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Preliminary mineralogical and geochemical data from the D.O.E. Gibson Dome Corehole no. 1, San Juan County, Utah

By

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PRELIMINARY MINERALOGICAL AND GEOCHEMICAL DATA FROM THE D.O.E. GIBSON DOME COREHOLE NO. 1, SAN JUAN COUNTY, UTAH

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As part of the U.S. Department of Energy's (D.O.E.) National Waste Terminal Storage program (N.W.T.S.), a deep corehole was drilled in sec. 21, T. 30 S., R. 21 E., San Juan County, Utah, by Woodward-Clyde Consultants in 1981. This corehole is located in the southwest part of the Paradox Basin on the southeast plunge of a small salt anticline known as Gibson Dome (fig. 1).

Figure 1.--Near here

The principal purpose of this core hole was to characterize the mineralogic, geochemical, hydrologic, and physical properties of the salt deposits and their enclosing strata and assess the economic value of any mineral resources that might exist in this area. This work would then enable the determination of the suitability of the salt deposits for a high-level nuclear waste repository. The U.S. Geological Survey was contracted by D.O.E. through the Office of Nuclear Waste Isolation (O.N.W.I.) to perform the mineralogic and geochemical studies in this investigation. This report represents a preliminary assemblage of mineralogic and geochemical data obtained thus far from the Gibson Dome core hole (GD-1). A portion of this data covering clay mineralogy (Bodine and Rueger, 1983) and potash deposits (Hite, 1982) has previously been interpreted and published. An interpretation of the data in this report will follow in additional reports.

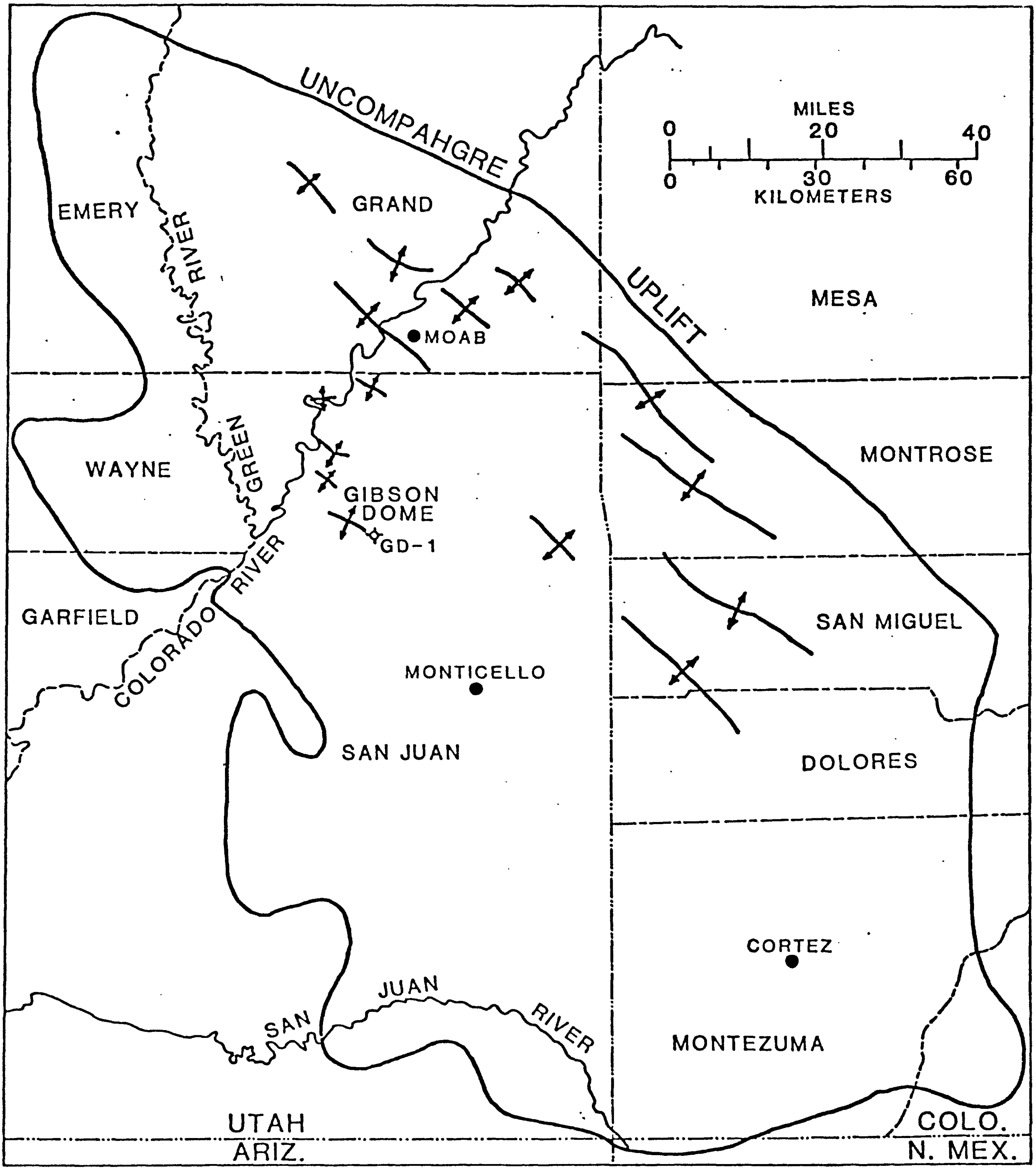

Figure 1.-- Index map showing boundaries of the Paradox Basin (solid line), salt anticlines (includes Gibson Dome) and the location of the GD-1 core hole.

The GD-1 core hole was cored continuously from 410 feet (125 m) to a total depth of 6,367 feet (1941 m). The hole was collared in the Permian Cutler Formation and bottomed in the Ouray Formation of Devonian age (fig. 2). In addition to providing the data necessary for the N.W.T.S. program in

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Figure 2.--Near here

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the Paradox Basin, the GD-1 core hole makes a major scientific contribution to the geologic community because this is the first time that the entire evaporite sequence of the Paradox Member and the Lower Member (Pinkerton Trail) of the Hermosa Formation have been cored.

REFERENCES

Bodine, M. W., and Rueger, B. F., 1983, Progress report on clay-mineral assemblages in the Gibson Dome No. 1 drill core, Paradox Basin, Utah: U.S. Geological Survey Open-File Report, in press.

Hite R. J., 1960, Stratigraphy of the saline facies of the Paradox Member of the Hermosa Formation of southeastern Utah and southwestern Colorado, in Four Corners Geological Society 3rd Field Conference Guidebook, Geology of the Paradox fold and fault belt, 1960: p. 86-89.

_______1982, Potash deposits in the Gibson Dome area, southeast Utah: U.S. Geological Survey Open-File Report 82-1067.

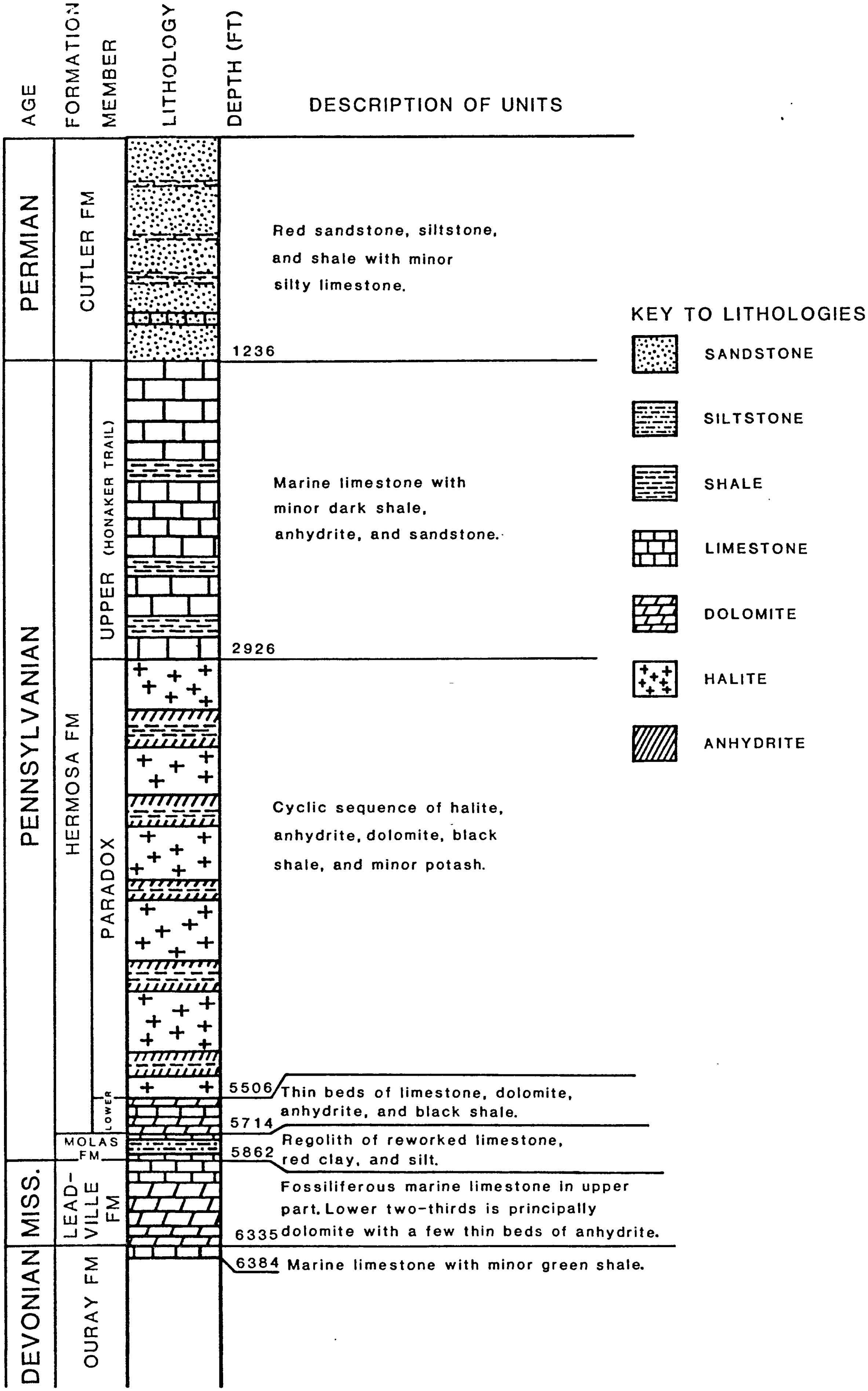

Figure 2.-- Generalized stratigraphy of the rocks penetrated by the GD-1 core hole.

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44. Distribution of magnesium from kieserite in GD-1 core hole. Determined by subtracting the amount of magnesium necessary to balance potassium in the mineral carnallite from total magnesium. Total magnesium was determined by atomic absorption spectrometry.

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46. Total bound water in the "carnallite marker" of salt 6 of the Paradox Member, GD-1 core hole. Includes water of crystallization from carnallite ($KCl.MgCl_2.6H_2O$) and kieserite ($MgSO_4.H_2O$).

TABLE LIST

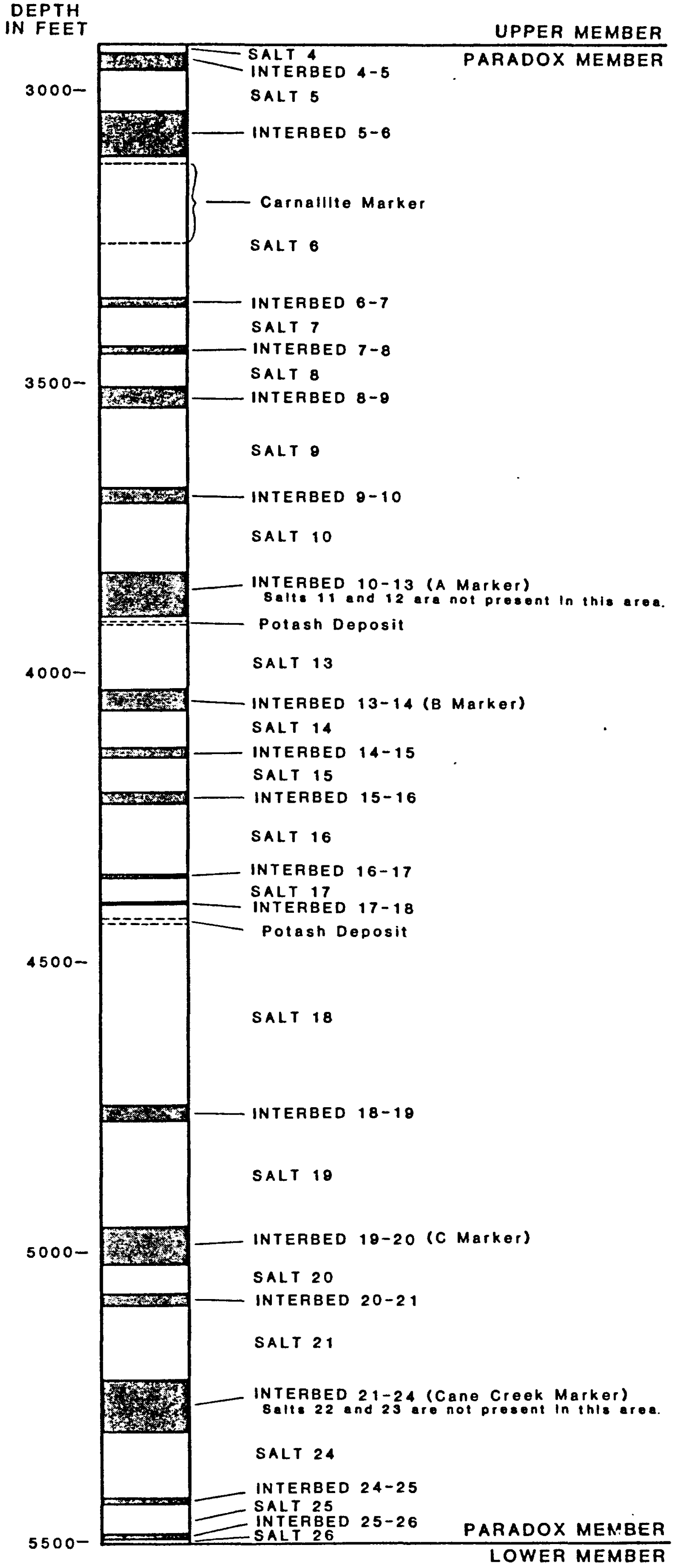


Figure 3.-- Detailed stratigraphy of the Paradox Member of the Hersmosa Formation (Hite, 1960). As defined here the upper and lower boundaries of the Paradox Member are the top of the uppermost salt bed and the base of the lowermost salt bed. All depths are adjusted to geophysical log measurements (measured from K.B.).

GIBSON DOME # 1 BROMINE DISTRIBUTION

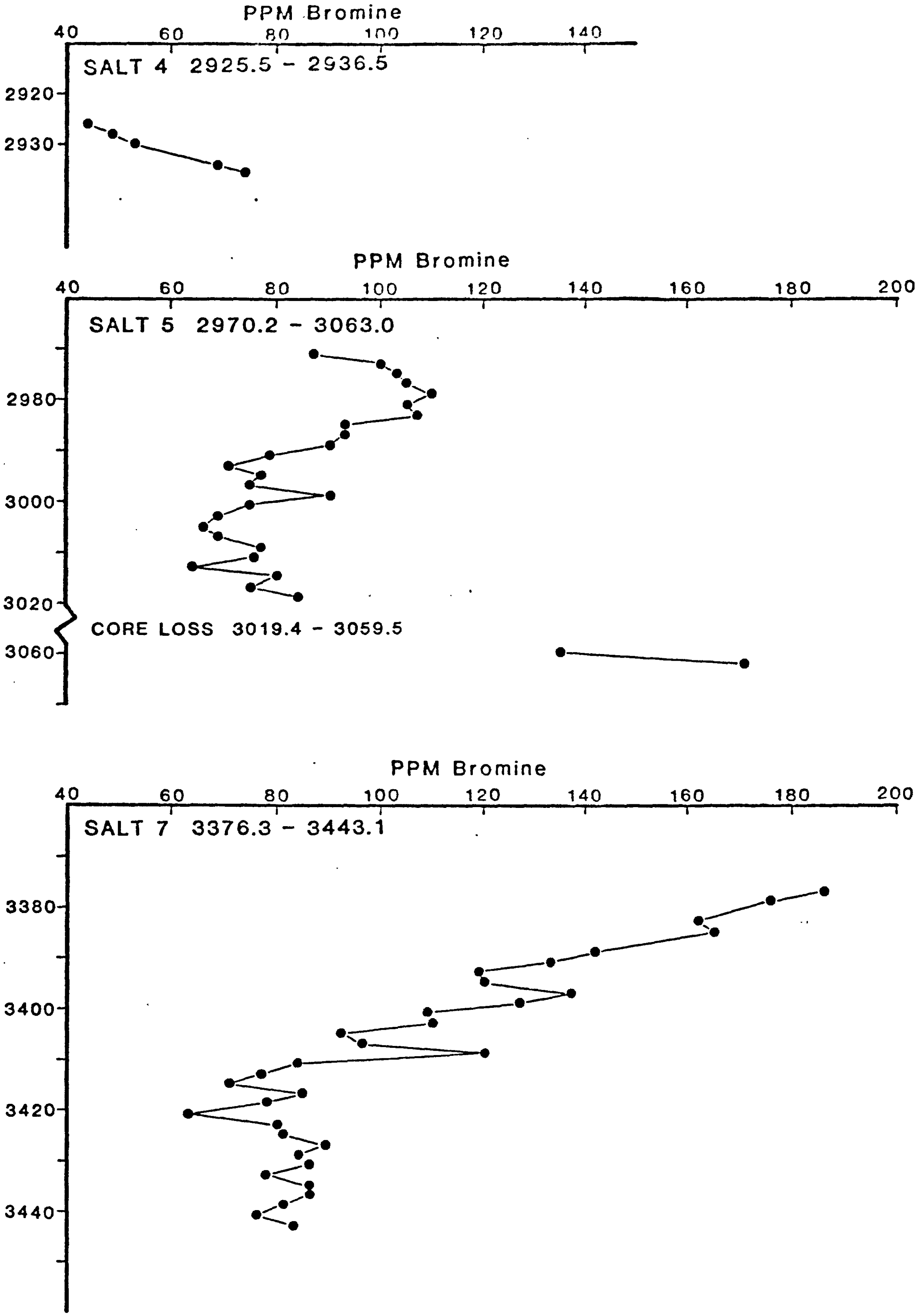


Figure 7.-- Bromine distribution in Salt 4, 5, and 7 of the Paradox Member, GD-1 core hole. Analyses by x-ray fluorescence.

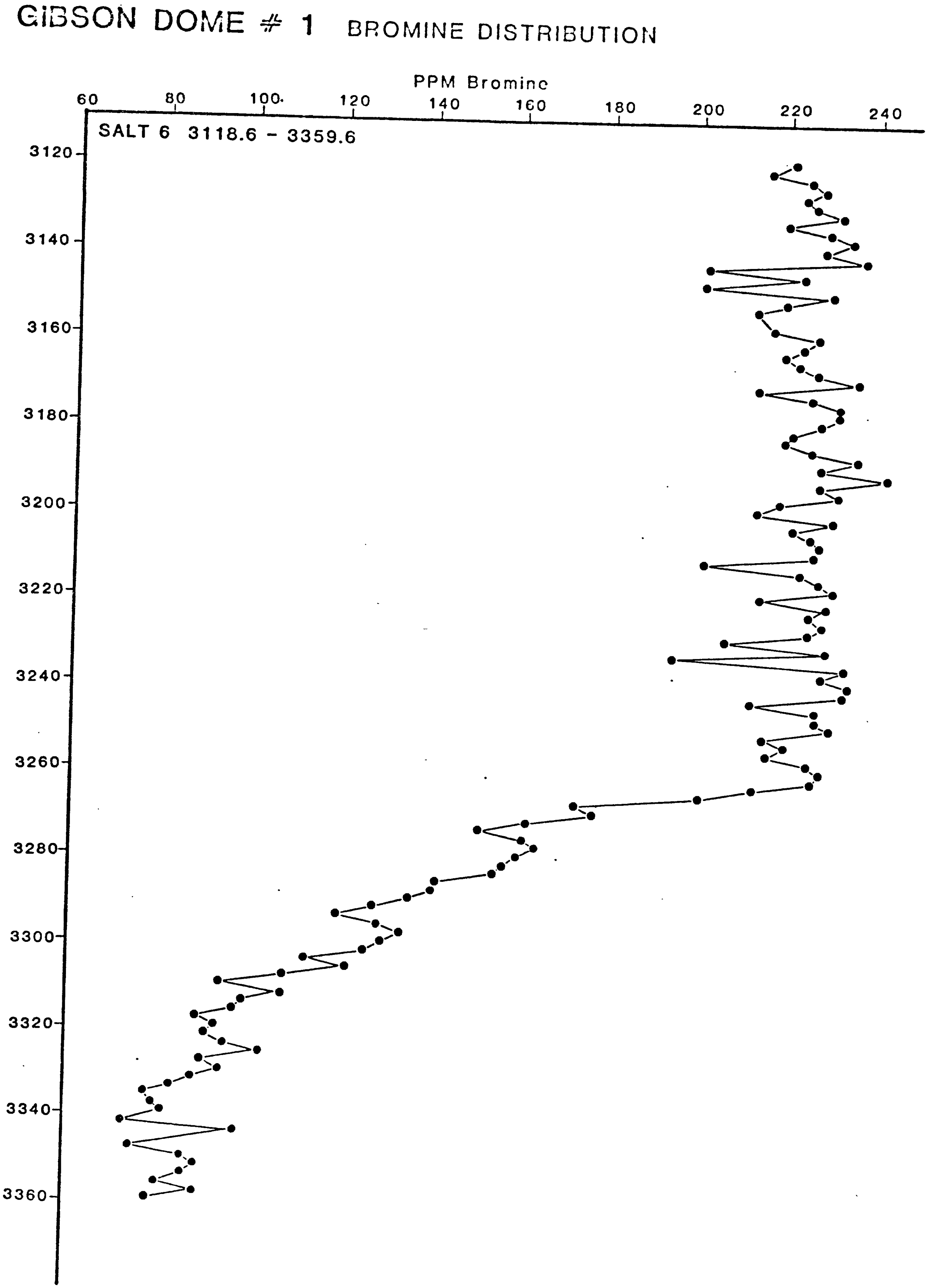


Figure 8.-- Bromine distribution in Salt 6 of the Paradox Member, GD-1 core hole. Analyses by x-ray fluorescence.

