Hydrogeological Data Collected from a Test Well in Barceloneta, Puerto Rico

By Carlos Conde-Costas

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CONVERSION FACTORS AND ABBREVIATED UNITS

Multiply	By	To obtain
foot	0.348	meter
inch	25.4	millimeter
mile	1.609	kilometer
million gallons	0.04381	cubic meter
million gallons per day	0.04381	cubic meter per day
square mile	259.0	hectare
cubic feet per second	448	gallons per minute

Temperature: In this report temperatures are given in degrees Celsius (°C). Temperatures may be converted to degrees Fahrenheit (°F) as follows:

$$°F = (9/5 \times °C) + 32$$

Abbreviated water-quality units used in this report:

micrograms per liter (µg/L)
milligrams per liter (mg/L)
microsiemens per centimeter at 25 °C (µS/cm)

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Abstract

A test well was drilled and installed into the north coast limestone sequence in Barceloneta, Puerto Rico, during September and November 1995. Water-quality, geologic, and hydraulic data were collected during drilling of this test well. The test well was drilled to a depth of 1,800 feet by using a dual-wall reverse circulation rotary drill rig. The water-table surface was located at a depth of about 235 feet below land surface. The upper aquifer was identified in the Aymamón Limestone and Aguada Limestone which extend 700 feet below land surface. The lower aquifer was found in the Montebello Limestone Member of the Cibao Formation and Lares Limestone which were penetrated beginning at a depth of 868 feet to the bottom of the well at 1,800 feet below land surface. The maximum potentiometric head in the lower aquifer was 4 feet below land surface. The confining unit between the upper and lower aquifers was an impermeable calcareous claystone, found from 700 to 868 feet below land surface.

Water samples for common ions, nutrients, trace metals, synthetic organic compounds (halogenated and aromatic hydrocarbons), and physical properties (temperature, pH, specific conductance, and alkalinity) were obtained from the upper aquifer at 440 feet below land surface and from the lower aquifer at a depth of 1,780 feet below land surface. The geochemical analyses indicate that ground water from both aquifers is predominantly a calcium-bicarbonate type.

Concentrations of common constituents, trace metals, and nutrients in the upper and lower aquifers were within the normal range for the geologic formations penetrated. Nevertheless, the sample obtained at a depth of 1,780 feet contained anomalous concentrations of lead, 20 micrograms per liter (normal < 10 micrograms per liter); molybdenum, 30 micrograms per liter (normal < 10 micrograms per liter); total ammonia nitrogen as N, 1.5 milligrams per liter (normal < 0.2 milligrams per liter as N); and total nitrite and nitrate as N, 1.3 milligrams per liter (normal < 0.1 milligrams per liter as N). The water sample obtained from the completed well contained an anomalous concentration of dissolved mercury, 0.2 micrograms per liter (normal < 0.1 micrograms per liter), and nitrogen species. Concentrations of synthetic organic compounds (halogenated and aromatic hydrocarbons) in the upper and lower aquifers were below the detection limits of the analytical procedures used, 0.1 micrograms per liter.

INTRODUCTION

During September and November 1995 a test well was drilled at Nycomed Puerto Rico Inc., Barceloneta, Puerto Rico (fig. 1) as part of a study of inter-aquifer water movement by the Puerto Rico Industrial Development Company, the Puerto Rico Department of Natural and Environmental Resources and the U.S. Geological Survey. The inter-aquifer study was initiated to investigate the greater than anticipated loss of hydrostatic pressure from the north coast lower (artesian) aquifer system. This report contains hydrogeologic data collected during the drilling operations of the test well drilled into the North Coast limestone sequence in Barceloneta, Puerto Rico.

