid resistivity; J, natural gamma; U, gamma-gamma; N, neutron; —, indicates no data available]

Well identifier	Mine well name	Local identifier	Site identification number	Depth logged	Well depth	Altitude	Logs available
K-01	Southern (Semple)	35S-23E-02 DDD 1	370103094510301	1,001	1,005	840	CSLFJUN
K-03	Big John E	35S-23E-02 CCC 1	370103094515801	1,049	1,059	850	SLFJUN
K-04	Lucky Jew	35S-23E-03 ABC 1	370149094524201	581	—	855	CJN
K-05	Big John D	35S-23E-03 DDA 1	370110094521401	527	—	850	CFJ
K-08	Tulsa Quapaw Silver Fox	35S-23E-11 ACC 1	370037094512701	986	—	830	C
K-09	Bendelari	35S-23E-11 DDD 1	370011094510301	568	—	830	CFJUN
K-10	Eagle-Picher Jarrett P-54	35S-23E-12 AAD 1	370058094495501	1,062	2,035	855	CSLPJUN
K-13	New Blue Mound	35S-23E-13 AAA 1	370001094500701	908	1,275	840	CLFJU
K-14	Wilbur Eagle Picher P34	35S-23E-11 CDD 1	370001094510701	1,405	1,876	850	CSLPJUN
K-15	M.E. Coe	35S-24E-03-CCC 1	370102094453201	290	—	855	CPJN
K-19	C.Y. Semple	35S-24E-10 ADA 1	370053094454001	1,120	1,125	855	CSLJUN
K-20	Clark (Boska 2)	35S-24E-10 CAA 1	370042094460801	935	955	850	SLFJUN
K-21	Ballard	35S-24E-10 ACB 1	370043094455001	692	—	855	C
K-23	Iron Mountain	35S-24E-10 CBD 1	370023094462401	756	—	855	SLPJUN
K-26	Goodeagle Refinery	35S-24E-14 BAA 1	370507094513401	333	—	845	CSLPJUN
K-2A	Webber-Eagle Picher 87-B	35S-23E-12 DDA 1	370017094451701	1,344	1,665	850	CSLPJUN
K-3A	Dill-Eagle Picher Testhole	35S-23E-10 DBB 1	370031094523401	692	—	840	CJUN
K-5A	Stoskoph	34S-24E-32 DCD 1	370155094481101	974	976	840	CSLPFJUN
K-6A	Barr	35S-24E-07 CCB 1	370017094494801	988	1,300	860	CSLJN
OK-01	Goodeagle (Midas)	28N-22E-01 DCD 1	365550094530401	976	1,000	810	C
OK-02	Bird Dog	29N-22E-13 DDC 1	365917094520901	1,197	1,267	822	CSLFJUN
OK-03	Adams	29N-22E-23 ADC 1	365859094531601	1,060	1,083	820	CSLFJUN
OK-04	Eagle-Picher Powerhouse	29N-22E-25 AAA 1	365820094520401	1,184	1,229	820	SLFJUN
OK-05	Goodeagle	29N-22E-25 ACB 1	365758094522801	971	1,229	830	CSLJUN
OK-06	Old Potter	29N- 22E-25 AAD 1	365811094520401	298	1,025	830	JUN
OK-09	Scott	29N-23E-13 DAC 1	365916094454201	213	1,115	840	C
OK-10	Brewster	29N-23E-15 ADD 1	365932094474401	830	1,000	840	SLFJU
OK-11	Beck 1	29N-23E-15 CDB 1	365920094482501	1,014	1,073	835	CSLFJUN
OK-14	Lucky Syndicate	29N-23E-17 CAC 1	365930094503201	995	1,525	840	CSLPJU
OK-15	Velie Lion	29N-23E-19 CAA 1	365843094513101	445	1,138	825	CU

Table 2. Geophysical logs of selected wells in northeast Oklahoma and southeast Kansas.—Continued

[Logs available: C, hole diameter; S, 16-inch normal; L, 64-inch normal; P, single point; F, fluid resistivity; J, natural gamma; U, gamma-gamma; N, neutron; —, indicates no data available]

Well identifier	Mine well name	Local identifier	Site identification number	Depth logged	Well depth	Altitude	Logs available
OK-16	Nettam	29N-23E-20 AAA 1	365901094500501	1,020	1,365	830	CSLFJUN
0K-18	Royal	29N-23E-21 DCA 1	365825094490501	389	1,040	830	CJN
OK-20	Massell	29N-23E-23 AAC 1	365856094464701	758	—	850	CSLPFJN
OK-21	Kropp	29N-23E-23 CBB 1	365845094473001	897	915	855	CSLFJUN
OK-29	Lucky Bill	29N-23E-30 AAC 1	365811094510701	858	—	815	CPJUN
OK-31	Central Mill 1	29N-23E-31 BDC 2	365704094513202	992	1,505	830	C
OK-34	Whitebird	29N-23E-35 ABB 1	365727094470401	440	993	840	JN
0K-35	Buckeye 1	29N-23E-35 DDD 1	365646094464701	376	—	835	CSLJUN
OK-36	Buckeye 2	29N-23E-35 DDC 1	365640094464701	397	—	835	N
OK-37	Discard	29N-24E-17 BCA 1	365938094441301	145	—	835	C
OK-38	Bendene-Rialto	29N-24E-19 AAD 1	365904094442901	528	—	840	SLFJUN
OK-39	Waxahachie	29N-24E-31 ADC 1	365706094443701	214	—	860	CSLFJUN
OK-40	Lancaster	29N-24E-32 BCC 1	365706094441301	726	760	865	SLFJUN
OK2A	Golden Hawk E. Picher P5	29N-23E-20 CAA 1	365837094501801	1,329	1,790	815	CSLPFJUN
OK-7A	Gordon	29N-23E-18 DBC 1	365934094511401	1,148	1,176	840	CSLPJN
OK-9A	Consolidated Lead & Zinc 6	29N-23E-32 ADD 1	365722094500401	898	985	820	CSLPFJUN

The logs shown in figure 2 are digitized versions of analog signals. The down-hole sonde returned a continuous analog signal during the well-logging operation, but the signal was recorded at 0.5-foot intervals.

Only the caliper logs are shown with the scales and units of measurement in figure 2. At the time the wells were logged (1985), the logging equipment used was not calibrated, except for the caliper log. The logs are useful for making stratigraphic picks or can be used for comparison between wells, but the actual value of the measured parameter (such as natural-gamma radiation) cannot be determined from these logs.

The site numbers were assigned in sequence as the wells were cleaned, logged, and plugged. Site numbers with an “A” suffix were cleaned and plugged at a later time by a different contractor.

The following explanations of the types of well logs are adapted from Keys and MacCary (1971), “Application of borehole geophysics to water-resources investigations.”

Hole diameter.—The hole diameter (caliper log) is a record of the average diameter of a drill hole.

Normal devices.—Normal logs measure the apparent resistivity of a volume of rock surrounding the electrodes. The short normals (16-inch) give good vertical detail and record the apparent resistivity of the zone immediately adjacent to the well bore. The long normals (64-inch) record the apparent resistivity beyond the zone immediately adjacent to the well bore.

Single-point resistance log.—Resistance-logging devices measure the resistance of the earth materials lying between an in-hole electrode and a surface electrode.

Fluid-resistivity log.—Fluid-resistivity logs provide a measurement of the resistivity of the in-hole liquid between electrodes in the probe.

Natural-gamma logs.—Natural-gamma logs are records of the amount of natural-gamma radiation that is emitted by rocks adjacent to the well bore.

Gamma-gamma logs.—Gamma-gamma logs are records of the intensity of gamma radiation from a source in the probe after it is backscattered and attenuated within the borehole and surrounding rocks. With the appropriate corrections, the intensity of the backscattered gamma radiation is inversely proportional to the bulk density of the rocks adjacent to the well bore.

Neutron log.—A neutron source and a detector are arranged in a probe so that the output primarily is a function of the hydrogen content of the borehole environment. Neutron logs are used chiefly for the measurement of the moisture content above the water table and of total porosity below the water table.

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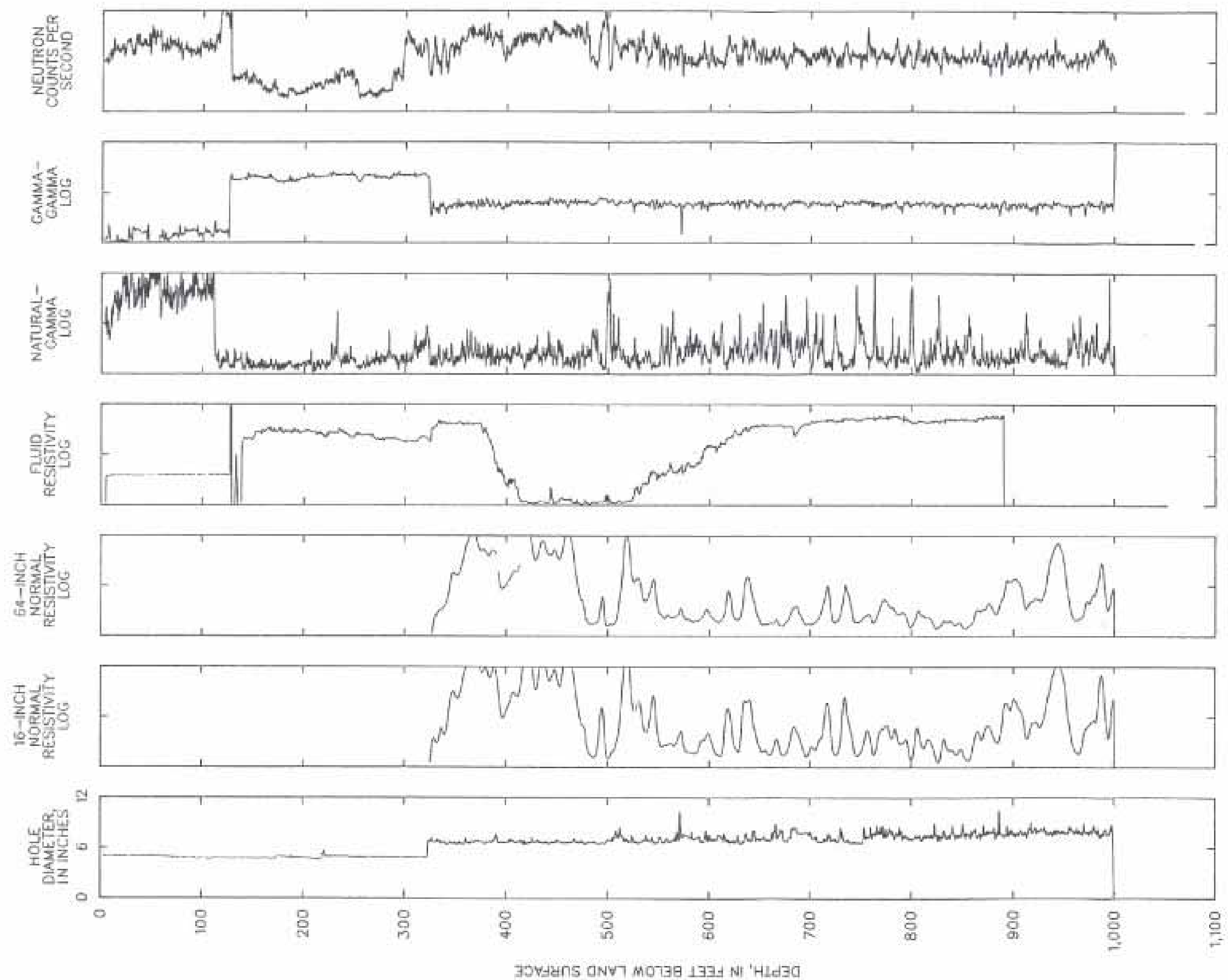
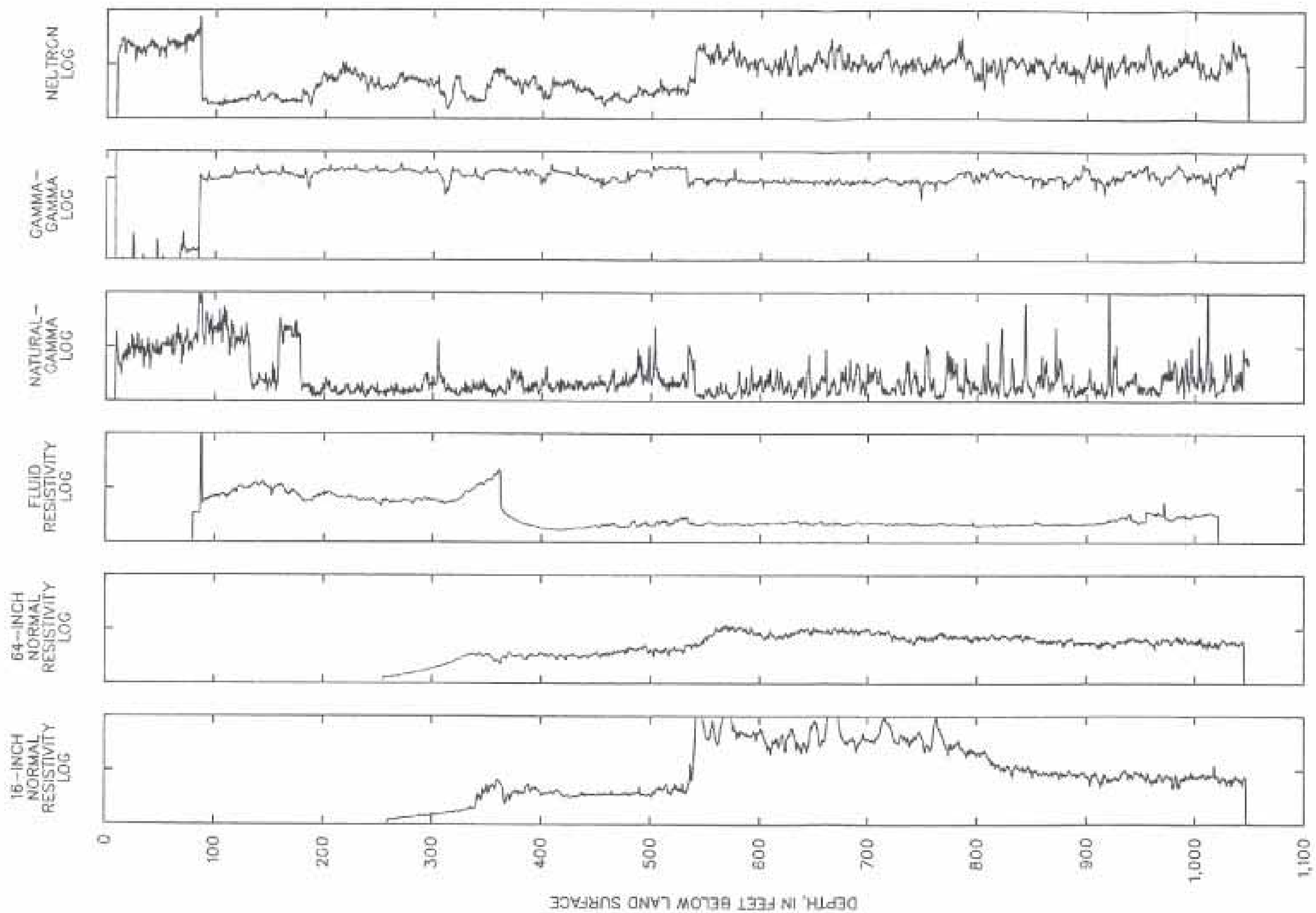


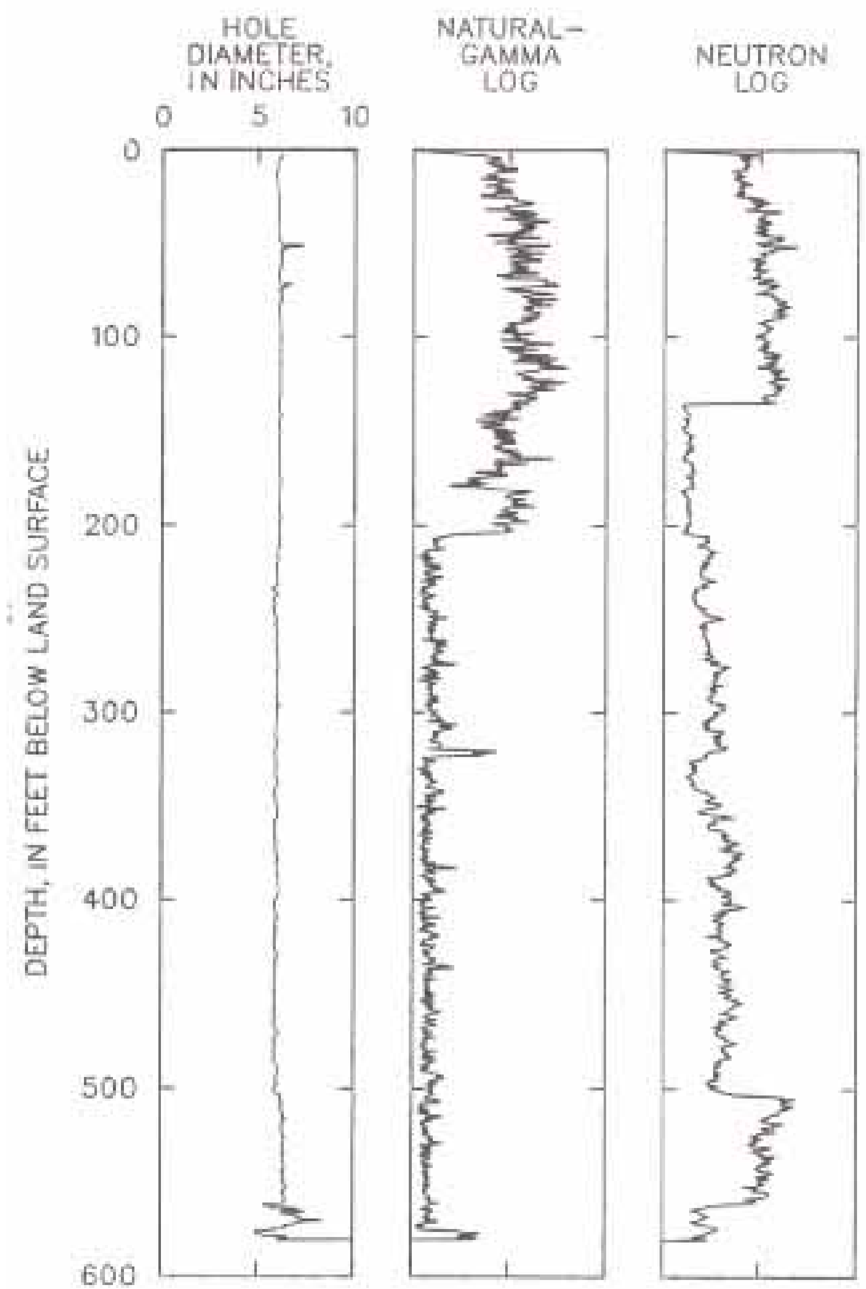
K–01 35S–23E–02 DDD 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.