GIBSON DOME # 1

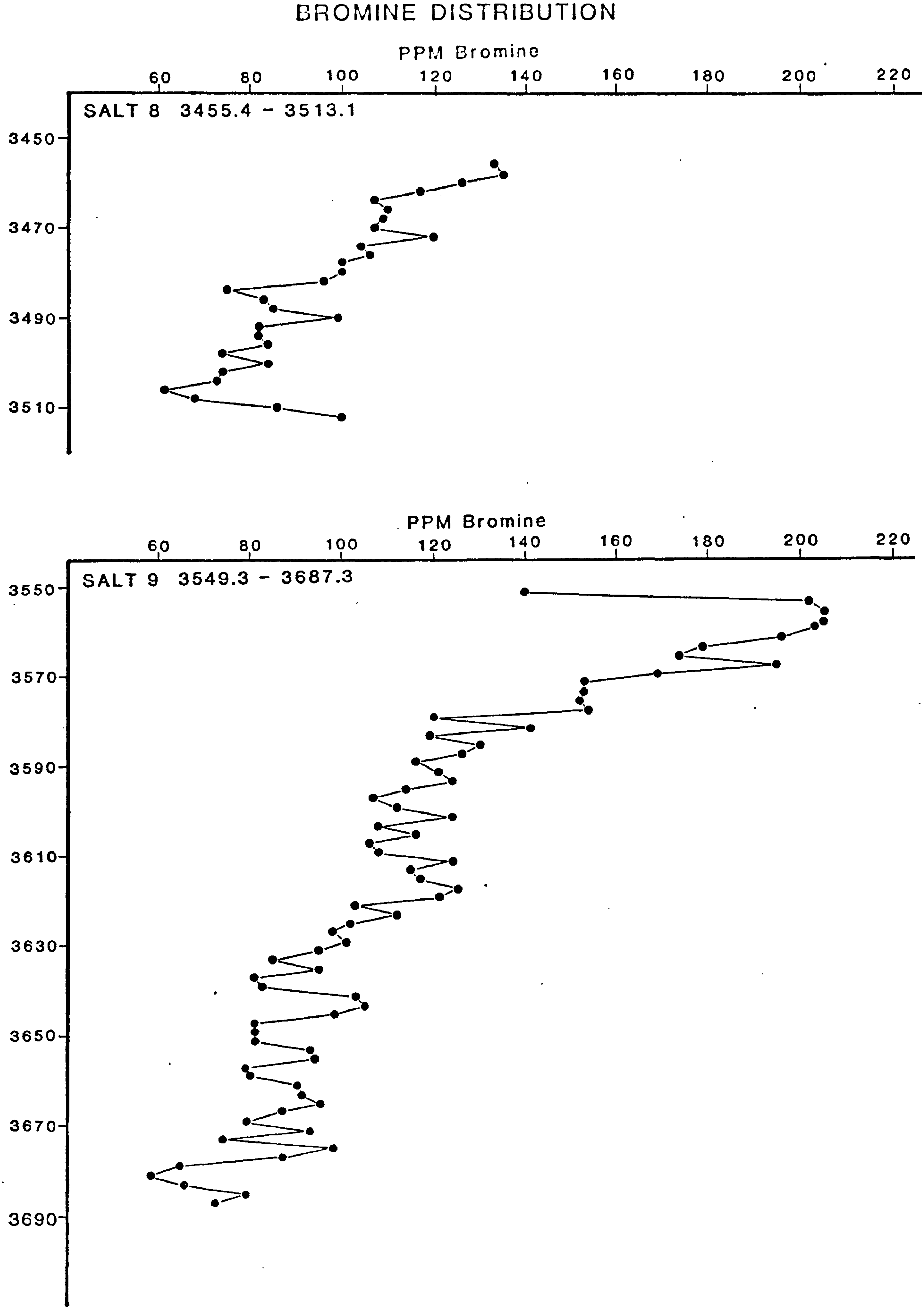


Figure 9.-- Bromine distribution in Salt 8 and 9 of the Paradox Member, GD-1 core hole. Analyses by x-ray fluorescence.

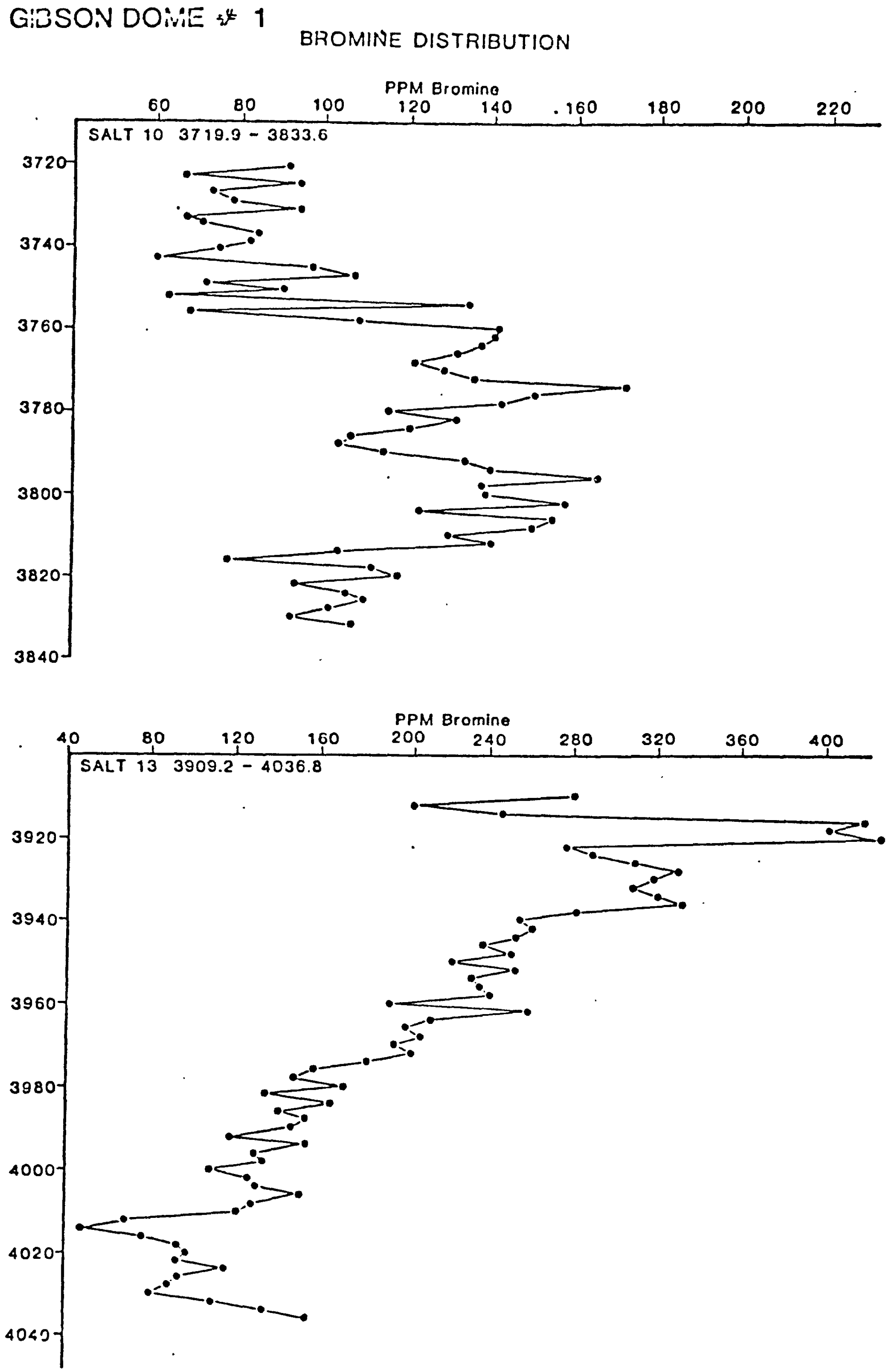


Figure 10.-- Bromine distribution in Salt 10 and 13 of the Paradox Member, GD-1 core hole. Analyses by x-ray fluorescence.

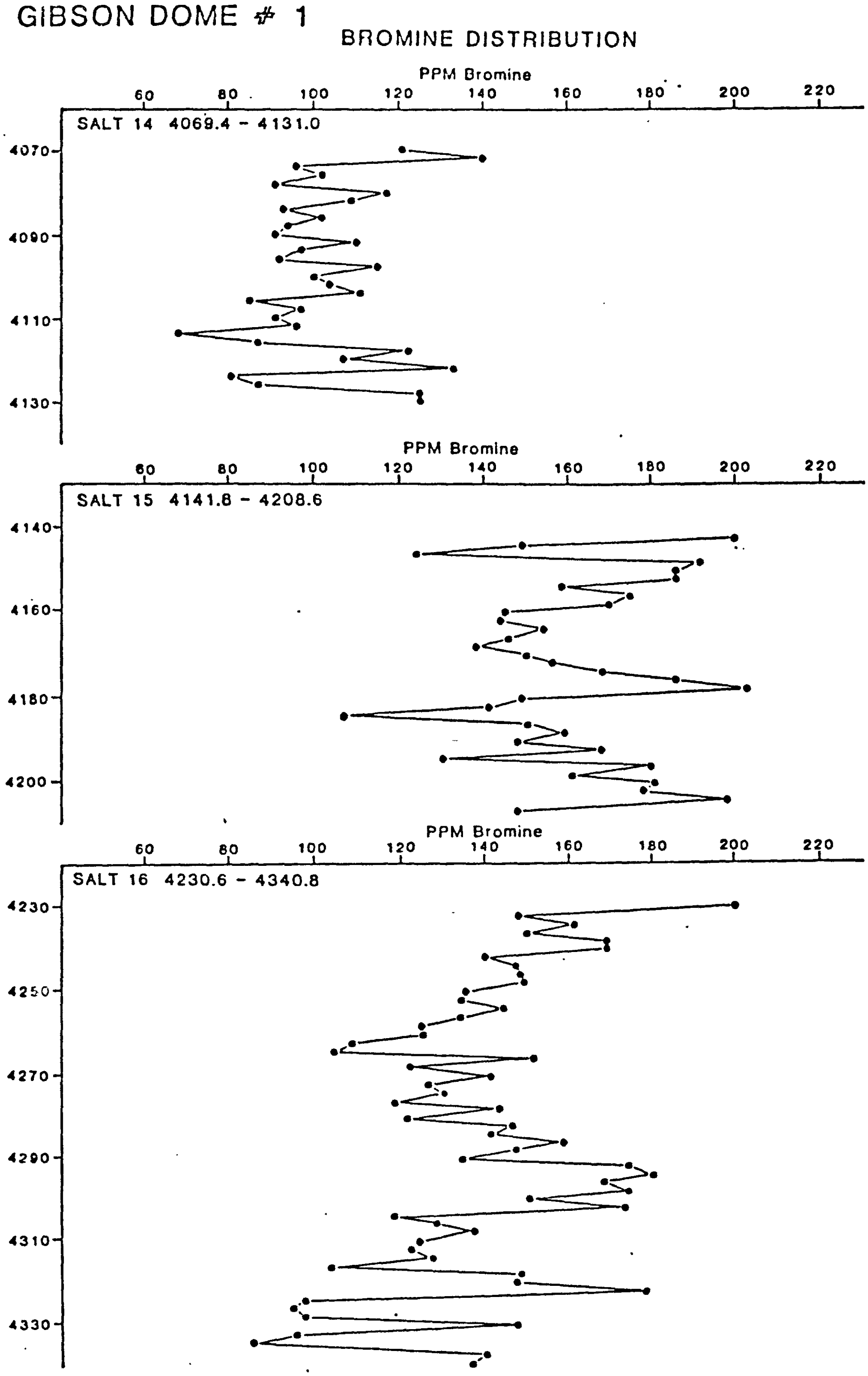


Figure 11.-- Bromine distribution in Salt 14, 15, and 16 of the Paradox Member, GD-1 core hole. Analyses by x-ray fluorescence.

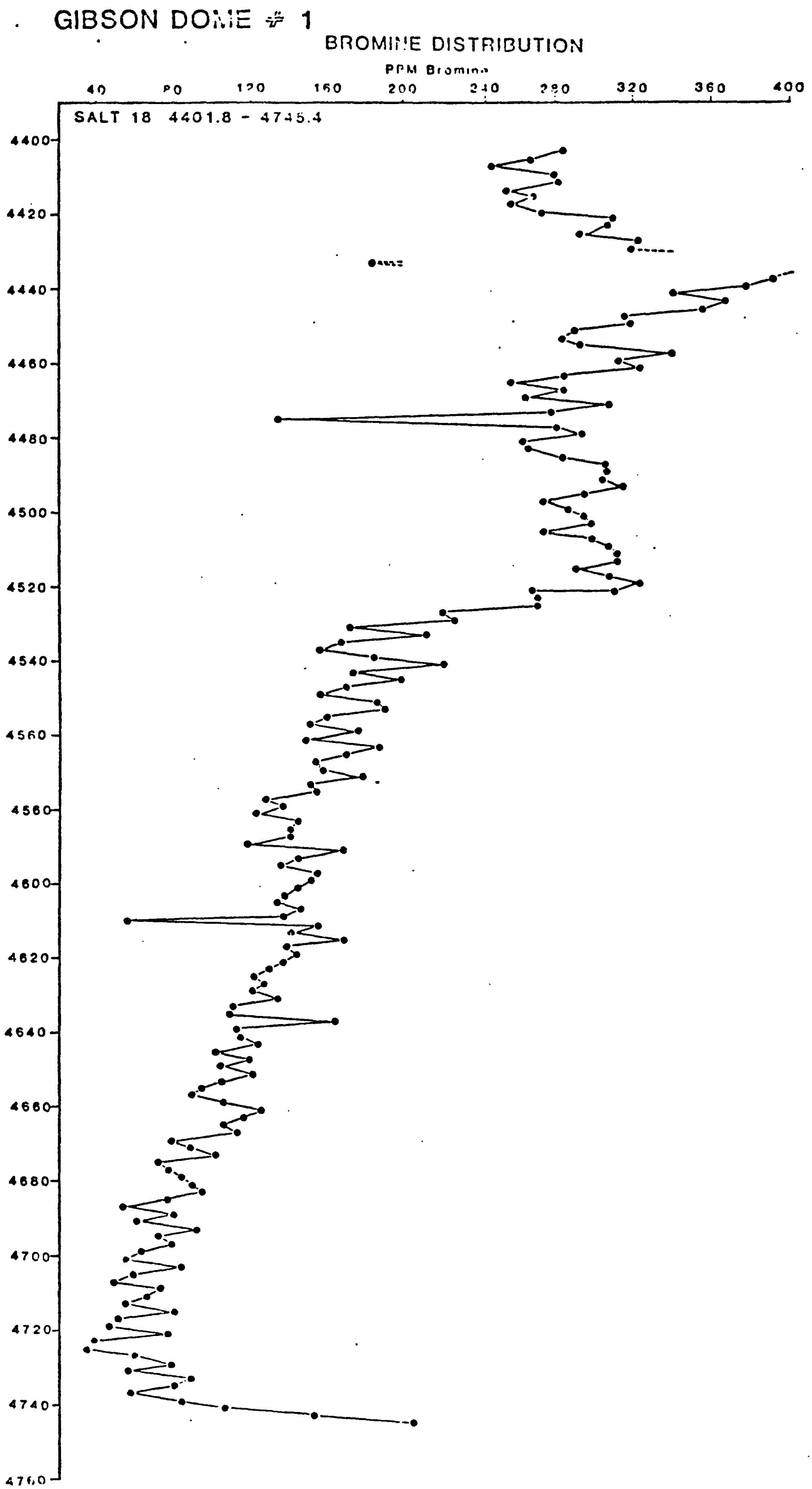


Figure 12.-- Bromine distribution in Salt 18 of the Paradox Member, GD-1 core hole. Analyses by x-ray fluorescence.

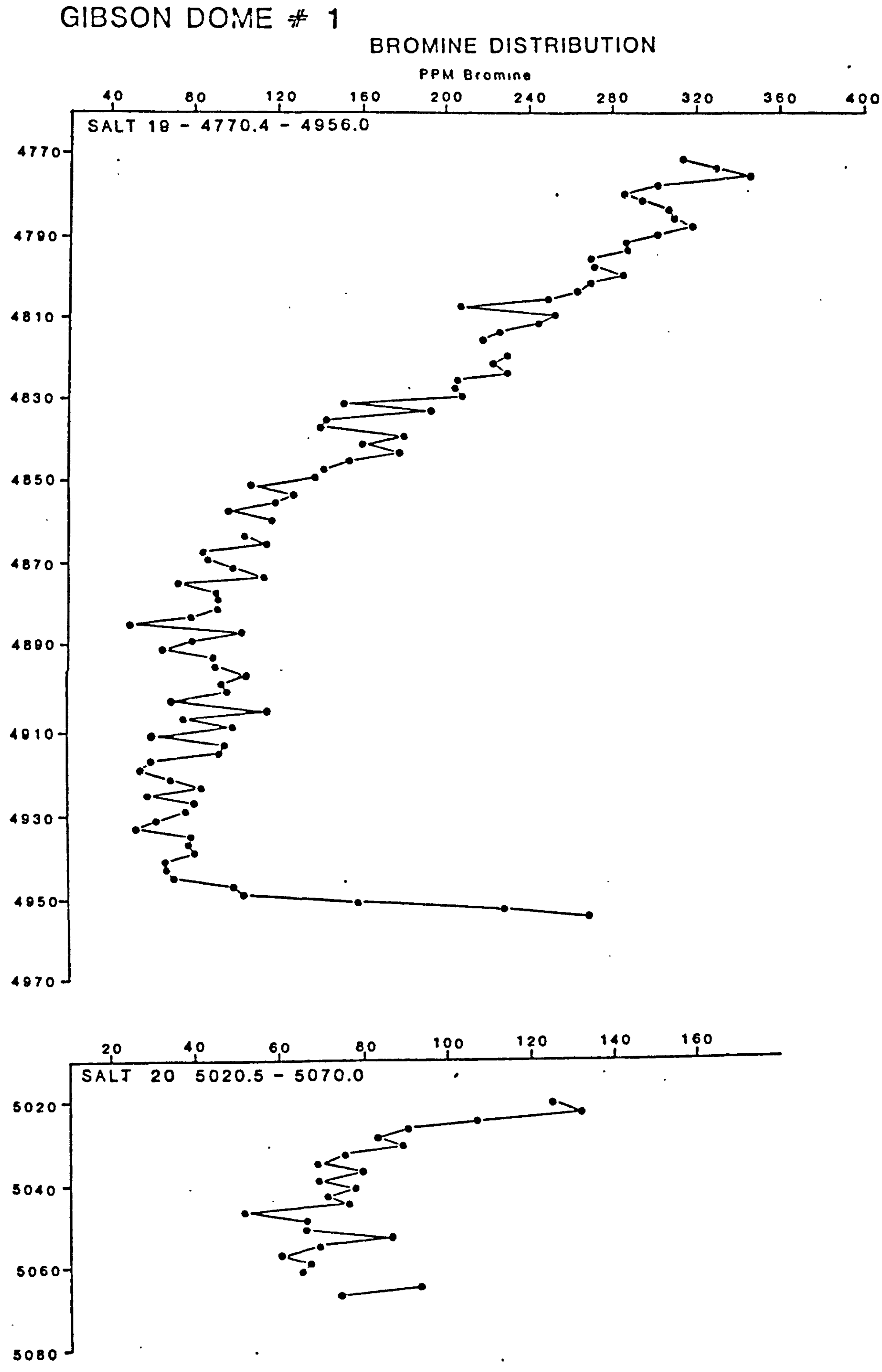


Figure 13.-- Bromine distribution in Salt 19 and 20 of the Paradox Member, GD-1 core hole. Analyses by x-ray fluorescence.

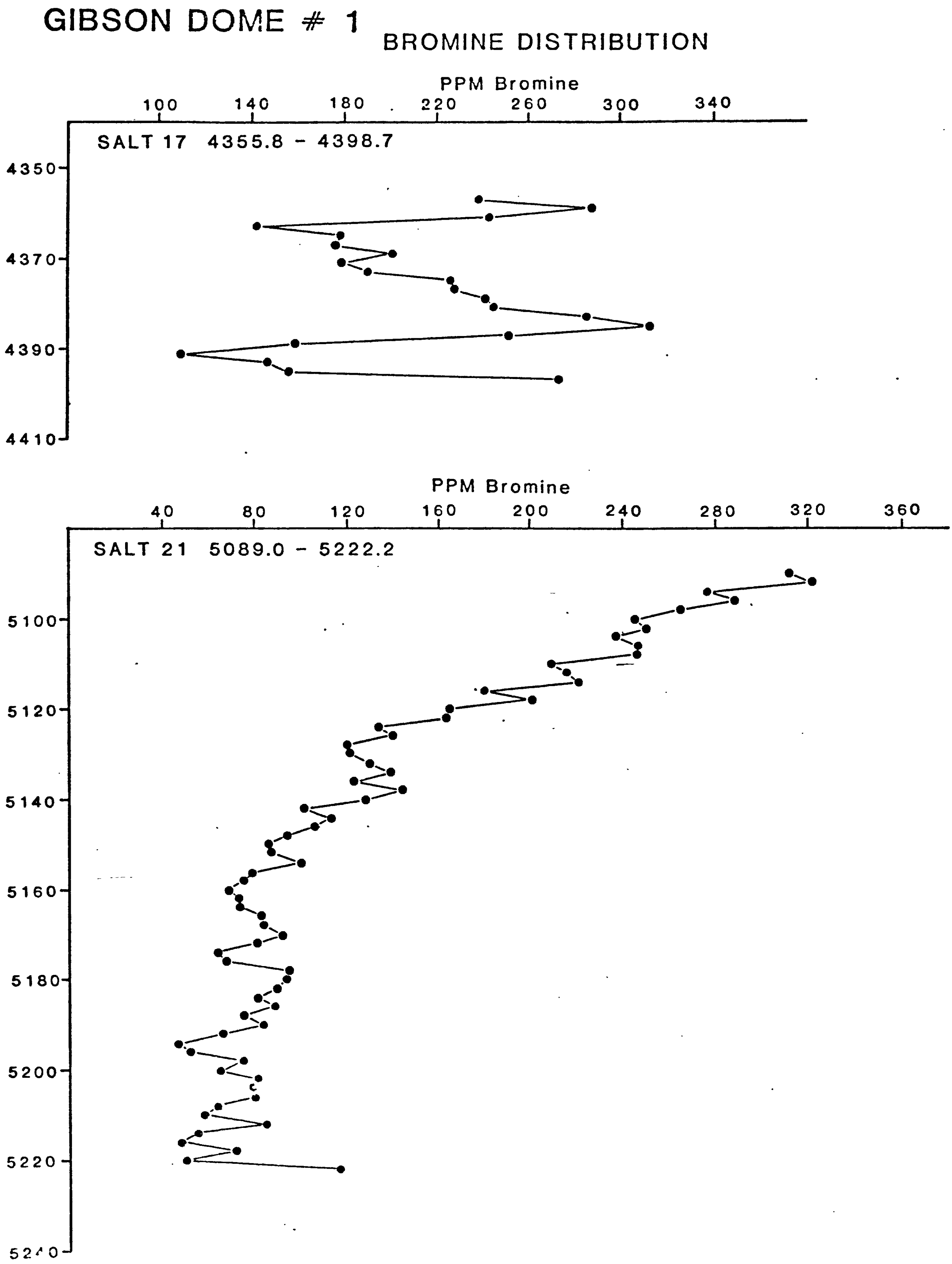


Figure 14.-- Bromine distribution in Salt 17 and 21 of the Paradox Member, GD-1 core hole. Analyses by x-ray fluorescence.