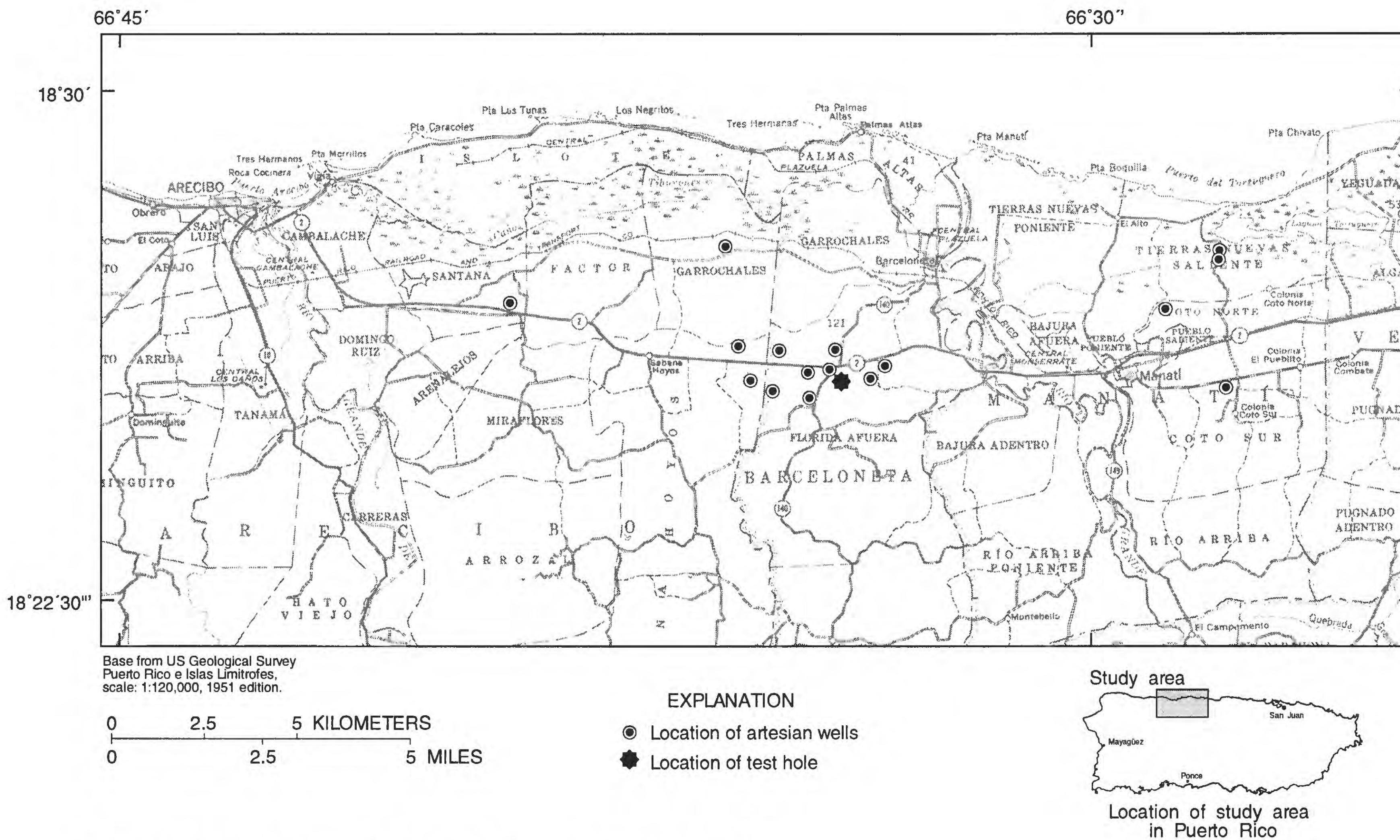

Figure 1. Location of artesian wells on the north coast of Puerto Rico.

Test-well drilling was completed by using a dual-wall reverse circulation rotary drill rig. Use of this type of drill rig is often referred to as dual-wall or dual-tube drilling. This method of drilling uses flush-jointed, double-walled pipe in which the drilling fluid, usually air, is injected down the annulus between the two pipes, with cuttings and ground water returned through the inner pipe. The drill pipe can be connected directly to a variety of drill bits which may include a down-hole air hammer, tricone bit, or open-center coring bit. By using the open-center coring bit on the test well, it was possible to collect continuous cores while drilling through the upper (unconfined) and lower aquifers at the site. The cores were used to improve geologic descriptions of the north coast aquifers at the drill site in terms of aquifer thickness and the location and thickness of the confining beds between the aquifers. The dual-tube method of drilling also allowed for the collection of hydraulic head and water-quality samples at depth-specific intervals.

During the course of the drilling, the cores and cuttings that were collected from the test well were stored in plastic core boxes which holds 20 feet of core or cuttings per box. Specific conductance measurements were made every 10 feet. Depth to the water surface was also determined during drilling (fig. 2). Following completion of the test well, two tests to estimate aquifer yield were conducted (at 500 and 1,800 feet below land surface datum).

Water quality samples were also collected at three distinct depths within the test well (one upper aquifer sample at 440 feet and two lower aquifer samples at 1,158 and 1,780 feet below land surface datum). Samples collected were analyzed for common ions, nutrients, trace metals, and synthetic organic compounds (halogenated and aromatic hydrocarbons). Physical characteristics (temperature, pH, specific conductance, and alkalinity) were also measured on site. Detailed information on the procedures and methods used for on site measurements and laboratory analyses, as well as for collecting, treating, and shipping samples are given in the following U.S. Geological Survey publications "Techniques of Water Resources Investigations of the U.S. Geological Survey" Book 1, Chapter D2 and Book 5, Chapter A1.

RESULTS

The test well was drilled to a depth of 1,800 feet during September and November 1995. The test well penetrated the north coast limestone sequence (table 1). The upper aquifer was found in the Aymamón Limestone and Aguada Limestone which extend 700 feet below land surface. The water-table surface was located at a depth of about 235 feet below land surface (fig. 2). The lower aquifer is found in the Montebello Limestone Member of the Cibao Formation and Lares Limestone which were penetrated beginning at a depth of 868 feet to the end of the hole at 1,800 feet below land surface.