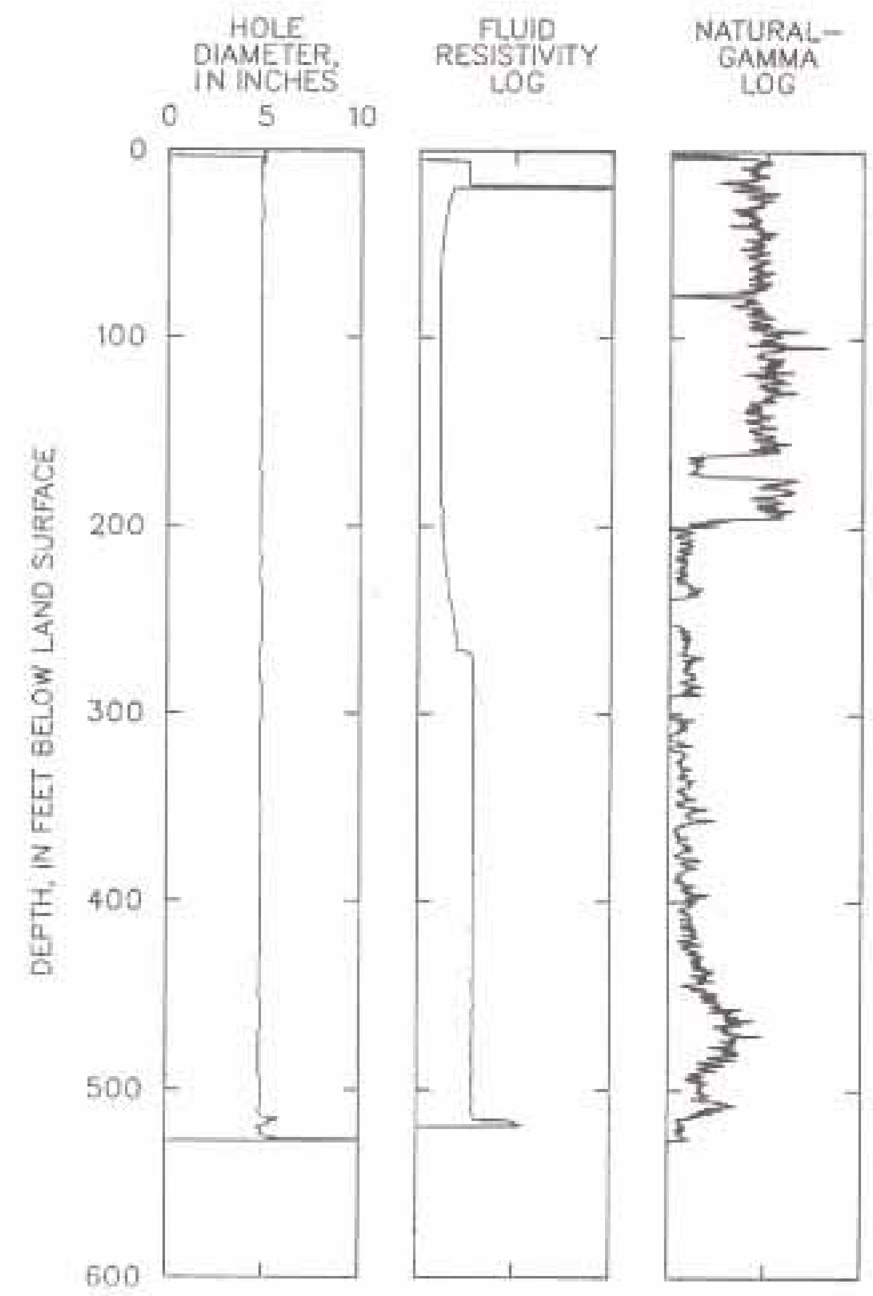


K–03 35S–23E–02 CCC1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued

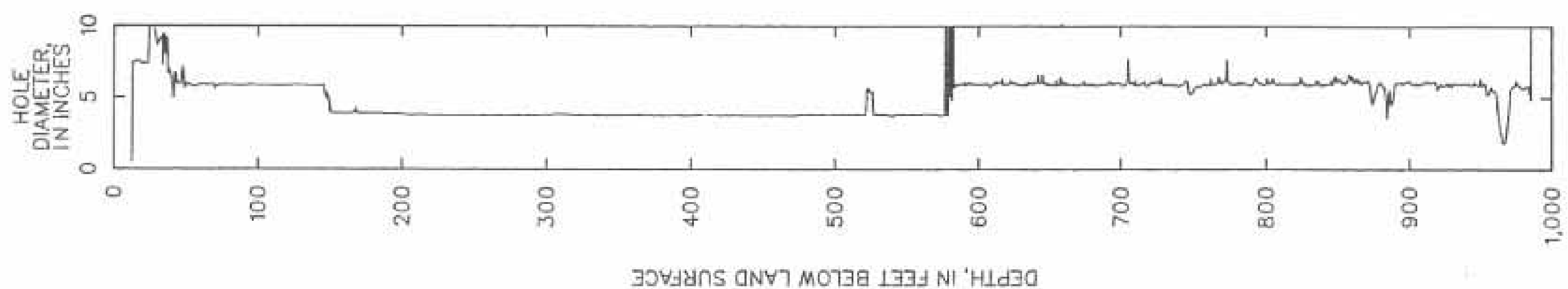


K–04 35S–23E–03 ABC 1



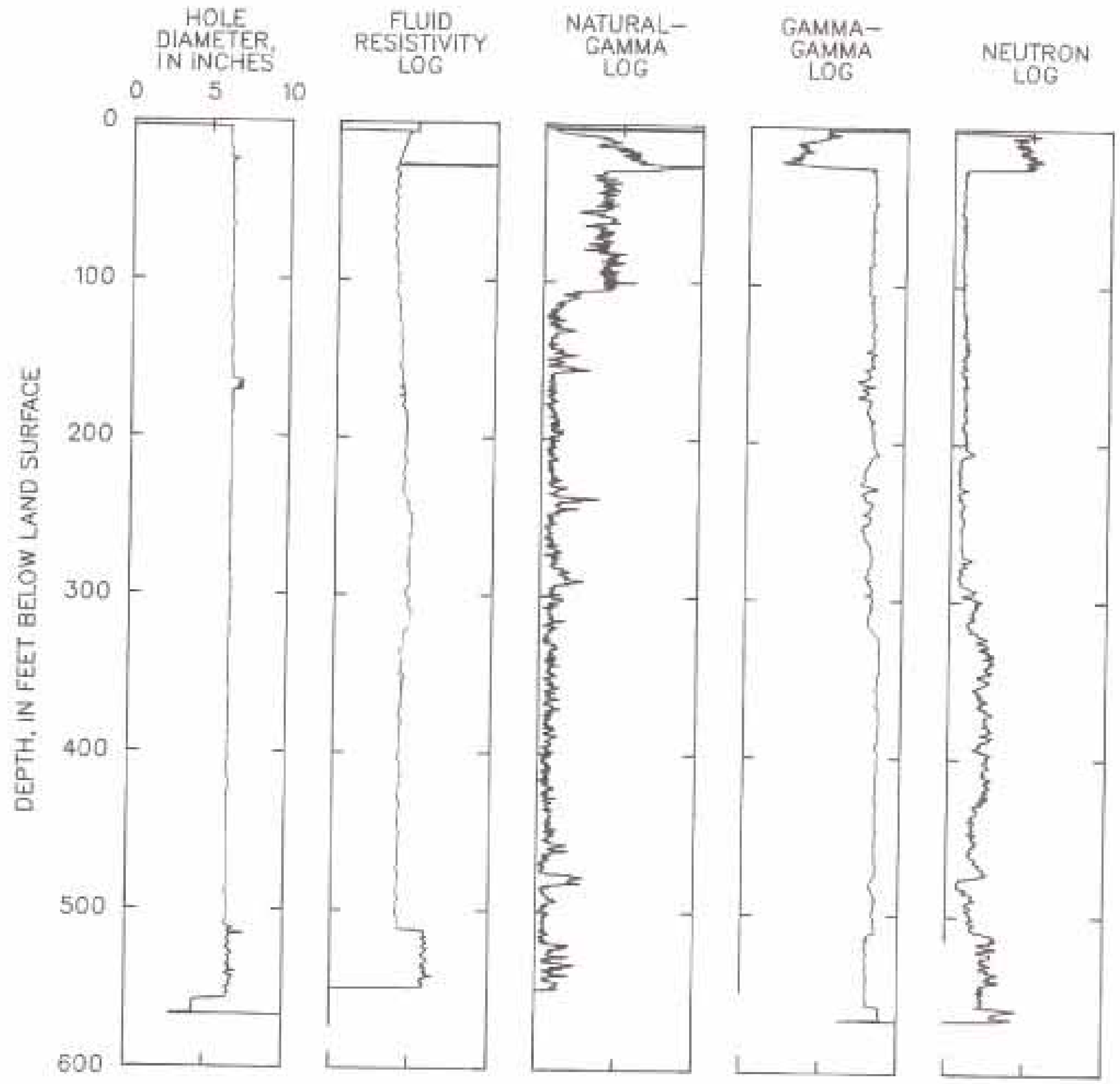
K–05 35S–23E–03 DDA 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



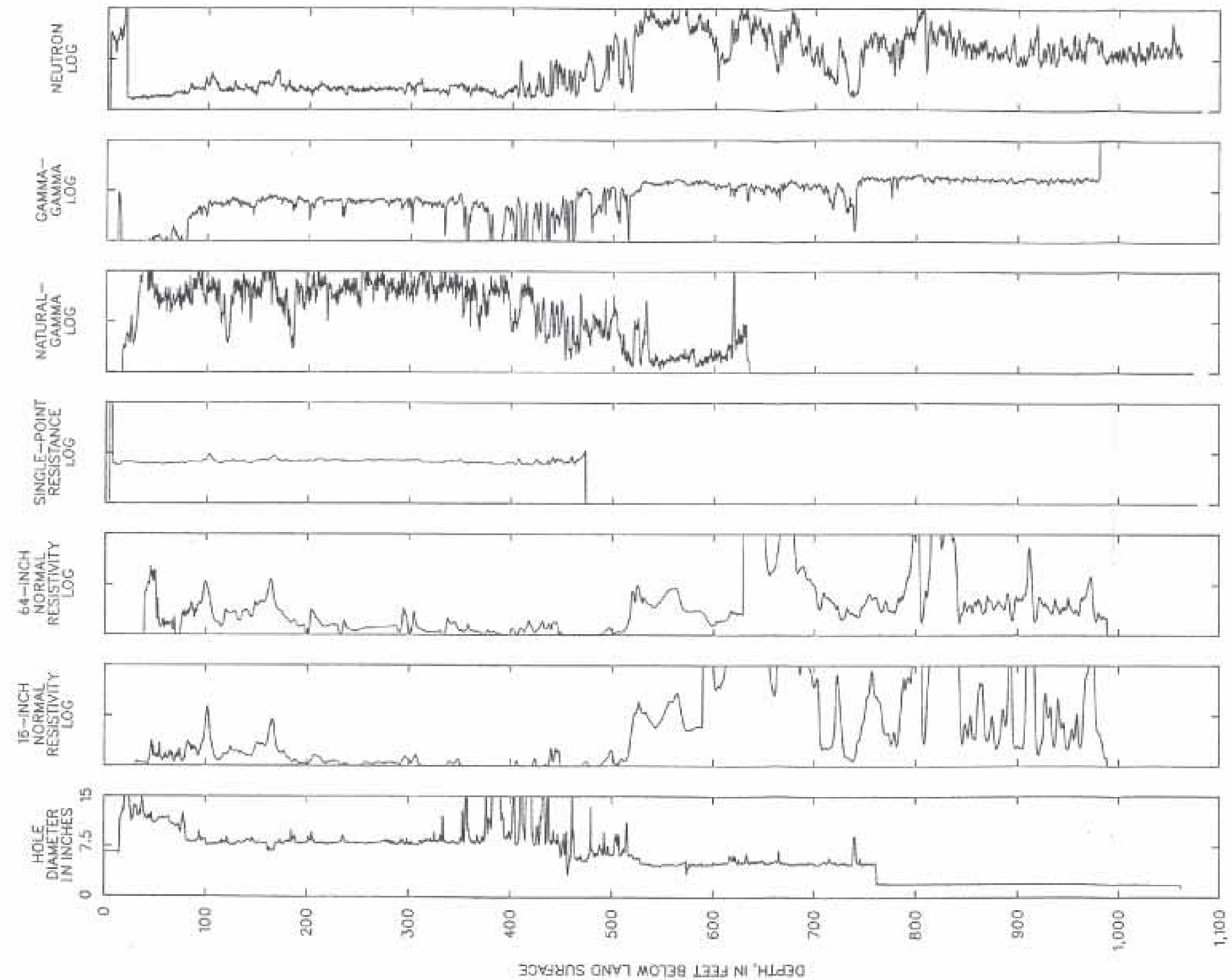
K–08 35S–23E–11 ACC 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



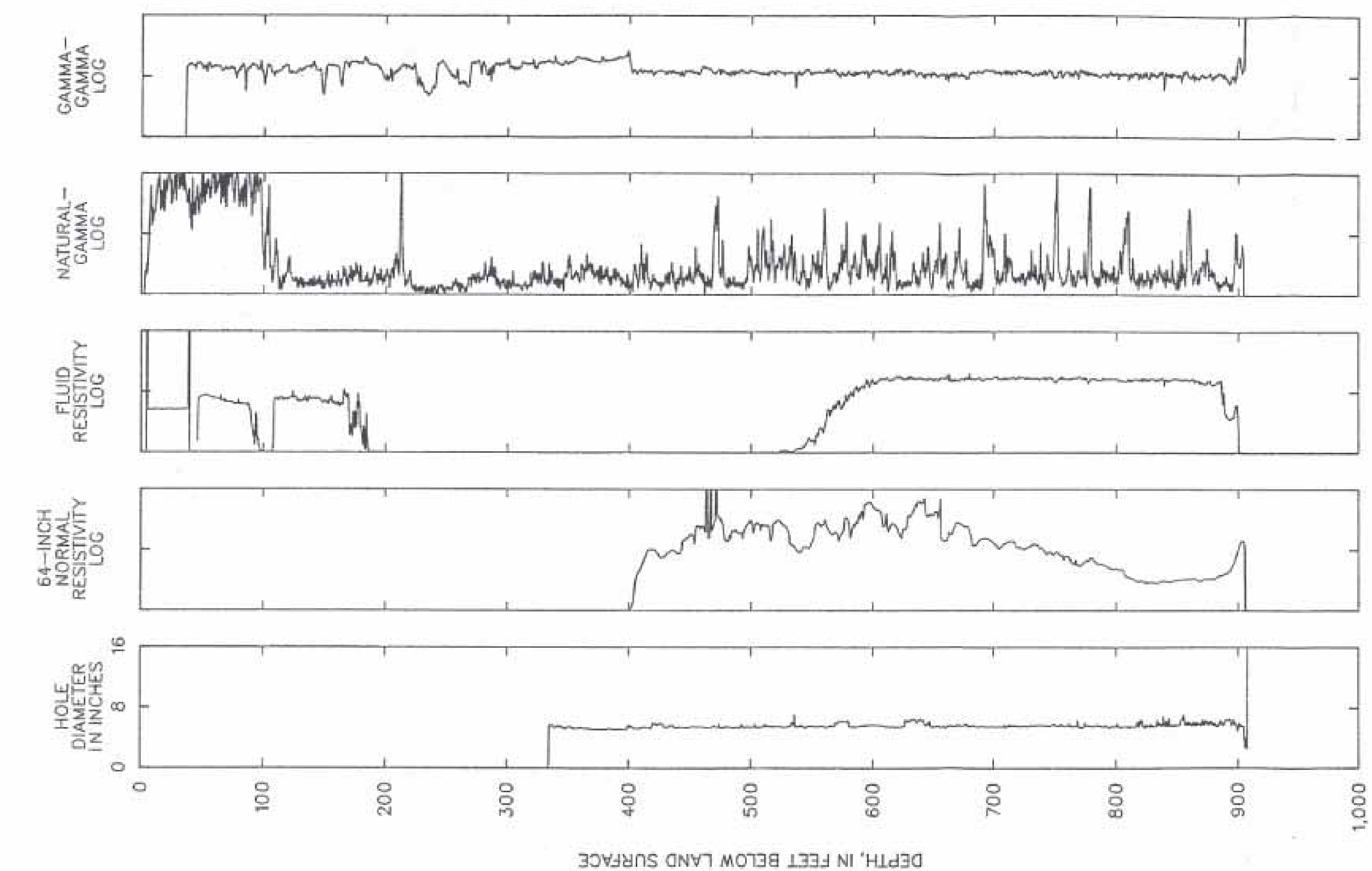
K–09 35S–23E–11 DDD 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



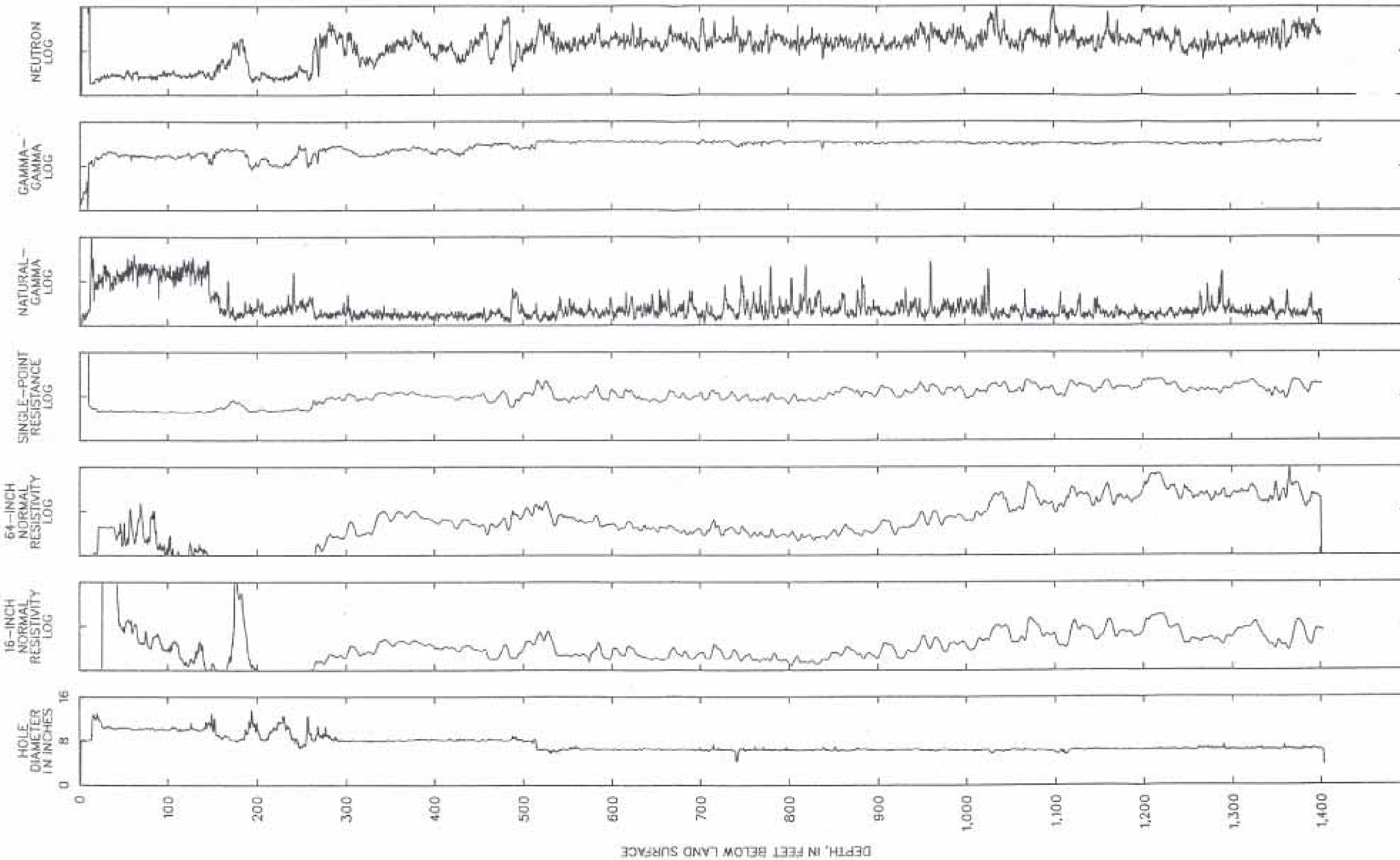
K–10 35S–23E–12 AAD 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



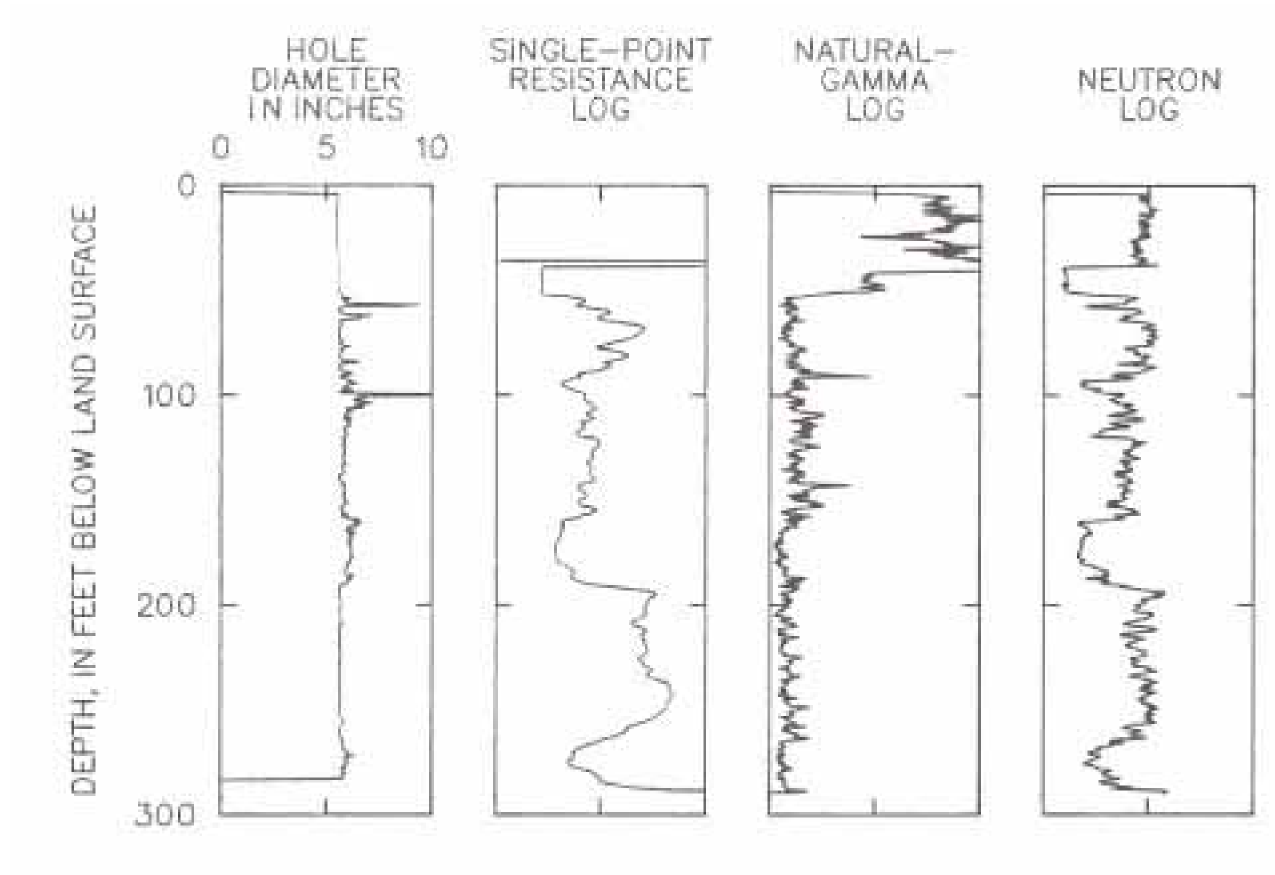
K–13 35S–23E–13 AAA 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