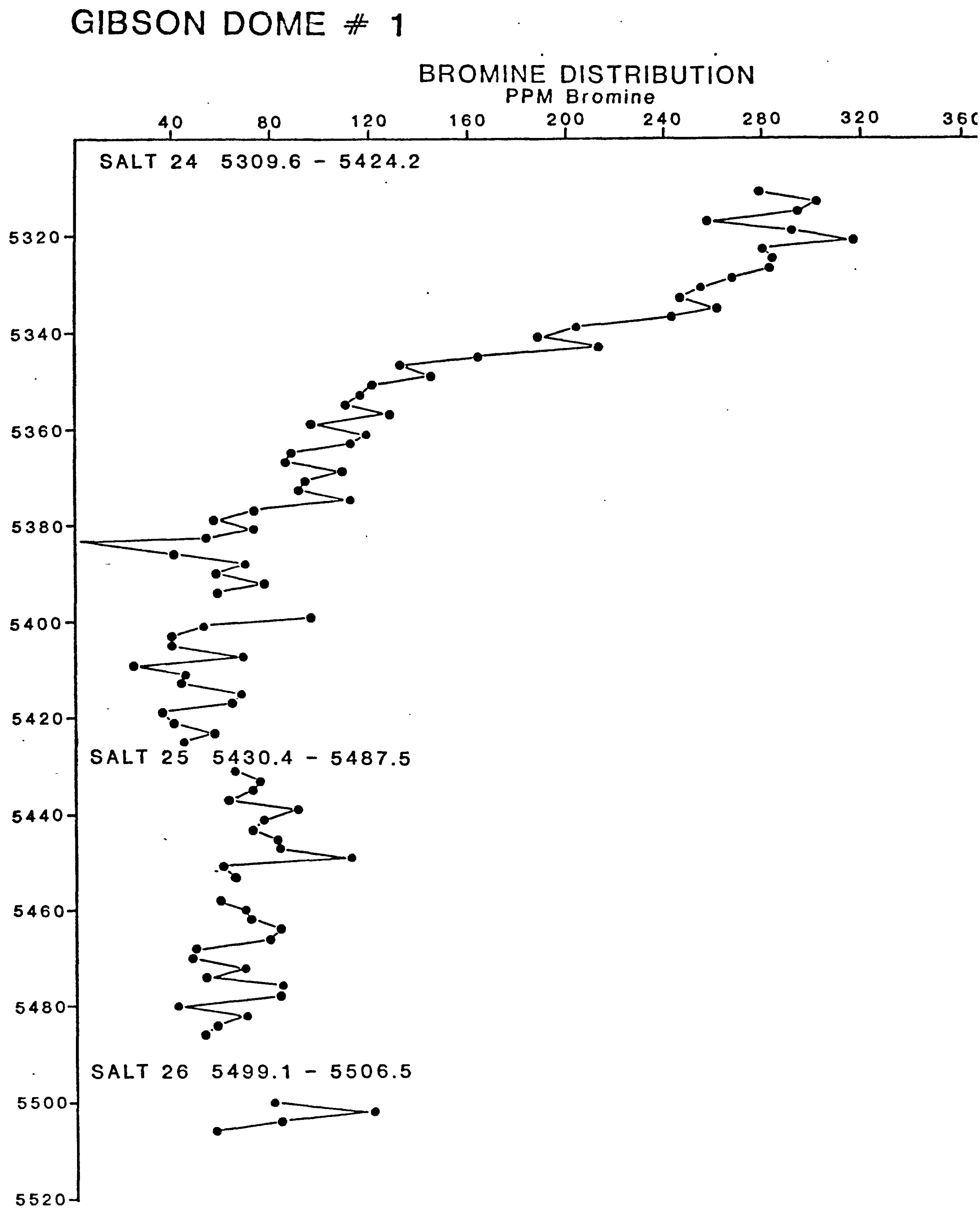


Figure 15.-- Bromine distribution in Salt 24, 25, and 26 of the Paradox Member, GD-1 core hole. Analyses by x-ray fluorescence.

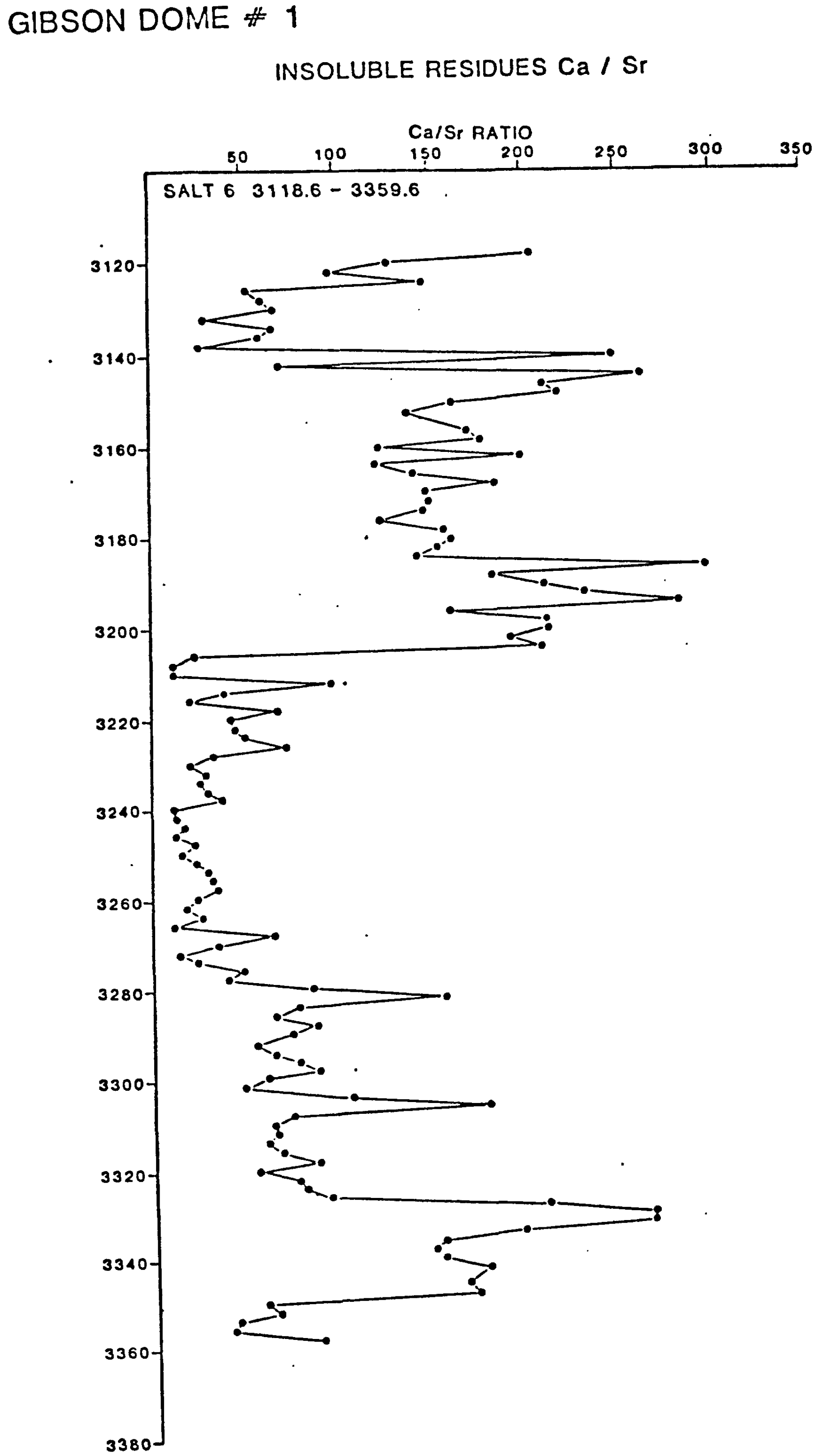


Figure 16.-- Ca/Sr ratios in anhydrite from water insoluble residues of two foot composited sample intervals in Salt 6 of the Paradox Member, GD-1 core hole. Analyses by x-ray fluorescence.

GIBSON DOME # 1

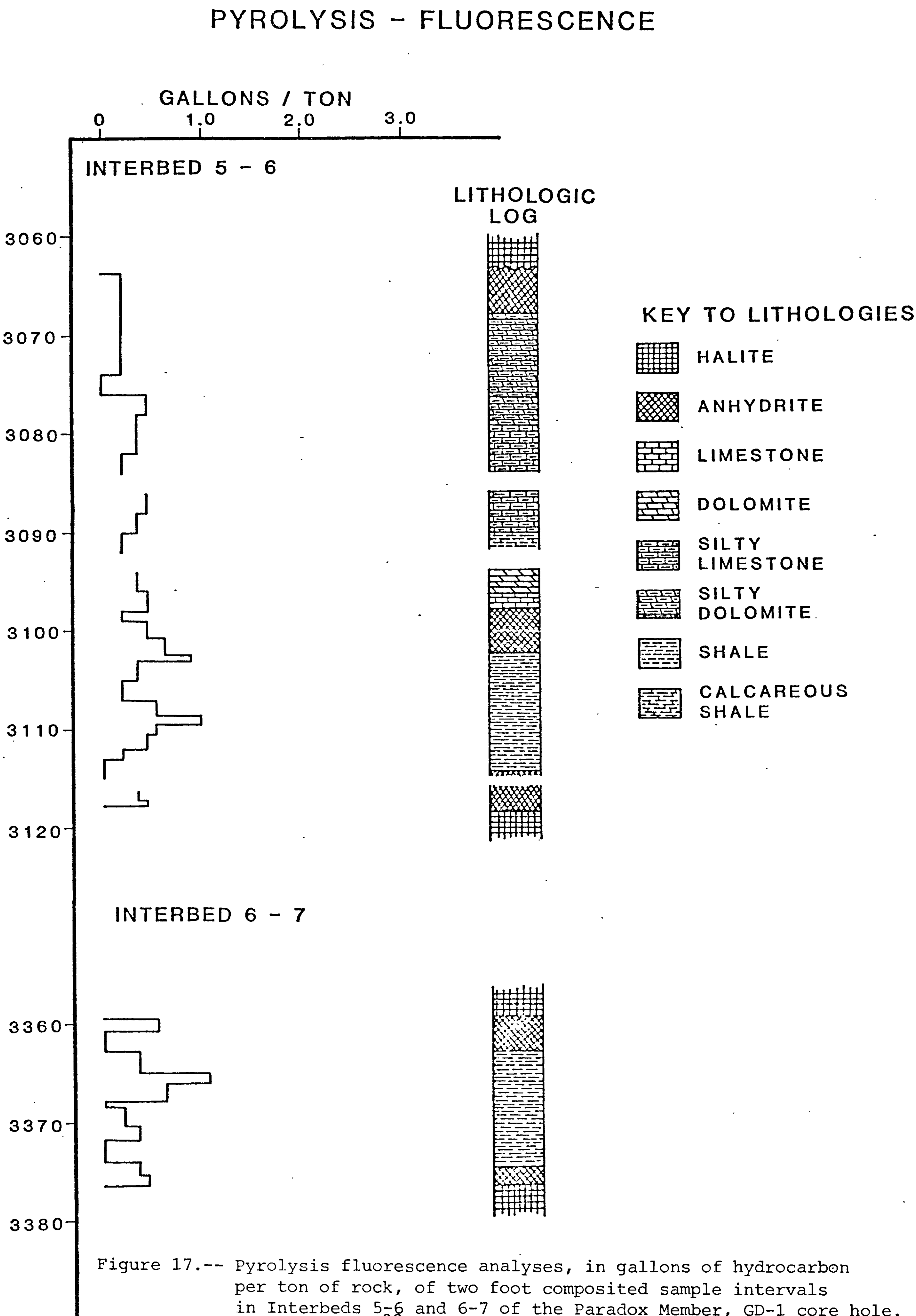


Figure 17.-- Pyrolysis fluorescence analyses, in gallons of hydrocarbon per ton of rock, of two foot composited sample intervals in Interbeds 5-6 and 6-7 of the Paradox Member, GD-1 core hole.

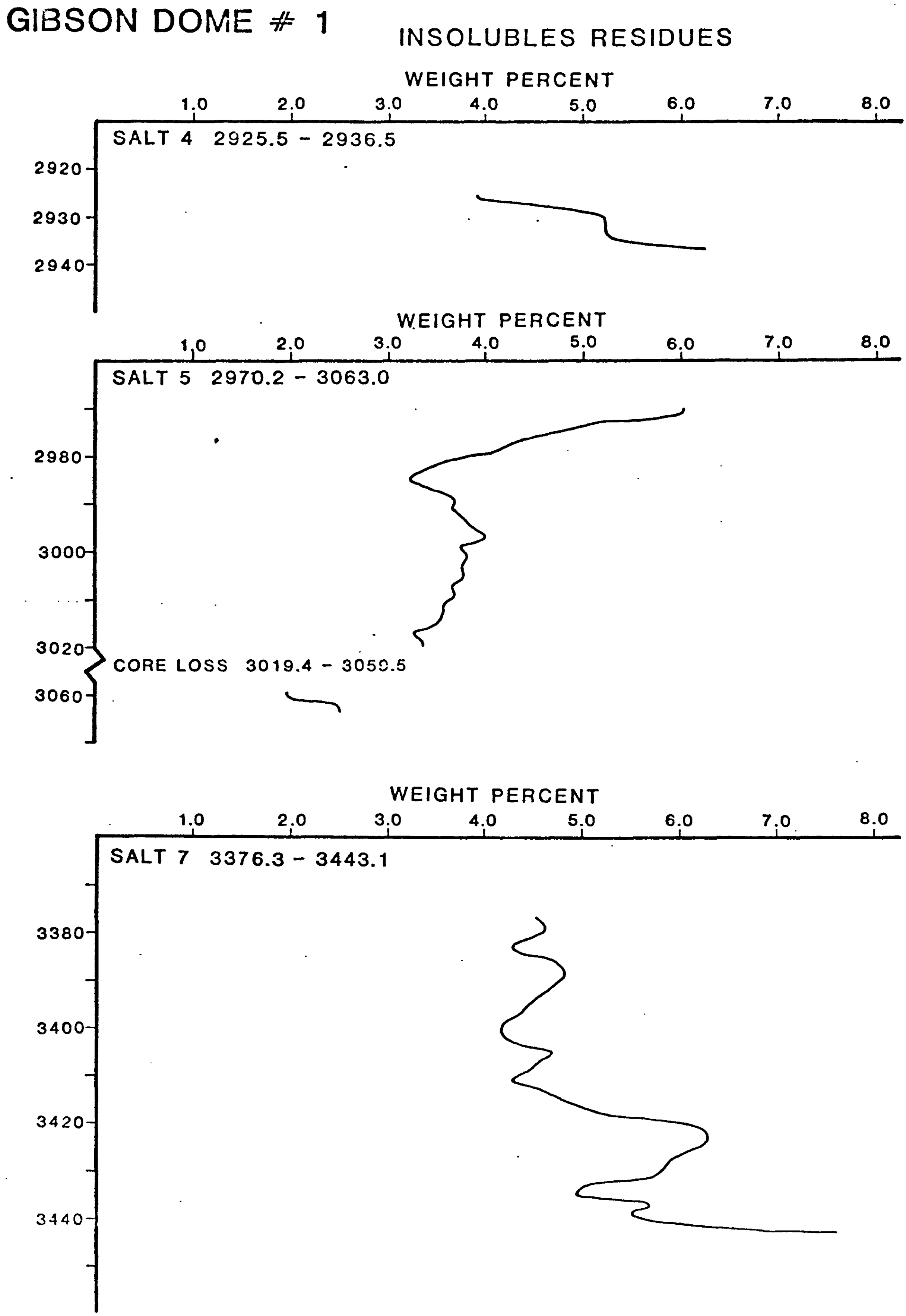


Figure 18.-- Water insoluble residues in weight percent from two foot composited sample intervals from Salt 4, 5, and 7 of the Paradox Member, GD-1 core hole.

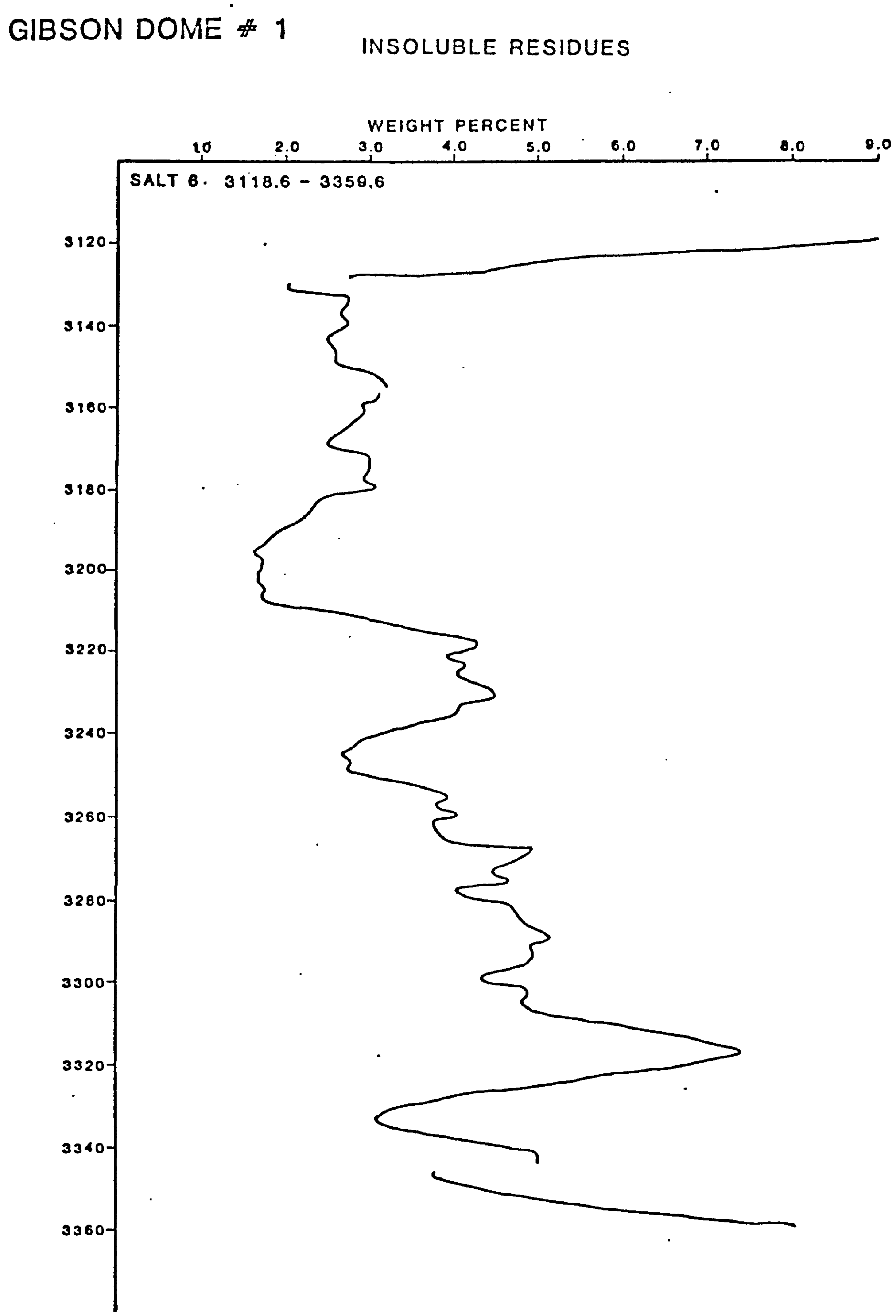


Figure 19.-- Water insoluble residues in weight percent from two foot composited sample intervals from Salt 6 of the Paradox Member, GD-1 core hole.

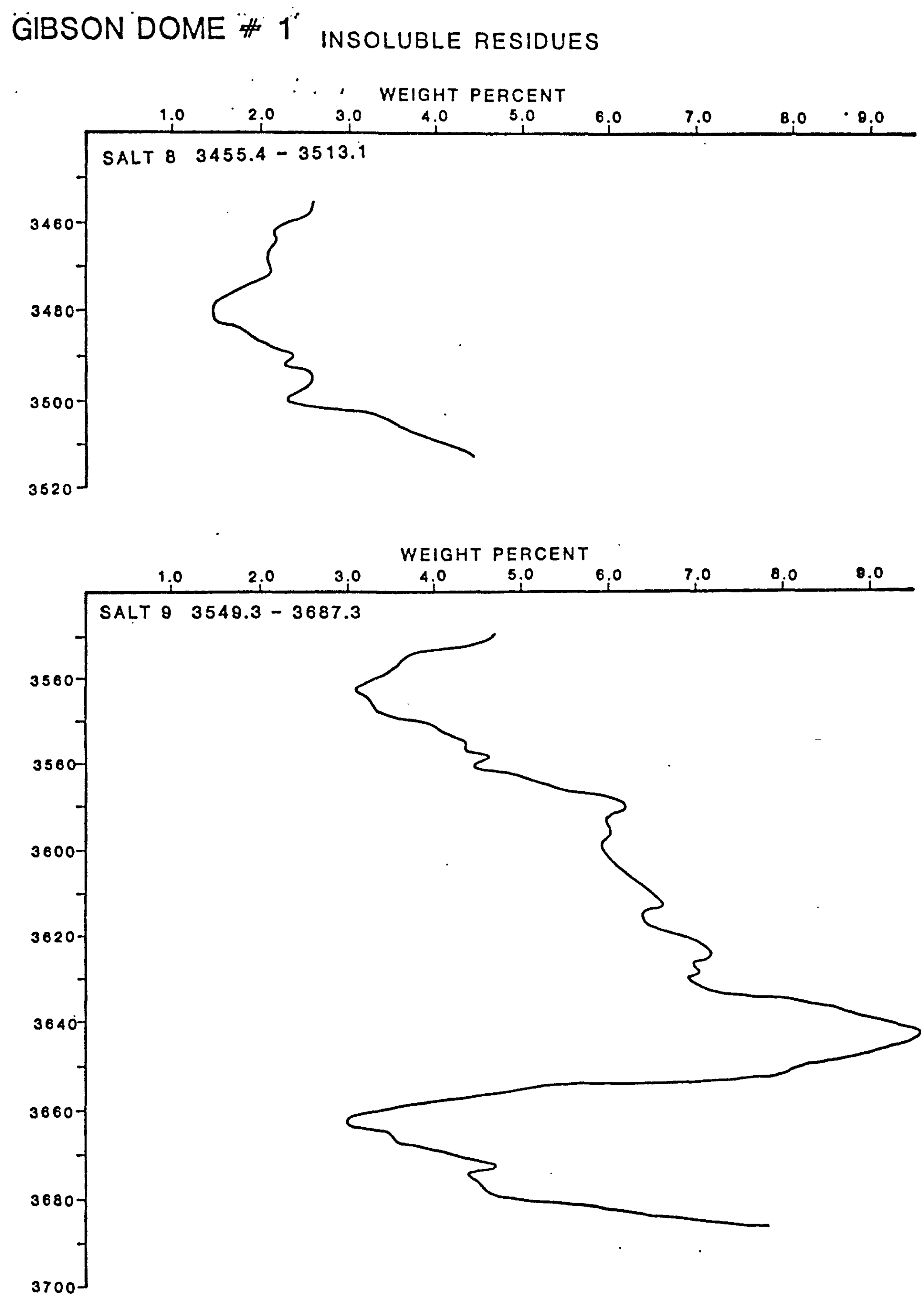


Figure 20.-- Water insoluble residues in weight percent from two foot composited intervals from Salt 8 and 9 of the Paradox Member, GD-1 core hole.

