

Geological, chemical and organopetrographic properties of San Juan coals (Cerrejón, Guajira, Colombia)

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Abstract

San Juan is a large potential underground coal mine located in the La Guajira region in the northeast of Colombia (Figure 1). The regional geology is composed of a Cretaceous age basement rock overlain by the coal-bearing sequence of the Tertiary age Cerrejón Formation. The Cerrejón Formation (Middle-Late Paleocene) consist of bituminous coal fields that are an important economic resource. The coal seams within the Cerrejón Formation are numerous and are variable in thickness, ranging from a few centimeters to 6 meters. The Cerrejón Formation has been divided into three groups (lower, middle, upper) based on the thickness and distribution of the coal beds (Figure 2). On the Tertiary deposits are Quaternary alluvial deposits of 400-700 m thickness, covering the San Juan mine area. The Cerrejón Formation was likely formed on a coastal plain, covered in a wet tropical rainforest and incised by a large river system. San Juan underground mine coal probable reserve is 671.7 million tons. Based on evaluation, 92% of the coal reserve is suitable as a PCI (pulverized coal injection) product to the steel industry (MPX, 2012). Proximate analyses of San Juan coals are moisture content (Wt. %) 16.2, ash content (Wt. %) 6.8, volatile matter (Wt. %) 35.2, fixed carbon (Wt. %) 41.9, total sulphur (Wt. %) 0.49 and calorific value (kcal/kg) 6289 (Figure 3, 4). The result of coal petrography analyses San Juan coals are composed of vitrinite (48.3-79.7 %), exinite (1.0-6.6 %), fusinite (0.3-5.6 %), semifusinite (5.5-25.9 %) and mineral matter (0.6-13.3 %) (Figure 5.). Based on vitrinite reflectance (0.5-07 Rm %), the coal of San Juan can be classified as high volatile bituminous coal in rank.