Table 1. General geologic units in the test well completed at Barceloneta, Puerto Rico (land surface altitude of the test well is approximately 250 feet above mean sea level)

Geologic Unit	Depth below land surface in feet
Aymamón Limestone and Aguada Limestone	0 - 700
Upper Member of the Cibao Formation	700 - 868
Montebello Limestone Member of the Cibao Formation	868 - 1,660
Lares Limestone	1,660 - 1,800

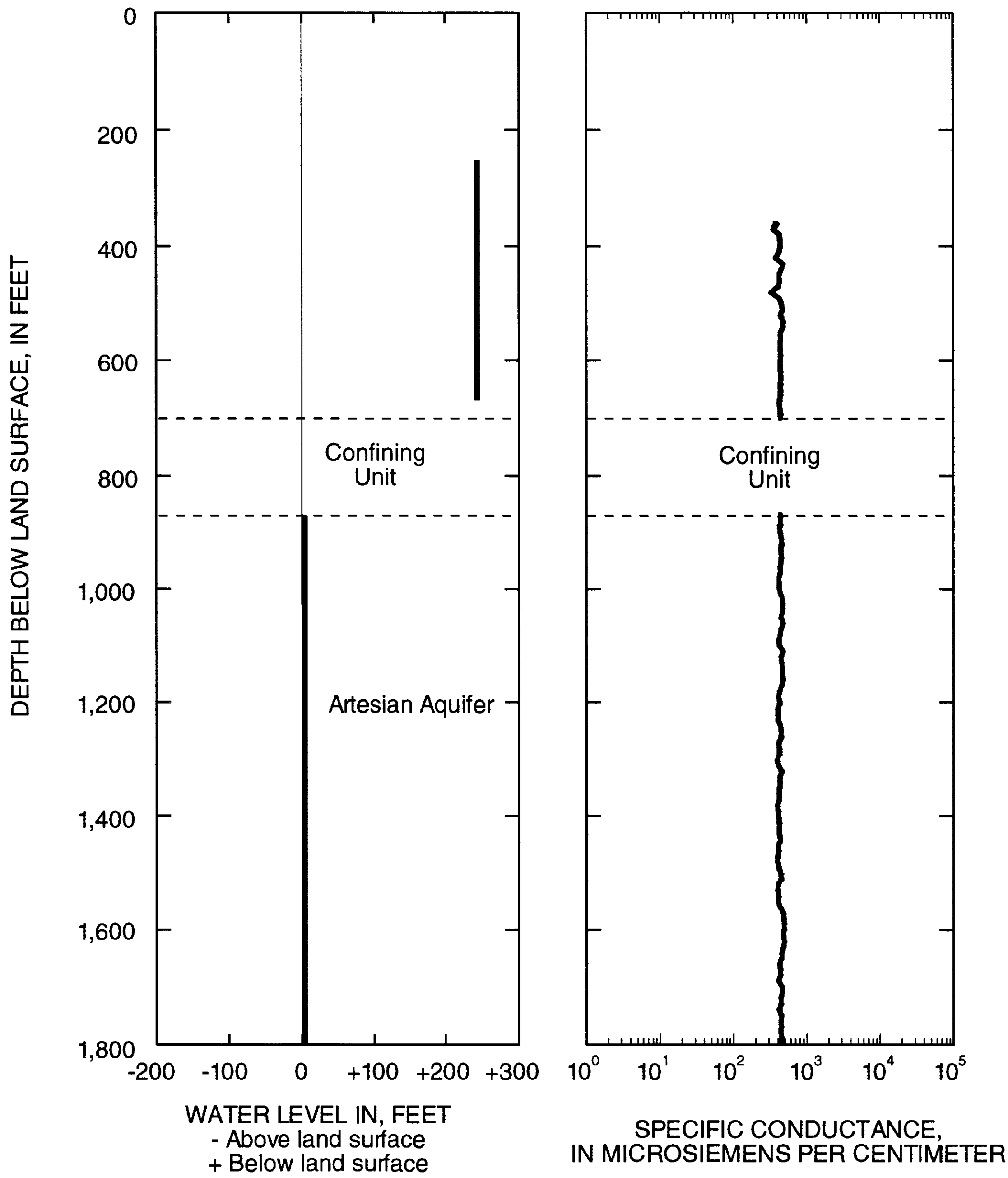

Figure 2. Water level and specific conductance data obtained during the drilling of the test well in Barceloneta, Puerto Rico.

The maximum potentiometric head in the lower aquifer was 4 feet below land surface. The confining unit between the upper and lower aquifers is an impermeable calcareous claystone, found from 700 to 868 feet below land surface.

To obtain an estimate of relative yield in the well, two flow tests were conducted. The first test was conducted on September 14, 1995, in the upper aquifer. Discharge was measured from the 3-inch diameter inner pipe of the double walled dual-tube drill pipe. The test was conducted by raising the bottom of the drill pipe to a depth of 440 feet below land surface, leaving an open well bore interval of 60 feet, and then air-pumping the well to force discharge from the inner pipe. This measured flow was 116 gallons per minute. The second flow test was made in the lower aquifer and was conducted on September 26, 1995, by placing the bottom of the drill pipe at a depth of 1,760 feet below land surface, leaving an open well bore interval of 40 feet. Air-pumping at this interval yielded a flow of 264 gallons per minute.

Complete water samples for common ions, nutrients, trace metals, and synthetic organic compounds (halogenated and aromatic hydrocarbons), and physical properties (temperature, pH, specific conductance, and alkalinity) were obtained from the upper aquifer at 440 feet below land surface and from the lower aquifer at a depth of 1,780 feet below land surface during drilling on September 14 and 26, 1995. Another sample was obtained on November 29, 1995, when the well was completed (cased to 1,158 feet below land surface) and left open to the aquifer from 1,158 to 1,800 feet. Water samples were analyzed at the U.S. Geological Survey National Water Quality Laboratory in Arvada, Colorado.