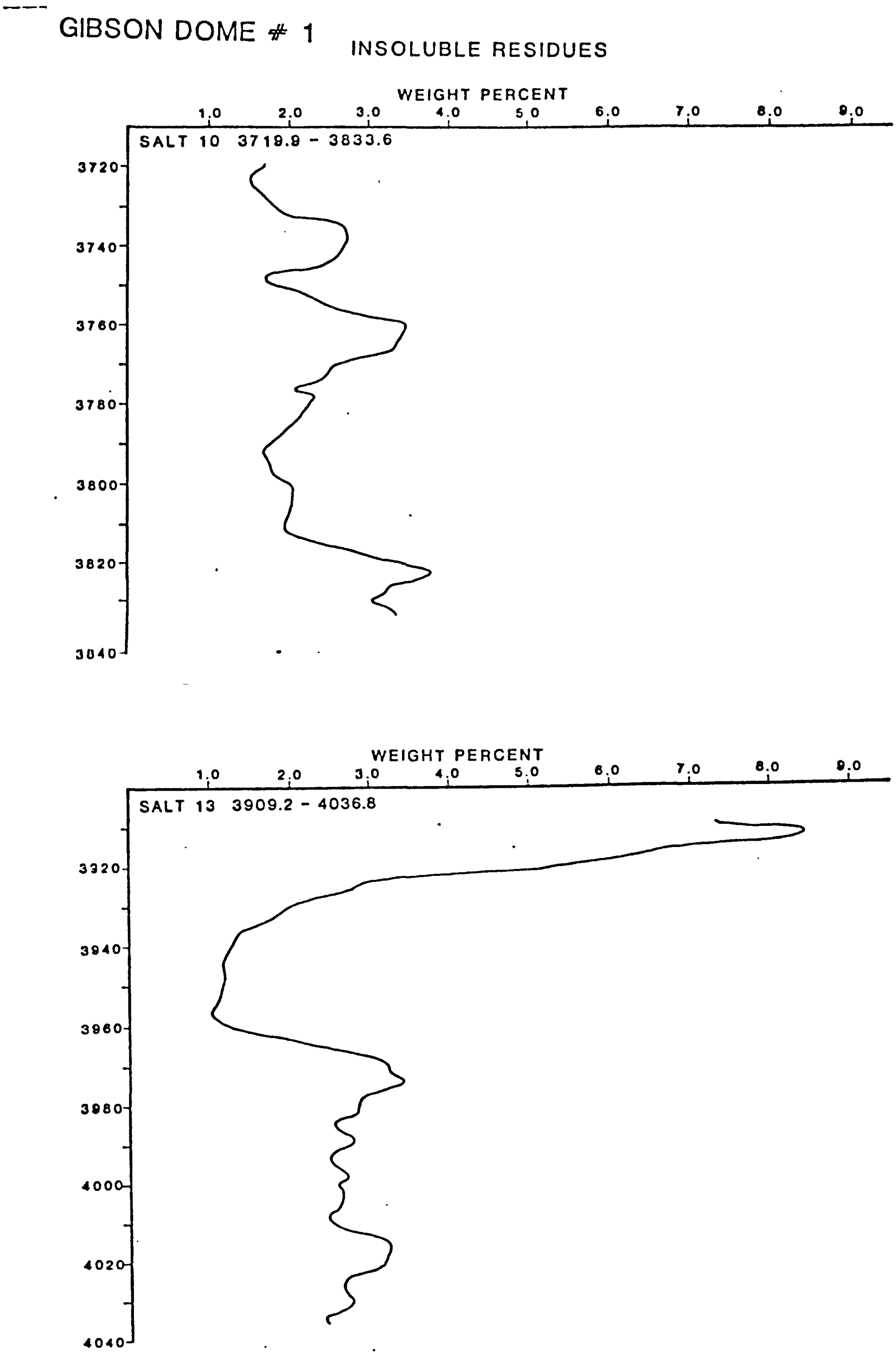


Figure 21.-- Water insoluble residues in weight percent from two foot composited sample intervals from Salt 10 and 13 of the Paradox Member, GD-1 core hole.

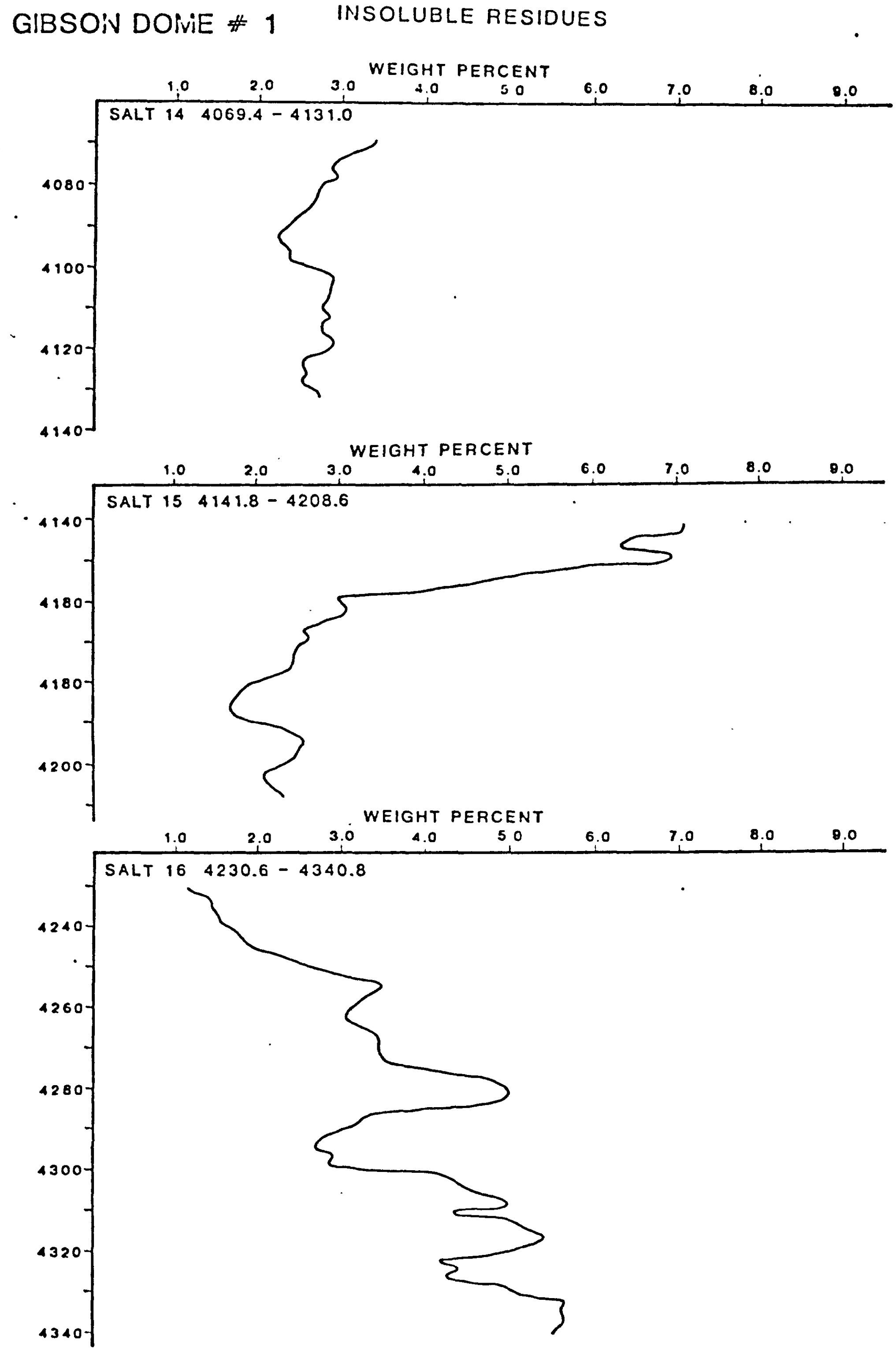


Figure 22.-- Water insoluble residues in weight percent from two foot composited sample intervals from Salt 14, 15, and 16 of the Paradox Member, GD-1 core hole.

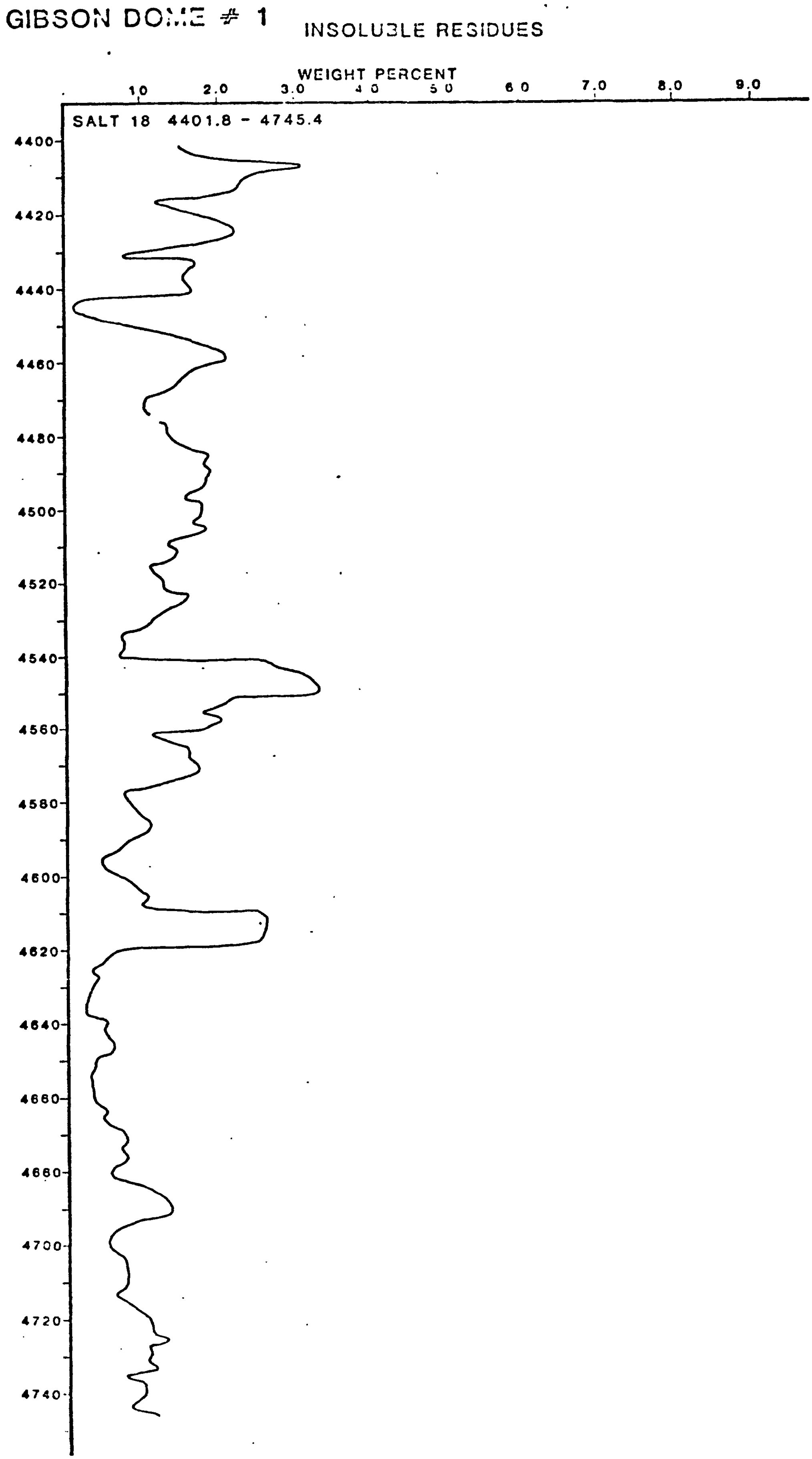


Figure 23.-- Water insoluble residues in weight percent from two foot composited sample intervals from Salt 18 of the Paradox Member, GD-1 core hole.

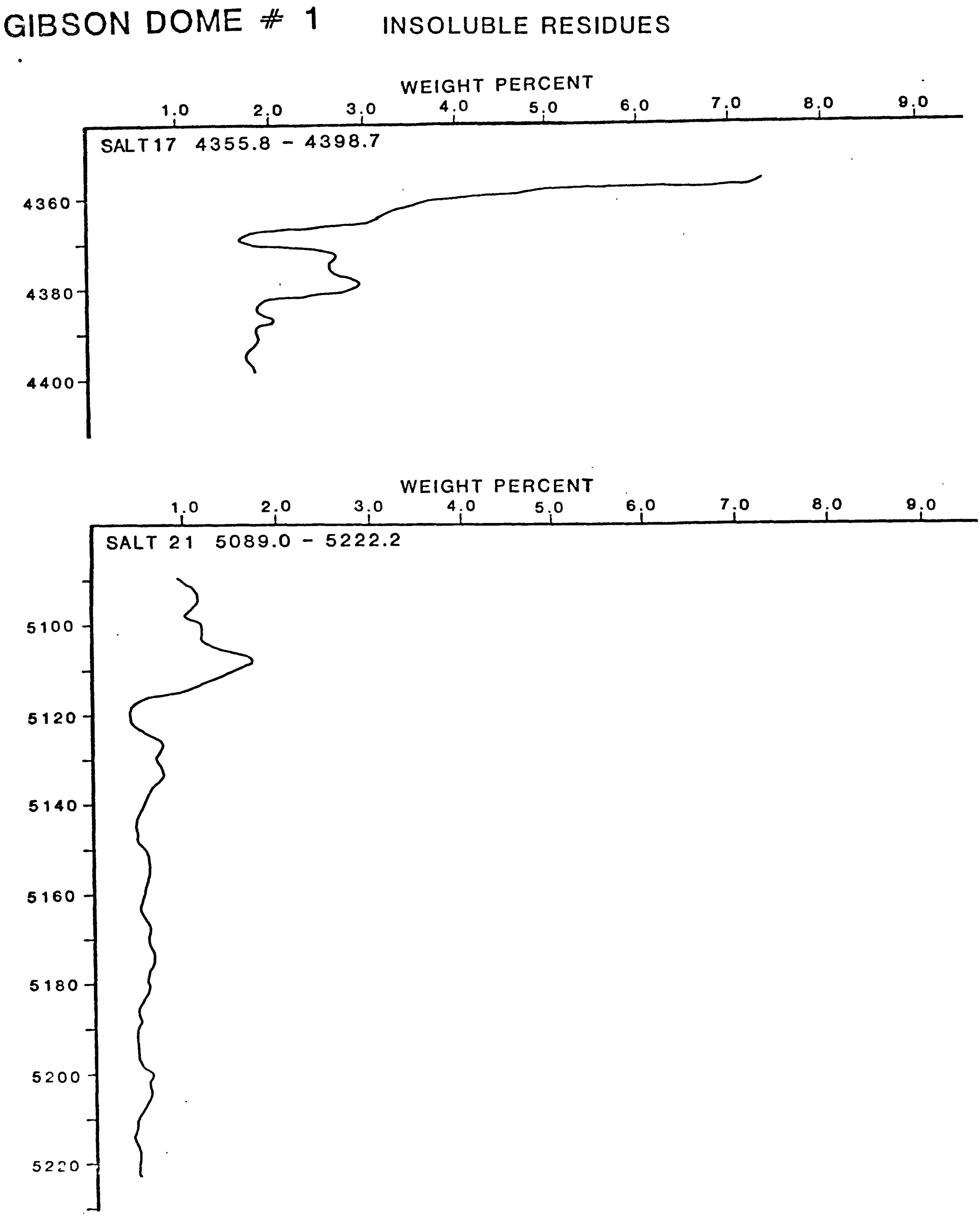
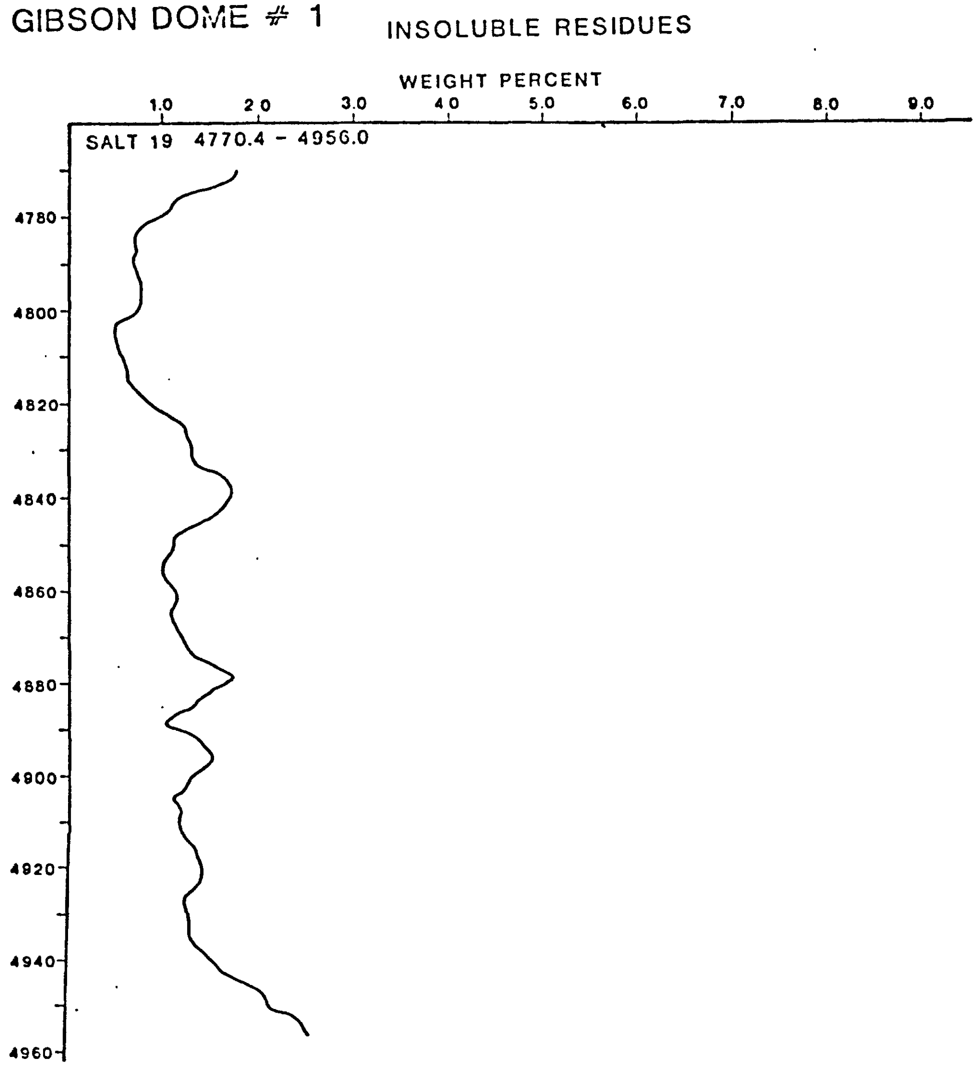


Figure 24.-- Water insoluble residues in weight percent from two foot composited sample intervals from Salt 17 and 21 of the Paradox Member, GD-1 core hole.

GIBSON DOME # 1



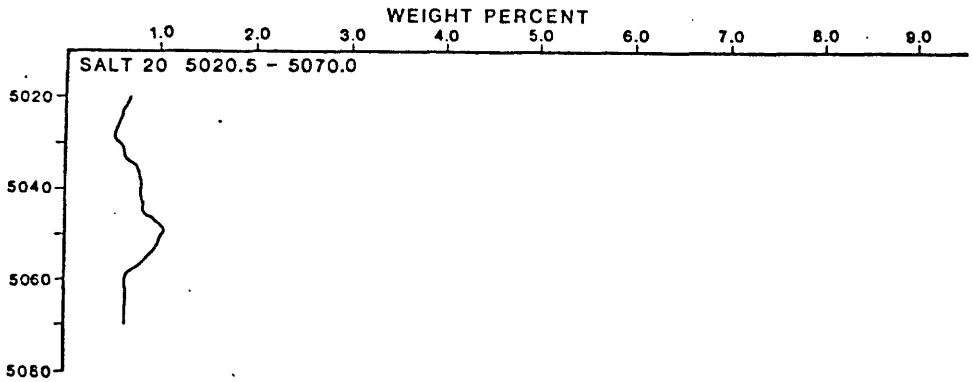


Figure 25.-- Water insoluble residues in weight percent from two foot composited sample intervals from Salt 19 and 20 of the Paradox Member, GD-1 core hole.

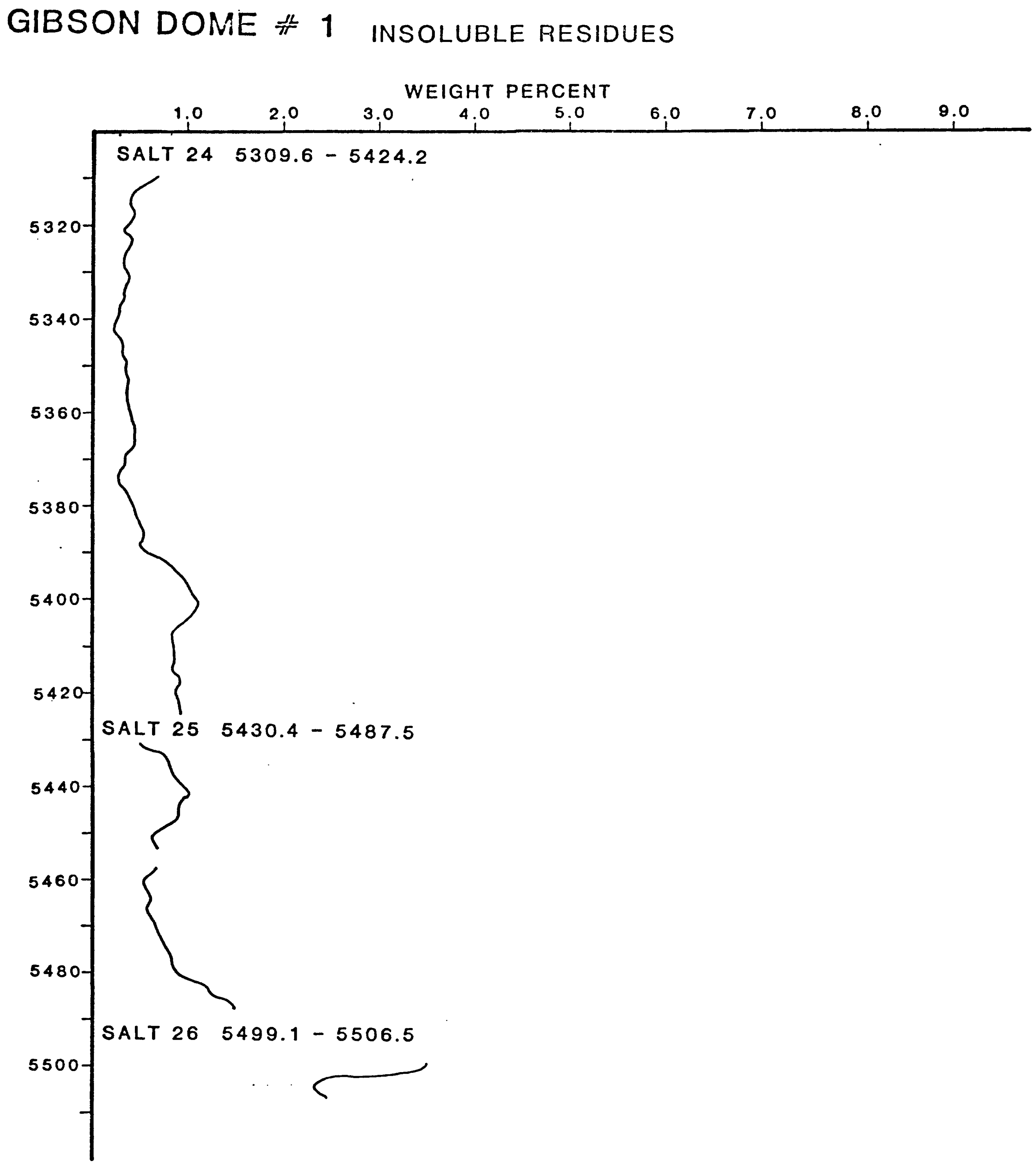


Figure 26.-- Water insoluble residues in weight percent from two foot composited sample intervals from Salt 24, 25, and 26 of the Paradox Member, GD-1 core hole.