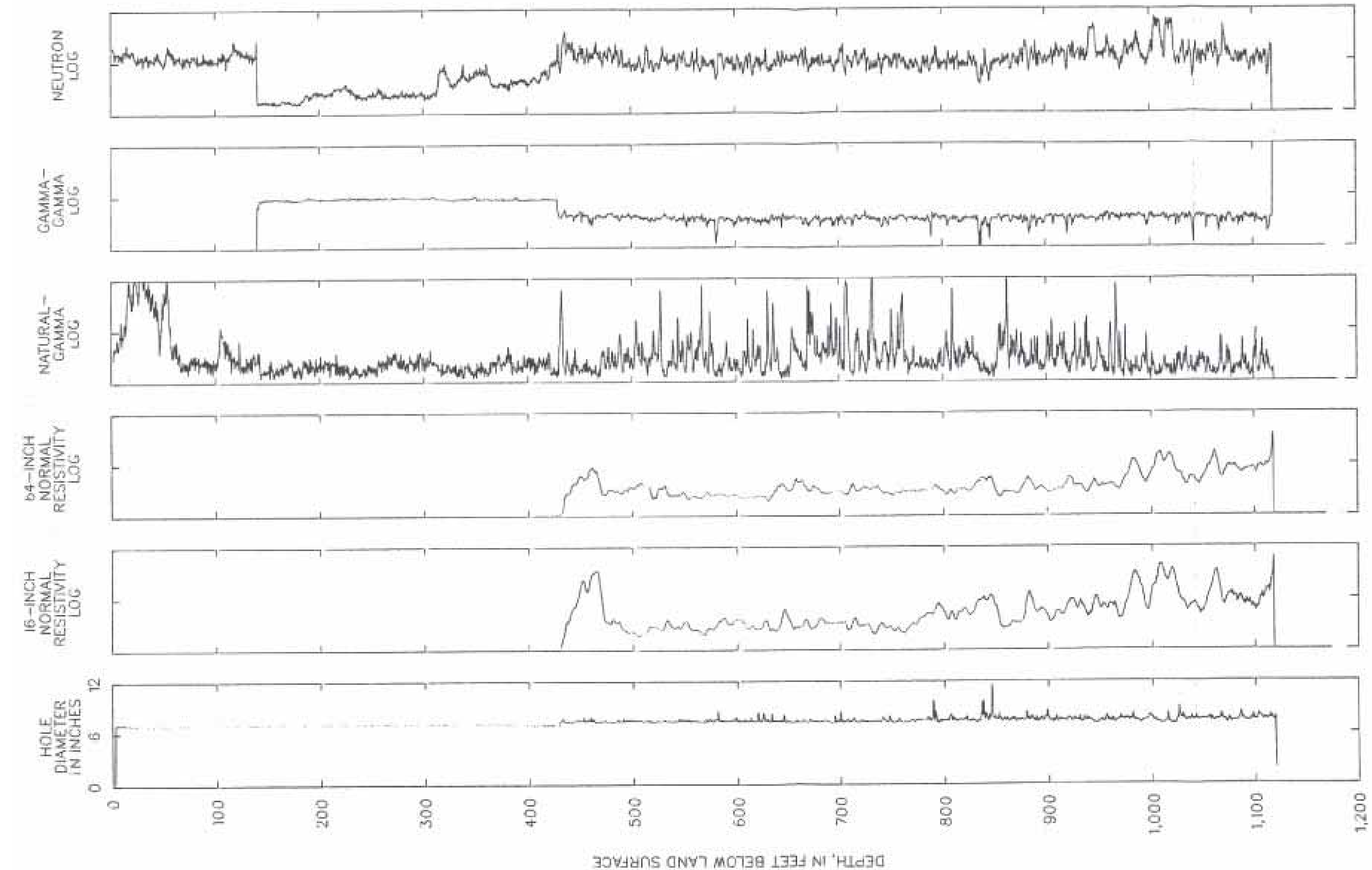
K–14 35S–23E–11 CDD 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



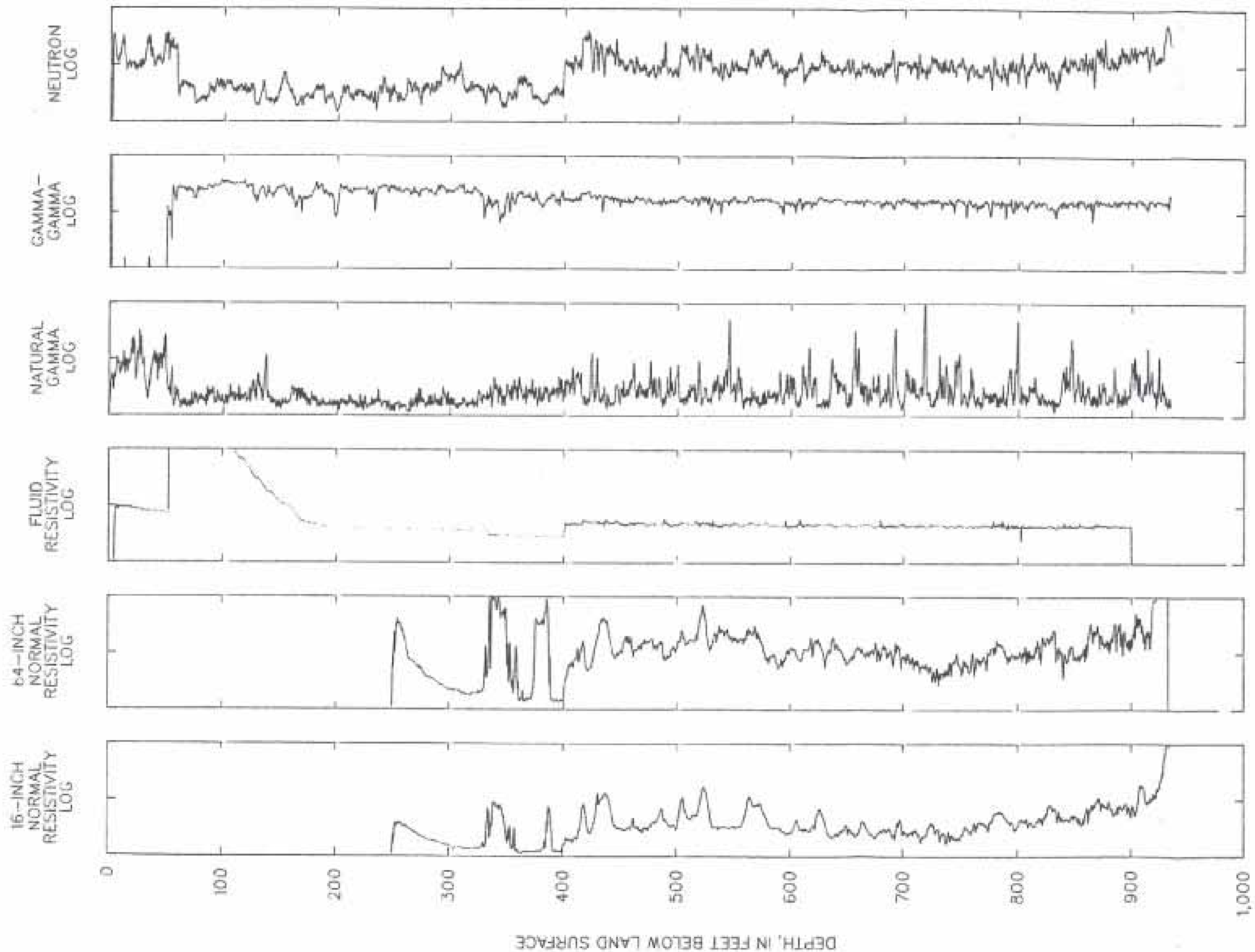
K–15 35S–24E–03 CCC 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



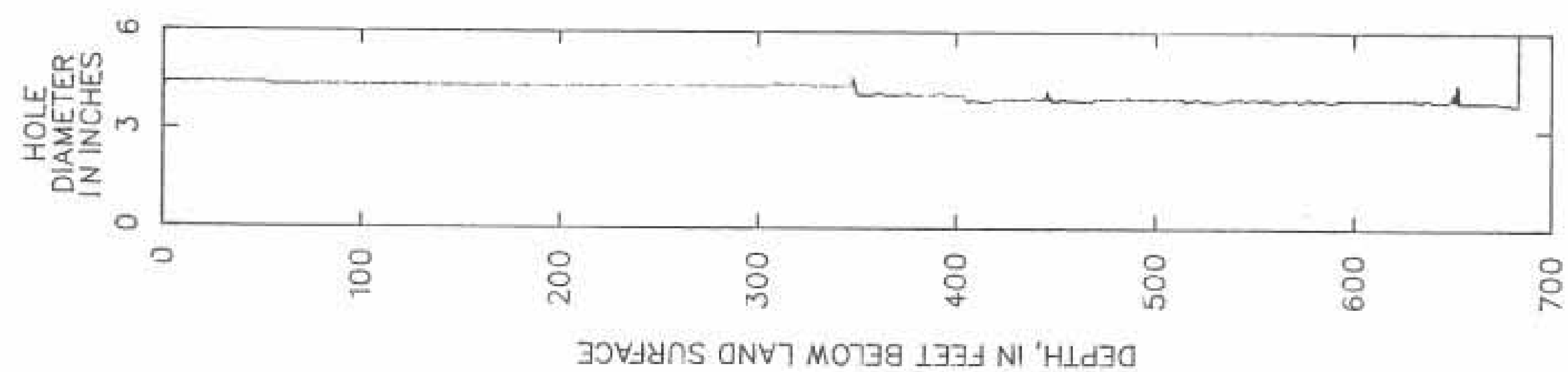
K–19 35s–24E–10 ADA 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



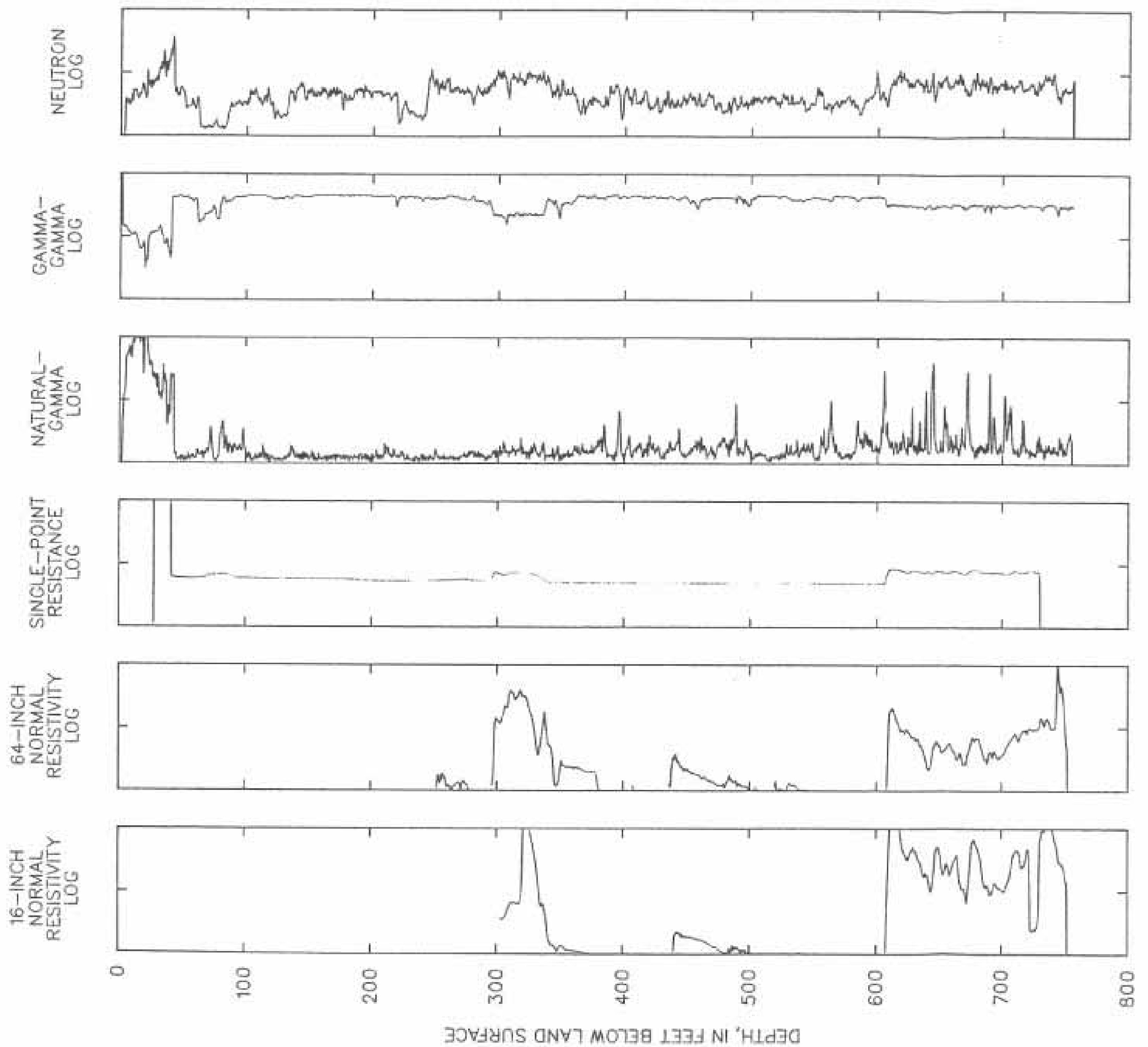
K–20 35S–24E–10 CAA 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



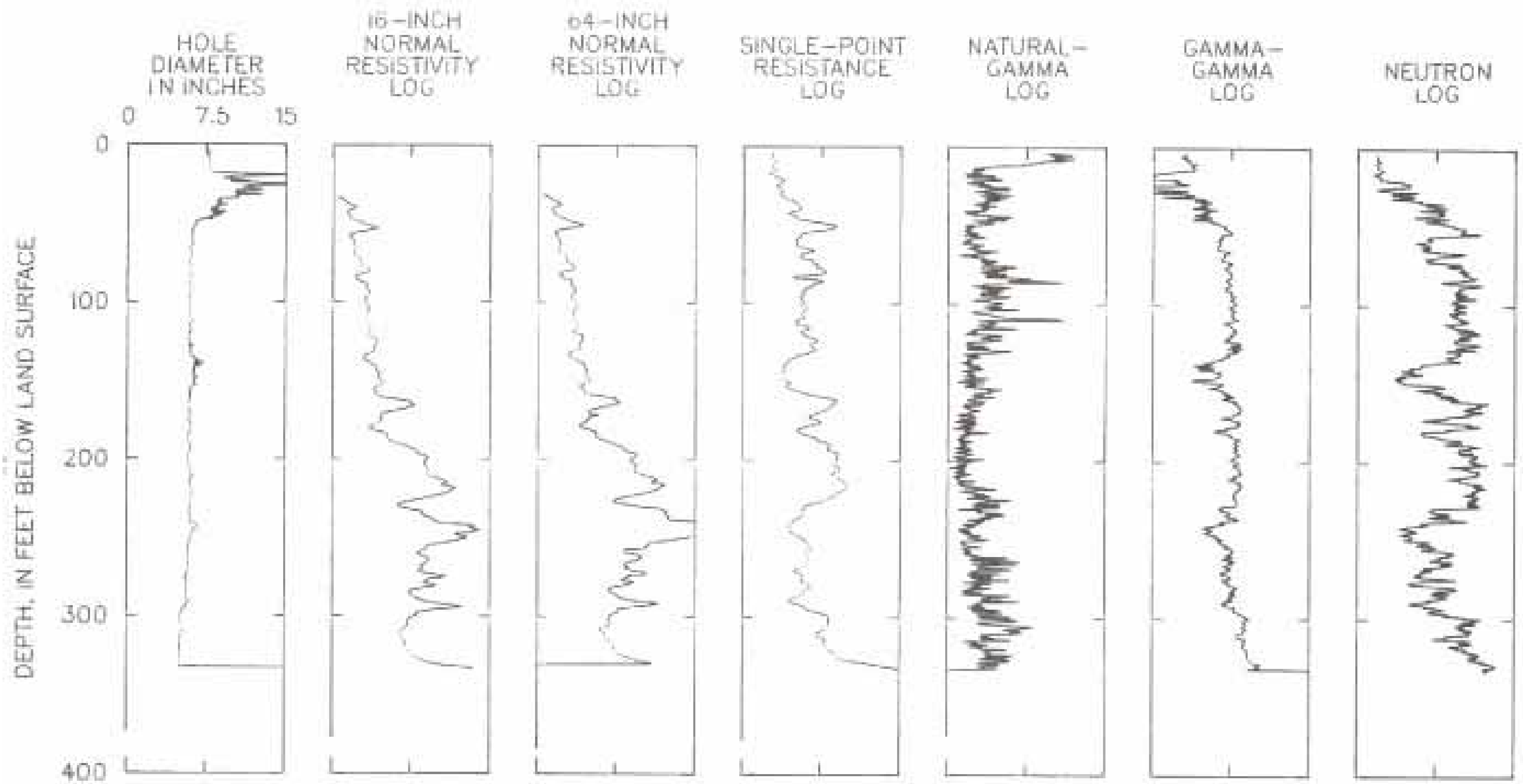
K–21 35S–24E–10 ACB 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



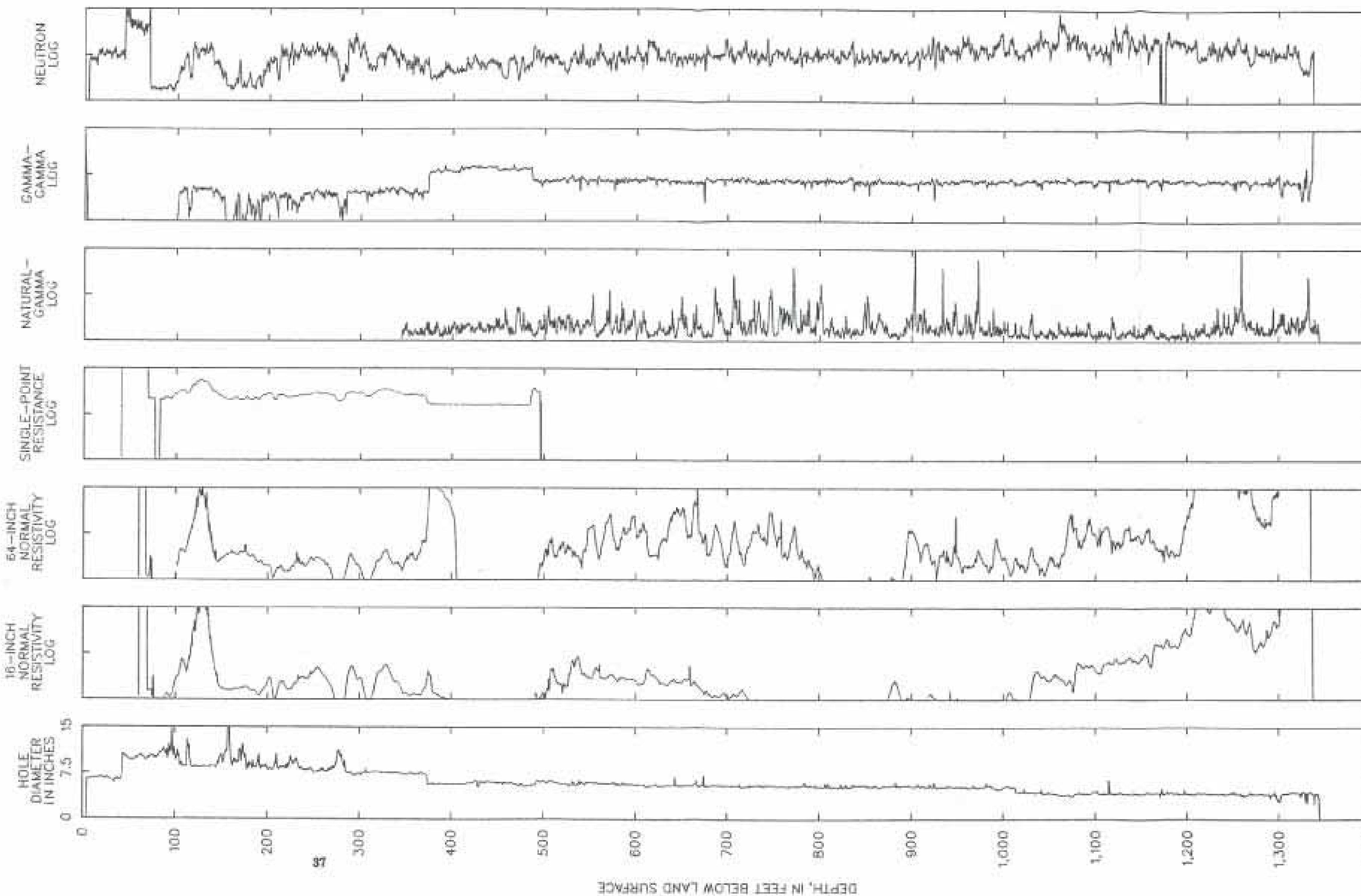
K–23 35S–24E–10 CBD 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



