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GEOLOGICAL SURVEY

Chemical Analysis of Coal from the Blackhawk Formation, Wasatch Plateau Coal Field, Sevier County, Utah

By

J. David Sanchez

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INTRODUCTION

In the summer of 1980, the Utah Geological and Mineral Survey drilled two exploratory holes for the U.S. Geological Survey. These two holes, BCR-3 and BCR-4 (Sanchez, 1980), are located in the Wasatch Plateau of central Utah (fig. 1). BCR-3 was rotary drilled to 850 ft and cored from 850 to 963 ft. BCR-4 was rotary drilled to 830 ft and cored from 830 ft to 963 ft. Drill-hole locations, shown on figure 2, are in the Mud Spring Hollow and Wildcat Knolls areas. The thickest coal beds in the Acord Lakes and Knight coal zones (Sanchez and others, 1983; fig. 3) were sampled and submitted for chemical analysis (table 1). This report lists and summarizes the chemical analysis made on three samples.

Geologic Setting

The Wasatch Plateau coal field in central Utah (fig. 1) lies on the eastern side of the Wasatch Plateau. It is elongate in a north-south direction, ranging in width from 7 to 20 miles and having a length of about 80 miles.

Coal deposits are contained within the Upper Cretaceous (Campanian) Blackhawk Formation. The Blackhawk Formation, which ranges in thickness from 700 to 1,000+ feet, consists of sandstone, siltstone, shale, coal, and minor amounts of limestone. Coal deposits of major importance are restricted to the lower portion (200-300 ft) of the Blackhawk Formation. Some of the thickest deposits of coal are located directly on top of or just above the Star Point Sandstone. The Star Point Sandstone and Blackhawk Formation are of the same genetic type and were deposited in a deltaplain/strandplain depositional environment during the general regression of the Cretaceous epieric seaway.