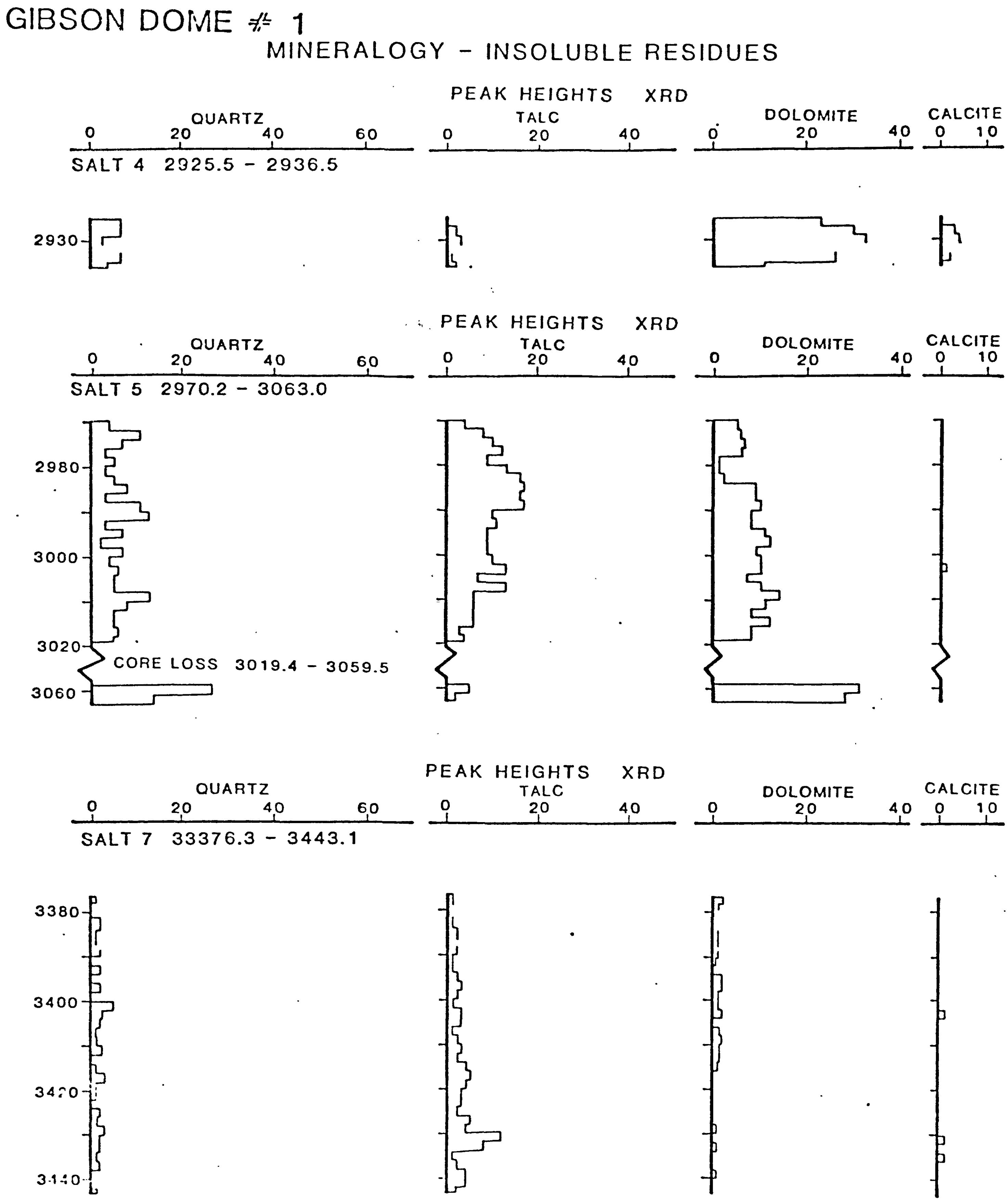


Figure 27.-- Mineralogy by x-ray diffraction of the water insoluble residues from Salt 4, 5, and 7 of the Paradox Member, GD-1 core hole. Measurements made on the principal diffraction peak of each mineral. Anhydrite, which consitutes more than 75% of most residues, is not shown.

GIBSON DOME # 1

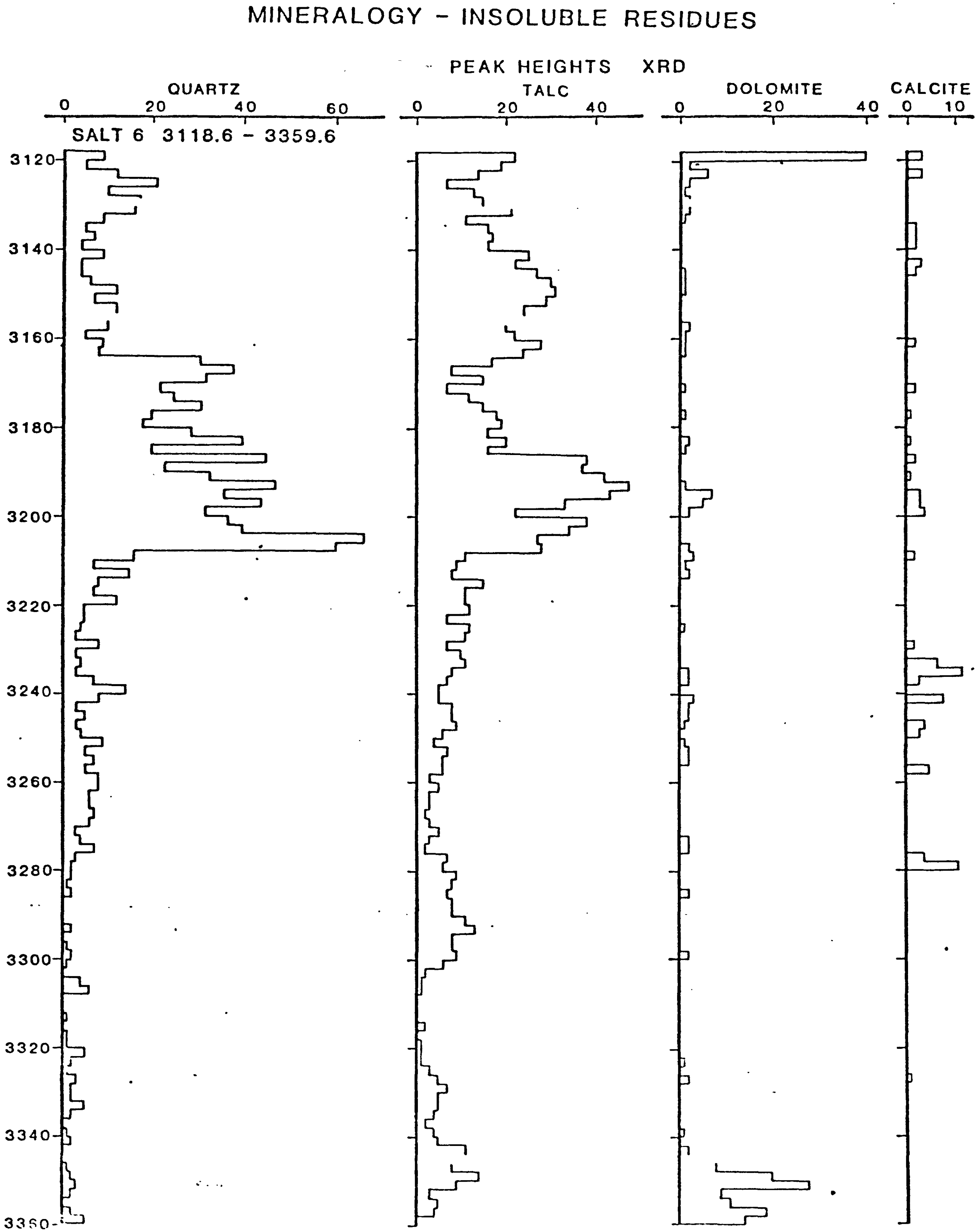


Figure 28.-- Mineralogy by x-ray diffration of the water insoluble residues from Salt 6 of the Paradox Member, GD-1 core hole. Measurements made on the principal diffraction peak of each mineral. Anhydrite, which consitutes 75% of most residues, is not shown.

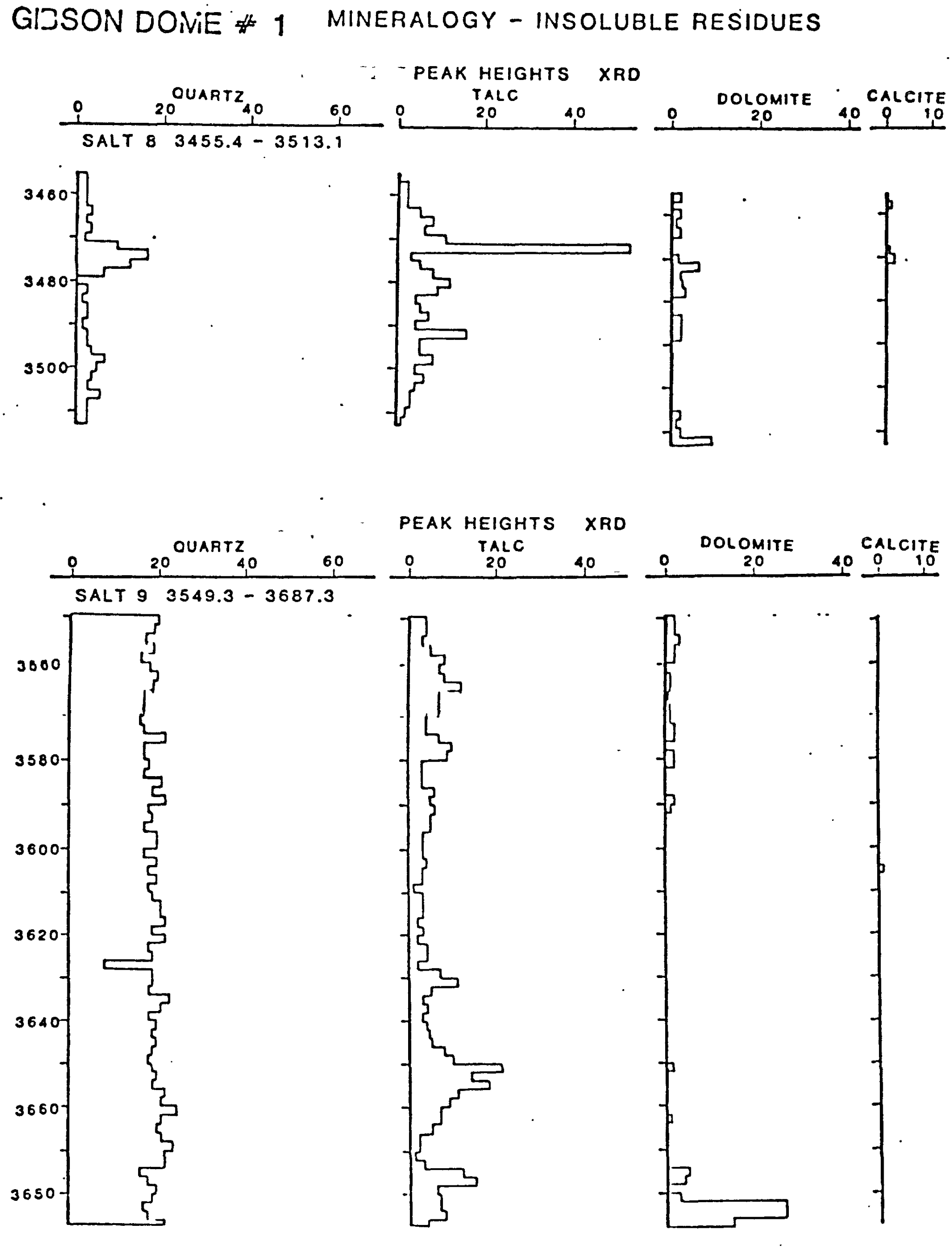


Figure 29.-- Mineralogy by x-ray diffraction of the water insoluble residues from Salt 8 and 9 of the Paradox Member, GD-1 core hole. Measurements made on the principal diffraction peak of each mineral. Anhydrite, which constitutes more than 75% of most residues, is not shown.

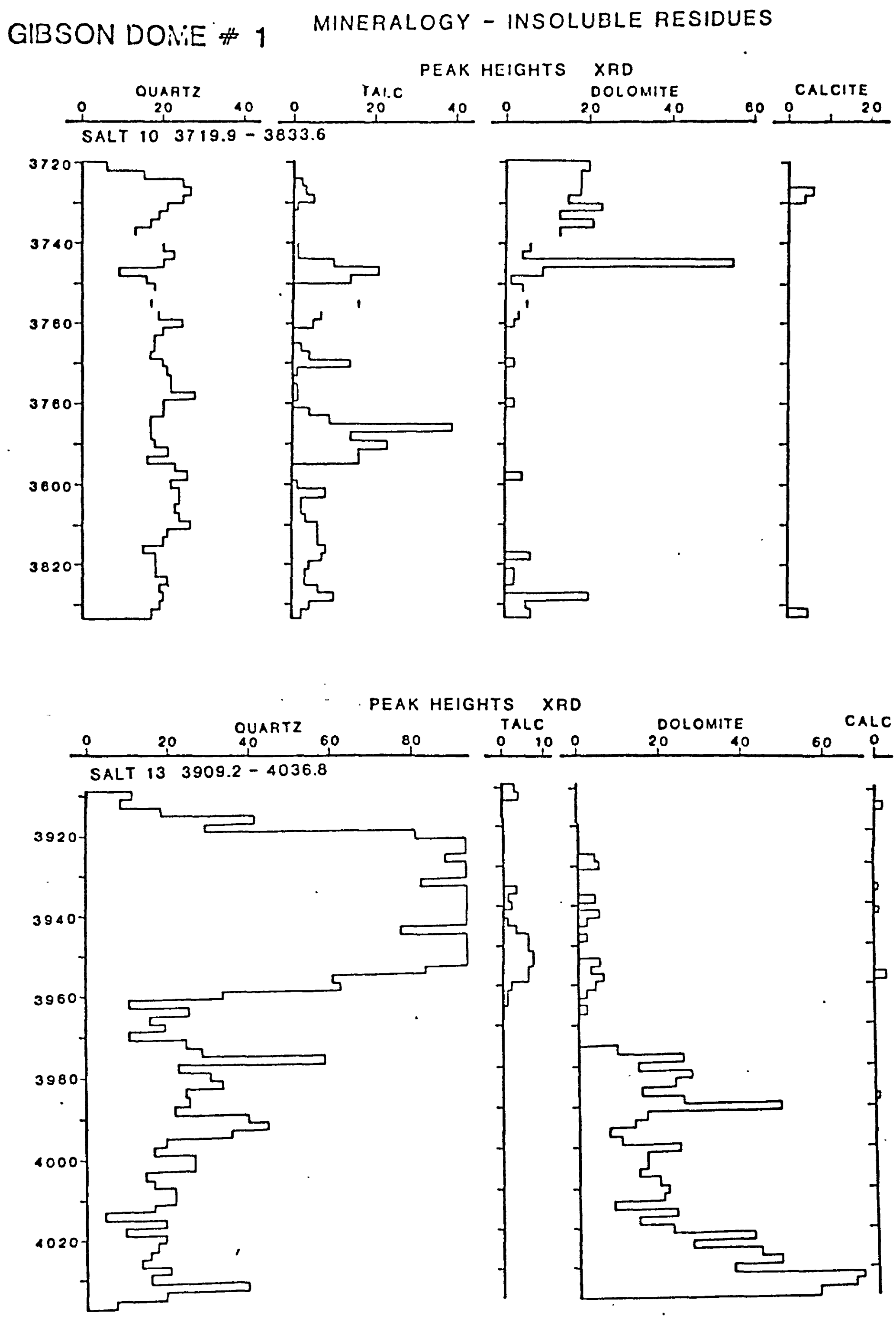


Figure 30.-- Mineralogy by x-ray diffraction of the water insoluble residues from Salt 10 and 13 of the Paradox Member, GD-1 core hole. Measurements made on the principal diffraction peak of each mineral. Anhydrite, which constitutes more than 75% of most residues, is not shown.

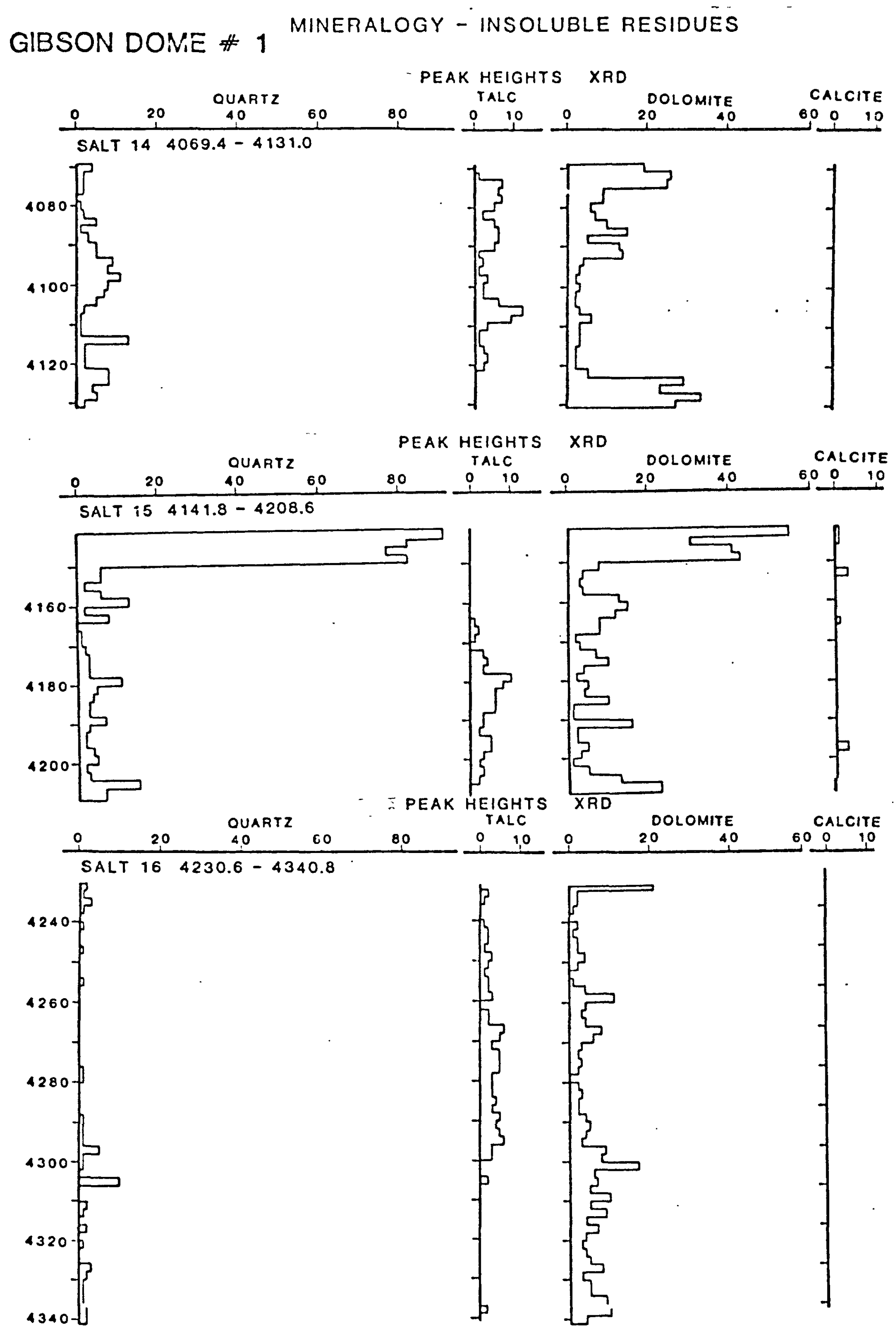


Figure 31.-- Mineralogy by x-ray diffraction of the water insoluble residues from Salt 14, 15, and 16 of the Paradox Member, GD-1 core hole. Measurements made on the principal diffraction peak of each mineral. Anhydrite, which constitutes more than 75% of most residues, is not shown.

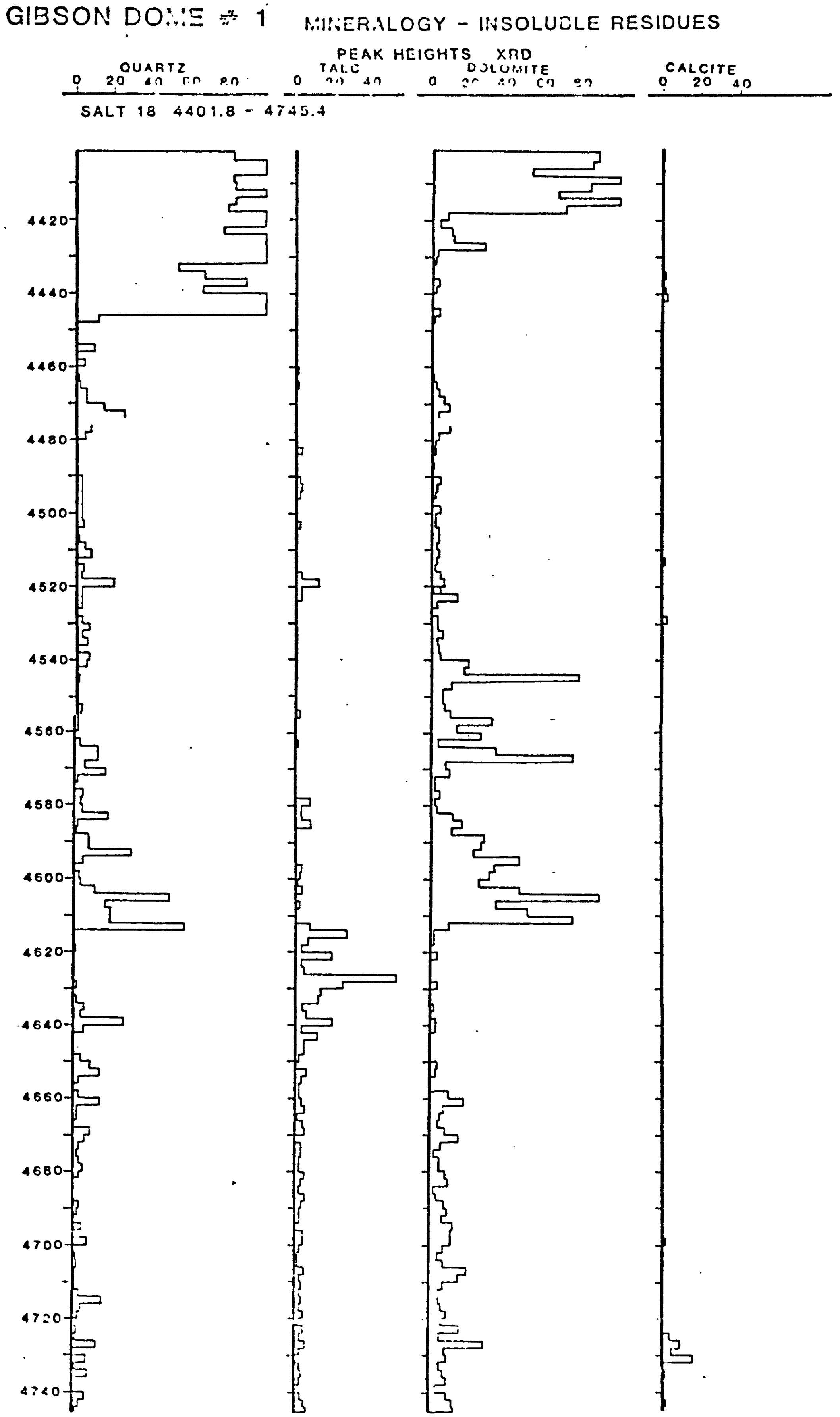


Figure 32.-- Mineralogy by x-ray diffraction of the water insoluble residues from Salt 18 of the Paradox Member, GD-1 core hole. Measurements made on principal peaks. Anhydrite, which constitutes 75% of most residues, is not shown.

