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CONCENTRATIONS OF PLATINUM GROUP ELEMENTS IN 122 U.S. COAL SAMPLES

by

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ABSTRACT

Analysis of more than 13,000 coal samples by semi-quantitative optical emission spectroscopy (OES) indicates that concentrations of the platinum group elements (iridium, palladium, platinum, osmium, rhodium, and ruthenium) are less than 1 ppm in the ash, the limit of detection for this method of analysis. In order to accurately determine the concentration of the platinum group elements (PGE) in coal, additional data were obtained by inductively coupled plasma mass spectroscopy, an analytical method having part-per-billion (ppb) detection limits for these elements. These data indicate that the PGE in coal occur in concentrations on the order of 1 ppb or less.

INTRODUCTION

Since the mid-1970s the U.S. Geological Survey has analyzed more than 13,000 coal samples for their trace element contents. Included in these analysis were determinations for the platinum group elements [iridium (Ir), palladium (Pd), platinum (Pt), osmium (Os), rhodium (Rh), and ruthenium (Ru)][1]. These determinations where done by 6-step and optical plate reader emission spectroscopy (Golightly and Simon, 1989). Except for a nine questionable results, all of the data were qualified as less than the limit of detection (2 ppm for Pt, Rh and Ru, 1 ppm for Pd, and 15 ppm for Os and Ir). To generate reliable data on the platinum group elements (Rh, Ru, Pt, Pd, Ir; Os was not determined) in coal we employed inductive plasma mass spectrometry (ICP-MS; Conrad and Krofcheck, 1992) on 122 selected coal samples. The detection limits for these PGE's by ICP-MS is generally a few parts per billion (Jackson and others, 1990).

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1. See Finkelman and Tewalt (1994) for a discussion of platinum group elements in coal including possible modes of occurrence.

SAMPLE SELECTION

Several groups of coal samples were selected for analysis. A small number of samples (8 of the 9) analyzed by emission spectrometry and reported by Bragg and others (1994) to have unqualified values (i.e. concentrations above the detection limits) were reanalyzed. A second group of 62 samples, primarily from the major coal producing areas, was selected for broad geographic coverage and to represent various coal ranks and coal-associated materials (coal waste, limestone, claystone, etc.). A third group of 7 coal samples was chosen because of the relatively high concentration of elements (such as Cr, Co, Ni, V, Ag, Pb, total sulfur, pyritic sulfur) that may be associated with PGE due to thier geochemical properties (Goldschmidt, 1954). A fourth group of 8 samples was chosen because of their proximity to the Cretaceous/Tertiary boundary. The K/T boundary is commonly shown to have anomalous high PGE values, particularly Ir (Gilmore and others, 1984). A fifth group of 37 samples was picked on the basis of their carbon, hydrogen, nitrogen, and oxygen ratios representing mostly cannel coal samples (initial results indicated higher concentrations of PGEs in cannel coals than in banded coals).

RESULTS AND DISCUSSION

Analytical results are presented in Table 1 and are discussed below by sample group and element. Table 1 provides the following information: the sample numbers as well as the original laboratory numbers for those samples previously analyzed by OES, field numbers, state, county, type of sample, the reason why the sample was selected, the lab numbers for this study, and the Rh, Ru, Pt, Pd, and Ir values. The PGE values in Table 1 are on an ash basis for the coal samples.

Sample Groupings

Group 1. (The eight samples reported by Bragg and others [1994] to have Pt or Pd values greater than 1ppm in the coal): None of these samples had PGE contents greater than a few ppb in the ash (Table 1). Thus, the previously reported OES data are spurious.

Group 2. (Comprehensive geographic, rank and sample type coverage): Only one Ru value and no Rh or Ir contents above detection limits. The Pt and Pd contents are generally less than 5 ppb. One coal waste sample from Coleman County Texas (an area that experienced silver mineralization) had 42 ppb Ru and 1900 ppb Pt! Because two other coal waste samples from this site had no more than ppb levels of the PGEs, these exceptionally high values are suspect.

Group 3. (Samples having a relatively high concentration of elements commonly associated with the PGE): None of these samples has PGE contents above a few ppb. Therefore, element associations do not appear to be a reliable indicator of PGE mineralization in coal.

