NEW MEXICO BUREAU OF MINES & MINERAL RESOURCES

Open-File Report 114

DESCRIPTION OF CUTTINGS FROM NAVAJO WATER WELLS IN NEW MEXICO--1978 & 1979

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INTRODUCTION

In June 1976 an informal agreement was made with the Water Works Department of the Navajo Tribe (now Technical and Engineering Services) whereby cuttings from Tribal water wells drilled in New Mexico would be turned over to the New Mexico Bureau of Mines and Mineral Resources for cataloging and permanent filing in their sample library. It was further agreed that copies of any descriptions made of the samples would be furnished to the Tribe. This agreement is mutually beneficial because, although cuttings are usually collected from Tribal wells and described in the field, samples are not always further studied or permanently filed. Under the present agreement not only may the Tribe and the Bureau routinely obtain detailed stratigraphic records for wells but the samples will be preserved for future use through storage in an established cuttings library.

USING THIS REPORT

Only cuttings received between January 1978 and 1980 are described in this report; other samples were described by Stone and others (1978). Table 1 (p. 8) lists wells for which sample descriptions are given by BIA (Bureau of Indian Affairs) field number. This number consists of 2 numerals and a letter: 14T-569. The first numeral identifies the BIA District (fig. 1a). The letter, since about 1950, denotes the source of funds used to construct the well. Common designations are: K = BIA funds and T =