Starting a depth of 360 feet below land surface, water samples for specific conductance were collected every 10 feet during drilling. The specific conductance in the upper aquifer averaged 410 microsiemens per centimeter (µS/cm) at 25 degrees Celsius and ranged from 320 near the water-table surface to 450 µS/cm (fig. 2). The specific conductance in the lower aquifer within the Montebello Limestone Member of the Cibao Formation averaged 430 µS/cm and ranged from 390 to 500 µS/cm, while in the Lares Limestone specific conductance averaged 450 µS/cm and ranged from 410 to 470 µS/cm. The geochemical analyses (tables 2 and 3; table 3 at end of report) of ground-water samples collected from the upper and lower aquifers indicate that ground water is predominantly a calcium-bicarbonate type in which the chemical properties of the water are dominated by alkaline earths (calcium and magnesium) and weak acids (bicarbonate) (Hem, 1989). The geochemical analyses of the first two samples are plotted in the Piper diagram in figure 3.

Table 2. Water-quality field determinations from test well in Barceloneta, Puerto Rico
[°C, degrees Celsius; µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter]

Date (m/d/y)	Depth (feet)	Temperature (°C)	pH (Units)	Specific Conductance (µS/cm)	Alkalinity (mg/L as $CaCO_3$)
9/14/95	440	24.5	7.4	450	210
9/26/95	1,780	23.5	7.6	475	243
11/29/95	1,158	24.5	7.3	450	232

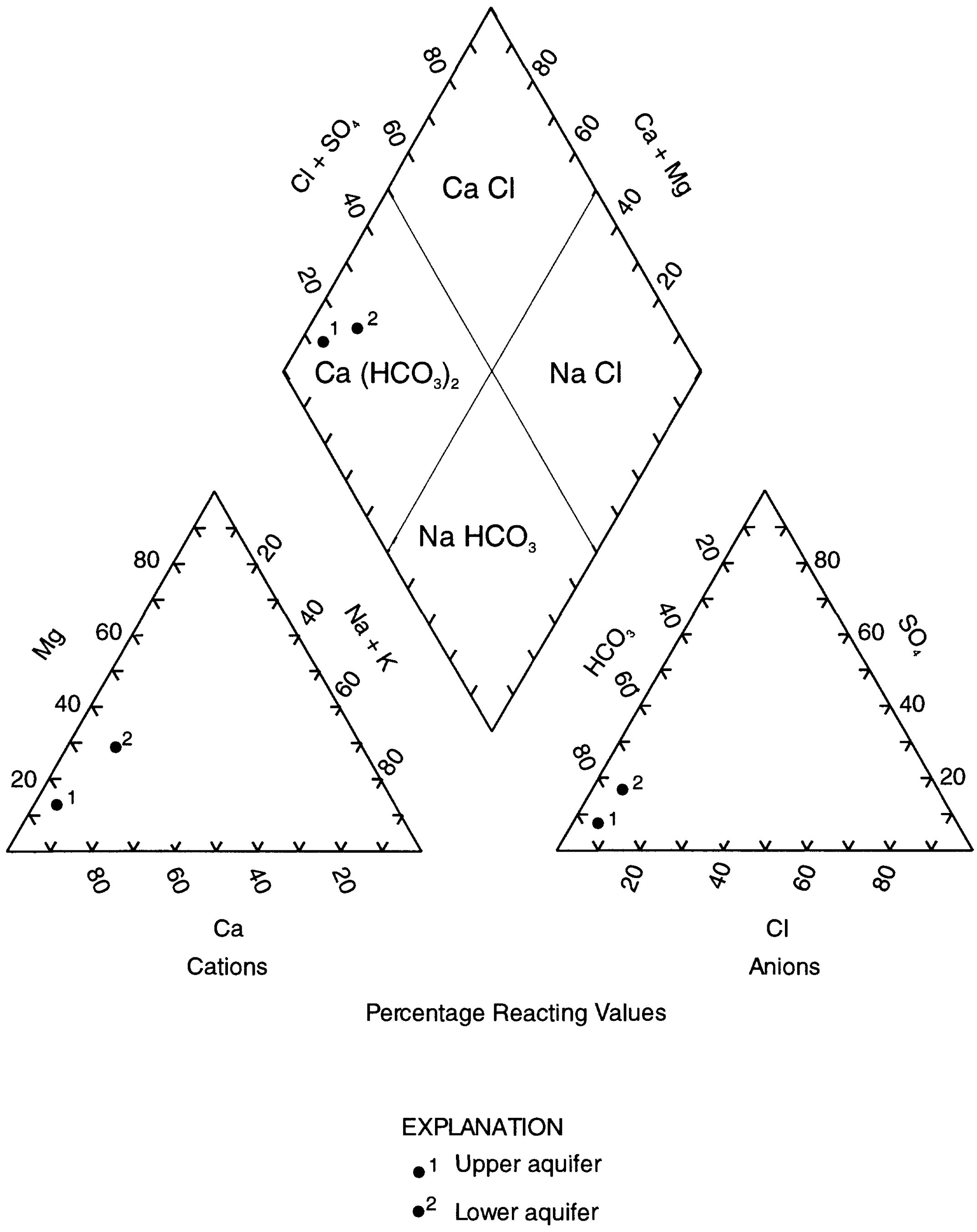

Figure 3. Chemical classification of ground water at test well in Barceloneta, Puerto Rico.