Group 4. (Cretaceous/Tertiary boundary samples): These samples have the highest average concentrations for the PGEs. This group contained the only two samples having Rh contents above the detection limit; 7 of the 8 samples having Ru contents above the detection limit; and all 7 samples having Ir contents above the detection limits. Pt contents ranged from 1.7 to 36 ppb, averaging more than 12 ppb. Pd contents ranged from 1.5 to 20 ppb, averaging more than 7 ppb. Two of these samples, a coal and a claystone, are the only samples that contain measurable amounts of all 5 platinum group elements determined for this study. It is apparent that these Cretaceous/Tertiary boundary samples exhibit anomalously high contents not only for Ir, but for all of the platinum group elements determined. Moreover, the PGE ratios in these samples are more like cosmic ratios than crustal ratios (see below).

Ratio	Boundary Samples	Crustal[1]	Cosmic[1]
Pt/Pd	1.7	2.3	1
Pt/Ir	2.5	10	2
Pt/Ru	1.8	1	1.1
Pt/Rh	12.3	2	8

1. From Mason and Moore (1982)

Group 5. (Cannel coals): Pt and Pd contents are generally less than 5 ppb with a maximum value of 12 and 13 ppb, respectively.

Platinum Group Elements

Iridium: The data for Iridium show that only seven of the 122 samples have Ir contents above the limit of detection (2-3 ppb). All seven of the samples are from the Raton area of New Mexico, and are associated with the Cretaceous/Tertiary boundary.

Palladium: Eighty-three samples had palladium values above the limit of detection (3-5 ppb). The highest Pd value is 28 parts per billion in a bituminous coal sample from Greenbrier County, West Virginia. A second coal sample from the same location has less than 4 ppb Pd.

Platinum: Thirty-six of the 122 samples had "less than" values for platinum (generally <2 ppb). The highest concentration of Pt (aside from the suspect value from the coal waste sample from Texas) is 33 ppb from the Greenbrier Co., WV sample. The second sample from that location has only 2 ppb Pt.

Rhodium: Rhodium concentrations were above the limit of detection (2-3 ppb) in only 2 samples, both from the Cretaceous/Tertiary boundary in New Mexico.

Ruthenium: Ruthenium is present in amounts greater than the limit of detection (2-3 ppb) in 9 samples. The highest Ru value (42 ppb) is in the bituminous coal waste sample from Texas. Seven of the remaining samples are from the Cretaceous/Tertiary boundary in New Mexico.

CONCLUSIONS

ICP-MS analyses of 122 selected samples of coal and associated rocks indicate that the concentrations of PGE are on the order of parts per billion or less. Only samples from the vicinity of the Cretaceous/Tertiary boundary have PGE concentrations in the range of crustal abundances and have measurable amounts of the PGE analyzed for (Rh, Ru, Pt, Pd, IR).

Aside from one sample of coal waste from Texas, no potentially economic concentrations of PGE were detected nor were there any values or trends suggestive of nearby PGE mineralization.

Platinum and palladium have a high correlation coefficient (+0.72). There are insufficient data for the other elements to test for statistical correlation. For the Group 4 samples the correlation between Pt and the other PGE is between 0.92 and 0.99.

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TABLE 1. SAMPLE LOCATION & ANALYTICAL RESULTS
VALUES IN PPB ON AN ASH BASIS FOR 5 GROUPS OF SELECTED COAL SAMPLES
L = Less than stated value