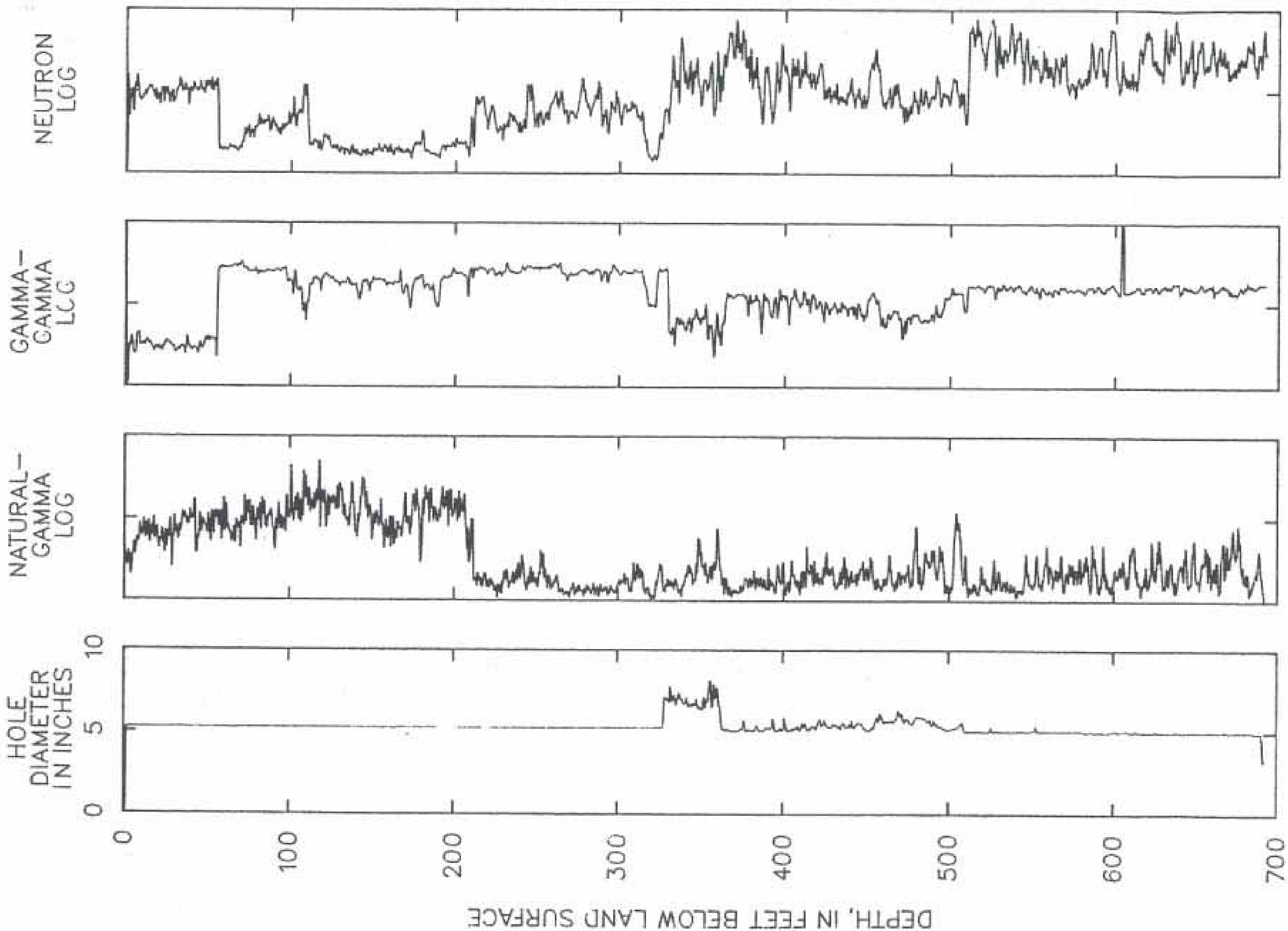
K–26 35S–24E–14 BAA 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



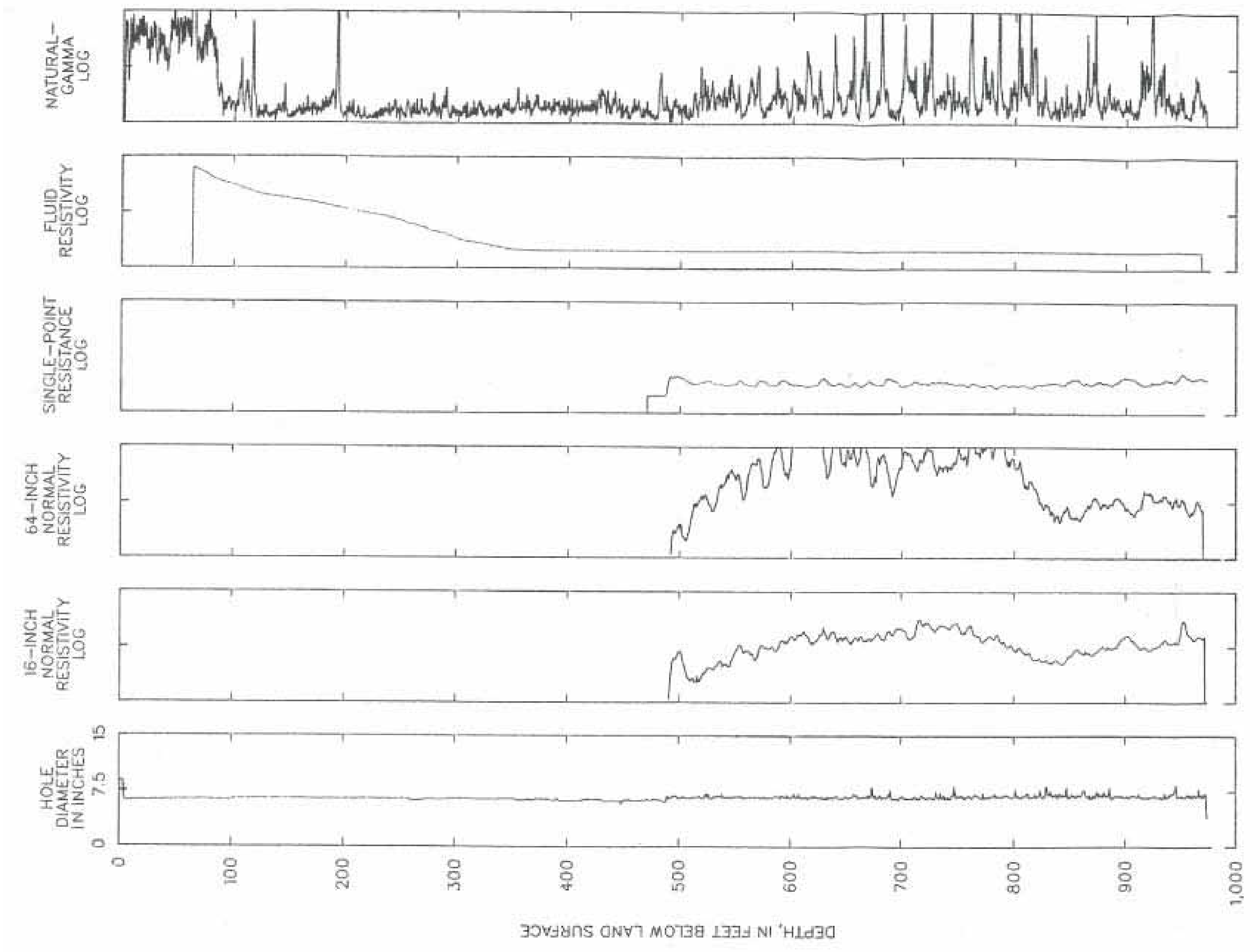
K–2A 35S–23E–12 DDA 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



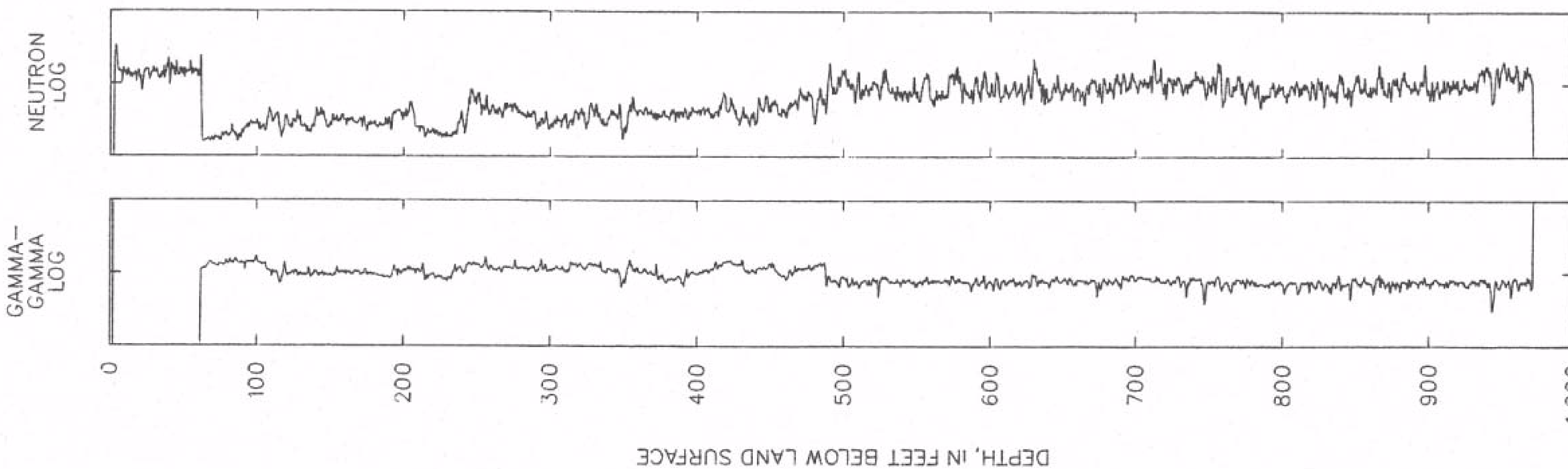
K–3A 35S–23E–10 DBB 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



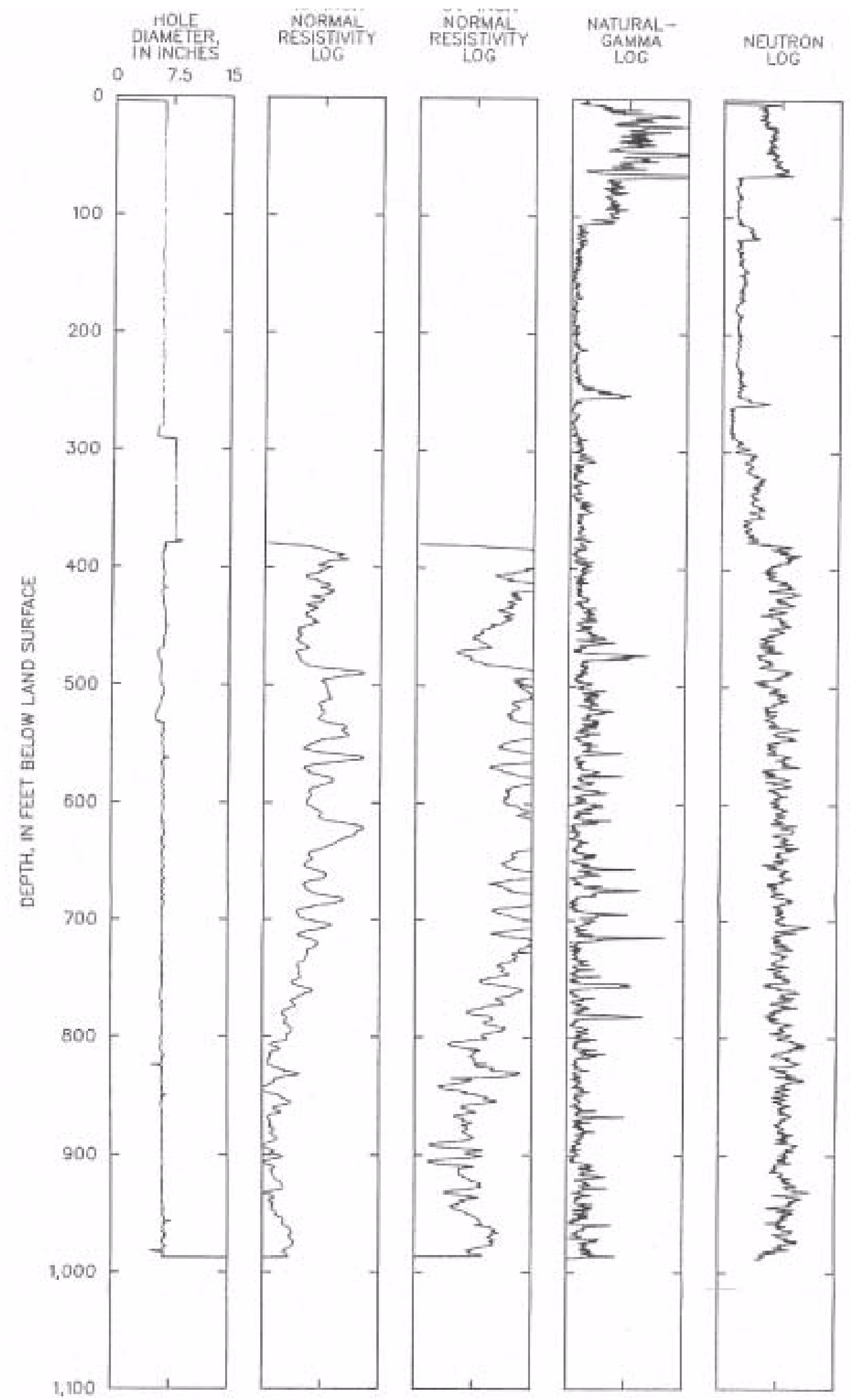
K–5A 34S–24E–32 DCD 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued

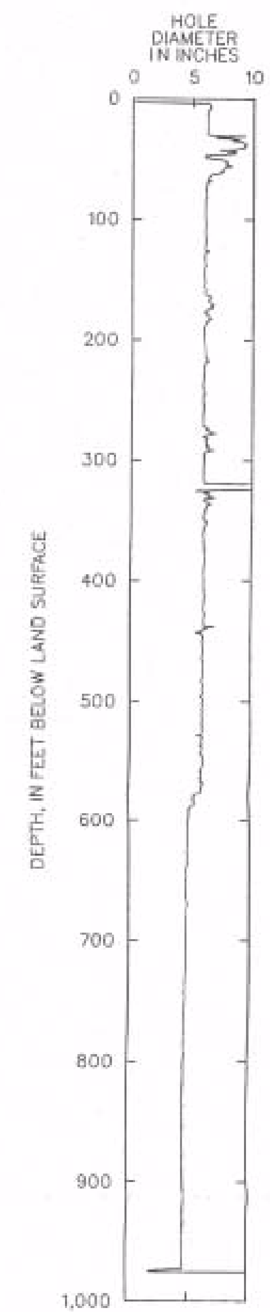


K–5A 34S–24E 32 DCD 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued

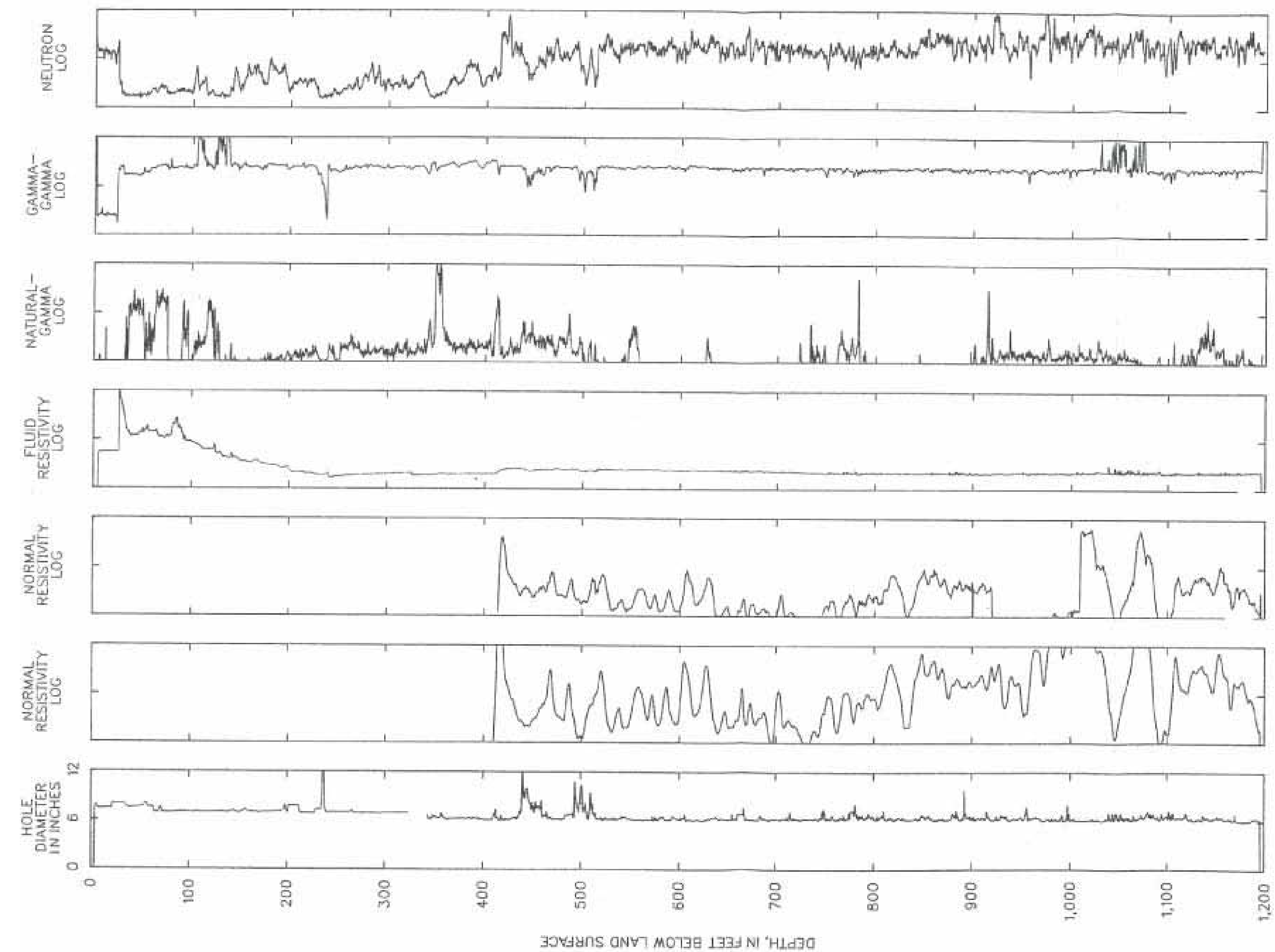


K–6A 35S–24E–07 CCB 1



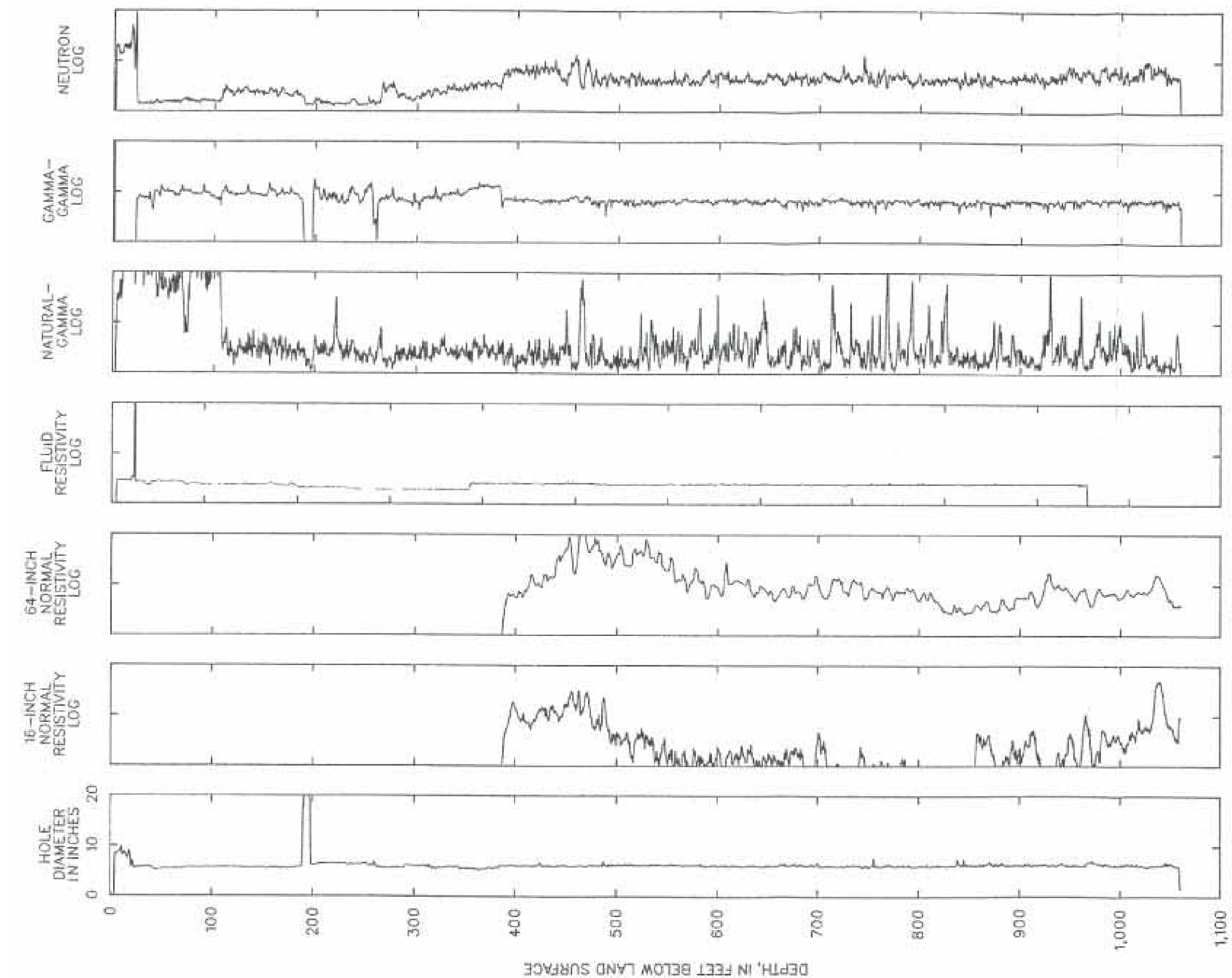
OK–01 28N–22E–01 DCD 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