Key words: Coal, geology, Cerrejón Formation, San Juan, Colombia

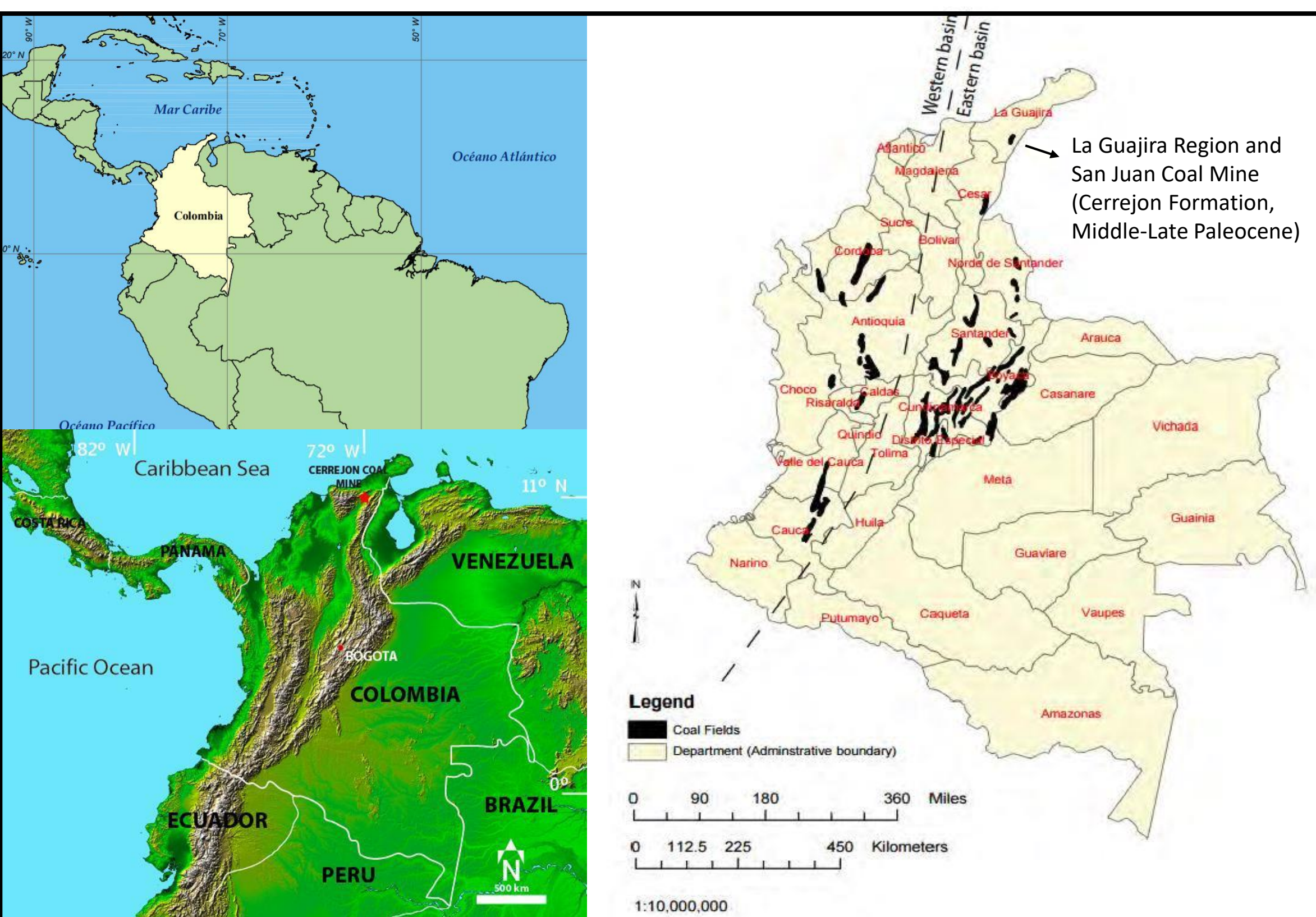


Figure 1. Location map of La Guajira Region and Coal Fields in Colombia

The geological structure of the Cerrejón Formation in this area, due to the earlier activity and erosion prior to its burial, has caused the coal seams to in-crop beneath the alluvium dipping at 6" to 14" on a south-easterly direction. As a result of this earlier activity, the coal seams are encountered in ascending order at the base of the alluvium, from west to east. This structure is further complicated by the presence of a number of major low angle thrust faults that also occurred prior to erosion and burial that have caused a number of seams to be repeated in vertical section.