LAB #	OLD LAB #	LATITUDE	LONGITUDE	FIELD #	STATE	COUNTY	MATERIAL	RH	RU	PT	PD	IR
					GROUP 1 Previous unqualified PGE values							
W248267	W211655	404649	805227	1377	OH	COLUMBIANA	COAL	2 L	2.0 L	7.7	8.9	2 L
W248280	W210255	372901	835338	KGS-345	KY	JACKSON	COAL	2 L	2.0 L	4.0	3.0	2 L
W248282	W206888	371042	822549	W8988	VA	DICKENSON	COAL	3 L	3.0 L	7.4	8.0	3 L
W248283	W207468	371109	840416	KGS-82	KY	LAUREL	COAL	3 L	3.0 L	3.0 L	5 L	3 L
W248310	W208236	332815	872545	KRCRA 3.12	AL	TUSCALOOSA	COAL	3 L	3.0 L	7.0	11.0	3 L
W248311	W207832	335135	873616	KRCRA 20.3	AL	FAYETTE	COAL	2 L	2.0 L	5.7	3.0	2 L
W248264	W190579	400307	792703	PAS121	PA	FAYETTE	COAL	2 L	2.0 L	2.0	3 L	2 L
W248266	W190570	400354	800005	PAS113	PA	WASHINGTON	COAL	2 L	2.0 L	2.0	3 L	2 L
					GROUP 2 Geographic distribution, rank, and associated materials							
W248250	W192721	373609	812331	61-74	WV	WYOMING	COAL	2 L	2.0 L	4.1	6.2	2 L
W248251	W199325	381702	813146	SI1-168	WV	KANAWHA	COAL	2 L	2.0 L	4.7	6.4	2 L
W248252	W192720	372942	812200	61-70	WV	WYOMING	COAL	2 L	2.0 L	2.0 L	3 L	2 L
W248253	W206539	375600	804257	80-20-A	WV	GREENBRIER	COAL	10 L	10.0 L	33.0	28.0	10 L
W248254	W206539	375600	804257	80-20-A	WV	GREENBRIER	COAL	2 L	2.0 L	2.0	4 L	2 L
W248255	W192715	373545	812550	61-56	WV	WYOMING	COAL	2 L	2.0 L	4.0	6.8	2 L
W248256	W194353	393730	800300	SR-141	WV	MONGALIA	COAL	10 L	10.0 L	10.0 L	20 L	10 L
W248257	W193960	372200	813614	64-15-AA	WV	MC DOWELL	COAL	2 L	2.0 L	2.0	4.0	2 L
W248258	W199739	411009	801047	PAS231	PA	MERCER	COAL	2 L	2.0 L	8.6	11.0	2 L
W248259	W199584	400915	781457	PAS164	PA	BEDFORD	COAL	2 L	2.0 L	3.0	4.0	2 L
W248260	W200450	412018	775302	PAS273	PA	CLINTON	COAL	2 L	2.0 L	2.0	3.0	2 L
W248261	W192712	372202	815041	61-41	WV	MC DOWELL	COAL	2 L	2.0 L	4.8	4.0	2 L
W248265	W197229	402830	791332	H2-1-4L 2.3	PA	INDIANA	COAL	2 L	2.0 L	3.0	5.4	2 L
W248269	W214062	394047	821710	1313	OH	PERRY	COAL	2 L	2.0 L	2.0 L	3 L	2 L
W248271	W216043	410408	795113	PAS538	PA	BUTLER	COAL	2 L	2.0 L	2.0	3.0	2 L
W248284	W214263	364841	835234	KGS-527	KY	KNOX	COAL	2 L	2.0 L	2.0	3 L	2 L
W248285	W224350	403506	812014	1448	OH	TUSCARAWAS	COAL	2 L	2.0 L	2.0 L	4.0	2 L
W248289	W210262	374546	823826	KGS-352	KY	MARTIN	COAL	2 L	2.0 L	4.3	4.9	2 L
W248299	W194312	371539	874353	SLC-57	KY	HOPKINS	COAL	2 L	2.0 L	5.1	5.5	2 L
W248300	W192930	380206	885748	LO1432	IL	FRANKLIN	COAL	2 L	2.0 L	2.0 L	5.1	2 L
W248302	W189332	380101	893309	LO1009	IL	PERRY	LIMESTONE	2 L	2.0 L	2.0 L	3 L	2 L
W248304	W209892	340404	873624	WIL-1	AL	WINSTON	COAL	3 L	3.0 L	4.0	8.1	3 L
W248305	W211203	333418	872812	KRCRA 11.C	AL	TUSCALOOSA	COAL	2 L	2.0 L	5.0	4.4	2 L
W248306	W189335	380101	893309	LO1017	IL	PERRY	CLAYSTONE	2 L	2.0 L	6.1	3 L	2 L
W248307	W211198	332630	872647	KRCRA 6.D	AL	TUSCALOOSA	COAL	2 L	2.0 L	2.0 L	3 L	2 L
W248313	W218628	373251	822124	KGS690	KY	BREATHITT	COAL	2 L	2.0 L	5.6	3.0	2 L