Concentrations of common constituents, trace metals, and nutrients in the upper and lower aquifers were within the normal range for the geologic formations penetrated as reported by Román-Más and Ramos-Ginés (1988) in their compilation of water-quality data for the north coast limestone aquifers. Nevertheless, the sample obtained at a depth of 1,780 feet contained anomalous concentrations of the following constituents: lead, 20 µg/L (normal < 10 µg/L); molybdenum, 30 µg/L (normal < 10 µg/L); total ammonia nitrogen as N, 1.5 mg/L (normal < 0.2 mg/L as N); and total nitrite and nitrate as N, 1.3 mg/L (normal < 0.1 mg/L as N). The water sample obtained from the completed well contained an anomalous concentration of dissolved mercury, 0.2 µg/L (normal < 0.1 µg/L), and for nitrogen species. Concentrations of synthetic organic compounds (halogenated and aromatic hydrocarbons) in the upper and lower aquifers were below the detection limits of the analytical procedures used, 0.1 µg/L.

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Table 3. Concentration of selected water-quality parameters determined from test well in Barceloneta, Puerto Rico

[°C, degrees Celsius; µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter; mg/L, micrograms per liter; <, concentration below detection limits; --, concentration not determined; (*), well open hole from 1158 to 1800 feet]

DATE	DEPTH OF WELL, TOTAL (FEET)	pH WATER WHOLE LAB (STA- DARD UNITS)	TEMPERA- TURE WATER (DEG °C)	SPECIFIC- CONDUC- TANCE (µS/CM)	ALKALIN- ITY LAB (MG/L AS CACO3)	HARD- NESS TOTAL (MG/L AS CACO3)	CALCIUM DIS- SOLVED (MG/L AS CA)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG)	SODIUM DIS- SOLVED (MG/L AS NA)	SODIUM ADSORP- TION RATIO	SODIUM PERCENT	POTAS- SIUM, DIS- SOLVED (MG/L AS K)
SEP 1995												
14...	440	7.4	24.5	450	210	240	83	7.9	6.3	0.2	5	0.60
26...	1780	7.3	24.5	450	232	260	70	20	15	0.4	11	1.2
NOV 1995												
29...	1158(*)	7.6	23.5	475	243	--	--	--	--	--	--	0.60

DATE	CHLO- RIDE, DIS- SOLVED (MG/L AS CL)	SULFATE DIS- SOLVED (MG/L AS SO4)	FLUO- RIDE, DIS- SOLVED (MG/L AS F)	SILICA DIS- SOLVED (MG/L AS SIO2)	NITRO- GEN, TOTAL (MG/L AS N)	NITRO- GEN, TOTAL (MG/L AS NO3)	NITRO- GEN, AM- MONIA + ORGANIC TOTAL (MG/L AS N)	NITRO- GEN, AMMO- NIA DIS- SOLVED (MG/L AS N)	NITRO- GEN, AMMO- NIA TOTAL (MG/L AS N)	NITRO- GEN, AMMO- NIA DIS- SOLVED (MG/L AS NH4)	NITRO- GEN, AMMO- NIA TOTAL (MG/L AS NH4)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N)
SEP 1995												
14...	10	13	<0.10	5.2	0.54	2.4	0.2	0.04	0.01	--	--	0.36
26...	14	39	0.50	6.4	2.4	11.0	1.1	1.2	1.5	1.5	1.5	1.3
NOV 1995												
29...	12	21	--	--	1.6	7.1	0.71	0.80	0.80	1.0	1.0	0.72

DATE	NITRO- GEN, NO2+NO3T OTAL (MG/L AS N)	NITRO- GEN, NITRITE- DIS- SOLVED (MG/L AS N)	NITRO- GEN, NITRITE TOTAL (MG/L AS N)	NITRO- GEN, NITRATE DIS- SOLVED (MG/L AS N)	NITRO- GEN, NITRATE TOTAL (MG/L AS N)	NITRO- GEN, NITRATE DIS- SOLVED (MG/L AS NO3)	NITRO- GEN, NITRATE TOTAL (MG/L AS NO3	PHOS- PHORUS TOTAL (MG/L AS P)	PHOS- PHORUS ORTHO, SOLVED (MG/L AS P)	ARSENIC DIS- SOLVED (µG/L AS AS)	BARIUM DIS- SOLVED (µG/L AS BA)	BERYL- LIUM, DIS- SOLVED (µG/L AS BE)
SEP 1995												
14...	0.34	0.01	0.01	0.35	0.33	1.5	1.5	0.02	0.02	<1	9	<0.5
26...	1.3	0.01	0.01	1.3	1.3	5.7	5.7	0.02	0.01	1	23	0.5
NOV 19												
29...	0.88	0.02	0.03	0.72	0.88	0.70	0.85	0.02	0.01	1	<100	--

Table 3. Concentration of selected water quality parameters determined from test well at Barceloneta, Puerto Rico--Continued