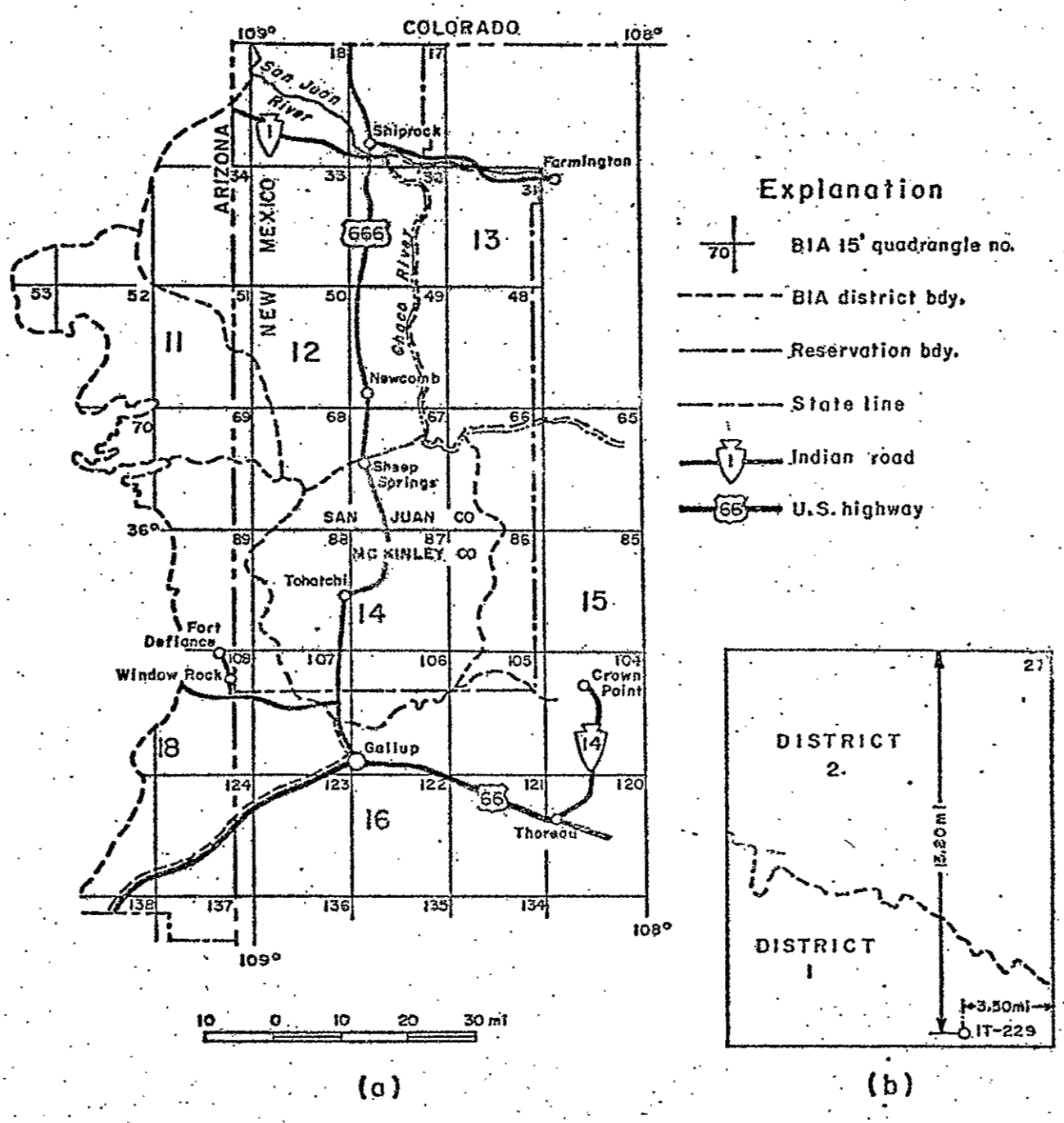

Figure 1. Reference map for northwestern New Mexico and key to numbering of Navajo water wells: a) location of BIA districts and 15' quadrangles associated with New Mexico portion of Navajo Indian Reservation; b) derivation of BIA quadrangle location numbers for wells (example shown has field number of 1 T-229 and quadrangle location number of 27-3.50-15.80).

Tribal funds. The significance of other letter designations used is less clear. The third part is an accession number for that district, representing the order in which the wells are drilled. In addition to the well number, the township-range location, total well depth, sampled interval, probable aquifer, and pages covered by the description are also given.

Table 1 may be used in 2 ways: 1) to determine the availability of sample descriptions for a specific well of interest and 2) to determine the identity of wells for which there are samples or sample descriptions in a general area of interest. In the first case, look for the well in Table 1 using the BIA field number. If it is listed, a sample description is included in this report and cuttings are on file in the Bureau. In the second case, consult Table 1 for the area of interest using county, township-range, or BIA district number (fig. 1). Samples and sample descriptions are available for all wells listed.

EXPLANATION OF DESCRIPTIONS

The descriptions which follow were made by conventional study of the cuttings with a binocular microscope. Abundance and textural characteristics are based on visual estimates following Terry and Chilingar (1958) and Powers (1953). All abbreviations used are defined in the "Key to Symbols and Terms" (p. 24). Each description includes the following heading information: well number, location, sampled interval, total depth (TD), name of analyst, and date of

description. The well number given is generally the BIA field number.

Where possible, location is given according to: 1) standard legal description (section, township, range, county; for this the land grid was extended into the reservation from adjacent areas), 2) distance and direction from a local landmark, and 3) location within BIA quadrangle. The BIA quadrangle location number consists of 3 parts (for example 27-3.50-15.80). The first part is the number of the BIA quadrangle in which the well is located (fig. 1a). The second is the distance in miles west of the northeast corner of the quadrangle, and the third part is the distance in miles south of the northeast corner of the quadrangle (fig. 1b).

Wells are arranged by BIA field number as in Table 1. Descriptions are presented in the order that the materials were encountered in drilling and depths of intervals described therefore increase down the page. The probable stratigraphic units (formations, groups, etc.) penetrated by the well are indicated by the abbreviations in the Depth column at the left. The term in caps at the beginning of each descriptive entry identifies the probable major rock or sediment type(s) in the interval indicated, based on examination of the cuttings. A single lithologic term is listed where it is deemed to constitute >50 percent of the total sample. Two lithologic terms joined by "and" are listed

where each constitutes 30-50 percent of the total sample. Other abundance terms used are defined in the Appendix (p. 24).

The specific descriptive information given after the general lithologic term(s) varies slightly with rock types; for clarity, this information is always presented in the same order as follows:

> SANDSTONES -- color; texture (grain size, grain sorting, grain shape); mineralogy; matrix, cement, induration; miscellaneous constituents or characteristics.
>
> CLAYEY OR SILTY SANDSTONES -- color; texture (of sand); general comment on clay or silt; mineralogy; matrix, cement, induration; miscellaneous constituents or characteristics.
>
> SHALE, SILTY SHALE, OR SILTSTONE -- color; general comment on silt or sand (if present); cement, induration; miscellaneous constituents or characteristics.
>
> SANDY SILTSTONE OR SANDY SHALE -- color; texture of sand grains; mineralogy of sand grains; cement, induration; miscellaneous constituents or characteristics.