W248326	none	361700	800800	601 ROBBINS	VA	STOKES	COAL	2 L	2.0 L	2.0	3.0	2 L
W248327	none	361700	800800	602 ROBBINS	VA	STOKES	COAL	2 L	2.0 L	4.9	5.9	2 L
W248328	none	323000	794000	633 ROBBINS	VA	PITTSYLVANIA	BLACK SHALE	2 L	2.0 L	2.0 L	3.0	2 L
W248329	none	353300	791700	1110 ROBBINS	NC	CHATHAM	COAL	2 L	2.0 L	16.0	17.0	2 L
W248330	none	373900	773400	1061 ROBBINS	VA	HENRICO	COAL	2 L	2.0 L	3.0	5.6	2 L
W248331	none	373700	773800	734 ROBBINS	VA	CHESTERFIEL	COAL	0.5 L	0.5 L	0.8	1.2	0.5 L
W248332	W248060	340000	992310	none	TX	DALLAS	LIGNITE	3 L	3.0 L	3.0 L	5 L	3 L
W248333	W248053	423736	842900	1	MI	INGHAM	COAL TILL	0.5 L	0.5 L	0.7 L	0.8 L	0.5 L
W248334	W248054	424000	841700	2	MI	INGHAM	CANNELOID	2 L	2.0 L	2.0 L	3 L	2 L
W248335	W248055	424500	844500	3	MI	EATON	COAL	10 L	10.0 L	10.0 L	20 L	10 L
W248336	W248056	431500	840730	4	MI	SAGINAW	CANNEL	5 L	5.0 L	5.0 L	8.0	5 L
W248337	W248057	431500	840730	5	MI	SAGINAW	COAL	10 L	10.0 L	10.0 L	20 L	10 L
W248336	W248058	432230	835330	6A	MI	SAGINAW	COAL	5 L	5.0 L	7.0 L	8 L	5 L
W253369	W253369	463900	1225800	90WABIG1	WA	LEWIS	COAL	0.7 L	0.7 L	1.2	1.5	0.7 L
W253370	W253370	373730	830730	91KY2145	KY	MAGOFFIN	COAL	0.8 L	0.8 L	1.0	2.4	0.8 L
W253371	W253371	373000	830730	91KY2155	KY	MAGOFFIN	COAL	0.9 L	0.9 L	2.0	2.6	0.9 L
W253372	W253372	375230	831500	91KY2169	KY	MORGAN	COAL	2 L	2 L	2.0 L	2.0	2.0 L
W253373	W253373	375230	831500	91KY2170	KY	MORGAN	COAL	0.9 L	0.9 L	1.0	1.0	0.9 L
W253374	W253374	373730	830730	91KY2174	KY	MAGOFFIN	COAL	0.5 L	0.5 L	1.4	2.5	0.5 L
W253375	W253375	374500	823730	91KY3758	KY	MARTIN	COAL	2 L	2 L	2.0 L	2.0	2.0 L
W253376	W253376	374500	823770	91KY3814	KY	MARTIN	COAL	0.9 L	0.9 L	2.0	0.9 L	0.9 L
W253377	W253377	371500	831530	91KY4631	KY	PERRY	COAL	2 L	2 L	2.0 L	2.0 L	2.0 L
W253378	W253378	373730	864500	91KY2170	KY	OHIO	COAL	2 L	2 L	3.0	3.0	2.0 L
W253387	W253387	435230	1084500	GC2T	WY	HOT SPRINGS	COAL	1 L	1.0 L	1.0	1.0	1.0 L
W253388	W253388	435230	1084500	GC4T	WY	HOT SPRINGS	COAL	1 L	1.0 L	1.0	1.0 L	1.0 L
W253389	W253388	435230	1084500	GC4M	WY	HOT SPRINGS	COAL	0.9 L	0.9 L	1.0	2.0	0.9 L
W253390	W253390	435230	1084500	GC4B	WY	HOT SPRINGS	COAL	0.5 L	0.5 L	1.2	2.1	0.5 L
W253391	W253391	435230	1084500	GC2M	WY	HOT SPRINGS	COAL	0.7 L	0.7 L	0.7	0.7 L	0.7 L
W253392	W253392	435230	1084500	GC2B	WY	HOT SPRINGS	COAL	0.5 L	0.5 L	0.6	0.5 L	0.5 L
W253393	W253393	435230	1084500	GC1T	WY	HOT SPRINGS	COAL	1 L	1.0 L	1.0	2.0	1.0 L
W253394	W253394	435230	1084500	GC1B	WY	HOT SPRINGS	COAL	1 L	1.0 L	1.0 L	1.0 L	1.0 L
W253398	W253390	323500	782600	91TX88-11A	TX	COLEMAN	COAL WASTE	0.6 L	0.6 L	1.0	1.0	0.6 L
W253399	W253399	323500	782600	91TX88-11B	TX	COLEMAN	COAL WASTE	0.6 L	0.6 L	0.9	1.0	0.6 L
W248325	none	312800	992310	LIT BULL 2	TX	COLEMAN	COAL WASTE	3 L	42.0	1900.0	5.0 L	3 L
W248249	none	323500	982000	THURBER	TX	ERATH	COAL WASTE	2 L	2.0 L	5.3	3 L	2 L
W248324	none	312800	992310	TXB88	TX	COLEMAN	COAL	2 L	2.0 L	4.0	4.8	2 L