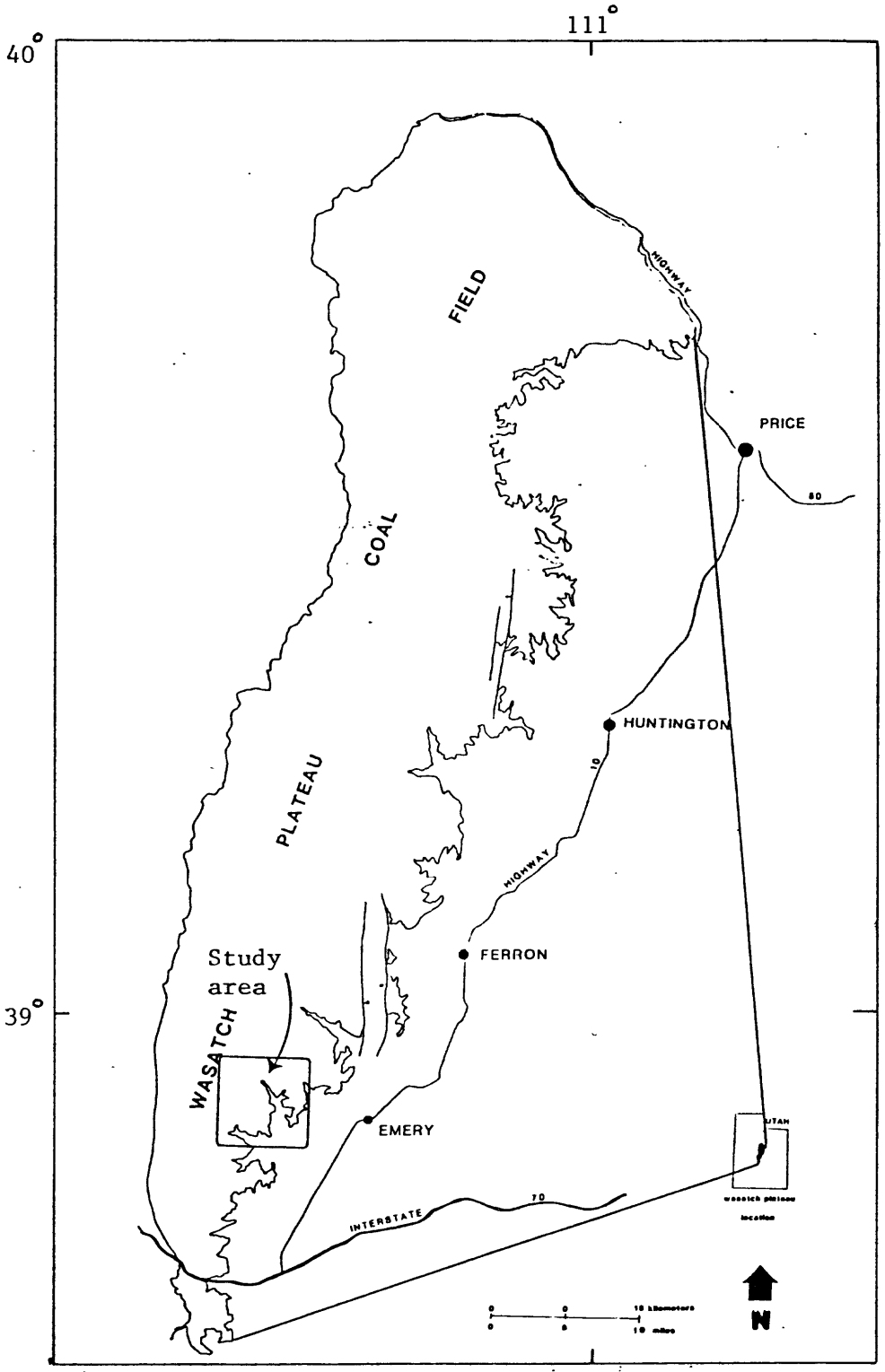


Figure 1. – Index map of Wasatch Plateau coal field and study area

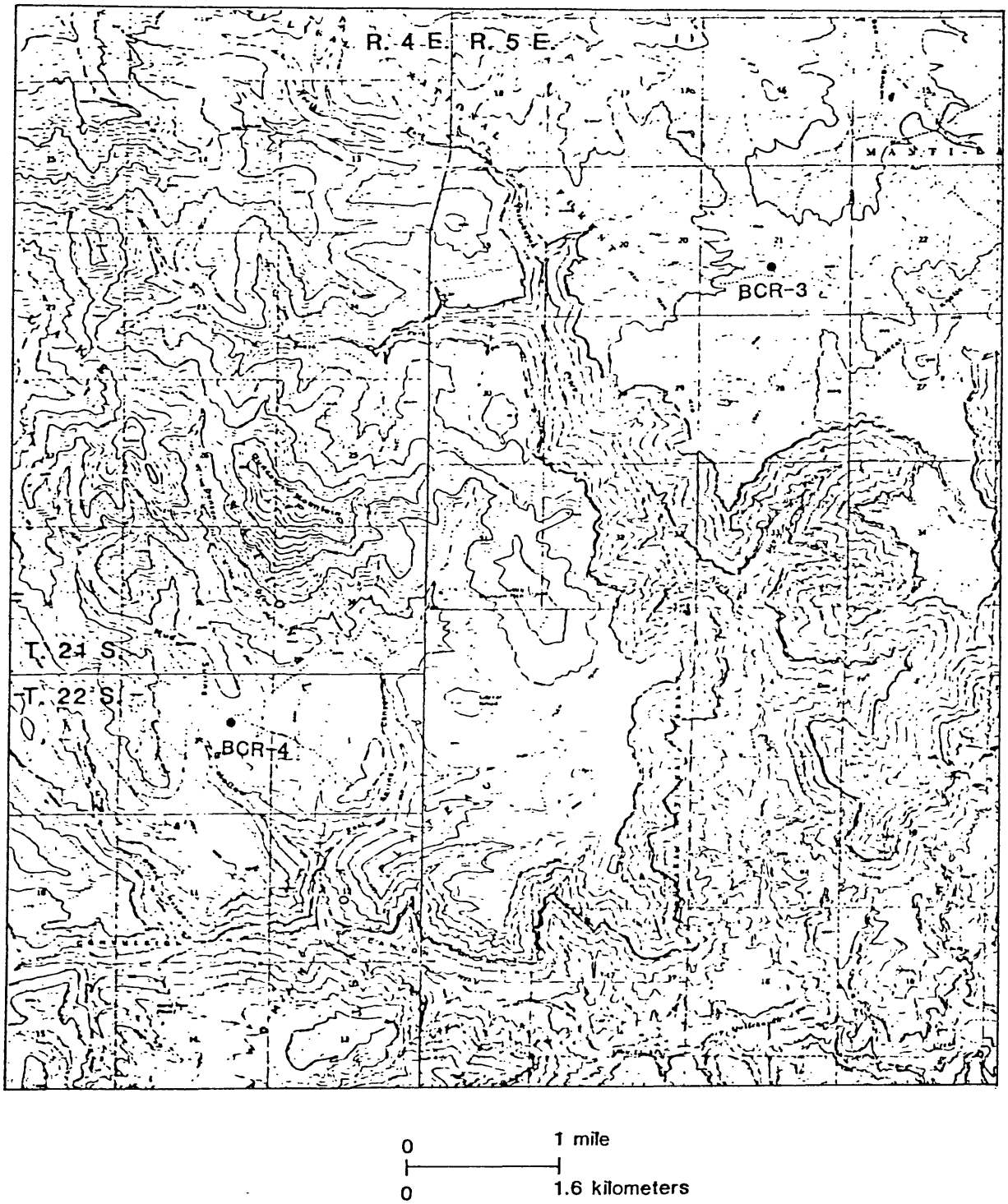
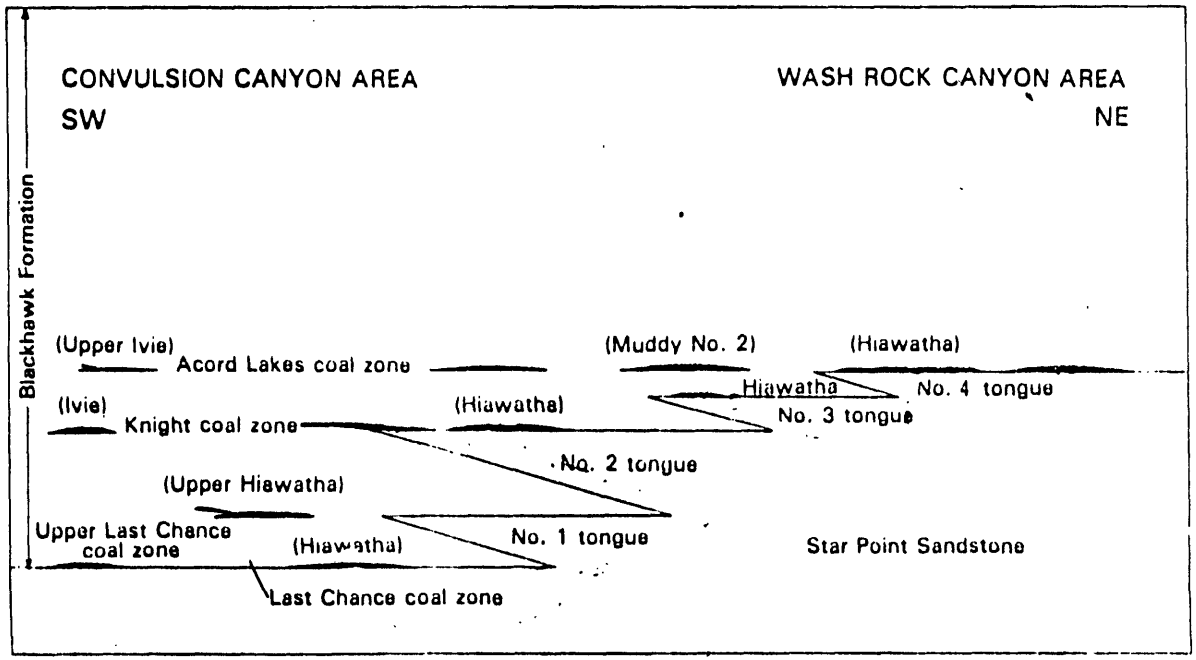


Figure 2.-- Index map of study area and drill hole locations



From Sanchez and others (1983)

Figure 3.--Diagramatic section showing the stratigraphic relationship between tongues of Star Point Sandstone and coal zones. Coal bed names in parentheses are used locally.

Explanation of tables

Table 1 lists the sample numbers, index-map locations, core-hole locations, coal-zone names, sample types, and depth and thickness intervals. Proximate and ultimate analyses, heat-of-combustion, air-dried-loss, forms-of-sulfur, free-swelling index, and ash-fusion-temperature determinations on three composite coal samples from the Blackhawk Formation are listed in tables 2, 3, and 4. These analyses were provided under contract by the Geochemical Testing Co., Somerset, Pa., Forest E. Walker, director of technical services.

Analyses for ash content and content of 38 major and minor oxides and trace elements in the laboratory ash (table 5) and analyses for content of seven trace elements in whole coal for all three samples (table 6) were provided by the U.S. Geological Survey, Denver, Colo. Analytical procedures used by the U.S. Geological Survey are described in Swanson and Huffman (1976).

Acknowledgments

Fundamental to this report is the contribution of the team of chemical laboratory personnel in the U.S. Geological Survey under the direction of Claude Huffman, Jr.