The rock color chart prepared by Goddard and others (1948) and distributed by the Geological Society of America (GSA) was used for rock color designations. In several cases identical names are given on the chart for two sightly different colors such that name alone cannot be used without creating doubt as to the color intended. Three cases of such duplicate color designations were encountered in samples covered by this report: "light brown", "yellowish gray", and "moderate red". As used here these terms refer to colors 5YR6/4, 5Y7/2, and 5R4/6 on the chart, respectively. All other color designations follow the GSA chart exactly.

The example below should aid in using the descriptions:

200-230 SANDSTONE AND SILTSTONE--ss wh; grains f to m, mod w sorted, subang, spher; milky qtz; clay and slt mat, tr silica cem, fri. Sltst lt gry; w ind; carb. Tr sh aa.

This description covers material from an interval lying between 200 and 230 feet below the surface. The interval is concluded to consist of nearly equal amounts sandstone and siltstone (each constituting 30-50 percent of the sample). The sandstone is white, moderately well sorted, with subangular spherical grains of milky quartz in the fine to medium size range (0.125-0.5mm). It is also friable (crumbly) with only a trace of silica cement between the grains but has an intergranular matrix consisting of clay and silt. The siltstone is light gray, cemented by undetermined material, well indurated (hardened), and contains carbonaceous material. There is also a trace of shale as described above.

The designations of probable stratigraphic units penetrated are based on sample lithology and Bureau maps of depth-to-top of selected units in northwestern New Mexico prepared by Stone and Mizell (1978).

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Goddard, E. N., Trask, P. D., De Ford, R. K., Rove, O. N., Singewald, J. T., Jr., and Overbeck, R. M., 1948, Rock Color Chart: Distributed by the Geological Society of America, Boulder, Co. (reprinted 1970).

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Table 1. Catalog of cuttings from Navajo water wells in New Mexico described in 1979.

Well No. (BIA Field No)	Location ½ Sec, Twp, Rge	T.D. (ft)	Sampled Interval	Probable Aquifer(s)	Description (Pages)
12T-618 (Newcomb School)	SE, 25, 24N, 18W (San Juan County)	1440	0-1440	Kmf	9-11
16T-594 (Smith Lake #1)	17, 15N, 12W (McKinley County)	2024	500-1560	Jm, Je	12-14
16T-595 (Mariano Lake #1)	NE27/NW26, 16N, 14W (McKinley County)	1640	350-1600	Jm, Je	15-16
16T-596 (Mariano Lake #2)	33(?), 16N, 14W (McKinley County)	1610	150-1610	Jm, Je	17-20
16T-597 (Smith Lake #2)	17, 15N, 12W (McKinley County)	1939	0-1939	Jm, Je	21-23

Well no: 12T-618 (Newcomb #1)

Location: Sec. 25, T24N, R18W, San Juan Co., N.M.;
100 ft. N of School; 49-11.65-14.70.

Sampled interval: 0-1440 ft

TD: 1440 ft

Described by: R. Jackson (12/79)

Depth (ft)	
0-10	SOIL/ALLUVIUM (Quaternary)
Kmf	
10-20	SILTY SHALE--m gry
20-30	SHALE AND SANDSTONE--Sh aa. Ss lt gry; grains f, p sorted, srd; qtz calc cem ind.
30-80	SANDY SILTSTONE--m gry; sand grains f, p sorted, subang; qtz; calc cem, ind.
80-90	SILTY SHALE--m gry.
90-100	SANDY SILTSTONE--aa.
100-110	SANDSTONE--lt gry; grains f-crse, p sorted, ang; qtz; calc cem, ind.
110-160	SANDSTONE AND SANDY SILTSTONE--aa.
160-180	SHALE--m gry.
180-200	SANDY SILTSTONE--aa.
200-210	SANDSTONE AND SANDY SILTSTONE--aa.
210--240	SILTSTONE--mm gry.
240-250	SANDY SILTSTONE--m gry; grains f-m, p sorted, subang; qtz and mica; fri.
250-260	SILTSTONE--aa.
260-270	SANDSTONE AND SANDY SILTSTONE--aa.
270-280	SILTSTONE--m gry, calc cem.
280-320	SANDSTONE AND SILTSTONE--ss lt gry; grains f-m, p sorted, subang; qtz; ind, Sltst m gry.
320-330	SANDSTONE--lt gry; grains f-crse, p sorted, ang; qtz; fri.