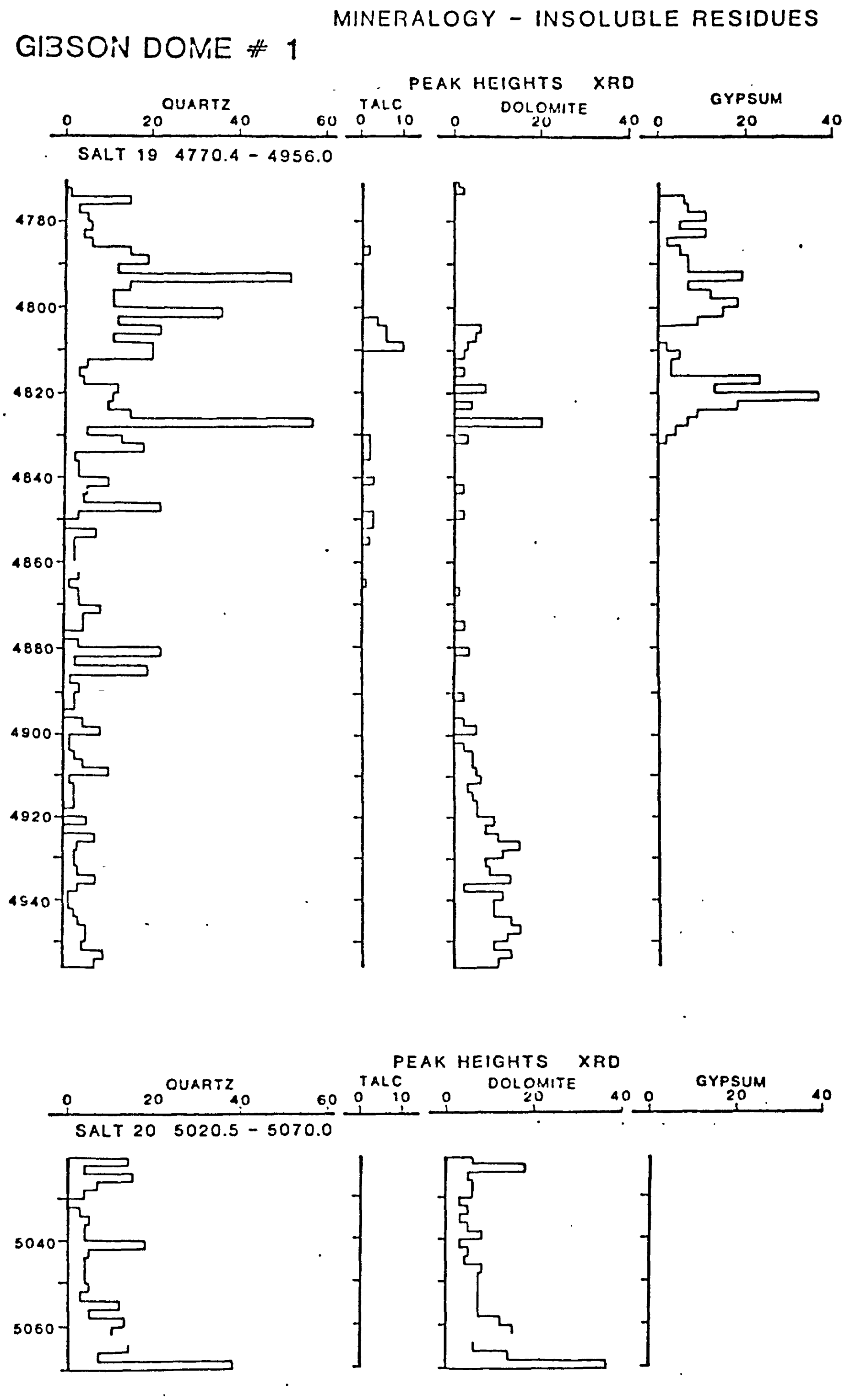


Figure 33.-- Mineralogy by x-ray diffraction of the water insoluble residues from Salt 19 and 20 of the Paradox Member, GD-1 core hole. Measurements made on the principal diffraction peak of each mineral. Anhydrite, which constitutes more than 75% of most residues, is not shown.

GIBSON DOME # 1 MINERALOGY - INSOLUBLE RESIDUES

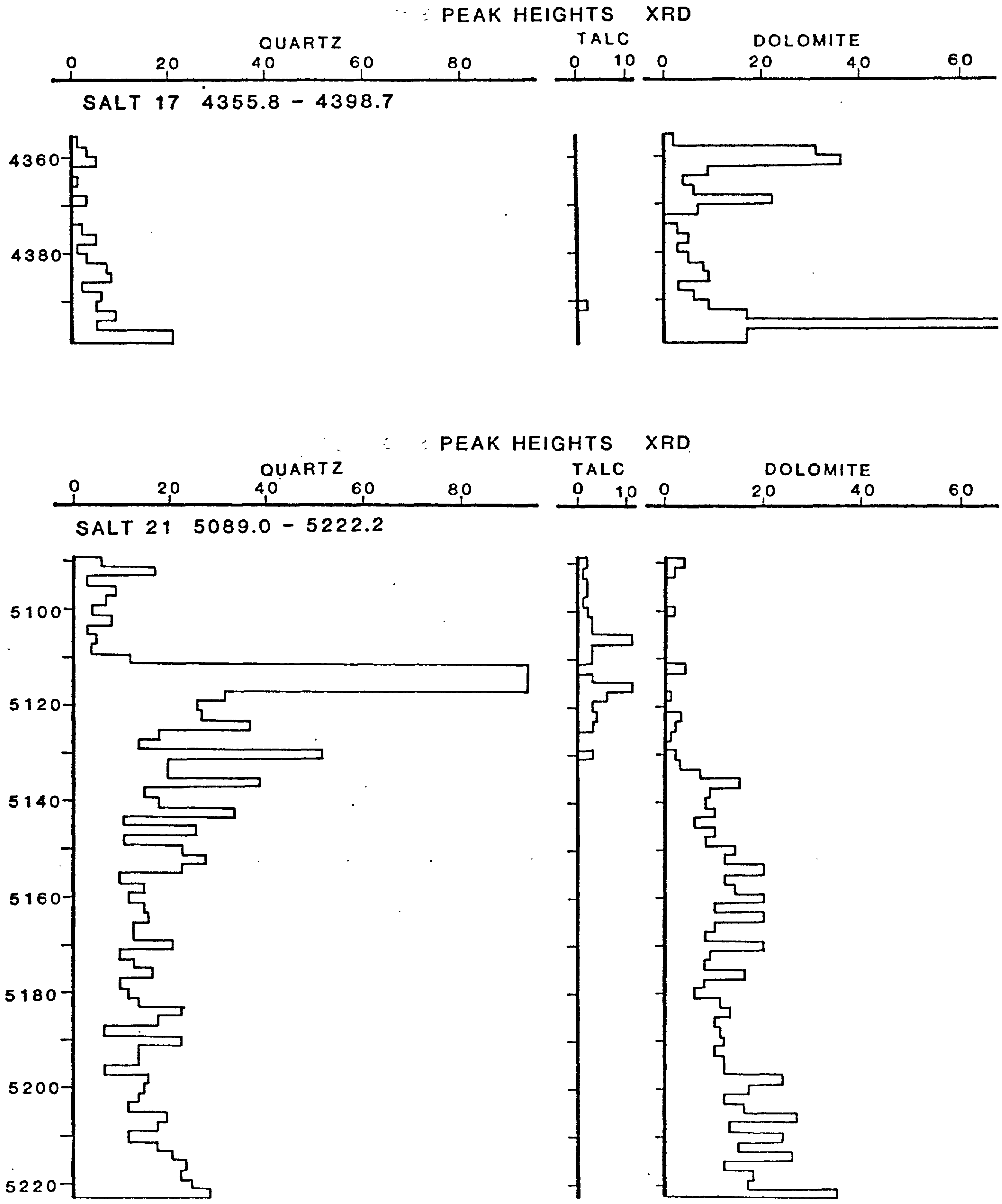


Figure 34.-- Mineralogy by x-ray diffraction of the water insoluble residues from Salt 17 and 21 of the Paradox Member, GD-1 core hole. Measurements made on the principal diffraction peak of each mineral. Anhydrite, which constitutes more than 75% of most residues, is not shown.

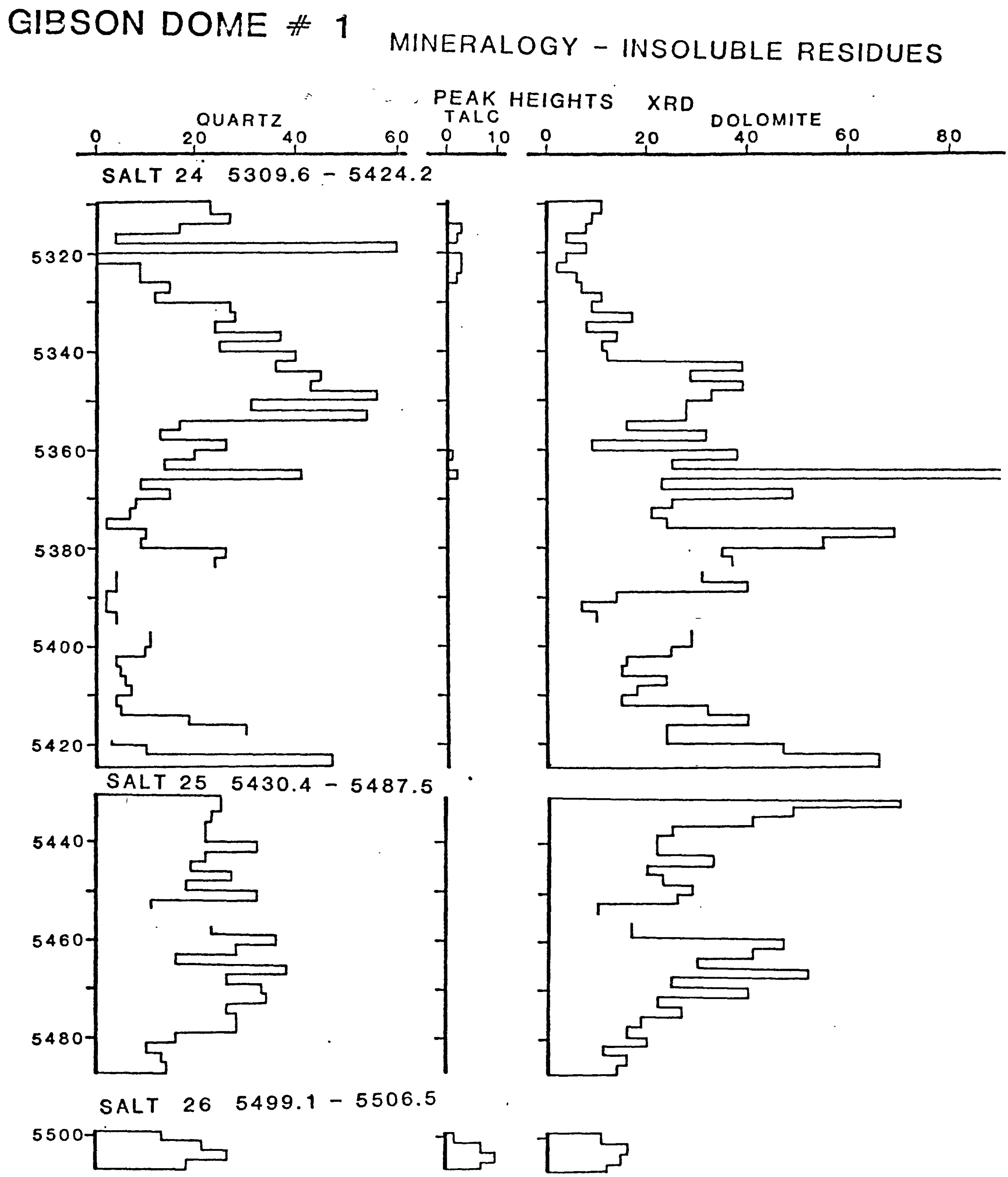


Figure 35.-- Mineralogy by x-ray diffraction of the water insoluble residues from Salt 24, 25, and 26 of the Paradox Member, GD-1 core hole. Measurements made on the principal diffraction peak of each mineral. Anhydrite, which constitutes more than 75% of most residues, is not shown.

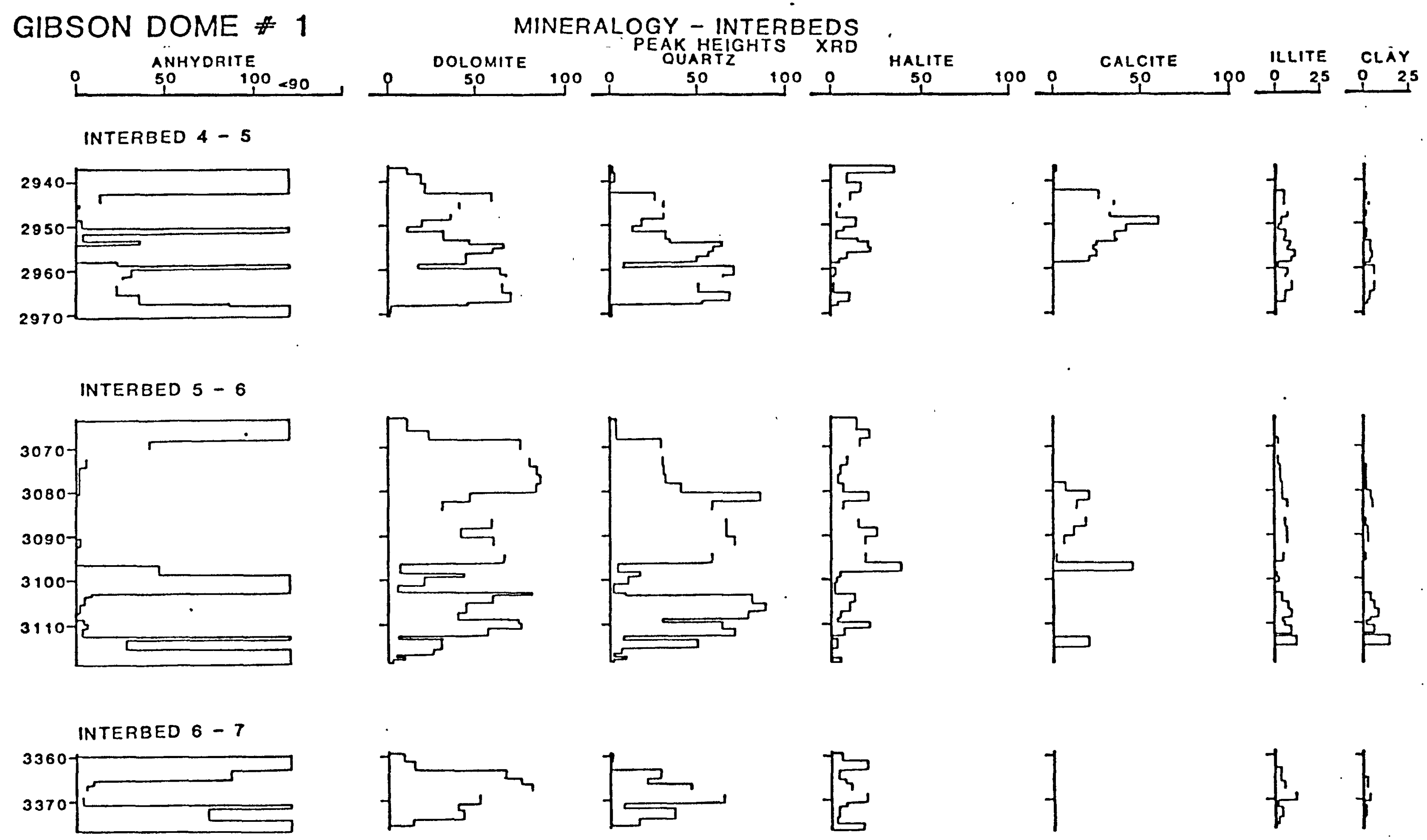


Figure 36.-- Mineralogy by x-ray diffraction of Interbeds 4-5, 5-6, and 6-7 of the Paradox Member, GD-1 core hole. Measurements made on the principal diffraction peak of each mineral.

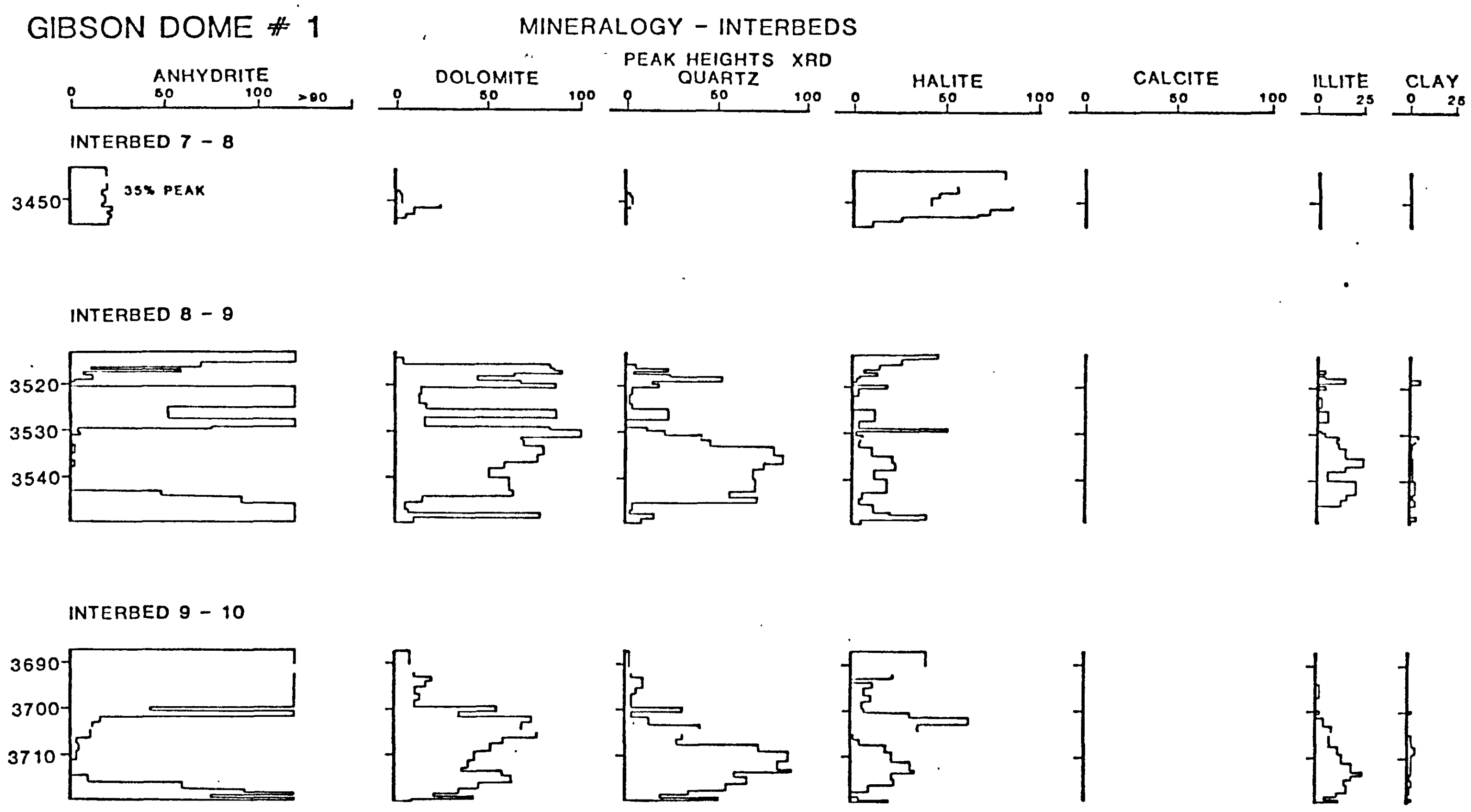


Figure 37.-- Mineralogy by x-ray diffraction of Interbeds 7-8, 8-9, and 9-10 of the Paradox Member, GD-1 core hole. Anhydrite peak at 31.4° 2θ (35% relative intensity) used when sample was mostly anhydrite. Measurements made on the principal diffraction peak of other minerals.

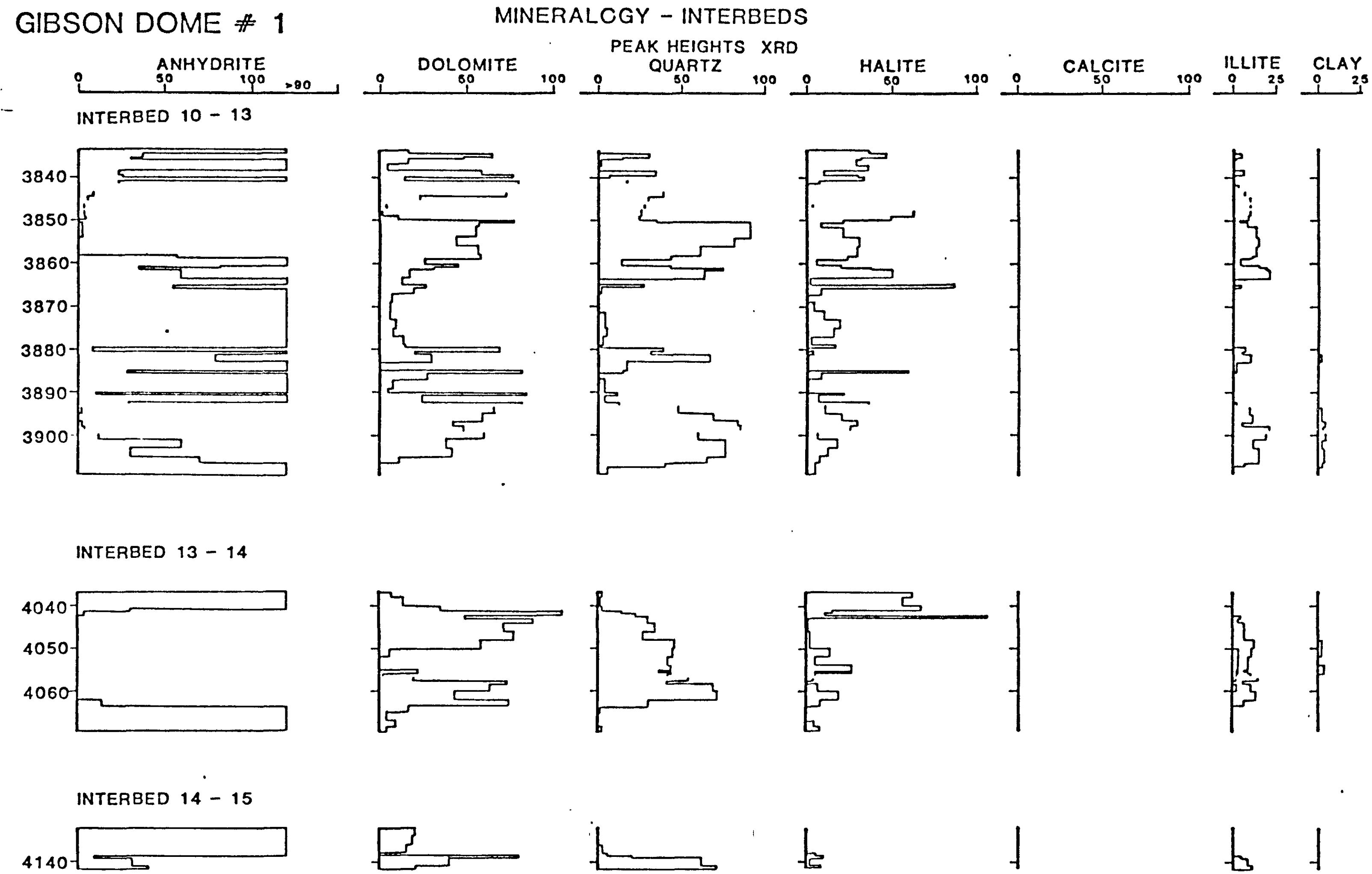


Figure 38.-- Mineralogy by x-ray diffraction of Interbeds 10-13, 13-14, and 14-15 of the Paradox Member, GD-1 core hole. Measurements made on the principal diffraction peak of each mineral.