LAB #	OLD LAB #	LATITUDE	LONGITUDE	FIELD #	STATE	COUNTY	MATERIAL	RH	RU	PT	PD	IR
					GROUP 3 PGE associated elements							
W248262	W200449	412019	775326	PAS272	PA	CLINTON	COAL	2 L	2.0 L	2.0	4.1	2 L
W248309	W214014	333613	873404	KRCRA 3.1	AL	TUSCALOOSA	COAL	2 L	2.0 L	3.0	3.0	2 L
W248263	W200451	412013	775300	PAS274	PA	CLINTON	COAL	3 L	3.0 L	3.0 L	5.0	3 L
W248268	W188895	315716	880120	ALA 75-90A	AL	CLARKE	COAL	2 L	2.0 L	2.0 L	4.0	2 L
W248312	W214010	333613	873404	KRCRA 3.E	AL	TUSCALOOSA	COAL	2 L	2.0 L	2.0 L	3 L	2 L
W248270	W217585	385413	822020	1004	OH	GALLIA	COAL	2 L	2.0 L	2.0	3 L	2 L
W248316	W206857	333030	873115	KRCRA 7.3	AL	TUSCALOOSA	COAL	3 L	3.0 L	4.0	6.0	3 L
					GROUP 4 K/T boundary							
W253379	W253379	365230	1043000	90NMP911B	NM	COLFAX	COAL	1 L	3.8	9.2	6.2	2.0
W253380	W253380	365230	1043000	90NMP901A	NM	COLFAX	COAL	1 L	4.1	9.7	6.3	2.0
W253381	W253381	365230	1043000	90NMP901C	NM	COLFAX	SHALEY COAL	0.5 L	2.2	3.8	2.5	1.1
W253382	W253382	365230	1043000	90NM901D	NM	COLFAX	CLAYSTONE	0.5 L	0.5 L	1.7	1.5	0.5 L
W253383	W253383	365230	1043000	90NMP895A	NM	COLFAX	CLAY	2.6	18.0	28.0	15.0	15.0
W253384	W253384	365230	1043000	90NMP895AC	NM	COLFAX	COAL	3.3	22.0	36.0	20.0	18.0
W253385	W253385	365230	1043000	90NMP895B	NM	COLFAX	CLAYSTONE	0.5 L	1.8	4.6	3.0	1.1
W253386	W253386	365230	1043000	90NMP895BKT	NM	COLFAX	CLAYSTONE	0.5 L	1.3	5.4	2.9	0.8
					GROUP 5 Cannel coals							
W248272	W188962	362930	841608	PIPI-1	TN	CAMPBELL	COAL	2 L	2.0 L	2.0	4.6	2 L
W248272	W188956	380739	841524	LC-bg-1	TN	ANDERSON	COAL	2 L	2.0 L	8.7	10.0	2 L
W248274	W188959	362822	841122	I-PC-1	TN	CAMPBELL	COAL	2 L	2.0 L	5.7	4.9	2 L
W248275	W188964	361709	841436	J-A-BN-4	TN	CAMPBELL	COAL	2 L	2.0 L	2.0	3.0	2 L
W248276	W188959	362822	841122	I-PC-1	TN	CAMPBELL	COAL	2 L	2.0 L	4.4	5.4	2 L
W248277	W188957	361552	841329	JA-PW-1	TN	CAMPBELL	COAL	2 L	2.0 L	3.0	3.0	2 L
W248248	W188964	361709	841436	J-A-BN-4	TN	CAMPBELL	COAL	2 L	2.0 L	2.0	3.0	2 L
W248279	W188961	363349	841018	JW-CC-1	TN	CAMPBELL	COAL	2 L	2.0 L	2.0	3 L	2 L
W248281	W188961	363349	841018	JW-CC-1	TN	CAMPBELL	COAL	2 L	2.0 L	4.4	3 L	2 L
W248286	W188956	380739	841524	LC-BG-1	TN	ANDERSON	COAL	3 L	3.0 L	8.5	11.0	3 L