Newcomb #1 continued

Depth (ft)	
330-350	SANDSTONE AND SILTSTONE--aa.
350-370	SANDSTONE--lt gry; grains vf, p sorted, srd; qtz; calc cem, fri.
370-510	SANDSTONE AND SILTSTONE--ss aa. Sltst m gry.
510-530	SILTSTONE--m gry.
530-550	SANDSTONE A SILTSTONE--aa.
550-560	SILTSTONE--aa.
560-570	SANDSTONE AND SILTSTONE--aa.
570-600	Missing
600-610	SANDSTONE AND SILTSTONE--aa.
610-630	Missing
630-770	SANDSTONE AND SILTSTONE--aa.
770-800	SANDSTONE--v lt gry; grains f-m, p sorted, srd; qtz; calc cem, ind.
800-830	SANDSTONE AND SILTSTONE--aa.
830-840	SANDSTONE--lt gry; grains f, p sorted, subang; qtz; calc cem, ind.
840-850	SANDSTONE AND SILTSTONE--aa.
850-860	SILTY SHALE--m gry.
860-1150	SANDSTONE AND SILTSTONE--ss lt gry; grains f, p sorted, srd; qtz; ind. Sltst m gry.
1150-1160	SANDSTONE--aa, lt gry and yel gry.
1160-1170	SANDSTONE AND SILTY SHALE--lt gry; grains m-crse; p sorted, ang; qtz; calc cem, ind. Sh m gry.
1170-1200	SANDSTONE AND SILTSTONE--ss lt gry; grains m- vcrse, p sorted, srd; qtz; ind. Sltst m gry.

Newcomb #1 continued

Depth (ft)

1200-1210 SANDSTONE AND SILTY SHALE--ss lt gry, grains f-m, p sorted, srd; qtz; ind. Silty sh m gry.

1210-1220 SILTSTONE AND SHALE--Sltst m gry; calc cem; mica. Shale m gry.

1220-1300 SANDSTONE AND SILTSTONE--ss lt gry; grains f, p sorted, subang; qtz, biotite; ind. Sltst m gry.

1300-1330 SANDSTONE--lt gry; grains f, p sorted, subang; qtz; calc cem, ind.

1330-1440 SANDSTONE AND SILTSTONE--ss lt gry; grains f, p sorted, subang; qtz; calc cem, ind. Sltst pk-m gry.

Well No: 16T-594 (Smith Lake #1)

Location: Sec. 17, T15N, R12W, McKinley Co., N.M.; 104-7.80-15.62

Sampled Interval: 500-1560 ft.

TD: 2024 ft.

Described by: R. Jackson (12/79)

Depth (ft)	
Km	
500-590	SILTY SHALE--m dk gry; calc cem; mica.
590-610	SILTSTONE-- m dk gry; calc cem. Lit silty ss lt gry; sand grains m-crse, p sorted, srd; qtz; calc cem, fri.
Kd	
610-630	SANDY SILTSTONE--m dk gry; sand grains vf, w sorted, ang; calc cem, fri; mica.
630-660	SANDSTONE--lt gry; grains vf, mod sorted, srd; qtz; calc cem, w ind.
660-670	SANDSTONE--aa; mica
670-690	SANDY SILTSTONE--aa.
690-700	SANDY SILTSTONE--m lt gry; grains vf f, m sorted, srd; qtz, biotite; fri.
700-710	SANDSTONE--lt gry; grains vf f, m sorted, srd; qtz, slightly calc, fri.
710-720	SANDSTONE--v lt gry; grains f-m, m sorted, srd; qtz, biotite; ind.
720-730	SANDSTONE--aa. Tr dk gry slty sh.
730-750	SANDSTONE--aa; but grains are f.
750-760	SANDSTONE--aa; but grains f-m.
760-770	SANDSTONE--aa; grains f.