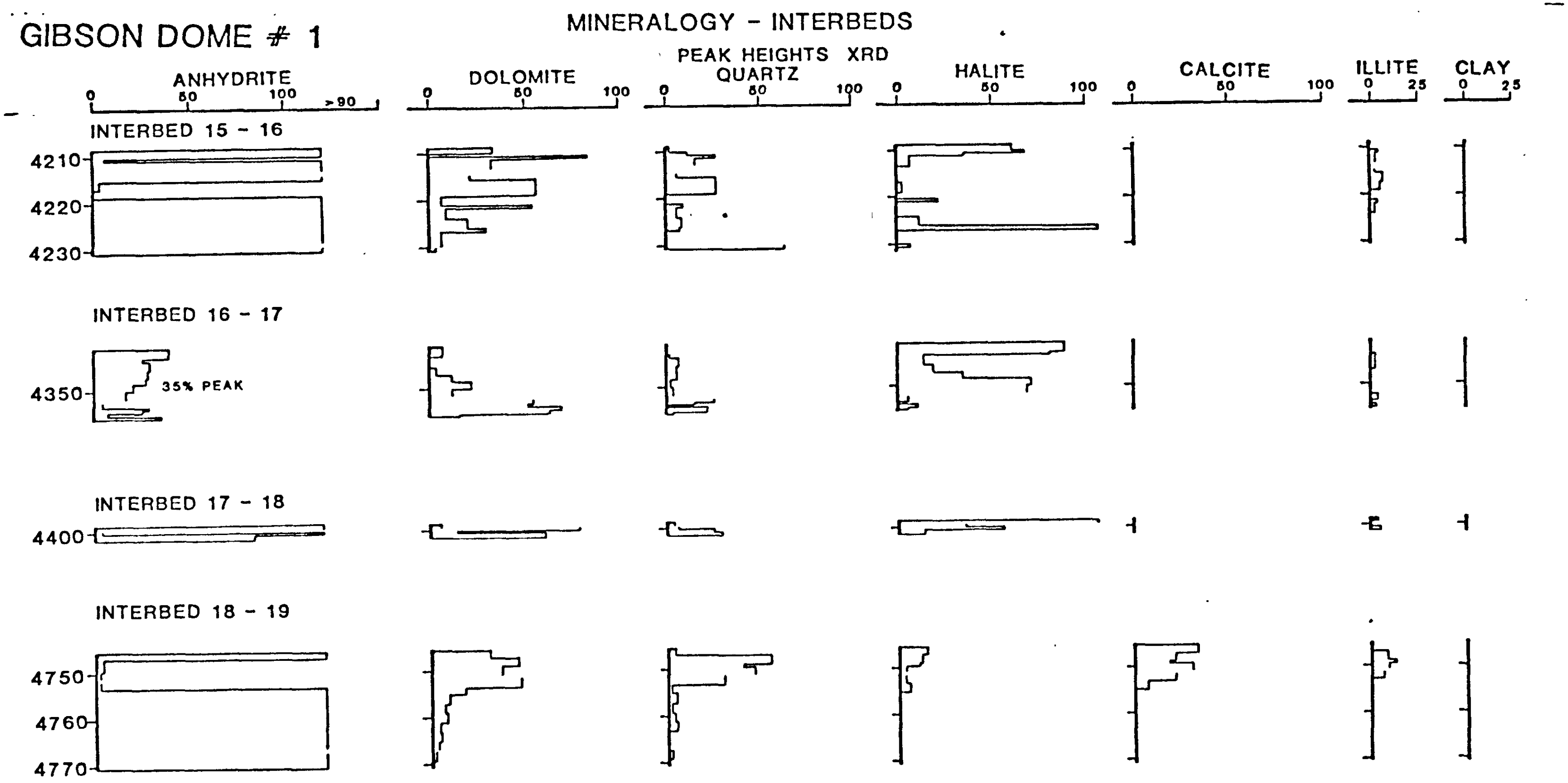


Figure 39.-- Mineralogy by x-ray diffraction of Interbeds 15-16, 16-17, 17-18, and 18-19 of the Paradox Member, GD-1 core hole. Anhydrite peak at 31.4° 2θ (35% relative intensity) used when sample was mostly anhydrite. All other measurements were made on the principal diffraction peak of each mineral.

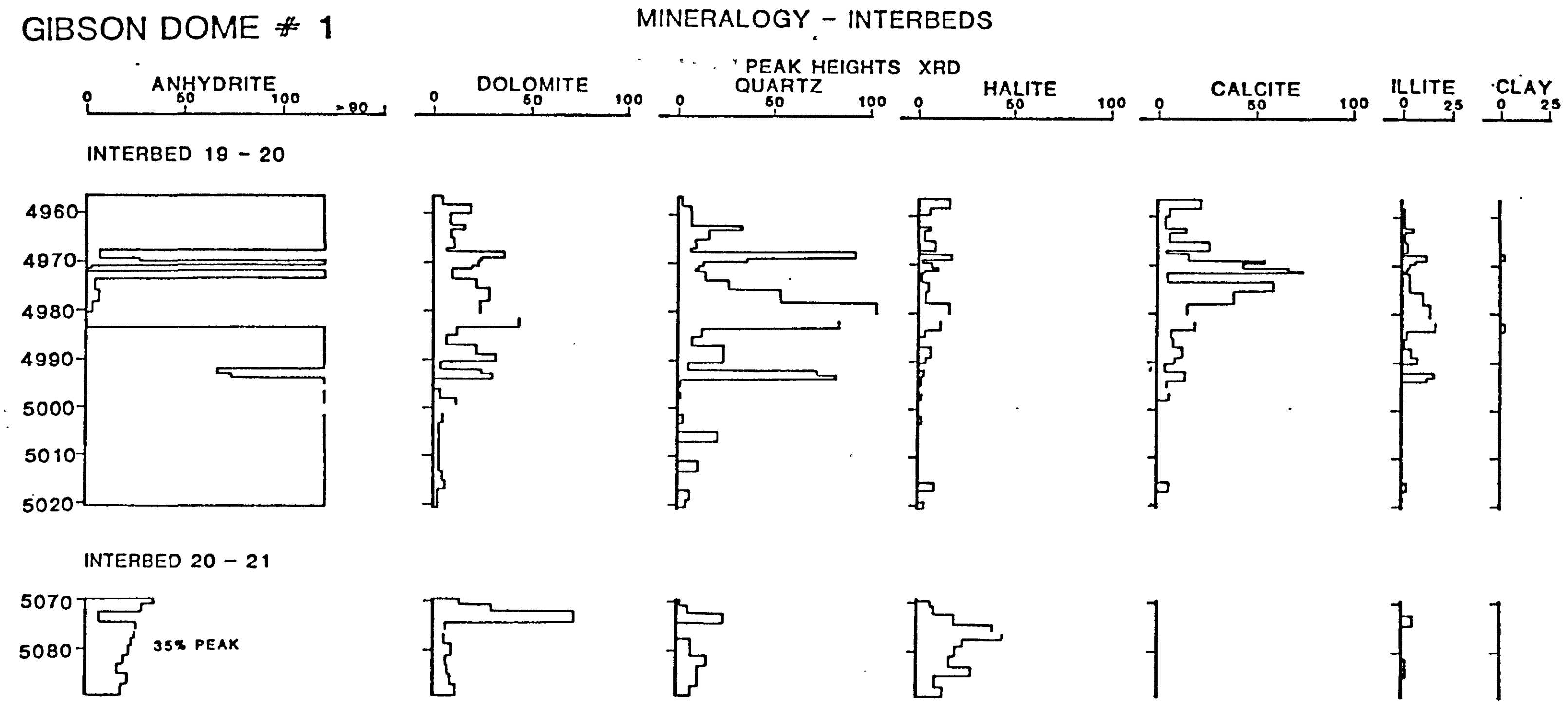


Figure 40.-- Mineralogy by x-ray diffraction of Interbeds 19-20 and 20-21 of the Paradox Member, GD-1 core hole. Anhydrite peak at 31.4° 2θ (35% relative intensity) used when sample was mostly anhydrite. All other measurements were made on the principal diffraction peak of each mineral.

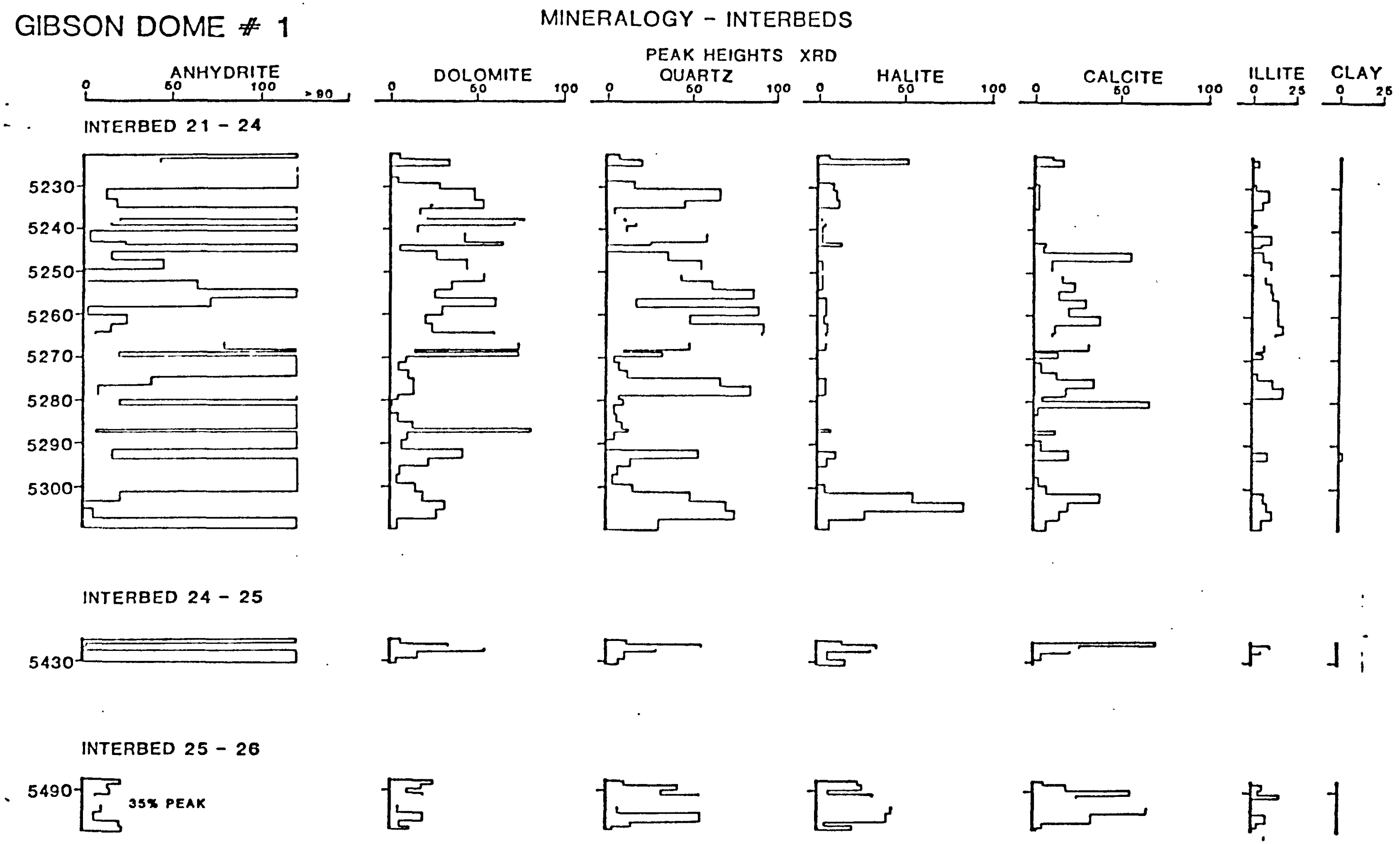


Figure 41.-- Mineralogy by x-ray diffraction of Interbeds 21-24, 24-25, and 25-26 of the Paradox Member, GD-1 core hole. Anhydrite peak at 31.4° 2θ (35% relative intensity) used when sample was mostly anhydrite. All other measurements made on the principal diffraction peak of each mineral.

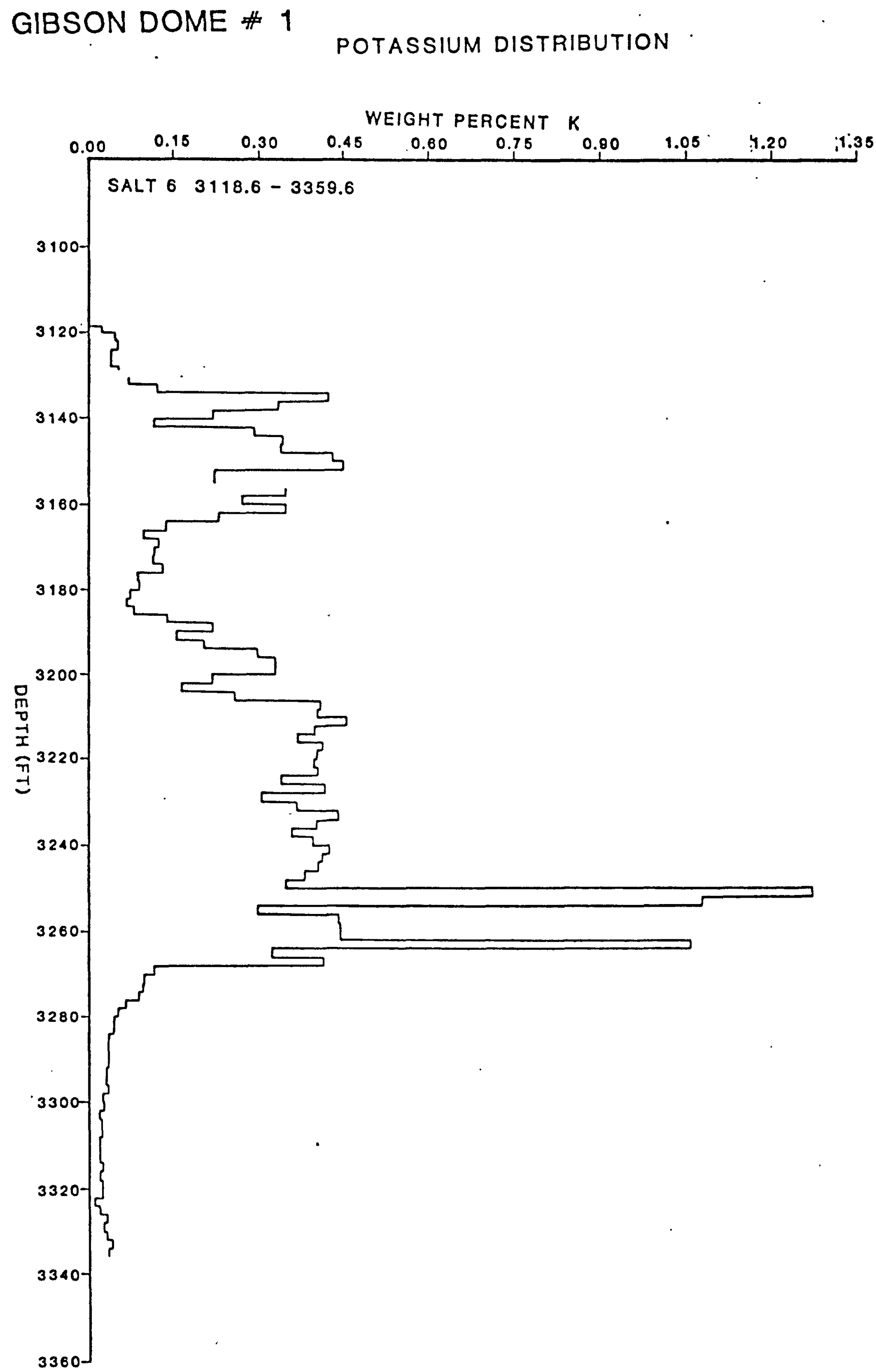


Figure 43.-- Potassium distribution in Salt 6 of the Paradox Member, GD-1 core hole. Analyses by x-ray fluorescence.

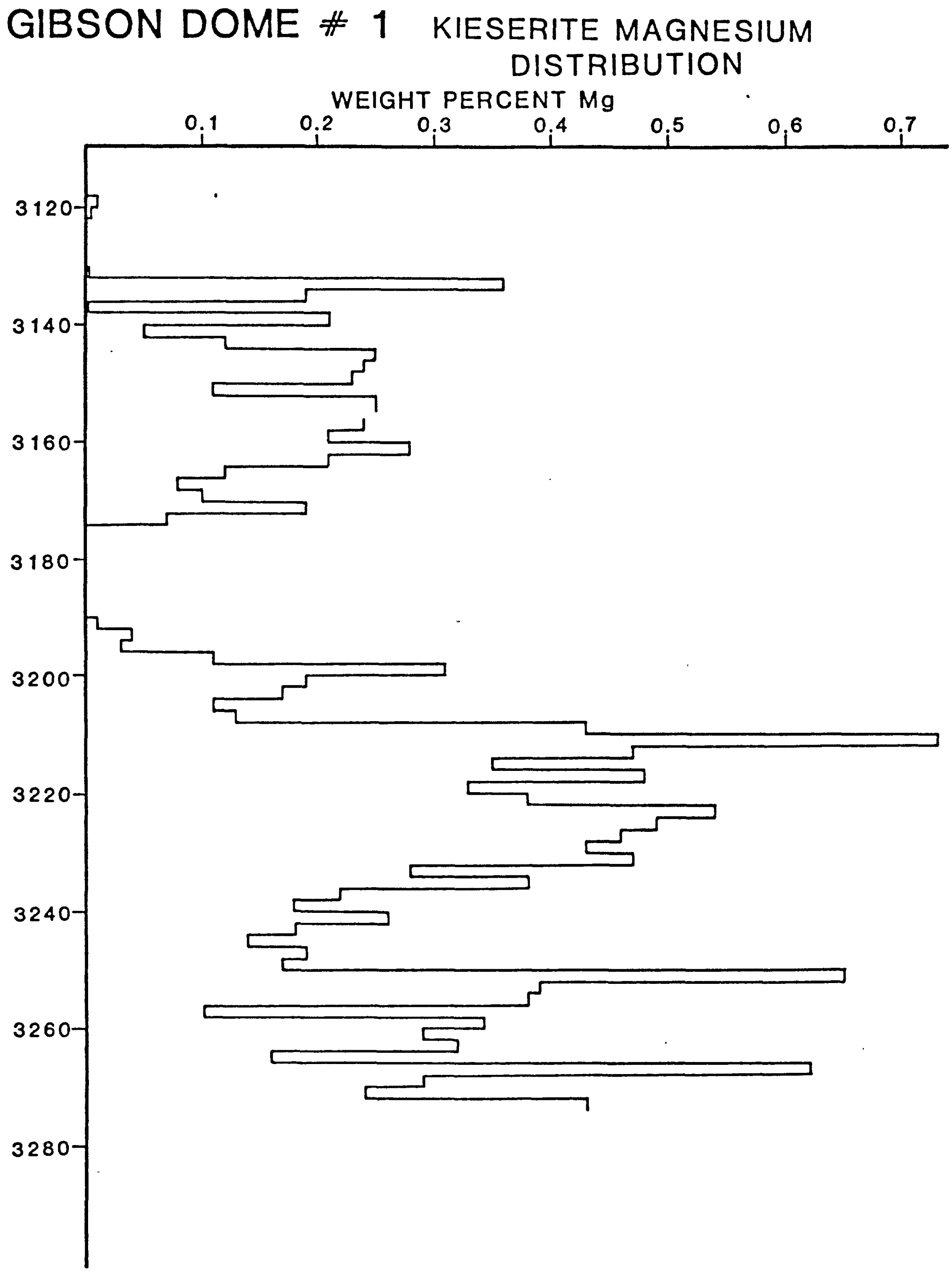


Figure 44.-- Distribution of magnesium from kieserite in the "carnallite marker" of Salt 6 of the Paradox Member, GD-1 core hole. Determined by subtracting the amount of magnesium necessary to balance potassium in the mineral carnallite from the total magnesium. Total magnesium was determined by atomic absorption spectrometry.

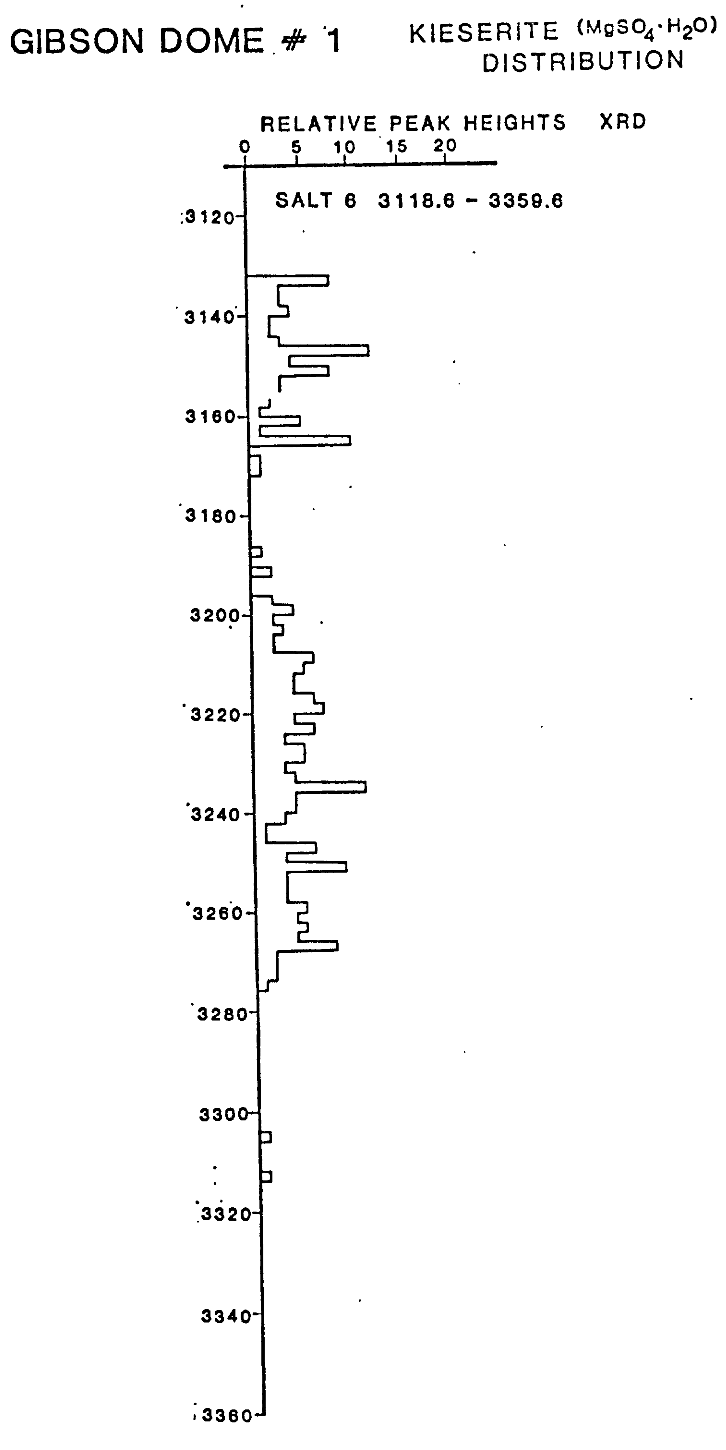


Figure 45.-- Kieserite distribution in Salt 6 of the Paradox Member, GD-1 core hole. Analyses by x-ray diffraction.