W248287	W188963	362900	841654	PI-J-1	TN	CAMPBELL	COAL	2 L	2.0 L	5.4	5.6	2 L
W248288	W188958	381136	841501	DF-W2	TN	CAMPBELL	COAL	3 L	3.0 L	3.0 L	5 L	3 L
W248290	W188960	362840	841127	I-RX-1	TN	CAMPBELL	COAL	3 L	3.0 L	9.1	7.0	3 L
W248291	W188902	362659	840718	LF-JO-1	TN	CAMPBELL	COAL	3 L	3.0 L	3.0	5 L	3 L
W248292	W188910	361611	843103	RB-BM-3	TN	SCOTT	COAL	2 L	2.0 L	3.0	4.0	2 L
W248293	W188904	363535	841800	K-BM-2	TN	SCOTT	COAL	2 L	2.0 L	5.2	5.6	2 L
W248294	W188903	363235	840327	JE-Bg-2	TN	CAMPBELL	COAL	3 L	3.0 L	12.0	13.0	3 L
W248295	W188907	363235	842950	WE-GM-1	TN	SCOTT	COAL	2 L	2.0 L	9.5	11.0	2 L
W248296	W188901	363249	835812	E-CC-2	TN	CLAIBORNE	COAL	3 L	3.0 L	3.0 L	5 L	3 L
W248297	W188900	363424	835720	E-RX-2	TN	CLAIBORNE	COAL	3 L	3.0 L	9.7	12.0	3 L
W248296	W188908	362645	843303	HW-GM-2	TN	SCOTT	COAL	2 L	2.0 L	5.2	8.7	2 L
W248301	W188917	361049	842136	DF-BM-4	TN	ANDERSON	COAL	2 L	2.0 L	2.0 L	3 L	2 L
W248303	W188918	363320	835420	E-M-1	TN	CLAIBORNE	COAL	3 L	3.0 L	3.0 L	5 L	3 L
W248308	W188905	363533	841801	K-W-3	TN	SCOTT	COAL	2 L	2.0 L	2.0 L	4.0	2 L
W248314	W188908	381608	843718	Rb-GM-3	TN	MORGAN	COAL	2 L	2.0 L	5.7	6.6	2 L
W248315	W215411	363424	834534	KGS570	TN	CLAIBORNE	COAL	2 L	2.0 L	3.0	6.7	2 L
W248317	W215410	363424	834534	KGS569	TN	CLAIBORNE	COAL	2 L	2.0 L	6.7	8.9	2 L
W248318	W216282	375227	831757	KGS634	KY	MORGAN	COAL	2 L	2.0 L	2.0 L	3 L	2 L
W248319	W216280	374032	833258	KGS631	KY	WOLFE	COAL	3 L	3.0 L	5.0	5 L	3 L
W248320	W193650	362405	845556	JM-N-2	TN	FENTRESS	COAL	2 L	2.0 L	2.0 L	5.4 L	2 L
W248321	W193661	363443	834649	FR-M-3	TN	CLAIBORNE	COAL	5 L	5.0 L	5.0 L	8 L	5 L
W248322	W193659	361125	842355	FM-BM-3	TN	SCOTT	COAL	2 L	2.0 L	2.0 L	4 L	2 L
W248323	W193647	363438	834620	FR-ST-1	TN	CLAIBORNE	COAL	10 L	10.0 L	10.0 L	20 L	10 L
W253395	W253395	395310	801010	SEW4LA	PA	GREENE	COAL	0.5 L	0.5 L	0.5 L	0.6	0.5 L
W253396	W253396	395310	801010	SEW4LB1	PA	GREENE	COAL	1 L	1.0 L	1.0 L	1.0 L	1.0 L
W253397	W253397	395310	801010	SEW4LD2	PA	GREENE	COAL	5 L	5.0 L	5.0 L	5.0 L	5.0 L
W253400	W253400	362413	841053	91TN1	TN	CAMPBELL	COAL	0.6 L	0.6 L	2.6	3.4	0.6 L