Smith Lake #1 continued

Depth (ft)

770-830 SANDSTONE AND SANDY SILTSTONE--ss aa but grains f-m. Sltst m dk gry; sand grains f, p sorted, srd; qtz; fri.

830-850 SANDY SILTSTONE AND SANDSTONE--aa but sltst predominates.

850-860 SANDSTONE AND SANDY SILTSTONE--aa but ss grains m-crse.

870-880 SANDY SILTSTONE AND SANDSTONE--aa but ss grains crse.

880-890 SILTSTONE--m dk gry; calc, fri.

Jm

890-900 SILTSTONE--aa.

900-910 SILTSTONE--aa; tr of ss aa.

910-920 SILTSTONE--aa but color m and lt gry.

920-940 SILTSTONE--aa; lt gry predominates.

940-980 SILTSTONE--aa.

980-990 SILTSTONE--aa except some brn gry.

990-1000 SILTSTONE--aa except slightly coarser grain size.

1000-1010 SANDSTONE AND SILTSTONE--ss lt brn gry; grains m-crse, p sorted, srd; qtz, biotite; calc cem. Sltst lt gry and brn gry; ind.

1010-1100 SANDSTONE AND SILTSTONE--aa.

1100-1110 SANDSTONE, SILTSTONE AND SHALE--ss aa. Sltst aa. Sh lt gry and m gry.

1110-1120 SANDSTONE, SILTSTONE, AND SHALE--ss lt brn gry; grains f-crse, p sorted, srd; qtz; ind. Sltst m gry, lt gry, and lt brn gry. Sh m dk gry.

1120-1210 SANDSTONE AND SILTSTONE--ss lt brn gry; grains v crse, p sorted, srd; qtz; ind. Sltst v lt gry; fis. Tr m gry sh.

Smith Lake #1 continued

Depth (ft)

1210-1220 SANDSTONE--lt brn gry; grains f-crse, p sorted, subang; qtz; calc cem, fri.

1220-1230 SANDSTONE AND SHALE--ss aa. Sh m gry.

1230-1270 Missing

1270-1320 SANDSTONE--lt brn gry; grains f-crse, p sorted, subang; qtz; calc cem, fri. Tr m gry sh.

1320-1370 SANDSTONE AND SHALE--ss lt brn gry; grains f-crse, p sorted, srd; qtz; calc cem, fri. Sh m dk gry; silty; calc cem.

Jcs

1370-1390 SANDY SILTSTONE AND SHALE--sltst lt brn gry; sand grains f, p sorted, srd; qtz; calc cem, fri. Sh m gry; silty.

1390-1430 SANDY SILTSTONE--m gry; sand grains f, p sorted, srd; calc cem, fri.

1430-1450 SILTY SHALE--m gry; calc cem.

1450-1560 SHALE--m gry; variable amounts calc cem.

Well no: 16T-595 (Mariano Lake #1)

Location: Sec. 26 or 27, T16N, R14W, McKinley Co., N.M.

Sampled Interval: 500-1600 ft.

TD: 1640 ft

Described by: R. Jackson (12/79)

Depth (ft)	
Km	
500-510	SANDSTONE--lt gry; grains m-crse, mod sorted, srd; qtz; calc cem.
510-520	SILTY SHALE--lt gry.
520-530	SILTSTONE--drk gry.
530-590	SHALE--lt and m gry; calc.
Kd	
590-600	SANDSTONE--lt gry; grains m-v crse, p sorted, srd; qtz; calc cem.
600-610	SHALE--lt gry and m gry.
610-710	SANDSTONE--lt brn gry; grains m-v crse, p sorted, srd; qtz. Tr lt gry sh.
Jm	
710-910	SANDSTONE--lt brn gry; grains f-m, p sorted, srd; qtz, fledspar; calc cem; tr lt gry sh.
910-950	SANDSTONE AND SHALE--ss aa. Sh m gry; calc cem.
950-1000	SANDSTONE--lt gry; grains f, p sorted, srd; qtz; calc cem.
1000-1020	SILTSTONE--lt brn gry. Tr ss aa.
Jcs/Js(?)	
1020-1450	SANDSTONE--lt brn gry; grains f-m, mod sorted, srd; qtz; calc. Tr m gry sh.