Table 1.--U.S. Geological Survey sample numbers, index-map locations, core-hole locations, coal-zone names, sample types, and depth and thickness intervals for Blackhawk Formation coal samples, Wasatch Plateau coal field, Sevier County, Utah

Sample number	Field number	Index-map location (fig. 2)	Core-hole location	Coal-zone name	Sample type	Depth interval (in ft)	Thickness (in ft)
			Sevier County				
D221593	BCR-3	BCR-3	Sec. 21, T. 21 S., R. 5 E., 1,650 ft FSL, 2,800 ft FEL	Acord Lakes	Core	931.5-942.1	10.6
D221592	SH-2	BCR-4 (BCR-4)	Sec. 2, T. 22 S., R. 4 E., 1,900 ft FNL, 1,300 ft FEL	Knight	Core	906.0-912.7	6.7
D221591	SH-1	BCR-4 (BCR-4)	Sec. 2, T. 22 S., R. 4 E., 1,900 ft FNL, 1,300 ft FEL	Acord Lakes	Core	874.5-887.5	13

Table 2.--Proximate and ultimate analyses, heat-of-combustion, forms-of-sulfur, free-swelling index, and ash-fusion-temperature determinations on an "as-received basis" for three coal samples from the Blackhawk Wasatch Plateau coal field, Sevier County, Utah

[All analyses in percent except heat of combustion, free-swelling index, and ash fusion temperature]

Sample number	Proximate analysis				Ultimate analysis					Heat of combustion	
	Moisture	Volatile matter	Fixed carbon	Ash	Hydrogen	Carbon	Nitrogen	Oxygen	Sulfur	Kcal/kg	Btu/lb
D221593	6.32	35.43	45.92	12.33	5.12	64.68	1.16	16.21	0.50	6,279	11,302
D221592	5.93	37.80	41.40	14.87	5.18	61.96	1.20	15.56	1.23	6,070	10,926
D221591	6.93	36.78	47.67	8.62	5.22	66.18	.50	18.30	.50	6,447	11,604

Sample number	Air-dried loss	Forms of sulfur			Free-swelling index	Ash fusion temperature, °F		
		Sulfate	Pyritic	Organic		Initial deformation	Softening	Fluid
D221593	2.31	0.02	0.13	0.35	0.5	2,340	2,590	2,640
D221592	2.21	.05	.55	.63	.5	2,300	2,470	2,560
D221591	2.84	.01	.06	.43	.5	2,200	2,270	2,350

Table 3.--Proximate and ultimate analyses, heat-of-combustion, forms-of-sulfur, free-swelling index, and ash-fusion-temperature determinations on "moisture free basis" for three coal samples from the Blackhawk Formation, Wasatch Plateau coal field, Sevier County, Utah

[All analyses in percent except heat of combustion, free-swelling index, and ash fusion temperatures]

Sample number	Proximate analysis				Ultimate analysis					Heat of combustion	
	Moisture	Volatile matter	Fixed carbon	Ash	Hydrogen	Carbon	Nitrogen	Oxygen	Sulfur	Kcal/kg	Btu/lb
D221593	0	37.82	49.02	13.16	4.71	69.05	1.24	11.31	0.53	6,703	12,065
D221592	0	40.18	44.01	15.81	4.81	65.86	1.27	10.94	1.31	6,453	11,615
D221591	0	39.52	51.22	9.26	4.77	71.11	1.27	13.05	.54	6,927	12,468

Sample number	Air-dried loss	Forms of sulfur			Free-swelling index	Ash fusion temperature, °F		
		Sulfate	Pyritic	Organic		Initial deformation	Softening	Fluid
D221593	2.31	0.03	0.14	0.36	0.5	2,340	2,590	2,640
D221592	2.21	.05	.58	.68	.5	2,300	2,470	2,560
D221591	2.84	.01	.06	.47	.5	2,200	2,270	2,350

Table 4.--Proximate and ultimate analyses, heat-of-combustion, forms-of-sulfur, free-swelling index, and ash-fusion-temperature determinations on "moisture and ash free basis" for three coal samples from the Blackhawk Formation, Wasatch Plateau coal field, Sevier County, Utah

[All analyses in percent except heat of combustion, free-swelling index, and ash fusion temperature]