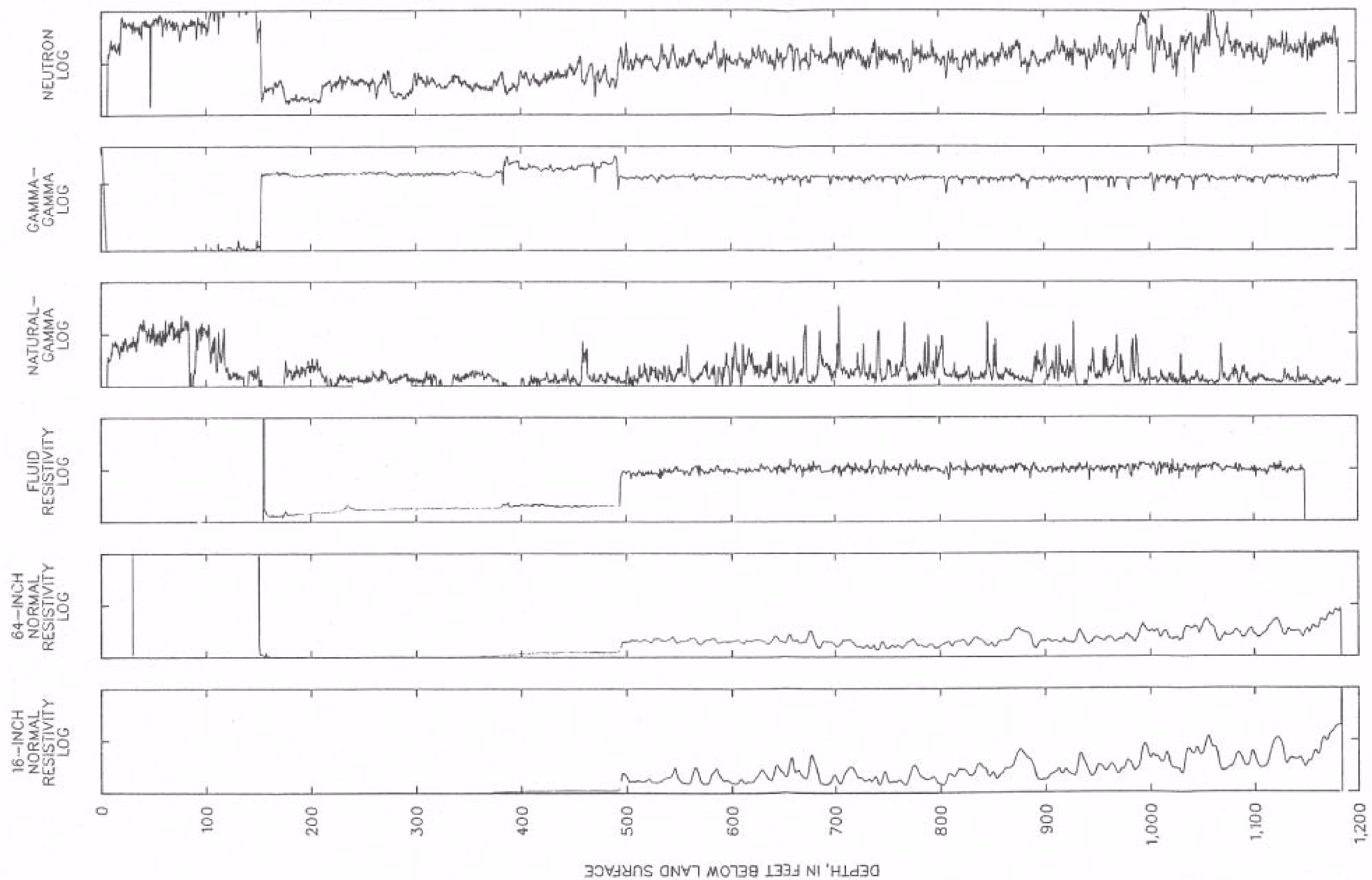
OK–02 29N–22E–13 DDC 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



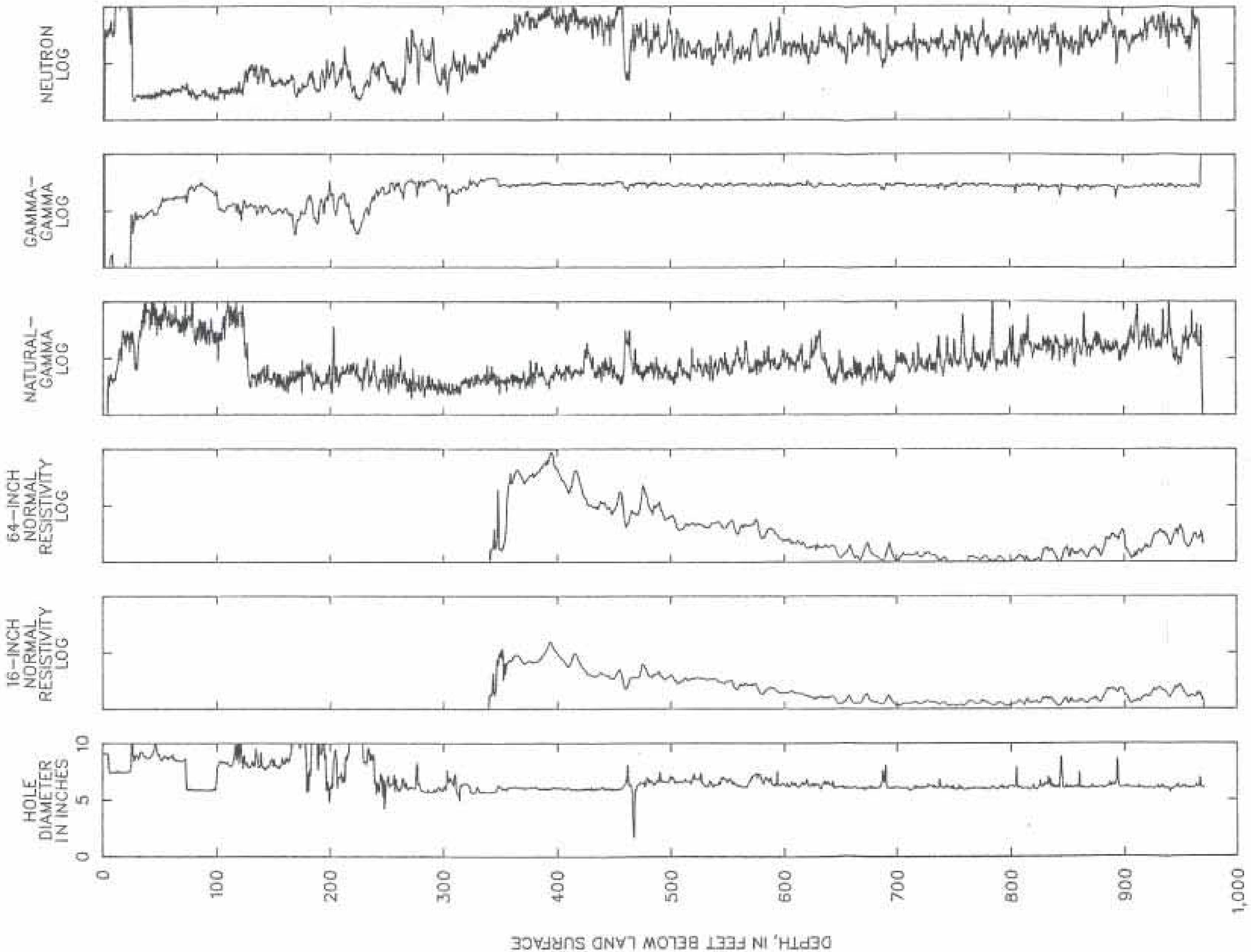
OK–03 29N–22E–23 ADC 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



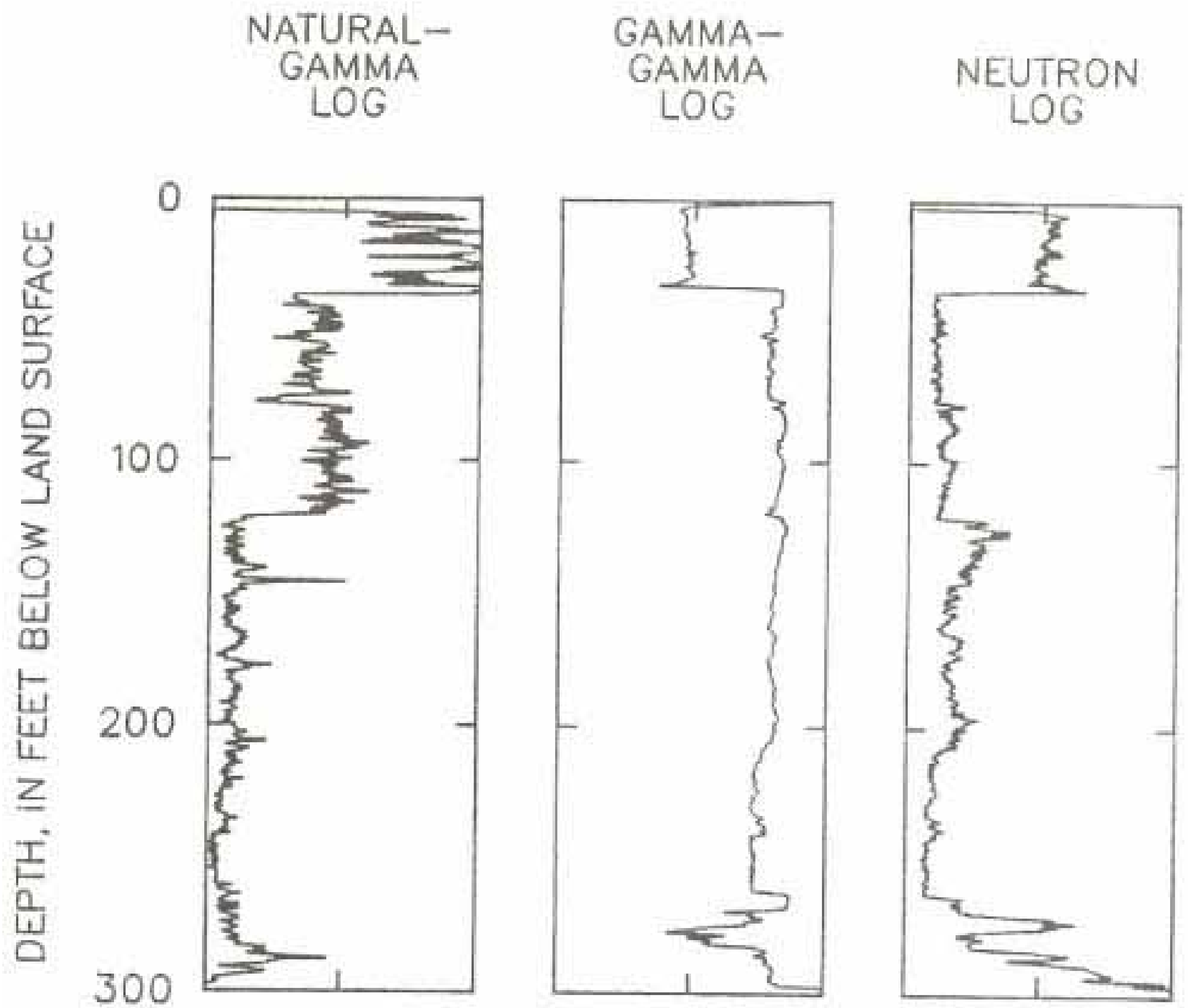
OK–04 29N–22E–25 AAA 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued

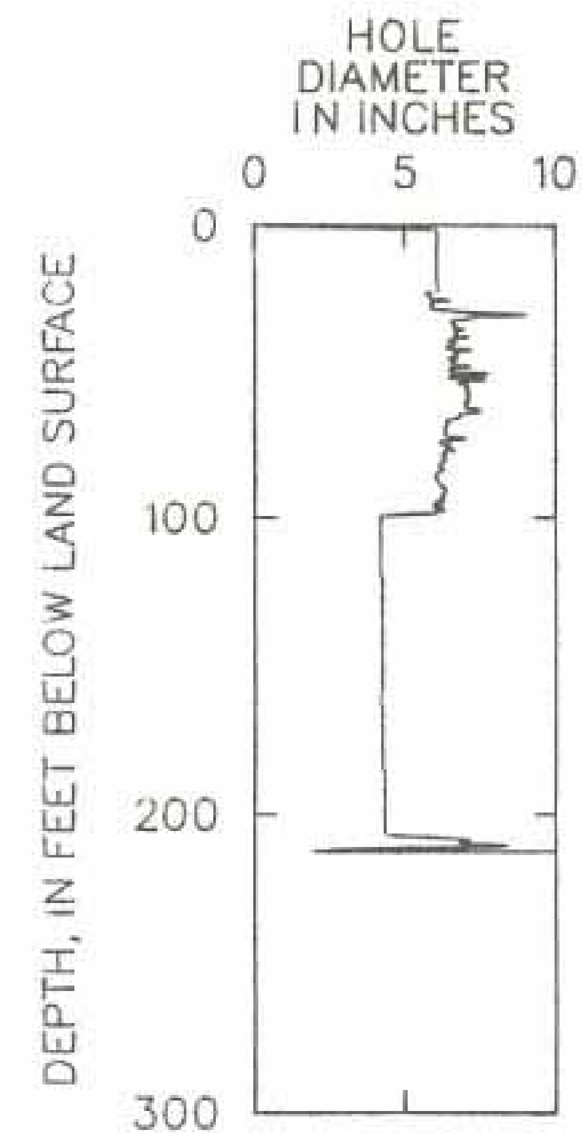


OK–05 29N–22E–25 ACB 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued

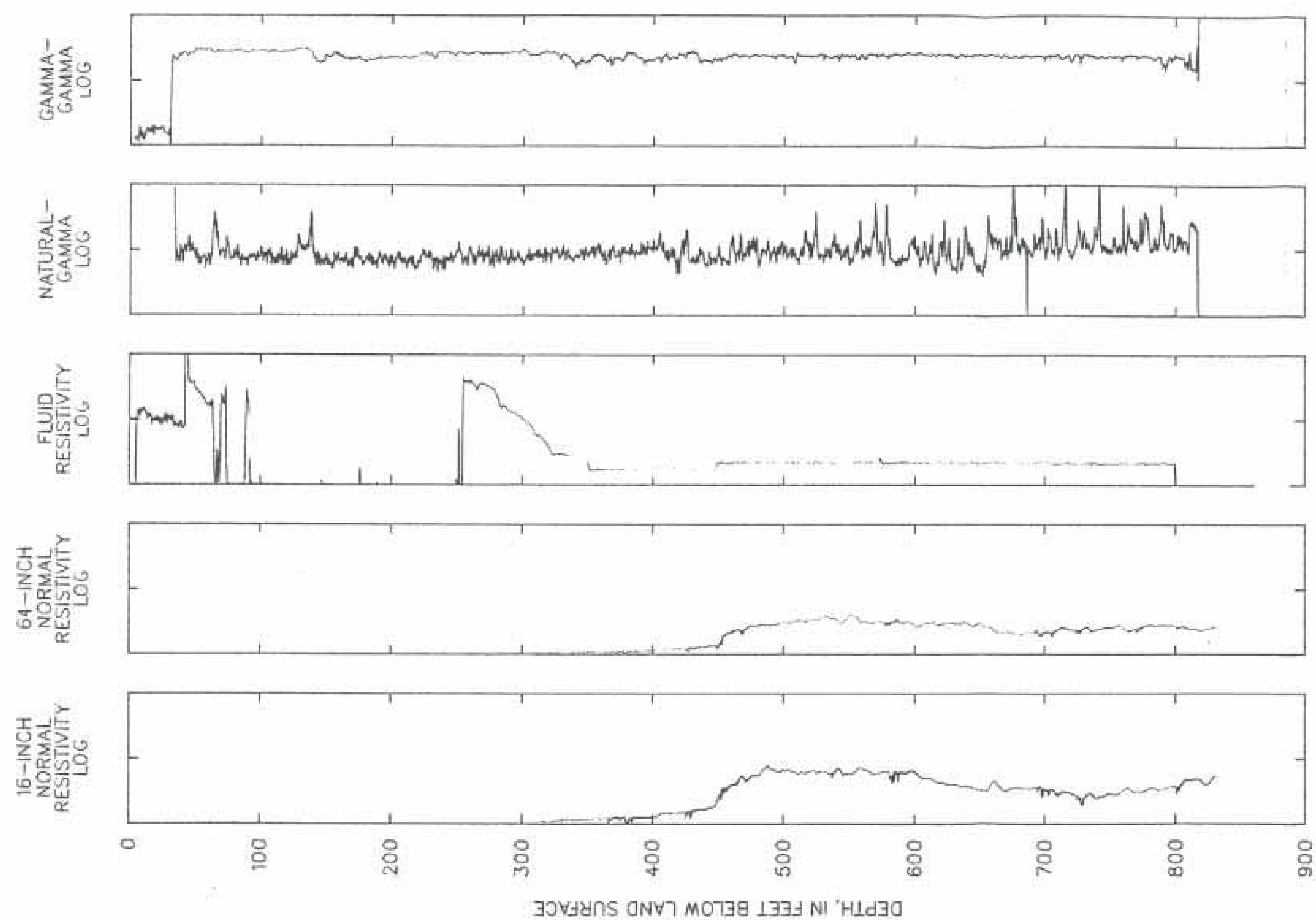


OK–06 29N–22E–25 AAD 1



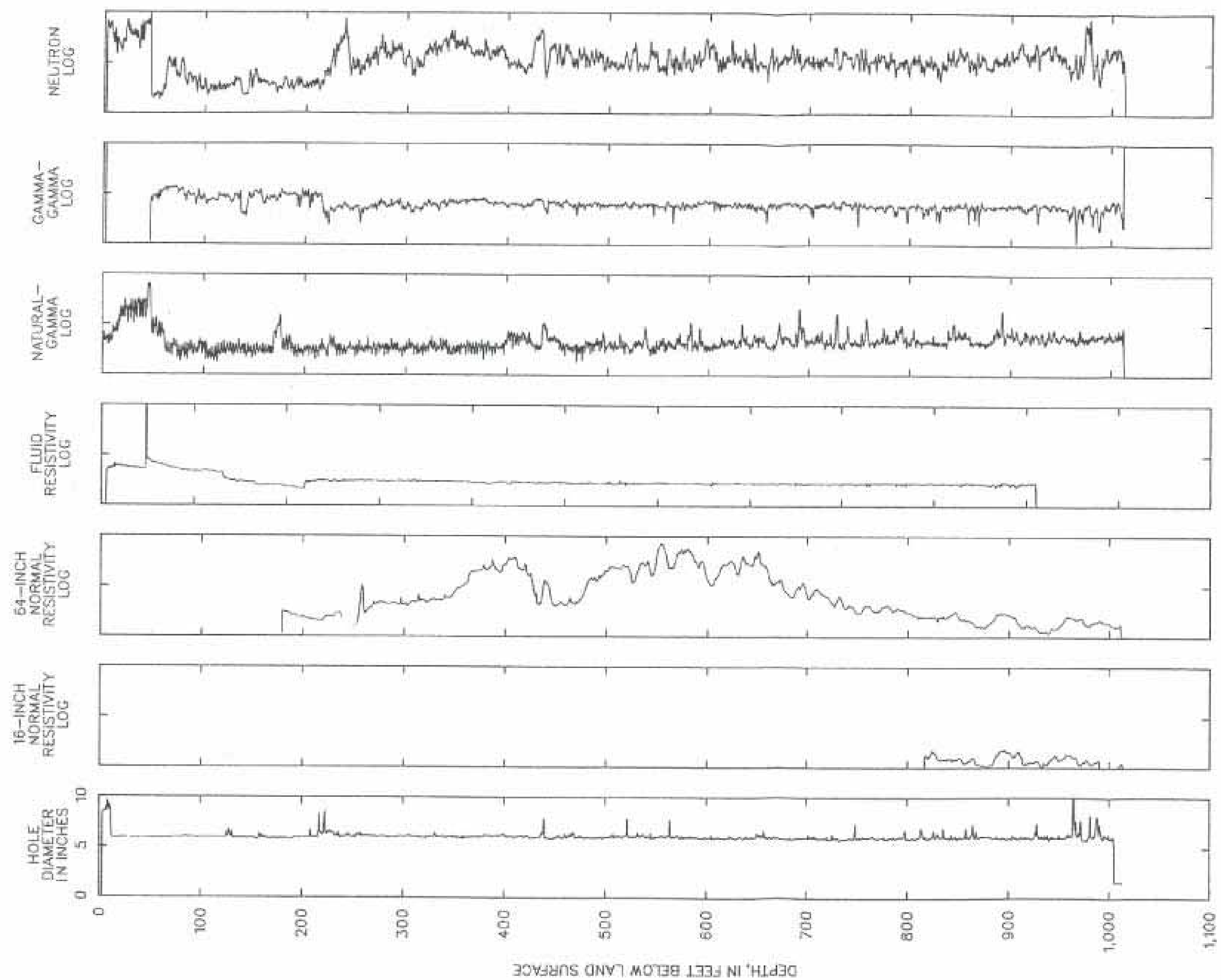
OK–09 29N–23E–13 DAC 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