Mariano Lake #1 continued

Depth (ft)	
Jt	
1450-1460	LIMESTONE--m-lt gry; finely crystalline; unfossiliferous.
Je	
1460-1600	SANDSTONE--mod reddish orange; grains m-c, m sorted, srd; qtz; calc cem. Tr m gry sh.

Well no: 16T-596 (Mariano Lake #2)

Location: Sec. 23?, T16N, R14W, McKinley Co., N.M.

Sampled interval: 150-1610 ft.

TD: 1610 ft.

Described by: R. Jackson (12/79)

Depth (ft)	
Km	
150-160	SHALE--m gry; calc cem; mica.
160-200	SANDSTONE AND SHALE--ss lt gry; grains m, p sorted, srd; qtz; calc cem, ind. Sh aa.
200-280	SANDSTONE--lt gry; grains m, mod sorted, srd; qtz; calc cem, ind. Tr m gry sh.
280-290	SANDSTONE AND SHALE--ss aa. Sh m gry.
290-300	SANDY SILTSTONE--m gry; sand grains f, p sorted, ang; qtz, mica; slightly calc.
300-350	SILTSTONE--m gry; qtz and mica; ind.
350-360	SILTSTONE AND SANDSTONE--sltst aa. Ss lt gry; grains m, p sorted, subang; qtz; ind.
360-390	SANDSTONE--lt gry; grains f-m; p sorted, srd; qtz; fri. Tr m gry sh.
390-400	SANDSTONE AND COAL--ss aa. Coal blk.
400-420	SANDSTONE AND SILTSTONE--ss aa. Sltst m gry; Tr coal.
420-450	SANDSTONE--lt gry; grains f-m, p sorted, srd; qtz; fri. Lit coal.
450-500	SILTSTONE--drk gry; mica; ind.
500-510	SANDY SILTSTONE--lt gry; grains vf-f, p sorted, subang; qtz; ind.
Kd	
510-520	SANDSTONE AND CARBONACEOUS SHALE--ss lt gry; grains vf-f, p sorted, srd; qtz; ind. Sh blk. Tr coal.

Mariano Lake #2 continued

Depth (ft)

520-560 SANDSTONE--lt brn gry; grains f-crse, p sorted, subang; qtz, feldspar; calc cem. Tr drk gry sh.

560-580 SANDY SILTSTONE--aa.

580-600 SANDSTONE--lt brn gry; grains f-crse, p sorted, srd; qtz, feldspar; calc cem.

600-610 SILTSTONE--lt gry and lt brn gry; ind.

610-630 SANDSTONE AND SILTSTONE--aa but ss vcrse

Jm?

630-640 SANDSTONE AND SILTSTONE--ss lt gry; grains f-crse, p sorted, srd; qtz, feldspar; ind. Sltst aa.

640-650 SANDSTONE--lt gry; grains f-m, p sorted, srd; qtz feldspar; ind.

650-660 SANDSTONE AND SILTSTONE--ss lt brn gry, grains m-vcrse, p sorted, srd; qtz, feldspar; ind. Sltst lt gry, lt brn gry, and m gry.

660-700 SANDSTONE--lt gry; grains f-m, p sorted, srd; qtz, feldspar, mica; ind.

710-750 SANDSTONE--aa. Little sltst m gry.

750-760 SANDSTONE--lt brn gry; grains m-vcrse, p sorted, srd; qtz; ind.

760-800 SANDSTONE--lt brn gry; grains vf-m, p sorted, srd; qtz, feldspar. Little m gry and lt gry sltst.

800-830 SANDSTONE AND SHALE--ss lt gry; grains f-m, p sorted, srd; qtz; ind. Sh lt gry; silty.

830-840 SILTSTONE--lt gry and m gry.

840-900 SANDSTONE--lt gry; grains m-crse, p sorted, srd; qtz; ind. Tr lt gry sh. Tr of coal 870-880 ft and 890-900 ft.

900-910 SILTSTONE AND SHALE--sltst m gry; calc. Sh m gry.

910-920 SANDSTONE AND SILTSTONE--ss lt gry; grains f-m, p sorted, srd; qtz; calc cem, ind. Sltst m gry.