DATE	BORON, DIS-SOLVED (µG/L AS B)	CAD-MIUM DIS-SOLVED (µG/L AS CD)	CHRO-MIUM, DIS-SOLVED (µG/L AS CR)	COBALT, DIS-SOLVED (µG/L AS CO)	COPPER, DIS-SOLVED (µG/L AS CU)	IRON, DIS-SOLVED (µG/L AS FE)	LEAD, DIS-SOLVED (µG/L AS PB)	MANGA-NESE, DIS-SOLVED (µG/L AS MN)	MOLYB-DENUM, DIS-SOLVED (µG/L AS MO)	NICKEL, DIS-SOLVED (µG/L AS NI)	SILVER, DIS-SOLVED (µG/L AS AG)	STRON-TIUM, DIS-SOLVED (µG/L AS SR)
SEP 1995												
14...	30	<1.0	<5	<3	<10	<3	<10	2	<10	<10	<1.0	790
26...	30	<1.0	<5	<3	<10	5	20	13	30	<10	<1.0	6400
NOV 1995												
29...	30	<1.0	<1	--	<1	<10	<1	<10	--	--	<1.0	--

DATE	VANA-DIUM, DIS-SOLVED (µG/L) AS V)	ZINC, DIS-SOLVED (µG/L) AS ZN)	LITHIUM DIS-SOLVED (µG/L) AS LI)	SELE-NIUM, DIS-SOLVED (µG/L AS SE)	IODIDE, DIS-SOLVED (MG/L AS I)	BROMID-EDIS-SOLVED (MG/L AS BR)	MER-CURY DIS-SOLVED (µG/L AS HG)	BENZENE 1,2,4- TRI-CHLORO-WAT UNF REC (µG/L)	1,2,5,6 -DIBENZ-ANTHRA-CENE TOTAL (µG/L)	BENZENE O-CHLORO-WATER UNFLTRD REC (µG/L)	1,2-DI-PHENYL-HYDRA-ZINE WATER TOT. REC (µG/L)	BENZENE 1,3-DI-CHLORO-WATER UNFL-TRD REC (µG/L)
SEP 1995												
14...	<6	<3	<4	<1	0.002	0.050	<0.1	<3.0	<10.0	<3.0	<5.0	<3.0
26...	8	<3	<4	<2	0.039	0.030	<0.1	<5.0	<10.0	<5.0	<5.0	<5.0
NOV 1995												
29...	--	<10	--	<1	0.027	0.050	0.2	<5.0	<10.0	<5.0	<5.0	<5.0

DATE	BENZENE 1,4-DI-CHLORO-WATER UNFLTRD REC (µG/L)	2,4,6- TRI-CHLORO-PHENOL TOTAL (µG/L)	2,4-DI-CHLORO-PHENOL TOTAL (µG/L)	2,4-DI-METHYL-PHENOL TOTAL (µG/L)	2,4,- DI-NITRO-PHENOL TOTAL (µG/L)	2,4-DI-NITRO-TOLU-ENE TOTAL (µG/L)	2,6-DI-NITRO-TOLUENE TOTAL (µG/L)	2-CHLORO-NAPH-THALENE TOTAL (µG/L)	2-CHLORO-PHENOL TOTAL (µG/L)	2-NITRO-PHENOL TOTAL (µG/L)	3,3'-DI-CHLORO-BENZI-DINE TOTAL (µG/L)	4,6-DINI-TRO-ORTHO-CRESOL TOTAL (µG/L)
SEP 1995												
14...	<3.0	<20.0	<5.0	<5.0	<20.0	<5.0	<5.0	<5.0	<5.0	<5.0	<20.0	<30.0
26...	<5.0	<20.0	<5.0	<5.0	<20.0	<5.0	<5.0	<5.0	<5.0	<5.0	<20.0	<30.0
NOV 1995												
29...	<5.0	<20.0	<5.0	<5.0	<20.0	<5.0	<5.0	<5.0	<5.0	<5.0	<20.0	<30.0

Table 3. Concentration of selected water quality parameters determined from test well at Barceloneta, Puerto Rico--Continued

DATE	4-BROMO-PHENYL PHENYL ETHER TOTAL (µG/L)	4-CHLORO-PHENYL PHENYL ETHER TOTAL (µG/L)	4-NITRO-PHENOL TOTAL (µG/L)	ACE-NAPHTH-ENE TOTAL (µG/L)	ACE-NAPHTH-YLENE TOTAL (µG/L)	ANTHRA-CENE TOTAL (µG/L)	BENZI-DINE TOTAL (µG/L)	BENZO-A-PYRENE TOTAL (µG/L)	BENZO B FLUORAN-THENE TOTAL (µG/L)	BENZO K FLUO-RAN-THENE TOTAL (µG/L)	BENZO A ANTHRA C ENE1,2-BEN-ZANT HRACENE TOTAL (µG/L)	BEN-ZOGH PERYL ENE1,12 - BENZOP ERYLENE TOTAL (µG/L)
SEP 1995												
29...	<5.0	<20.0	<5.0	<5.0	<20.0	<5.0	<5.0	<5.0	<5.0	<5.0	<20.0	<30.0
29...	<5.0	<20.0	<5.0	<5.0	<20.0	<5.0	<5.0	<5.0	<5.0	<5.0	<20.0	<30.0
NOV 1995	<5.0	<5.0	<30.0	<5.0	<5.0	<5.0	<40.0	<10.0	<10.0	<10.0	<10.0	<10.0