Sample number	Proximate analysis				Ultimate analysis					Heat of combustion	
	Moisture	Volatile matter	Fixed carbon	Ash	Hydrogen	Carbon	Nitrogen	Oxygen	Sulfur	Kcal/kg	Btu/lb
D221593	0	43.55	56.45	0	5.42	79.51	1.43	13.03	0.61	7,718	13,893
D221592	0	47.73	52.27	0	5.71	78.23	1.51	12.99	1.56	7,664	13,796
D221591	0	43.55	56.45	0	5.26	78.37	1.40	14.37	.60	7,634	13,741

Sample number	Air-dried loss	Forms of sulfur			Free-swelling index	Ash fusion temperature, °F		
		Sulfate	Pyritic	Organic		Initial deformation	Softening	Fluid
D221593	2.31	0.03	0.16	0.42	0.5	2,340	2,590	2,640
D221592	2.21	.06	.67	.81	.5	2,300	2,470	2,560
D221591	2.84	.01	.07	.52	.5	2,200	2,270	2,350

Table 5.--Major- and minor-oxide and trace-element composition of the laboratory ash of three coal samples from the Blackhawk Formation, Wasatch Plateau coal field, Sevier County, Utah

[Values in percent or parts per million. Coal ashed at 525°C. L, less than the value shown; N, not detected; B, not determined. S after element title indicates determinations by semiquantitative emission spectrography. The spectrograpic results are to be identified with geometric brackets whose boundaries are part of the ascending series 0.12, 0.18, 0.26, 0.38, 0.56, 0.83, 1.2, and so forth, but reported as midpoints of the brackets, 0.1, 0.15, 0.2, 0.3, 0.5, 0.7, 1.0, and so forth. Precision of the spectrographic data is plus-or-minus one bracket at, or 68 percent plus-or-minus two brackets at 95 percent confidence level]

Sample number	Ash (percent)	SiO_2 (percent)	Al_2O_3 (percent)	CaO (percent)	MgO (percent)	Na_2O (percent)	K_2O (percent)	Fe_2O_3 (percent)	TiO_2 (percent)	P_2O_5 (percent)
D221593	12.33	B	21	B	B	B	0.39L	3.0	1.6	2.1L
D221592	14.87	B	19	B	B	B	.39L	5.0	1.1	2.1L
D221591	8.62	B	11	B	B	B	.39L	4.0	.57	2.1L

Sample number	MnO (percent)	Ag-S (ppm)	B-S (ppm)	Ba-S (ppm)	Be-S (ppm)	Cd-S (ppm)	Ce-S (ppm)	Co-S (ppm)	Cr-S (ppm)	Cu (ppm)
D221593	0.012	0.92L	540	500	4.2	20L	190	11	46	80
D221592	.022	.92L	420	320	3.8	20L	150	12	53	65
D221591	.018	.92L	460	810	2.5	20L	130	11	54	64

Table 5.--Major- and minor-oxide and trace-element composition of the laboratory ash of three coal samples from the Blackhawk Formation, Wasatch Plateau coal field, Sevier County, Utah--Continued

Sample number	Ga-S (ppm)	Ge-S (ppm)	La-S (ppm)	Li-S (ppm)	Mn-S (ppm)	Mo-S (ppm)	Nb-S (ppm)	Nd-S (ppm)	Ni-S (ppm)	Pb-S (ppm)	Sb-S (ppm)
D221593	24	3.8	82	200L	91	4.8	46	93L	31	53	92L
D221592	31	3.6	54	200L	170	6.8	38	93L	43	1400	92L
D221591	11	2.6	58	200L	140	5.8	34	93L	43	1800	92L

Sample number	Sc-S (ppm)	Sr-S (ppm)	Th-S (ppm)	V-S (ppm)	Y-S (ppm)	Yb-S (ppm)	Zn-S (ppm)	Zr-S (ppm)
D221593	25	760	430L	140	81	5.9	65	890
D221592	16	300	430L	130	76	4.2	130	930
D221591	16	750	430L	130	61	3.7	110	820

Table 6.--Content of seven trace elements in three coal samples from the Blackhawk Formation, Wasatch Plateau coal field, Sevier County, Utah

[Analyses on air-dried (32°C) coal using Instrument Neutron Activation Analysis (INAA). L, less than the value shown, ppm = parts per million]

Sample number	As (ppm)	Cr (ppm)	Co (ppm)	Sb (ppm)	Se (ppm)	Th (ppm)	U (ppm)
D221593	2.63	4.79	0.738	0.145	1.53	2.4L	0.86
D221592	13.8	26.7	7.92	3.21	1.2	2.7L	1.07
D221591	.689	7.02	.837	.17	1.19	2.4L	.65

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