Mariano Lake #2 continued

Depth (ft)

920-940 SANDSTONE--lt gry; grains m-crse, p sorted, srd; qtz; calc cem, ind. Tr m gry sh. Tr lt brn gry ss. Tr coal.

940-950 SILTSTONE--m gry and lt brn gry; calc. Tr of lt gry ss aa.

950-1000 SANDSTONE--lt gry; grains m-crse, p sorted, srd; qtz; calc cem, fri.

1000-1080 SANDSTONE AND SILTSTONE--ss aa. Sltst m gry and brn gry.

1080-1130 SANDSTONE--lt gry; grains f-m, p sorted, srd; qtz; ind. Tr m gry and brn gry sltst.

1130-1140 SANDSTONE AND SILTSTONE--ss lt gry and lt brn gry; grains f-m, p sorted, subang; qtz; calc cem. Sltst m gry and gry red purple. Tr coal.

1140-1150 SANDSTONE--lt gry and lt brn gry; grains f-m, mod sorted, subang; qtz; calc cem. Tr m gry sh.

1150-1170 SANDSTONE AND SILTSTONE--ss lt gry; grains f-crse, p sorted, subang; qtz; calc cem, fri. Slst lt-m gry and lt brn gry.

1170-1180 SANDSTONE--aa.

Jcs/Js(?)

1180-1250 SANDSTONE AND SILTSTONE--ss aa. Sltst m gry and lt brn gry.

1250-1260 SILTSTONE--m gry.

1260-1400 SANDSTONE--lt brn gry; grains f, mod sorted, srd; qtz; calc cem, fri. Little m and lt gry silty sh.

1400-1410 SANDSTONE--lt brn gry; grains f, mod sorted, srd; qtz; calc cem.

1410-1420 SANDSTONE--aa.

Jt

1420-1450 LIMESTONE--lt gry, finely crystalline, unfossiliferous.

Je

1450-1470 SANDSTONE--ss lt gry; grains f-m, mod sorted, srd; qtz. Little sh m gry; calc.

1470-1480 Missing

1480-1610 SANDSTONE--mod or pd; grains m-c, mod sorted, srd; qtz; calc cem. Tr m gry sh.

Well No: 16T-597 (Smith Lake #2)

Location: Sec. 17, T15N, R12W, McKinley Co., N.M.

Sampled Interval: 0-1939 ft.

TD: 1939 ft.

Described by: R. Jackson (12/79)

Depth (ft)	
Km	
0-400	SILTY SHALE--m gry; mica.
400-500	SILTY SHALE--aa; calc.
500-510	SANDSTONE--lt gry; grains f-m, p sorted, srd; qtz; calc cem.
510-610	SILTY SHALE--aa.
Kd	
610-660	SANDSTONE AND SILTY SHALE--ss lt gry; grains f-m, p sorted, srd; qtz; calc cem, ind. Sh aa.
660-770	SANDSTONE AND SILTY SHALE--aa but ss not calc.
770-780	SILTY SHALE--m gry.
780-790	SILTY SHALE--dk gry; v carb.
790-800	SANDSTONE AND SILTY SHALE--aa.
800-810	SANDSTONE AND SHALE--ss lt gry; grains f-m, p sorted, subang; qtz; calc, ind. Sh m gry.
810-820	SANDSTONE AND SANDY SHALE--ss aa; grains crse. Sh m gry. Tr coal.
820-840	SILTY SHALE--lt and m gry.
840-850	SANDSTONE AND SILTY SHALE--ss lt gry; grains f-m, mod sorted; qtz; ind. Sh m gry.
Jmbb	
850-880	SILTY SHALE--lt and m gry.
880-900	SANDSTONE AND SHALE--ss lt brn gry; grains f, mod sorted, subang; qtz; ind. Sh m gry.

Smith Lake #2 continued

Depth (ft)

900-910 SANDSTONE--lt gry; grains f, mod sorted, subang; qtz; ind. Tr m gry sh.

910-930 SHALE--lt and m gry. Tr vcrse ss.

Jmwc

930-940 SHALE AND SANDSTONE--sh aa. Ss lt gry; grains vcrse, srd; qtz.

940-960 SANDSTONE--lt brn; grains vcrse, srd; qtz.

960-980 SANDSTONE AND SHALE--ss aa. Sh m gry.