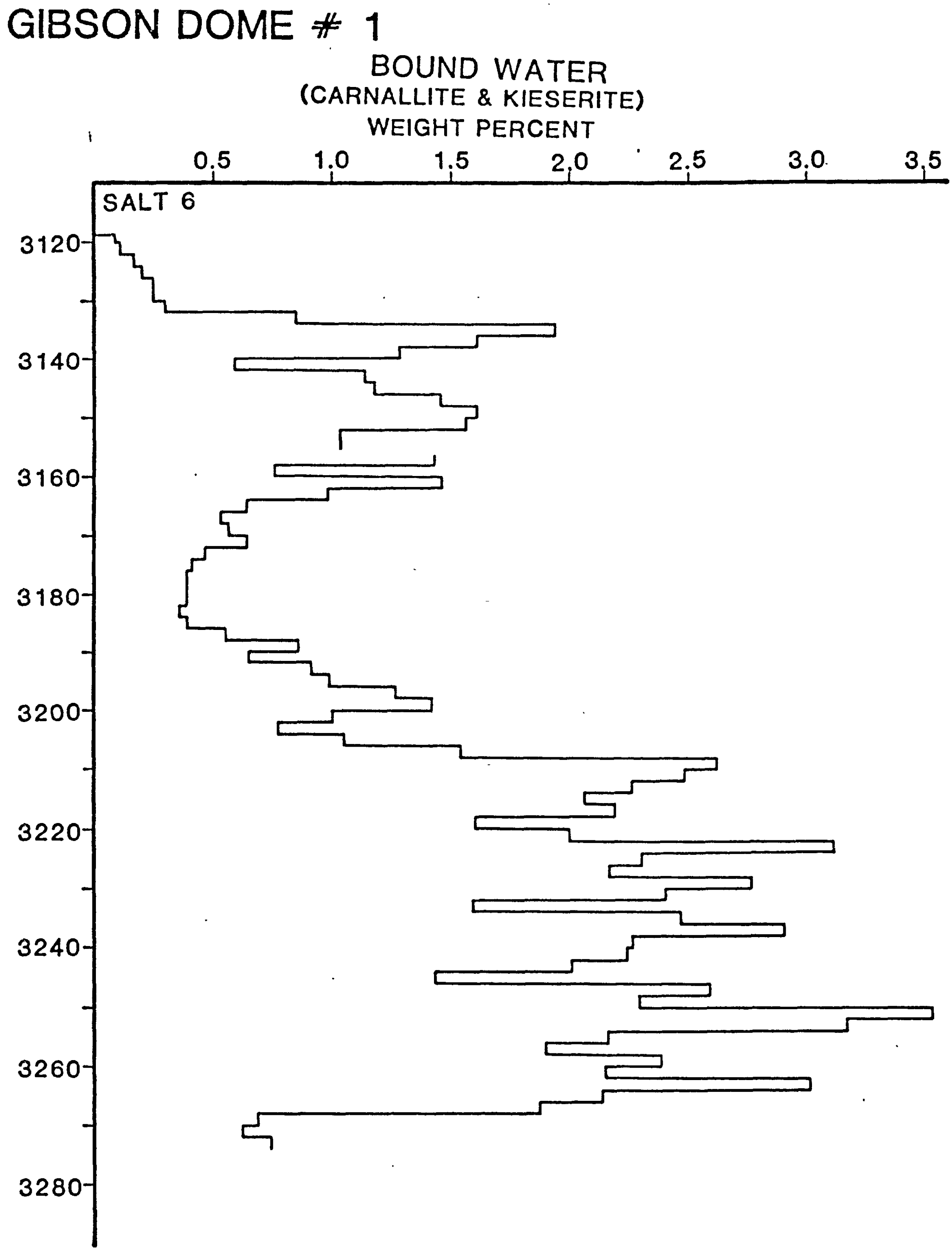


Figure 46.-- Total bound water in the "carnallite marker" of Salt 6 of the Paradox Member, GD-1 core hole. Includes water of crystallization from carnallite ($KCl \cdot MgCl_2 \cdot 6H_2O$) and kieserite ($MgSO_4 \cdot H_2O$).

Table 1.--Weight percent of major rock-forming minerals in Salt 6, Gibson Dome No. 1 corehole

[Calculated from elemental chemical analyses. Analysts: M. Malcolm, B. Hatfield, and J. Crock, USGS, Denver, Colorado.]

Interval (feet)	% Halite	%Anhydrite	%Carnallite	%Kieserite	Total
3118.6-3120.0	86.3	5.12	0.21	0.06	91.7
3120.0-3122.0	86.3	6.71	0.28	0.03	93.3
3122.0-3124.0	93.9	1.90	0.43	--	96.2
3124.0-3126.0	91.4	2.71	0.53	--	94.6
3126.0-3128.0	93.9	2.90	0.64	--	97.4
3128.0-3128.4	93.9	2.54	0.64	--	97.1
3130.4-3132.0	91.4	2.71	0.78	--	94.9
3132.0-3134.0	91.4	2.73	1.49	2.04	97.7
3134.0-3136.0	91.4	2.15	4.62	1.08	99.3
3136.0-3138.0	91.4	1.90	4.12	0.01	97.4
3138.0-3140.0	93.9	2.05	2.91	1.19	100.0
3140.0-3142.0	96.4	1.54	1.42	0.28	99.6
3142.0-3144.0	93.9	2.12	2.70	0.68	99.4
3144.0-3146.0	93.9	1.71	2.56	1.42	99.6
3146.0-3148.0	91.4	1.71	3.27	1.36	97.7
3148.0-3150.0	91.4	1.78	3.69	1.31	98.2
3150.0-3152.0	91.4	2.07	3.83	0.62	97.9
3152.0-3154.7	91.4	2.49	2.20	1.42	97.5
3156.3-3158.0	91.4	2.17	3.20	1.36	98.1
3158.0-3160.0	91.4	1.68	2.84	1.19	97.1
3160.0-3162.0	91.4	1.71	3.20	1.59	97.9
3162.0-3164.0	91.4	1.63	2.13	1.19	96.4
3164.0-3166.0	91.4	1.98	1.42	0.68	95.5
3166.0-3168.0	88.8	2.98	1.21	0.48	93.5
3168.0-3170.0	88.8	2.49	1.78	0.57	93.1
3170.0-3172.0	86.3	3.12	1.28	1.08	91.8
3172.0-3174.0	91.4	2.64	1.07	0.40	95.5
3174.0-3176.0	91.4	2.56	1.07	--	95.0
3176.0-3178.0	96.4	2.00	0.99	--	99.4
3178.0-3180.0	86.3	3.49	0.99	--	90.8
3180.0-3182.0	91.4	2.83	0.99	--	95.2
3182.0-3184.0	91.4	2.19	0.92	--	94.5
3184.0-3186.0	93.9	1.93	0.99	--	96.8
3186.0-3188.0	93.9	1.42	1.42	--	96.7
3188.0-3190.0	91.4	2.76	2.20	--	96.4
3190.0-3192.0	91.4	2.10	1.63	0.06	95.2
3192.0-3194.0	91.4	2.19	2.27	0.23	96.1
3194.0-3196.0	91.4	1.68	2.49	0.17	95.7
3196.0-3198.0	93.9	2.12	3.05	0.62	99.7
3198.0-3200.0	91.4	2.07	3.05	1.76	98.3
3200.0-3202.0	93.9	1.78	2.20	1.08	99.0
3202.0-3204.0	93.9	1.63	1.63	0.97	98.1
3204.0-3206.0	91.4	1.85	2.49	0.62	96.4
3206.0-3208.0	91.4	1.88	3.69	0.74	97.7
3208.0-3210.0	86.3	3.02	5.89	2.44	97.7
3210.0-3212.0	86.3	3.83	4.97	4.15	99.3
3212.0-3214.0	88.8	2.51	4.90	2.67	98.9
3214.0-3216.0	88.8	2.10	4.62	1.99	97.5
3216.0-3218.0	88.8	2.51	4.69	2.73	98.7
3218.0-3220.0	91.4	1.83	3.48	1.87	98.6
3220.0-3222.0	88.8	2.34	4.40	2.16	97.7
3222.0-3224.0	86.3	2.87	6.96	3.07	99.2
3224.0-3226.0	86.3	2.95	4.97	2.78	97.0
3226.0-3228.0	88.8	2.76	4.69	2.61	98.9
3228.0-3230.0	86.3	2.81	6.25	2.44	97.8
3230.0-3232.0	86.3	2.90	5.25	2.67	97.1
3232.0-3234.0	91.4	1.87	3.55	1.59	98.4
3234.0-3236.0	86.3	2.51	5.61	2.16	96.6
3236.0-3238.0	91.4	2.12	4.47	1.25	99.2
3238.0-3240.0	88.8	2.05	5.47	1.02	97.3
3240.0-3242.0	88.8	2.27	5.25	1.48	97.8
3242.0-3244.0	88.8	2.32	4.83	1.02	97.0
3244.0-3246.0	91.4	1.63	3.41	0.80	97.0
3246.0-3248.0	88.8	2.78	6.25	1.08	98.9
3248.0-3250.0	88.8	2.49	5.54	0.97	97.8
3250.0-3252.0	78.7	4.51	7.81	3.69	94.7
3252.0-3254.0	81.2	3.49	7.38	2.22	94.3
3254.0-3256.0	86.3	2.85	4.83	2.16	96.1
3256.0-3258.0	88.8	2.68	4.69	0.57	96.7
3258.0-3260.0	86.3	2.95	5.47	1.93	96.7
3260.0-3262.0	88.8	2.59	4.97	1.65	98.0
3262.0-3264.0	83.8	4.12	7.10	1.82	96.9
3264.0-3266.0	88.8	3.51	5.18	0.91	98.4
3266.0-3268.0	83.8	3.88	3.62	3.52	94.8
3268.0-3270.0	88.8	3.66	1.21	1.65	95.3
3270.0-3272.0	91.4	2.95	1.14	1.26	96.9
3272.0-3274.0	86.3	3.66	1.07	2.44	93.5

Table 2.--Organic carbon content of various rock types from the Gibson Dome No. 1 core hole

Upper Member of Hermosa Formation (Honaker Trail)

Depth (feet)	Interval	Lithology	Weight Percent C
2618.7-2621.0		calcareous siltstone	0.56
2629.0-2630.1		calcareous siltstone	0.59
2657.0-2658.2		silty calcareous dolomite	0.83
2667.0-2669.6		silty calcareous shale	1.82
2682.3-2683.9		silty calcareous dolomite	0.47
2756.0-2758.3	Upper Ismay	silty dolomite	0.55
2762.0-2764.4	Upper Ismay	calcareous siltstone	1.42
2771.5-2773.2	Upper Ismay	silty calcareous shale	2.15
2779.0-2781.0	Upper Ismay	silty calcareous shale	2.89
2876.6-2878.6	Lower Ismay	silty dolomite	0.28
2884.5-2886.0	Lower Ismay	calcareous silty shale	2.36
2890.0-2892.3	Lower Ismay	calcareous silty shale	1.95
2899.0-2901.0	Lower Ismay	calcareous silty shale	2.52
2907.0-2907.8	Lower Ismay	silty calcareous shale	2.21

Paradox Member of Hermosa Formation

2942.2-2944.1	Interbed 4-5	silty dolomite	0.38
2951.2-2953.0	Interbed 4-5	silty calcareous shale	1.03
2954.7-2956.0	Interbed 4-5	silty dolomite	0.08
2961.0-2961.7	Interbed 4-5	silty dolomite	0.07
2965.0-2967.0	Interbed 4-5	silty dolomite	0.09
3068.7-3070.3	Interbed 5-6	silty dolomite	0.11
3075.0-3077.0	Interbed 5-6	silty dolomite	0.35
3079.4-3081.0	Interbed 5-6	silty dolomite	0.17
3086.9-3089.0	Interbed 5-6	silty dolomite	0.14
3108.9-3109.7	Interbed 5-6	silty dolomitic shale	1.46
3252.8-3252.9	Salt 6	halite with carnallite	0.51
3264.0-3264.1	Salt 6	halite with carnallite	0.05
3275.5-3275.6	Salt 6	halite	0.18
3281.0-3281.1	Salt 6	halite	0.18
3295.9-3296.0	Salt 6	halite	0.17

Paradox Member of Hermosa Formation--Continued

Depth (feet)	Interval	Lithology	Weight Percent C
3302.8-3302.9	Salt 6	halite	0.15
3314.2-3314.8	Salt 6	halite	0.14
3326.7-3327.8	Salt 6	halite	0.34
3331.2-3331.9	Salt 6	halite	0.07
3343.8-3344.5	Salt 6	halite	0.05
3356.0-3356.1	Salt 6	halite	0.09
3364.0-3365.3	Interbed 6-7	silty dolomite	0.42
3516.7-3517.1	Interbed 8-9	dolomite	0.29
3531.8-3533.0	Interbed 8-9	dolomitic silty shale	0.55
3538.0-3540.0	Interbed 8-9	dolomitic siltstone	0.37
3706.2-3707.7	Interbed 9-10	dolomitic silty shale	2.78
3843.3-3844.2	Interbed 10-11	silty dolomite	0.57
3847.7-3849.0	Interbed 10-11	silty shale	7.68
4139.0-4141.0	Interbed 14-15	silty dolomite	0.14
4194.3-4194.4	Salt 15	halite	0.39
4194.4-4194.6	Salt 15	halite	0.31
4194.6-4194.7	Salt 15	halite	0.22
4194.7-4194.8	Salt 15	halite	0.33
4194.8-4194.9	Salt 15	halite	0.20
4194.9-4195.0	Salt 15	halite	0.32
4195.0-4195.1	Salt 15	halite	0.36
4195.1-4195.2	Salt 15	halite	0.21
4195.2-4195.3	Salt 15	halite	0.08
4196.8-4196.9	Salt 15	halite	0.08
4197.0-4197.1	Salt 15	halite	0.03
4197.1-4197.2	Salt 15	halite	0.12
4217.0-4219.0	Interbed 15-16	silty dolomitic shale	1.30
5223.1-5224.6	Cane Creek	anhydritic calcareous shale	1.66
5227.8-5228.7	Cane Creek	dolomitic anhydrite	0.12
5234.7-5236.4	Cane Creek	dolomitic anhydrite	0.25
5238.5-5238.9	Cane Creek	dolomitic silty shale	3.96
5240.9-5243.0	Cane Creek	silty dolomitic shale	2.11
5252.0-5254.0	Cane Creek	silty dolomitic calcareous shale	0.90
5260.0-5262.0	Cane Creek	silty calcareous dolomitic shale	0.42
5268.0-5268.4	Cane Creek	dolomitic silty anhydrite	0.17

Paradox Member of Hermosa Formation--Continued

Depth (feet)	Interval	Lithology	Weight Percent C
5291.4-5293.6	Cane Creek	silty dolomitic calcareous shale	1.51
5300.9-5303.0	Cane Creek	silty calcareous dolomitic shale	0.87
5495.0-5497.1	Interbed 25-26	silty calcareous shale	0.32
Lower Member of Hermosa Formation (Pinkerton Trail)			
5507.0-5509.0		silty calcareous shale	2.03
5515.2-5516.1		anhydritic dolomite	2.31
5580.2-5582.0		calcareous silty shale	2.86
5594.0-5595.4		silty calcareous shale	4.22
5603.0-5605.2		calcareous siltstone	0.49
5630.5-5632.7		silty argillaceous limestone	2.85
5667.5-5668.5		argillaceous calcareous siltstone	0.17
5673.4-5674.0		argillaceous calcareous siltstone	0.25

Table 3.--Results of "Rock Eval" pyrolysis technique applied to GD-1 core samples

[Analyst T. A. Daws, U.S. Geological Survey, Denver, Colorado. --Below detection limit]

Sample Interval (in feet)	Stratigraphic Interval	Lithology	Organic carbon wt. percent	S_1[1]	S_2[2]	S_3[3]	T°C[4]	Genetic Potential[5]	Hydrogen Index[6]	Oxygen Index[7]	Transformation Ratio[8]
2951.2-2953.0	Interbed 4-5	Dolomite	1.03	0.525	2.35	0.62	435	2.880	228	60	0.18
2954.7-2956.0		--do--	0.08	0.012	--	0.44	--	0.012	--	550	1.0
2961.0-2961.7		--do--	0.07	0.047	--	0.47	--	0.047	--	670	1.0
2965.0-2967.0		--do--	0.09	0.083	--	0.48	--	0.083	--	533	1.0
3068.7-3070.3	Interbed 5-6	--do--	0.11	0.050	0.039	0.89	433	0.089	35	809	0.56
3075.0-3077.0		--do--	0.35	0.083	0.160	0.93	424	0.240	46	266	0.34
3079.4-3081.0		Siltstone	0.17	0.040	0.012	0.84	430	0.052	7	492	0.77
3086.9-3089.0		Dolomite	0.14	0.030	--	0.72	--	0.030	--	517	1.0
3108.4-3109.7		--do--	1.46	2.909	6.900	0.63	431	9.810	473	43	0.30
3252.8-3252.9	Salt 6	Halite	0.51	0.057	0.048	0.15	359	0.105	21	29	0.54
3264.0-3264.1		--do--	0.05	0.014	0.025	0.10	357	0.039	78	200	0.37
3275.5-3275.6		--do--	0.18	0.240	--	0.29	--	0.024	--	100	1.0
3281.0-3281.1		--do--	0.18	0.130	--	0.11	--	0.013	--	61	1.0
3295.9-3296.0		--do--	0.17	0.004	--	0.06	--	0.004	--	35	1.0
3302.8-3302.9		--do--	0.15	0.013	--	0.07	--	0.013	--	46	1.0
3314.2-3314.3		--do--	0.14	0.010	--	0.08	--	0.010	--	57	1.0
3326.7-3326.8		--do--	0.34	0.007	--	0.07	--	0.007	--	21	1.0
3331.2-3331.9		--do--	0.07	0.013	--	0.07	--	0.013	--	100	1.0
3343.8-3344.5		--do--	0.05	0.003	--	0.08	--	0.003	--	160	1.0
3356.0-3356.1		--do--	0.09	0.013	--	0.14	--	0.013	--	156	1.0
3364.0-3365.3	Interbed 6-7	Dolomite	0.42	1.088	0.140	1.14	428	1.230	26	272	0.89

1/ S_1 = hydrocarbons already present in rock which are volatilized at 200°-250°C expressed as mg hydrocarbons/g organic carbon.

2/ S_2 = hydrocarbons and related compounds generated by heating from 250°-550°C expressed as mg hydrocarbons/g organic carbon.

3/ S_3 = carbon dioxide and water expressed as mg CO_2+H_2O/gm organic carbon

4/ T°C = temperature of maximum hydrocarbon generation

5/ Genetic potential = S_1+S_2 or total hydrocarbons in parts per thousand

6/ Hydrogen index = S_1/organic carbon

7/ Oxygen index = S_3/organic carbon

8/ Transformation ratio = $S_1:(S_1+S_2)$

Table 4.--Water content of halite rock Gibson Dome No. 1 corehole determined by open system methanol extraction and Karl Fischer titration

Sample No.	Depth (feet)	Salt bed	Weight Percent H_2O	Comment
GD1-75	3018.6-3018.8	5	---	1
GD1-76	3308.4-3308.6	6	0.196	
GD1-77	3349.6-3349.8	6	0.053	
GD1-236	3217.7-3218.1	6	2.148	2
GD1-237	3242.9-3243.3	6	1.192	2
GD1-238	3260.0-3260.4	6	2.110	2
GD1-239	3312.2-3312.6	6	0.137	
GD1-240	3324.1-3324.5	6	0.078	
GD1-320	3134.1-3134.5	6	0.449	2
GD1-321	3201.3-3201.7	6	0.627	2
GD1-322	3234.4-3234.8	6	0.850	2
GD1-323	3301.4-3301.8	6	0.126	
GD1-324	3340.3-3340.7	6	0.078	
GD1-325	3377.5-3377.9	7	0.086	
GD1-326	3399.7-3400.1	7	0.036	
GD1-327	3421.3-3421.7	7	0.112	
GD1-328	3435.2-3435.6	7	0.089	
GD1-624	4716.3-4716.7	18	0.025	
GD1-625	4856.3-4856.7	19	0.038	
GD1-626	4954.2-4954.6	19	0.046	
GD1-627	5138.3-5138.7	21	0.088	
GD1-628	5211.3-5211.7	21	0.056	
GD1-629	5313.3-5313.7	24	0.108	
GD1-630	5380.3-5380.7	24	0.028	
GD1-631	5462.3-5462.7	25	0.056	
GD1-632	5485.3-5485.7	25	0.059	
GD1-636	5211.3-5211.7	21	0.056	3
GD1-637	5380.3-5380.7	24	0.027	4
GD1-638	5485.3-5485.7	25	0.055	5

1. Water content too low for accurate measurement.
2. Includes bound water from carnallite in sample.
3. Duplicate sample of GD1-628. Analysis by closed system methanol extraction.
4. Duplicate sample of GD1-630. Analysis by closed system methanol extraction.
5. Duplicate sample of GD1-632. Analysis by closed system methanol extraction.

Table 5.--Occluded Gas in Halite Rock, Gibson Dome No. 1 Corehole

			ccGAS/kg SALT				
Sample #	Salt Bed	Depth (feet)	Total	N_2	CH_4	CO_2	O_2
GD 1-100	6	3123.5	30.7	0.25	0.15	28.2	T[1]
GD 1-101	6	3231.9	73.9	0.52	0.48	74.5	0.27
GD 1-102	6	3284.7	142.5	1.10	0.27	135.9	0.84
GD 1-103	6	3302.4	39.1	0.71	0.48	37.5	0.23
GD 1-104	6	3321.6	4.5	0.13	0.14	4.3	
GD 1-105	6	3340.8	19.9	0.40	0.77	19.2	0.12
GD 1-106	7	3381.6	9.1	0.40	0.10	7.4	0.05
GD 1-107	7	3421.9	58.2	1.04	0.64	56.1	0.11
GD 1-108	10	3721.5	57.9	1.04	0.16	58.5	0.18
GD 1-109	13	3914.8	192.0	1.60	1.14	187.0	0.46
GD 1-110	18	4417.7	34.0	0.55	0.24	30.0	
GD 1-111	18	4743.6	23.0	0.30	0.06	21.0	
GD 1-112	21	5090.7	3.2	0.32	T[1]	3.4	T[1]
GD 1-115	26	5504.7	14.9	0.04	8.40	15.6	

[1]/T=trace