DATE	BIS (2-CHLORO-ETHOXY) METHANE TOTAL (µG/L)	BIS 2-CHLORO-ETHYL ETHER TOTAL (µG/L)	BIS (2-CHLORO-ISO-PROPYL) ETHER TOTAL (µG/L)	BIS (2-ETHYL HEXYL) PHTHAL-ATE TOTAL (µG/L)	N-BUTYL BENZYL PHTHA-LATE TOTAL (µG/L)	PARA-CHLORO-META CRESOL TOTAL (µG/L)	CHRY-SENE TOTAL (µG/L)	DI-N-BUTYL PHTHA-LATE TOTAL (µG/L)	DI-N-OCTYL PHTHA-LATE TOTAL (µG/L)	DIETHYL PHTHA-LATE TOTAL (µG/L)	DI-METHYL PHTHA-LATE TOTAL (µG/L)
SEP 1995											
14...	<5.0	<5.0	<5.0	<5.0	<5.0	<30.0	<10.0	<5.0	<10.0	<5.0	<5.0
26...	<5.0	<5.0	<5.0	<5.0	<5.0	<30.0	<10.0	<5.0	<10.0	<5.0	<5.0
NOV 1995											
29...	<5.0	<5.0	<5.0	<5.0	<5.0	<30.0	<10.0	<5.0	<10.0	<5.0	<5.0

DATE	FLUORAN-THENE TOTAL (µG/L)	FLUO-RENE TOTAL (µG/L)	HEXA-CHLORO-BENZENE TOTAL (µG/L)	HEXA-CHLORO-BUTADI-ENE TOTAL (µG/L)	HEXA-CHLORO-CYCLO-PENTADI-ENE TOTAL (µG/L)	HEXA-CHLORO-ETHANE TOTAL (µG/L)	INDENO (1,2,3-CD) PYRENE TOTAL (µG/L)	ISO-PHOR-ONE TOTAL (µG/L)	N-NITRO-SODI-N-PROPYL-AMINE TOTAL (µG/L)	N-NITRO--SODI-METHY LAMINE TOTAL (µG/L)	N-NITRO -SODI-PHENY-LAMINE TOTAL (µG/L)
SEP 1995											
14...	<5.0	<5.0	<5.0	<3.0	<5.0	<5.0	<10.0	<5.0	<5.0	<5.0	<5.0
26...	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0	<5.0	<5.0	<5.0	<5.0
NOV 1995											
29...	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0	<5.0	<5.0	<5.0	<5.0

Table 3. Concentration of selected water quality parameters determined from test well at Barceloneta, Puerto Rico--Continued

DATE	NAPHTH- ALENE TOTAL (µG/L)	NITRO- BENZENE TOTAL (µG/L)	PENTA- CHLORO- PHENOL TOTAL (µG/L)	BRO- MOME- THANE WATER WHOLE RECOVER (µG/L)	DI- CHLORO- BROMO- METH- ANE TOTAL (µG/L)	DI- CARBON- TETRA- CHLO- RIDE TOTAL (µG/L)	1,2-DI- CHLORO- ETHANE TOTAL (µG/L)	BROMO- FORM TOTAL (µG/L)	CHLORO- DI- BROMO- METHANE TOTAL (µG/L)	CHLORO- FORM TOTAL (µG/L)	TOLU- ENE TOTAL (µG/L)
SEP 1995											
14...	<3.0	<5.0	<30.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
26...	<5.0	<5.0	<30.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
NOV 1995											
29...	<5.0	<5.0	<30.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0

DATE	BENZENE TOTAL (µG/L)	CHLORO- BENZENE TOTAL (µG/L)	CHLORO- ETHANE TOTAL (µG/L)	ETHYL- BENZENE TOTAL (µG/L)	METHYL- BRO- MIDE TOTAL (µG/L)	METHYL- CHLO- RIDE TOTAL (µG/L)	METHYL- ENE CHLO- RIDE TOTAL (µG/L)	TETRA- CHLORO- ETHYL- ENE TOTAL (µG/L)	TRI- CHLORO- FLUORO- METHANE TOTAL (µG/L)	1,1-DI- CHLORO- ETHANE TOTAL (µG/L)	1,1-DI- CHLORO- ETHYL- ENE TOTAL (µG/L)
SEP 1995											
14...	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
26...	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
NOV 1995											
29...	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0

DATE	1,1,1- TRI- CHLORO- ETHANE TOTAL (µG/L)	1,1,2-TRI- CHLORO- ETHANE TOTAL (µG/L)	ETHANE, 1,1,2,2 TETRA- CHLORO- WAT UNF REC (µG/L)	1,2-DI- CHLORO- PROPANE TOTAL (µG/L)	1,2- TRANSDI CHLORO- ETHENE TOTAL (µG/L)	2- CHLORO- ETHYL- VINYL- ETHER TOTAL (µG/L)	DI- CHLORO- DI- FLUORO- METH- ANE TOTAL (µG/L)	TRANS- 1,3-DI- CHLORO- PROPENE TOTAL (µG/L)	CIS 1,3-DI- CHLORO- PROPENE TOTAL (µG/L)	VINYL CHLO- RIDE TOTAL (µG/L)	TRI- CHLORO- ETHYL- ENE TOTAL (µG/L)
SEP 1995											
14...	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<1.0	<3.0
26...	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<1.0	<3.0
NOV 1995											
29 ...	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<1.0	<3.0