980-1000 SANDSTONE--aa. Tr m gry sh.

1000-1050 SANDSTONE AND SHALE--lt brn gry; grains f-m, p sorted; qtz. Sh m gry.

1050-1070 SHALE--m gry.

1070-1080 SHALE AND SANDSTONE--sh aa. Ss lt gry; grains f-m, p sorted, srd; qtz.

1080-1100 SANDSTONE AND SHALE--aa.

1100-1110 SHALE--m gry.

1110-1190 SANDSTONE AND SHALE--ss lt brn gry; grains f-crse, p sorted, srd; qtz. Sh m gry.

Jmr

1190-1290 SANDSTONE AND SHALE--ss lt gry; grains f, mod sorted, srd; qtz. Sh m gry and mod red.

1290-1310 SANDSTONE--aa.

1310-1320 SHALE--m gry aa.

1320-1330 SANDSTONE AND SHALE--ss lt gry, aa. Sh m gry, aa.

1330-1350 SHALE AND SANDSTONE--sh m gry, mod red. aa. Ss lt gry, aa.

1350-1500 SHALE--v sh m gry. Little ss; lt gry; f-m, p sorted, srd; qtz; calc. Tr gry red purple sh.

1500-1550 SHALE--m gry; calc. Tr gry red purple sltst.

Smith Lake #2 continued

Depth (ft)	
Js	
1550-1690	SHALE AND SANDSTONE--sh m gry; calc. Ss lt brn; grains f-m, mod sorted, srd; qtz.
1690-1720	SANDSTONE AND SHALE--ss lt brn; grains f-m, p sorted, srd; qtz. Sh, m gry; calc.
1720-1740	SHALE--aa.
Jt	
1740-1760	SHALE--lt and m gry; calc. Tr gypsum.
1760-1780	SHALE AND GYPSUM--sh lt and m gry; calc. Gypsum wh.
1780-1800	SHALE--m gry; calc.
Je/Trw(?)	
1800-1820	SHALE AND SANDSTONE--sh m gry; calc. Ss lt brn; grains f-m, mod sorted, srd; qtz.
1820-1830	SANDSTONE AND SHALE--aa.
1830-1840	SHALE--m gry; calc.
1840-1850	SHALE AND SANDSTONE--aa.
1850-1920	SANDSTONE AND SHALE--ss lt brn; grains f-m, mod sorted, srd; qtz; calc cem. Sh m gry.
Trc(?)	
1920-1939	SHALE AND SANDSTONE--aa.

Appendix

KEY TO SYMBOLS AND TERMS USED

Abundance Terms Used for Minor Constituents:

trace:	0-5% of total sample
little:	5-15% of total sample
some:	15-30% of total sample
much:	30% of total sample

Stratigraphic Units (not intended as complete geologic column):

Symbol	Rock Unit	Age
Kmf	Menefee Fm.	
Km	Mancos Sh.	Cretaceous
Kd	Dakota Ss.	
Jm	Morrison Fm.	
Jmbb	Brushy Basin Mbr.	
Jmwc	Westwater Canyon Mbr.	Jurassic
Jmr	Recapture Mbr.	
Jcs	Cow Springs Ss.	
Js	Summerville Fm.	
Trw	Wingate Ss.	Triassic
Trc	Chinle Fm.	

Abbreviations:

aa	as above	ol	olive
ang	angular	or	orange/orangish
blk	black	p	poorly
brn	brown/brownish	pk	pink
calc	calcareous/calcite	qtz	quartz
carb	carbonaceous/carbon	rd	rounded
cem	cement	ss	sandstone
crse	coarse (0.5-1mm)	sh	shale
dk	dark	slt	silt
f	fine (p.125-0.25mm)	siltst	siltstone
fis	fissile (platy)	spher	spherical
fri	friable (crumbly)	subang	subangular
ft	feet	srd	subrounded
grn	green/greenish	TD	total depth
gry	gray/grayish	tr	trace
ind	indurated (hardened)	v	very
lit	little	vcrse	very coarse (1.0-2.0mm)
lt	light	vf	very fine (0.0625-0.125mm)
mat	matrix	w	well
m	medium (0.25-0.5 mm if textural term)	wh	white-whitish
		yel	yellow-yellowish
mod	moderate, moderately		