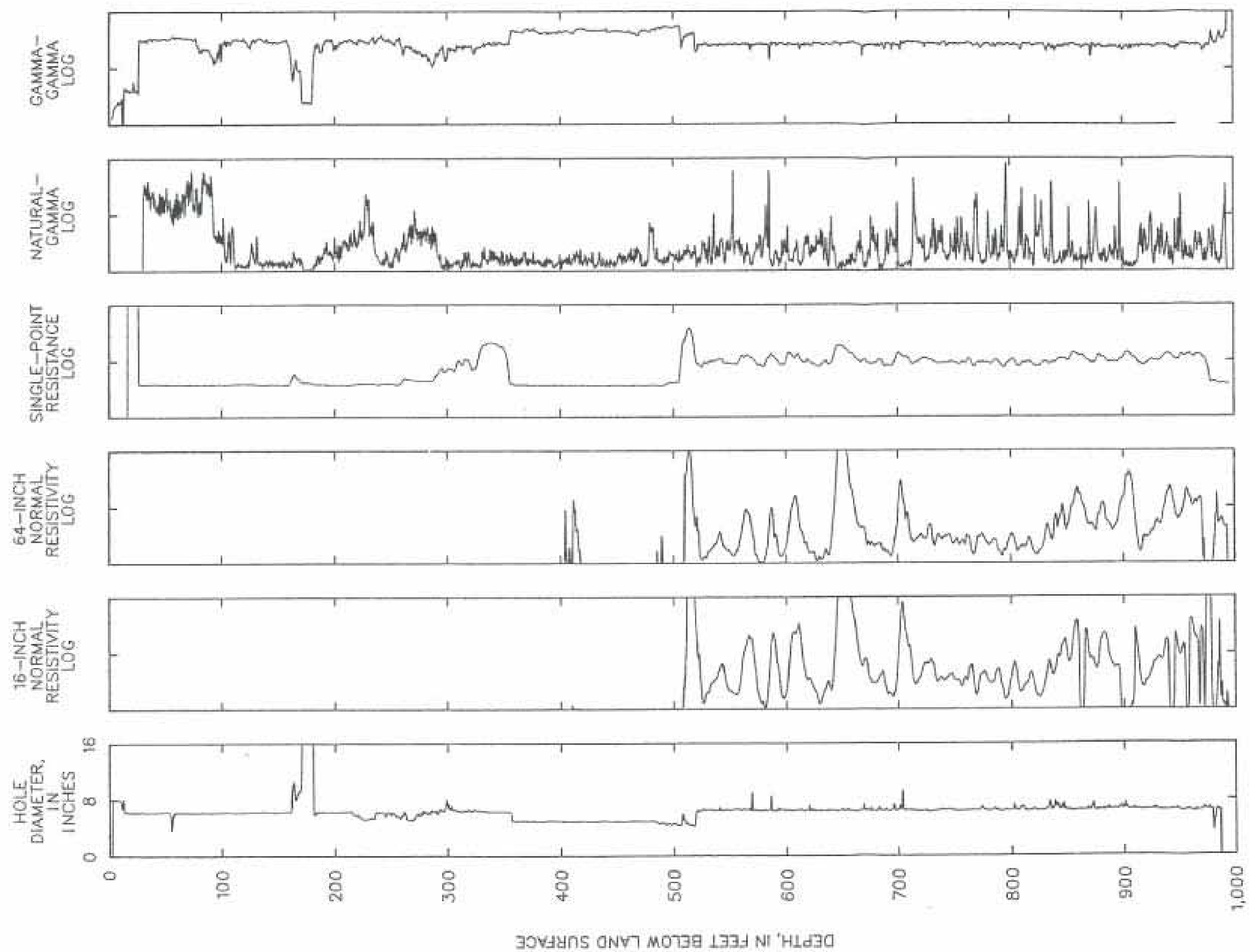
OK–10 29N–23E–15 ADD 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



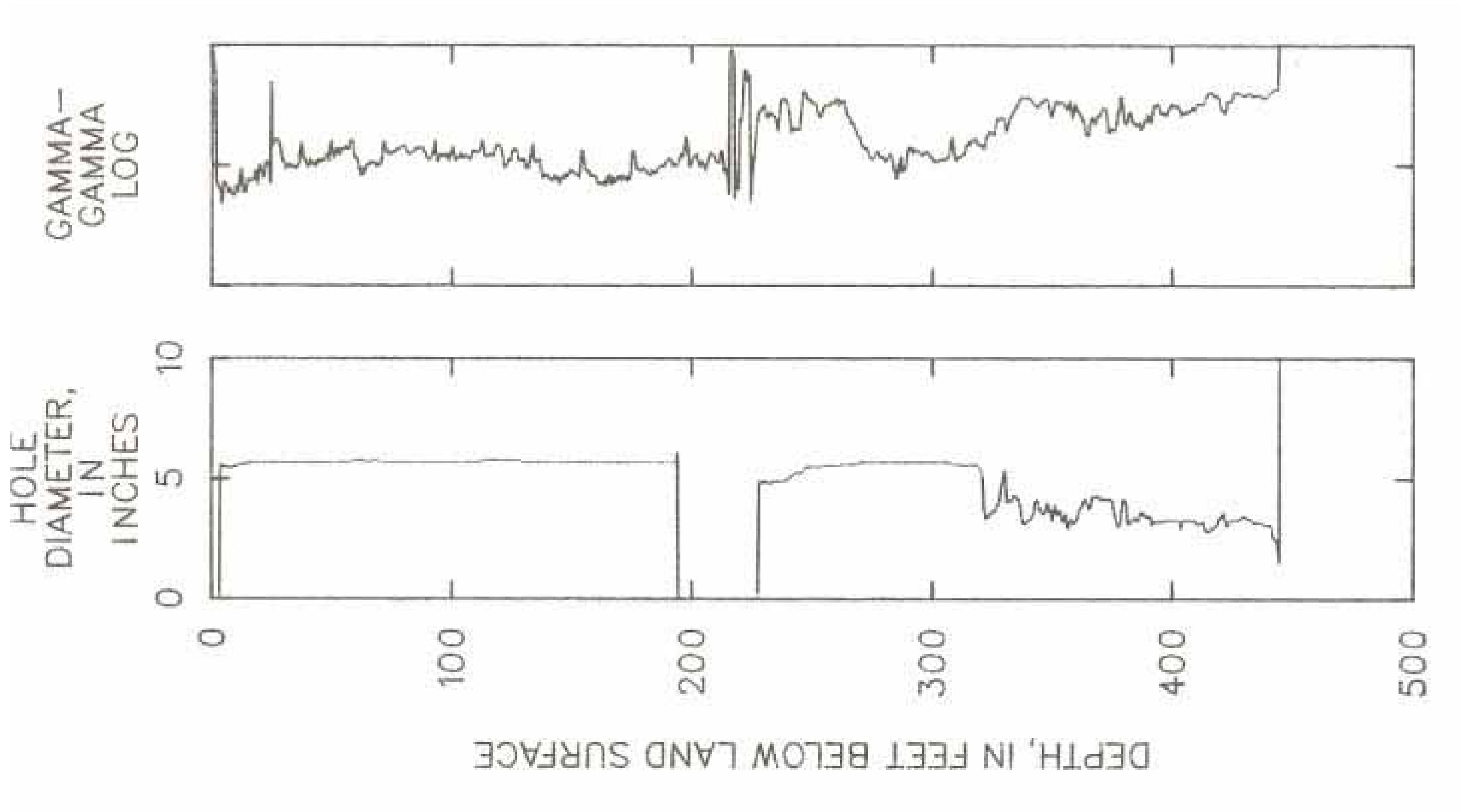
OK–11 29N–23E–15 CDB 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



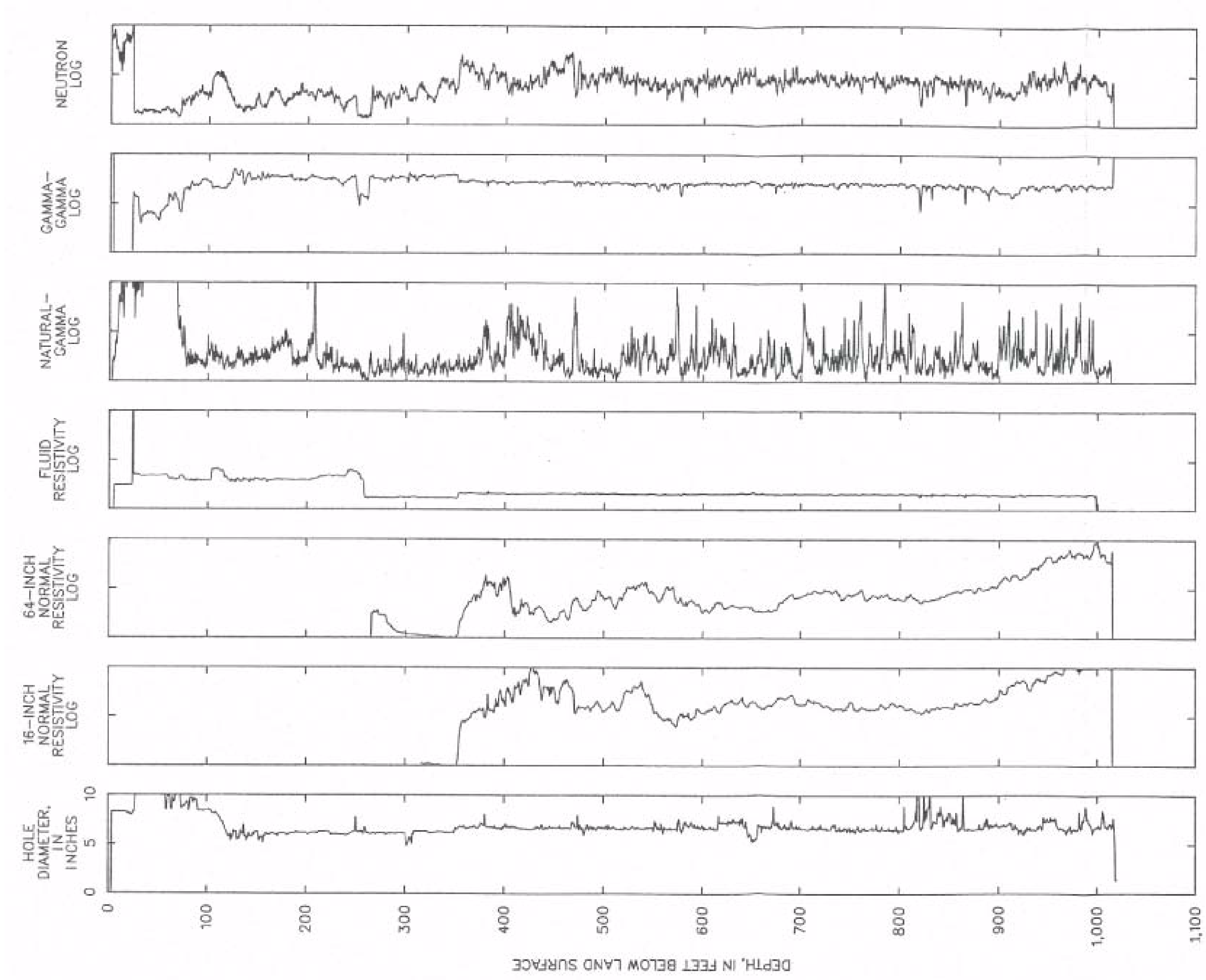
OK–14 29N–23E–17 CAC 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



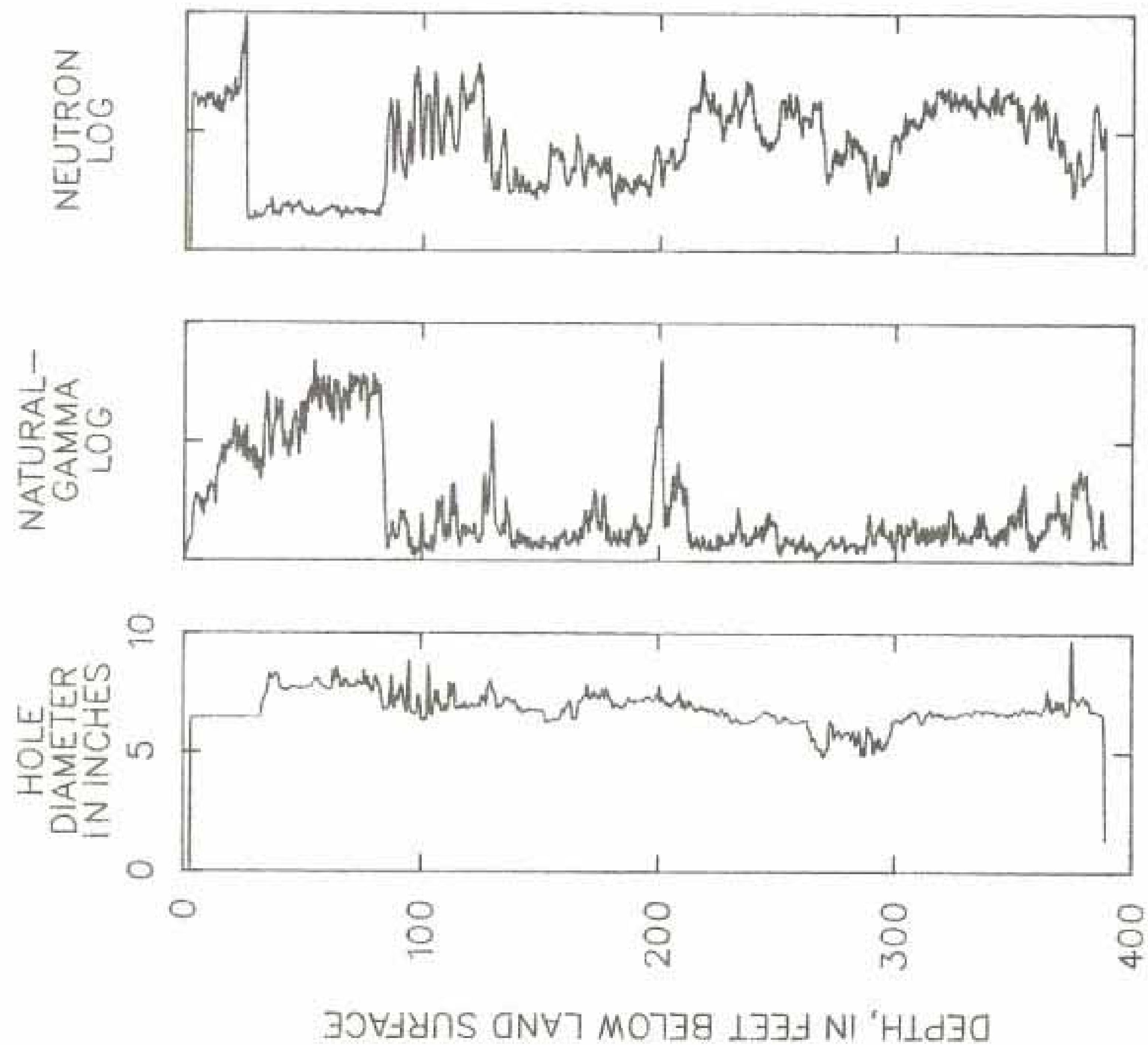
OK–15 29N–23E–19 CAA 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



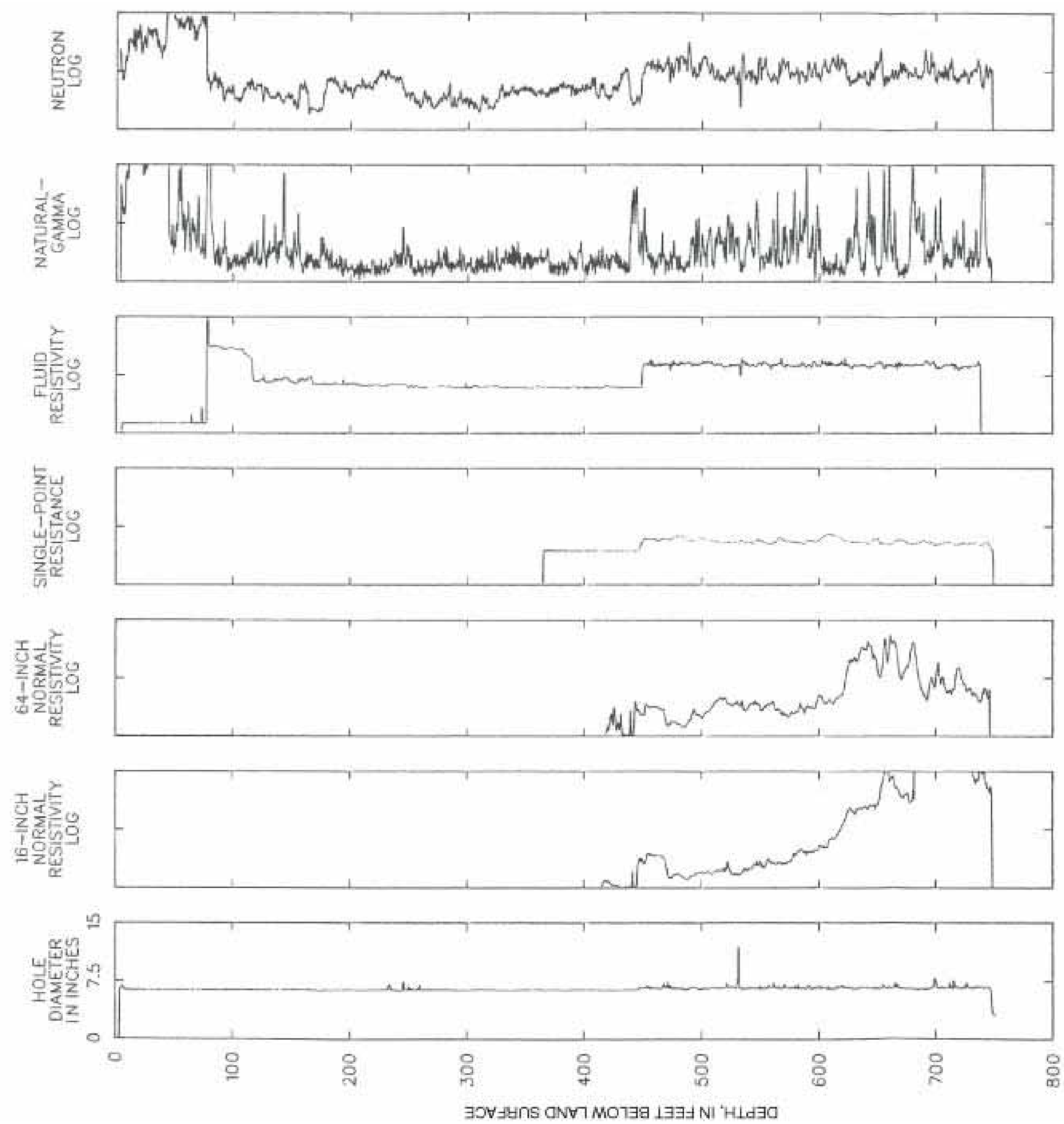
OK–16 29N–23E–20 AAA 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