Table 3. Concentration of selected water quality parameters determined from test well at Barceloneta, Puerto Rico--Continued

DATE	CIS-1,2 -DI-CHLORO-ETHENE WATER TOTAL (µG/L)	STYRENE TOTAL (µG/L)	2,2-DI CHLORO-PROPANE WAT, WH TOTAL (µG/L)	1,3-DI-CHLORO-PROPANE WAT, WH TOTAL (µG/L)	PSEUDO-CUMENE WATER UNFLTRD REC (µG/L)	ISO-PROPYL-BEN-ZENE WATER WHOLE REC (µG/L)	BENZENE N-PROPY WATER UNFLTRD REC (µG/L)	MESIT-YLENE WATER UNFLTRD REC (µG/L)	O-CHLORO-TOLUENE WATER WHOLE TOTAL (µG/L)	MET-LANE BROMO CHLORO-WAT UNFLTRD REC (µG/L)	BEN-ZENE N-BUTYL WATER UNFL-TRD REC (µG/L)
SEP 1995											
14...	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.00	<3.0
26...	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.00	<3.0
NOV 1995											
29...	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.00	<3.0

DATE	BENZENE SEC BUTYL-WATER UNFLTRD REC (µG/L)	BENZENE TERT-BUTYL-WATER UNFLTRD REC (µG/L)	P-ISO-PROPYL-TOLUENE WATER WHOLE REC (µG/L)	123-TRI CHLORO-PROPANE WATER WHOLE TOTAL (µG/L)	ETHANE, 1112-TETRA-CHLORO-WAT UNF REC (µG/L)	1,2,3-TRI-CHLORO BEN-ZENE WAT, WH REC (µG/L)	1,2-DIBROMO ETHANE WATER WHOLE TOTAL (µG/L)	FREON-113 WATER UNFLTRD REC (µG/L)	METHYL ETHER TERT-BUTYL WAT UNF REC (µG/L)	XYLENE WATER UNFLTRD REC (µG/L)	BROMO-BEN-ZENE WATER, WHOLE, TOTAL (µG/L)
SEP 1995											
14...	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
26...	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
NOV 1995											
29...	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0

DATE	DIBROMO CHLORO-PROPANE WATER WHOLE-TOT.REC (µG/L)	CHLOR-PYRIFOS TOTAL RECOVER (µG/L)	DI-SYSTON TOTAL (µG/L)	PHORATE TOTAL (µG/L)	PER-THANE TOTAL (µG/L)	DEF TOTAL (µG/L)	NAPH-THA-LENES, POLY-CHLOR. TOTAL (µG/L)	ALDRIN, TOTAL (µG/L)	LINDANE TOTAL (µG/L)	CHLOR-DANE, TOTAL (µG/L)	DDD, TOTAL (µG/L)
SEP 1995											
14...	<3.0	<0.01	<0.01	<0.01	<0.1	<0.01	<0.10	<0.010	<0.010	<0.1	<0.010
26...	<3.0	<0.01	--	<0.03	<0.1	<0.01	<0.10	<0.010	<0.010	<0.1	<0.010
NOV 1995											
29...	<3.0	<0.01	<0.01	<0.01	<0.1	<0.01	<0.10	<0.010	<0.010	<0.1	<0.010

Table 3. Concentration of selected water quality parameters determined from test well at Barceloneta, Puerto Rico--Continued

DATE	DDE, TOTAL (µG/L)	DDT, TOTAL (µG/L)	DI-ELDRIN TOTAL (µG/L)	ENDO-SULFAN, TOTAL (µG/L)	ENDRIN WATER UNFLTRD REC (µG/L)	ETHION, TOTAL (µG/L)	TOX-APHENE, TOTAL (µG/L)	HEPTA-CHLOR, TOTAL (µG/L)	HEPTA-CHLOR EPOXIDE-TOTAL (µG/L)	METH-OXY-CHLOR, TOTAL (µG/L)	PCB, TOTAL (µG/L)
SEP 1995											
14...	<0.010	<0.010	<0.010	<0.010	<0.010	<0.01	<1	<0.010	<0.010	<0.01	<0.1
26...	<0.010	<0.010	<0.010	<0.010	<0.010	<0.01	<1	<0.010	<0.010	<0.01	<0.1
NOV 1995											
29...	<0.010	<0.010	<0.010	<0.010	<0.010	<0.01	<1	<0.010	<0.010	<0.01	<0.1

DATE	MALA-THION, TOTAL (µG/L)	PARA-THION, TOTAL (µG/L)	DI-AZINON, TOTAL (µG/L)	METHYL PARA-THION, TOTAL (µG/L)	MIREX, TOTAL (µG/L)	TOTAL TRITHION (µG/L)	FONOFOS (DY-FONATE WATER WHOLE TOT.REC (µG/L)	1,1-DI CHLORO-PRO-PENE, WAT, WH TOTAL (µG/L)	TOLUENE P-CHLOR WATER UNFLTRD REC (µG/L)
SEP 1995									
14...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<3.0	<3.0
26...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<3.0	<3.0
NOV 1995									
29...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<3.0	<3.0