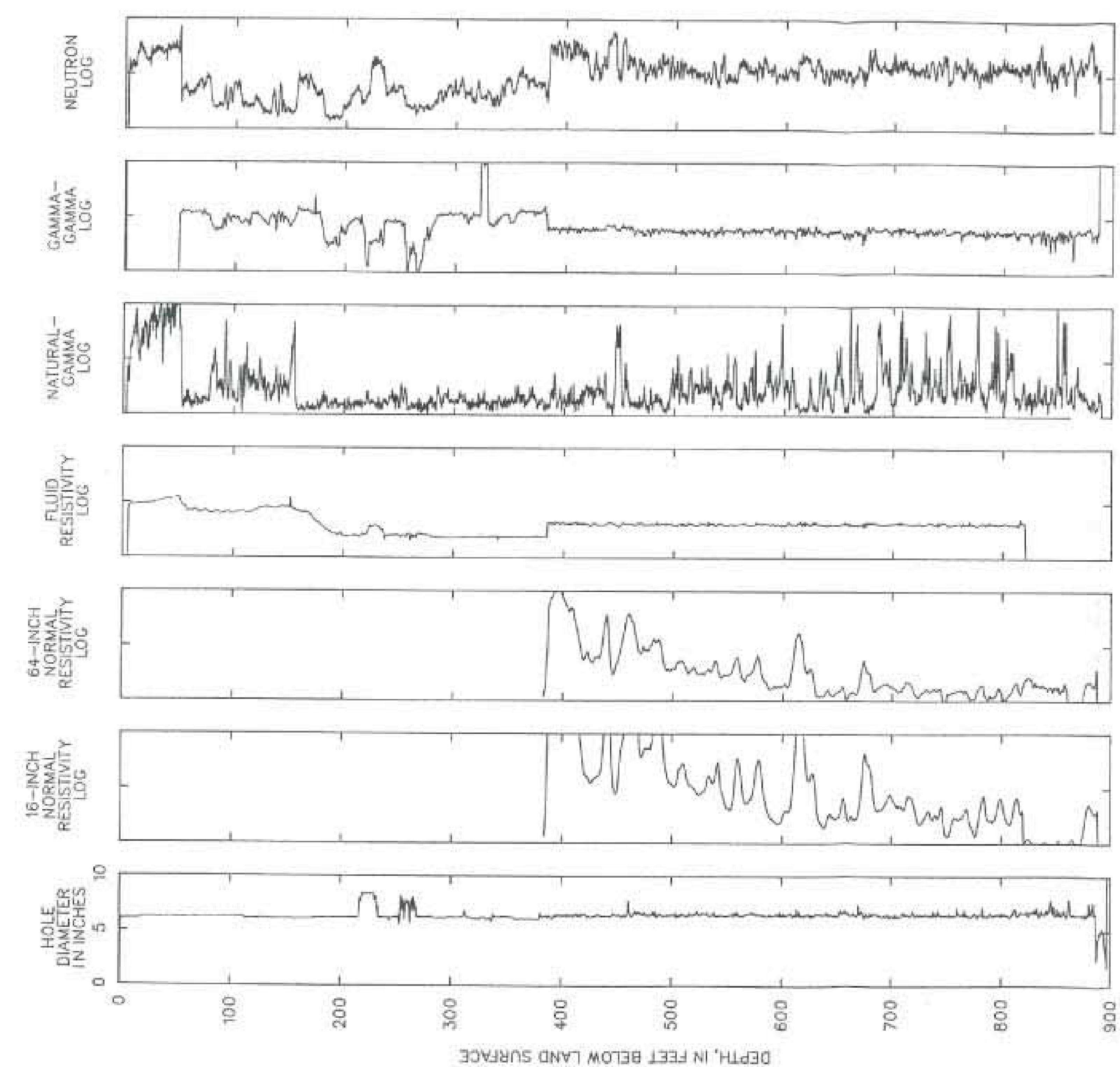
OK–18 29N–23E–DCA 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



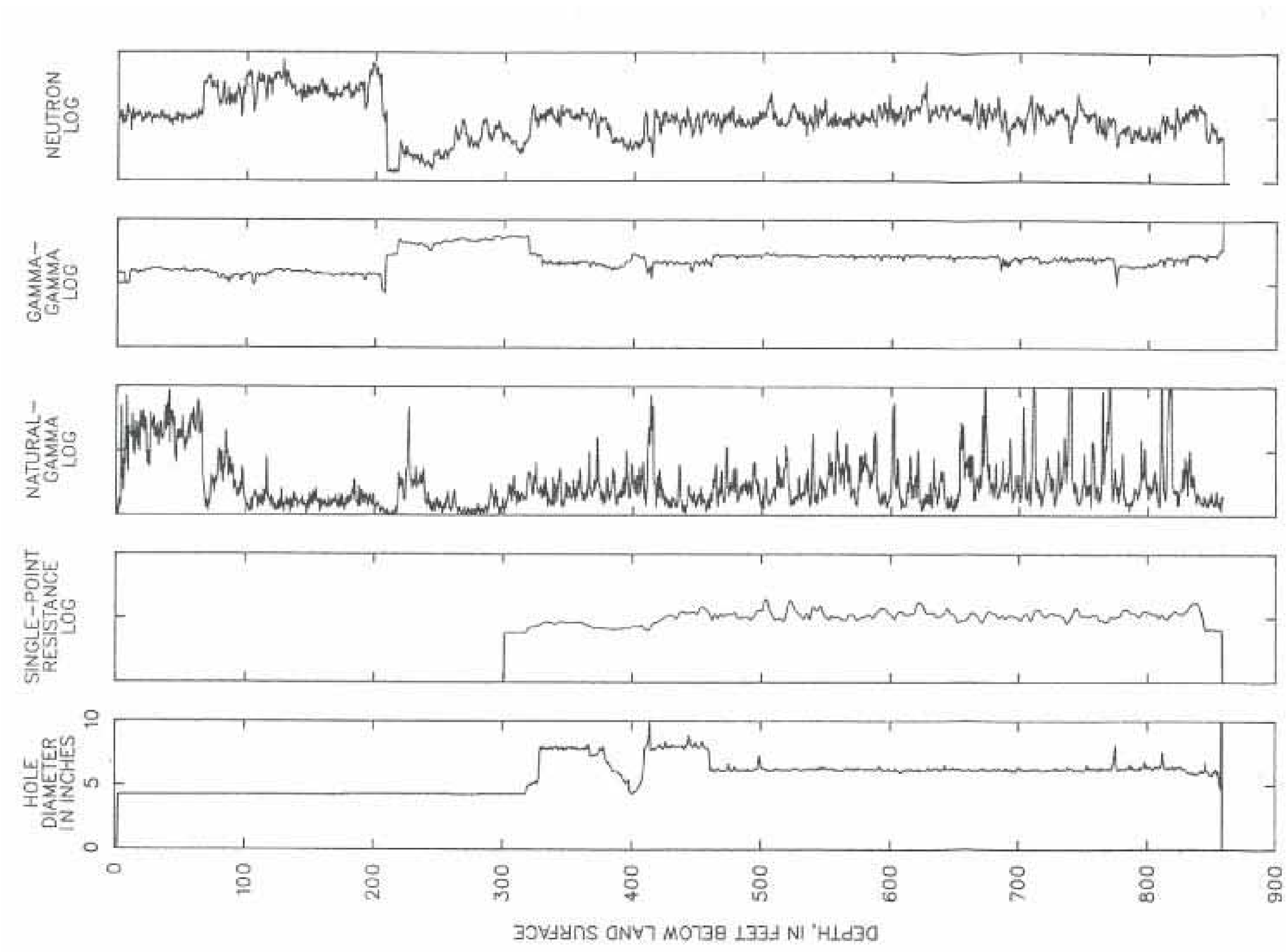
OK–20 29N–23E–23 AAC 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



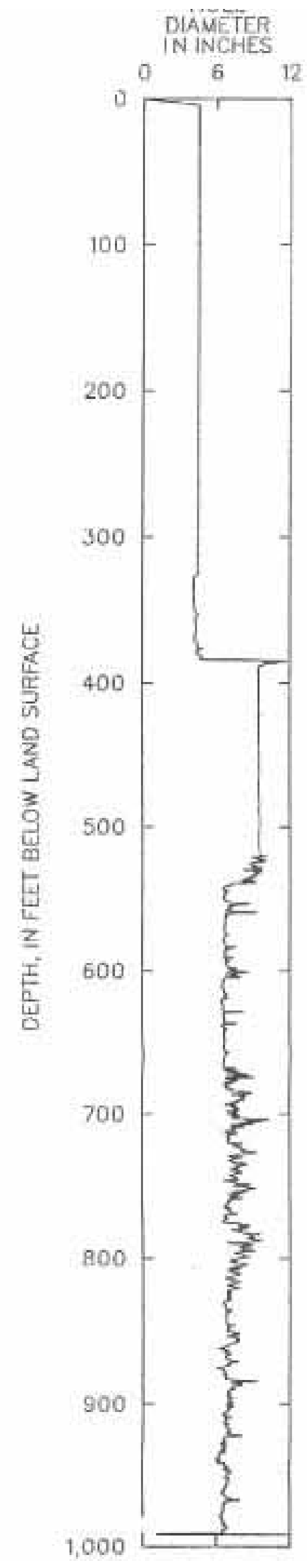
OK–21 29N–23E–23 CBB 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued

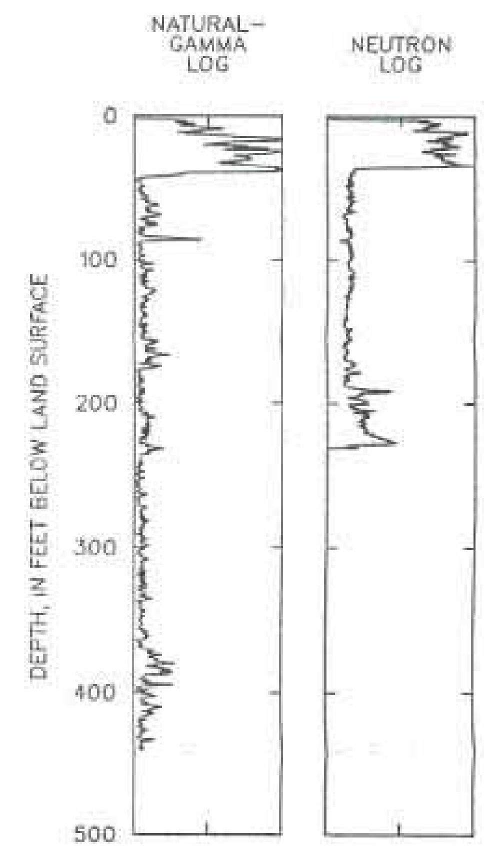


OK–29 29N–23E–30 AAC 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued

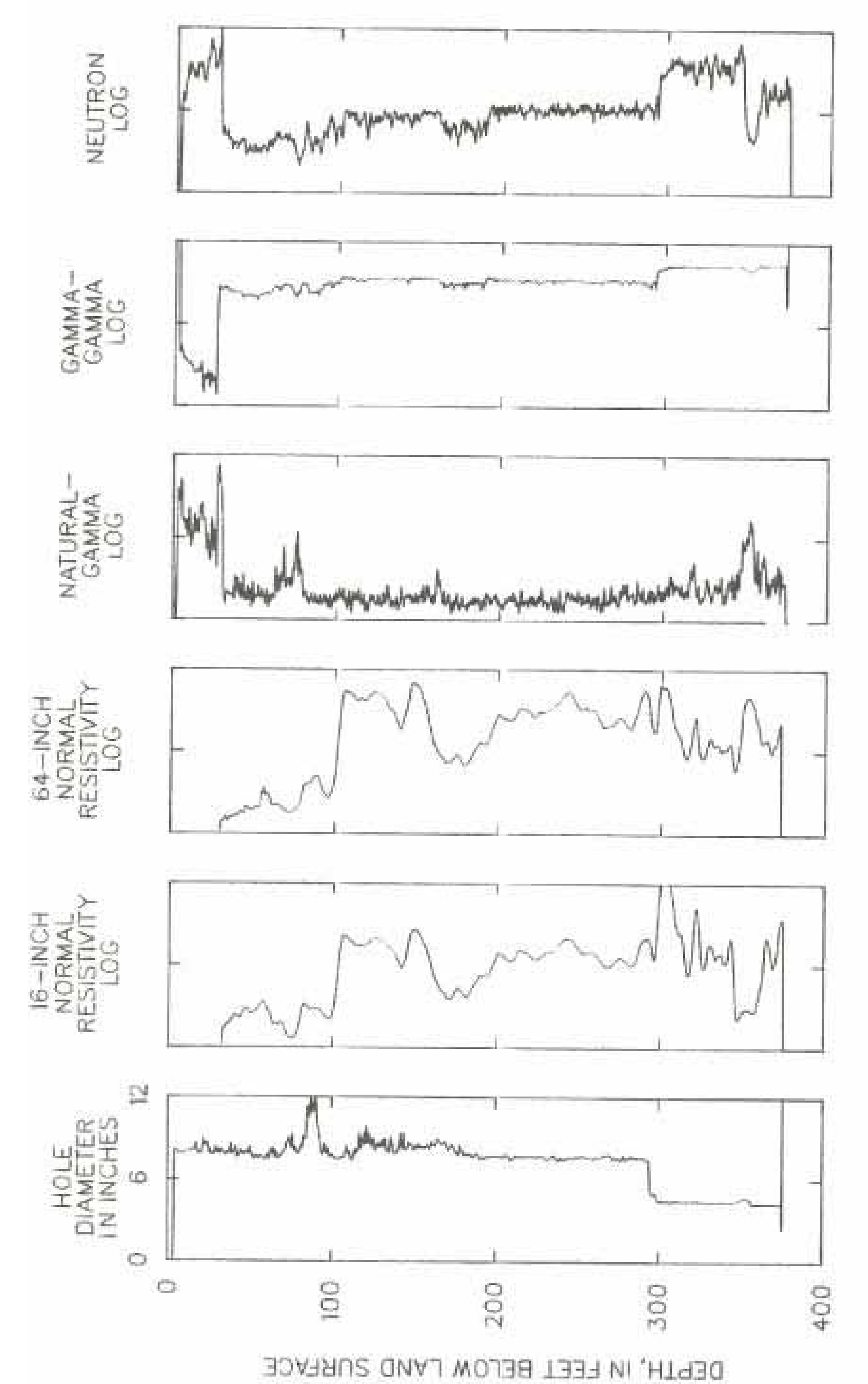


OK–31 29N–23E–31 BDC 2



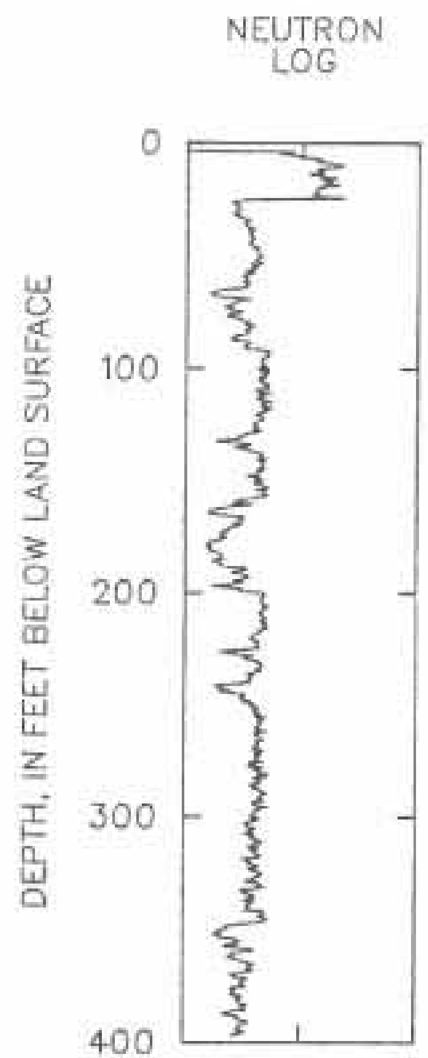
OK–34 29N–23E–35 ABB 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued

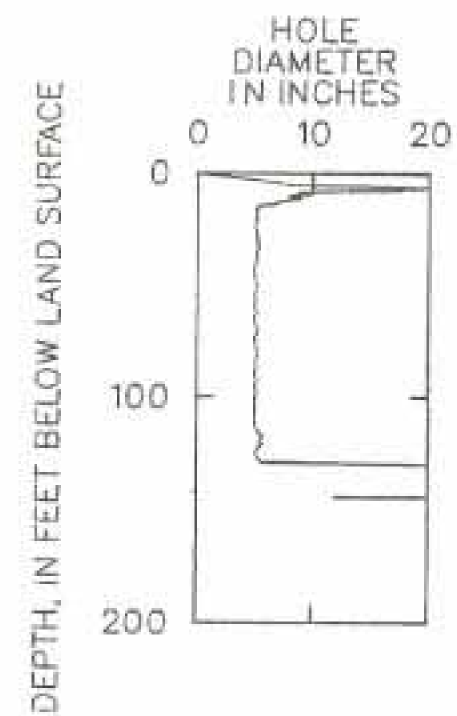


OK–35 29N–23E–35 DDD 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued

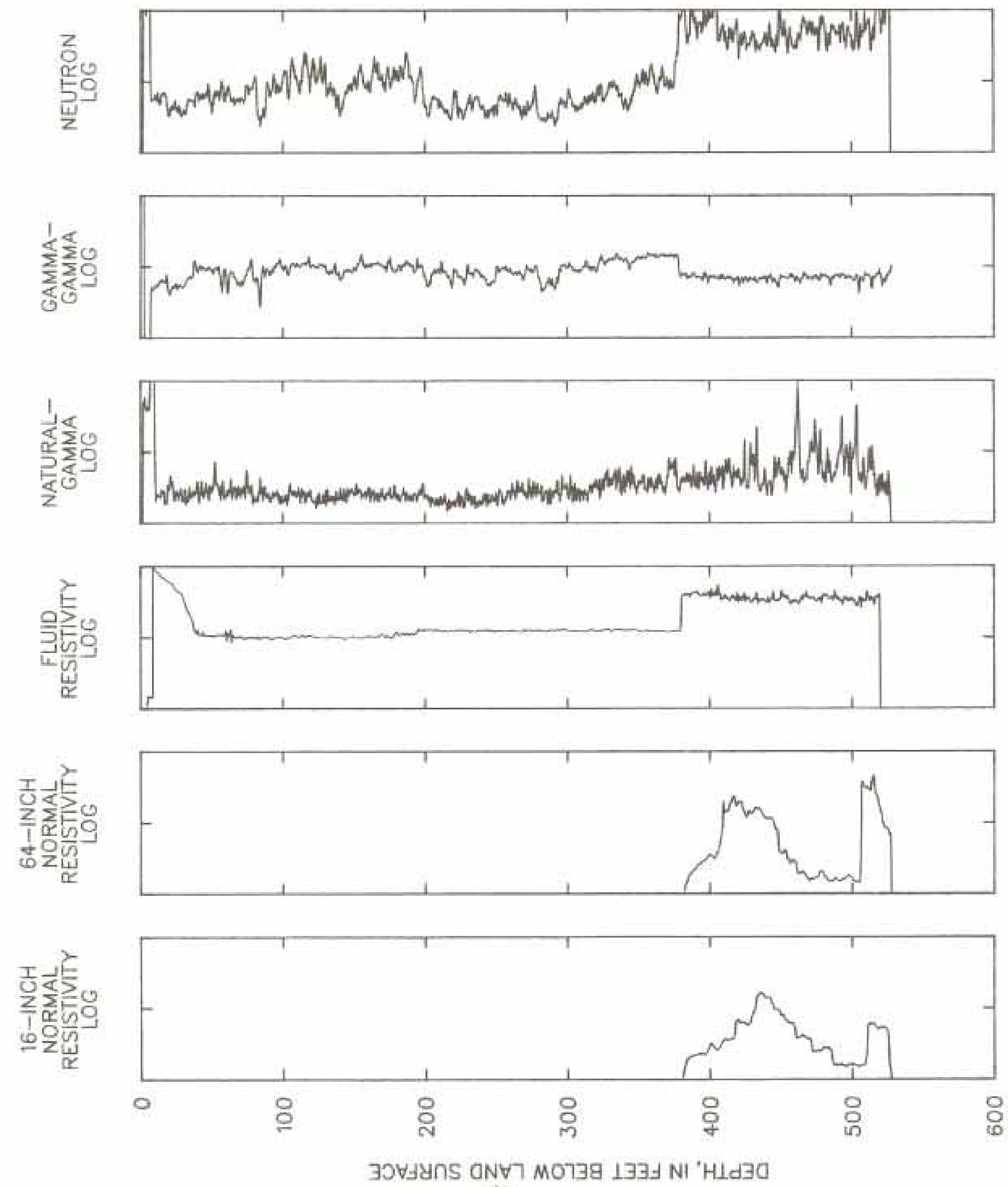


OK–36 29N–23E–35 DDC 1



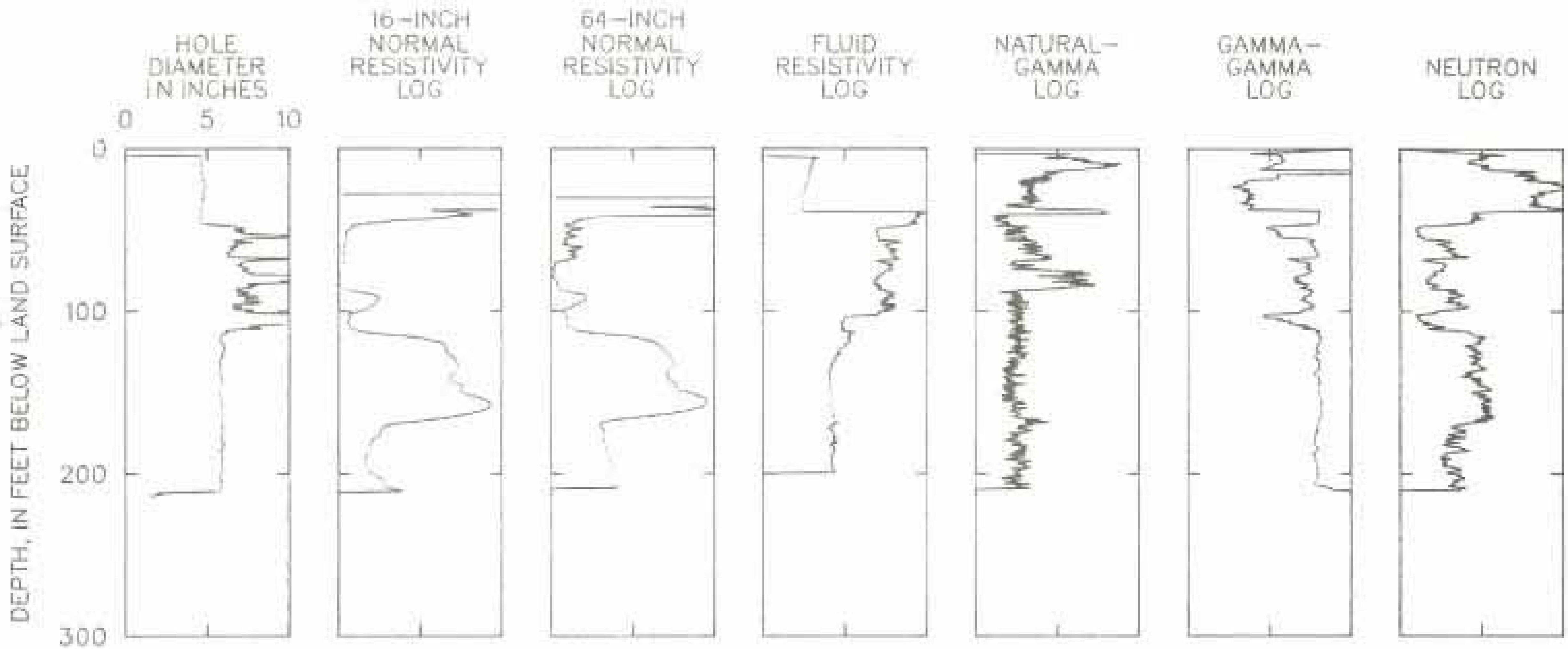
OK–37 29N–24E–17 BCA 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



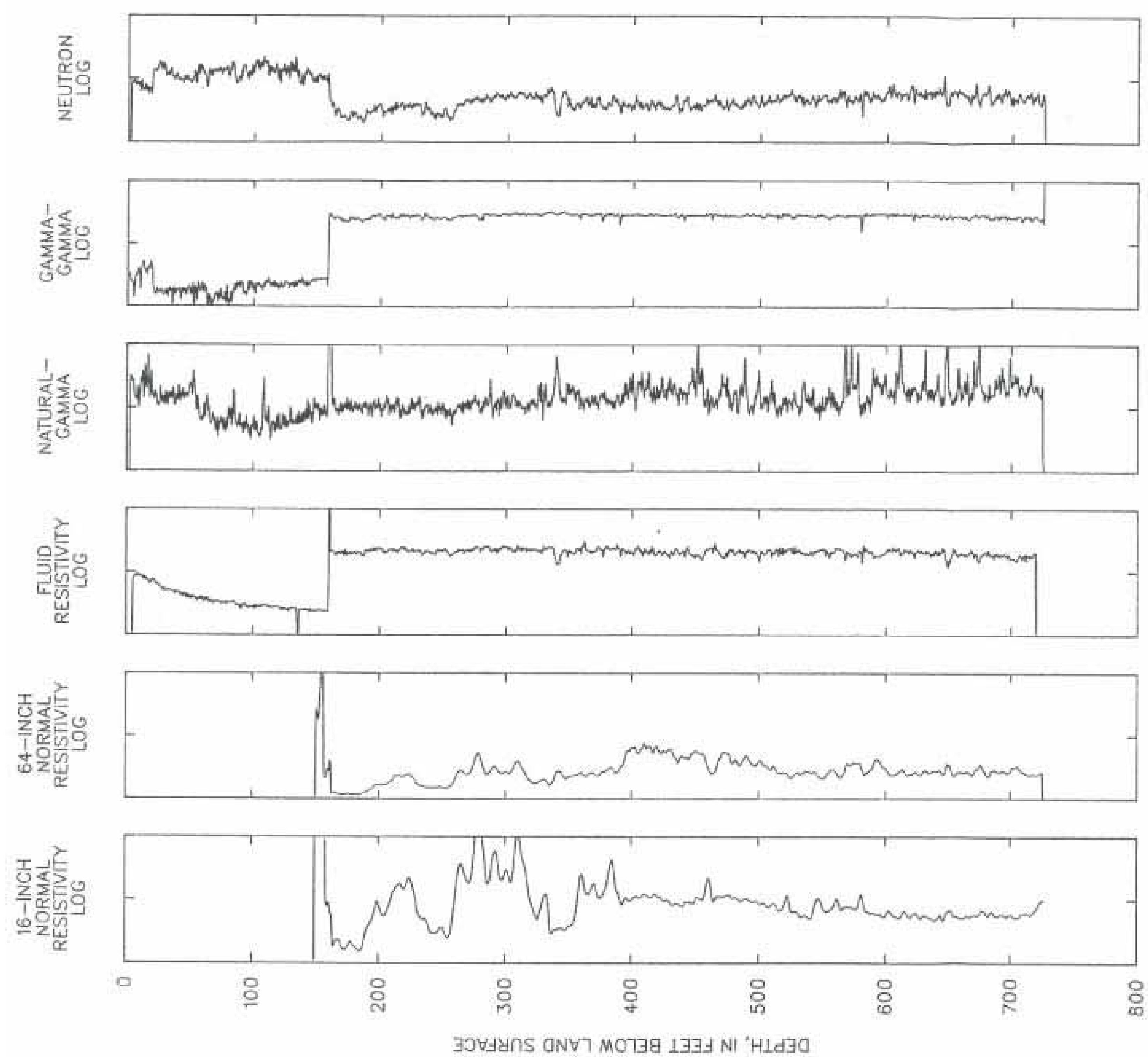
OK–38 29N–24E–19 AAD 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



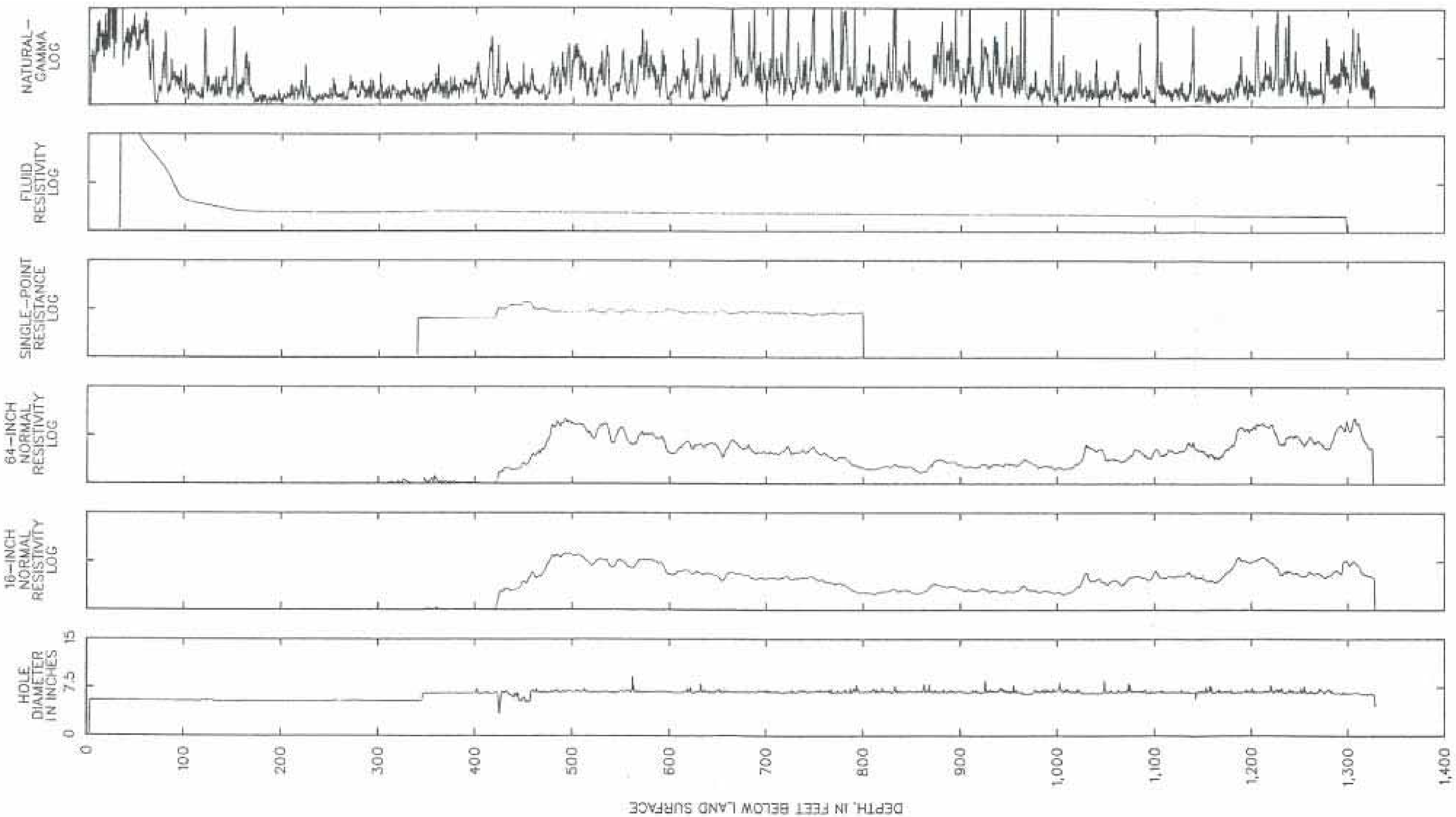
OK–39 29N–24E–31 ADC 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



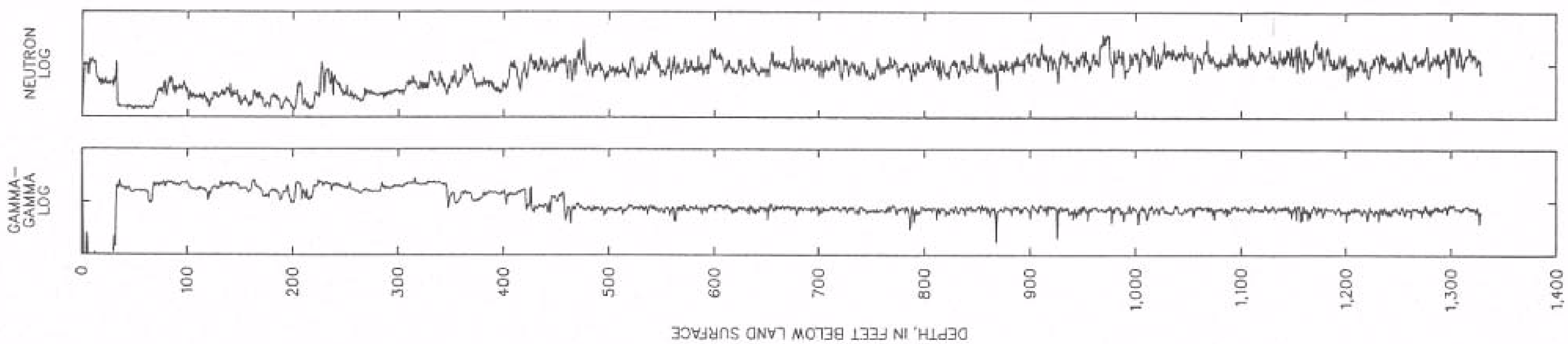
OK–40 29N–24E–32 BCC 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



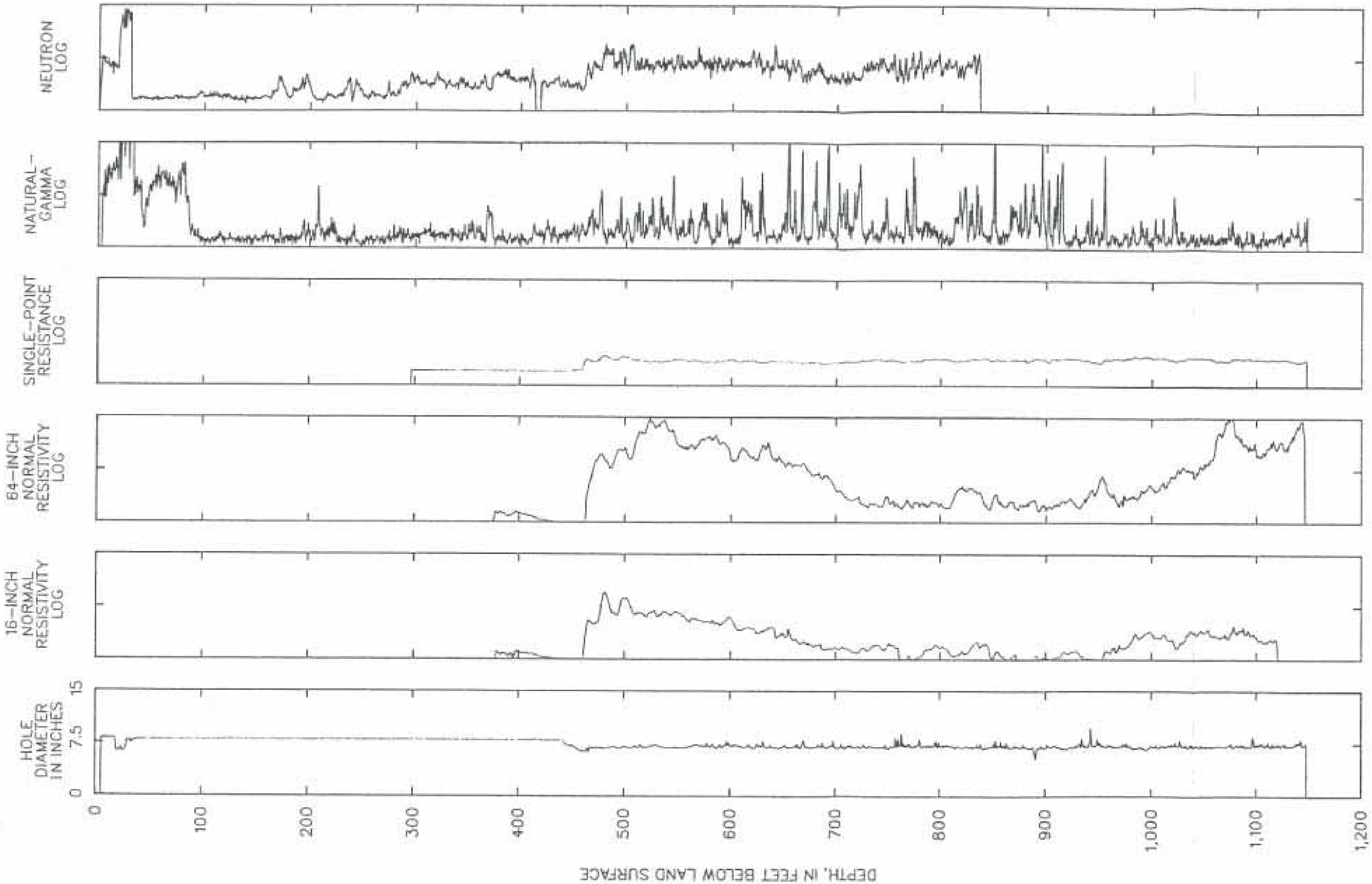
OK–2A 29N–23E–20 CAA 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



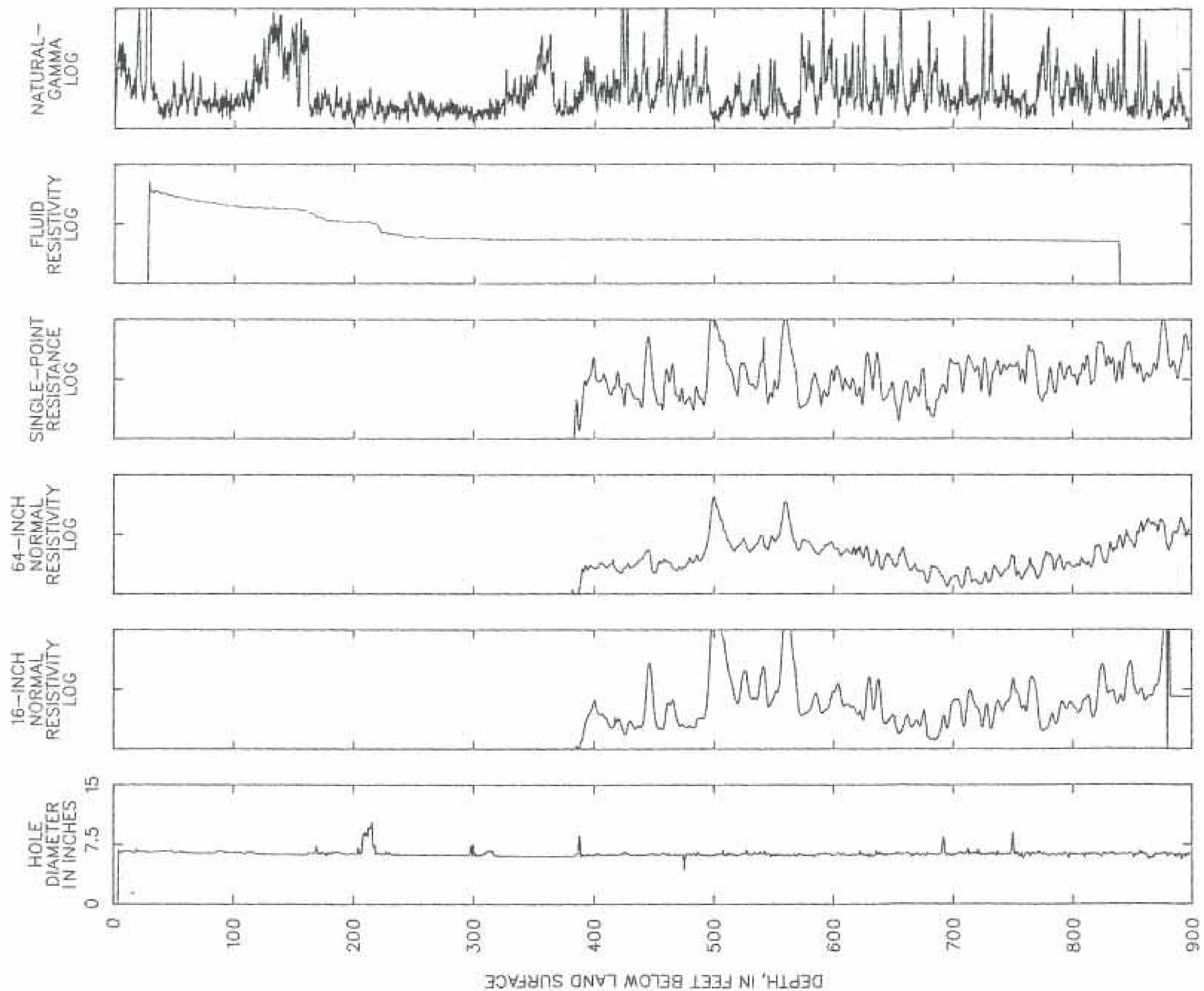
OK–2A 29N–23E–20 CAA 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



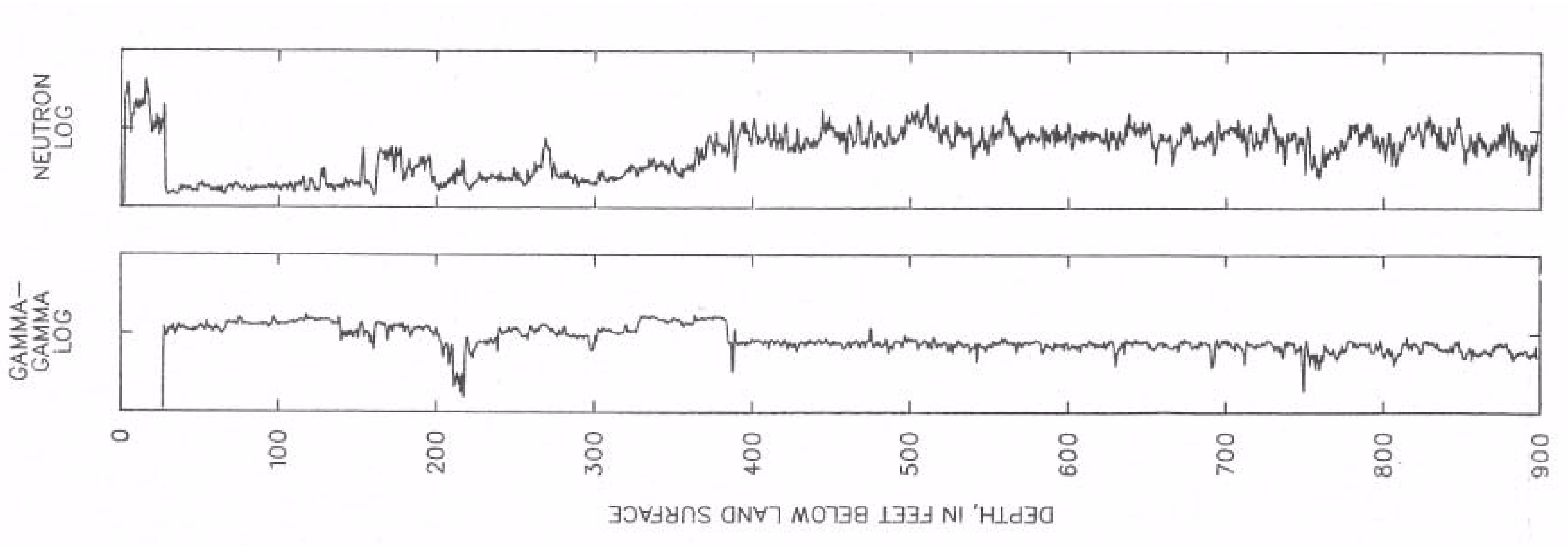
OK–7A 29N–23E–18 DBC 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



OK–9A 29N–23E–32 ADD 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued



OK–9A 29N–23E–32 ADD 1

Figure 2. Geophysical logs of selected wells in the Roubidoux aquifer, northeast Oklahoma and southeast Kansas.—Continued