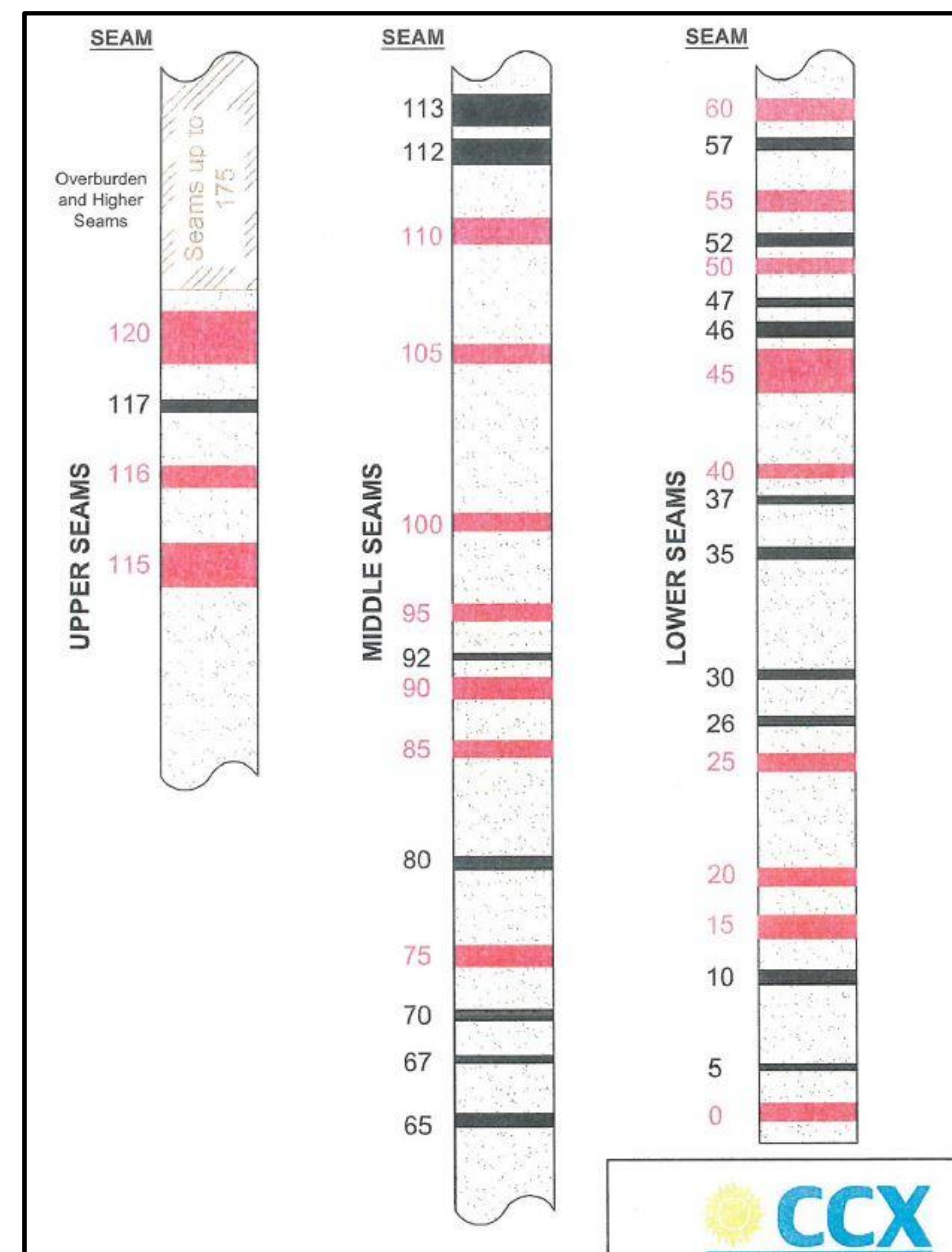


Figure 2. Coal Seams of San Juan Coal Resources

Table 1. San Juan Coal Resources

Seam	Average Thickness (m)	Measured (000s tonnes)	Indicated (000s tonnes)	Total (000s tonnes)	Target Seams
120	7.7	43,171	142,221	185,392	YES
117	1.6	7,485	25,527	33,012	NO
116	3.3	16,731	67,812	84,543	YES
115	6.3	47,885	170,763	218,648	YES
113	5.0	23,218	92,885	116,103	NO
112	4.2	11,207	42,316	53,523	NO
110	3.9	33,932	106,142	140,074	YES
105	2.9	36,832	88,444	125,276	YES
100	2.6	37,667	81,957	119,624	YES
95	2.5	37,962	86,157	124,119	YES
92	1.0	4,796	6,605	11,401	NO
90	3.3	45,461	115,337	160,798	YES
85	2.6	36,396	90,968	127,364	YES
80	1.8	27,682	58,578	86,260	NO
75	3.1	51,347	137,876	189,223	YES
70	1.4	24,294	53,095	77,379	NO
67	1.1	11,426	27,354	38,780	NO
65	2.8	44,263	88,499	132,762	NO
60	3.4	40,947	127,027	167,974	YES
57	1.3	13,939	29,307	43,246	NO
55	3.3	75,282	166,168	241,450	YES
52	2.0	38,592	87,413	126,005	NO
50	2.5	71,334	176,673	248,007	YES
47	1.0	16,089	41,089	57,178	NO
45	2.0	29,358	70,069	99,427	NO
40	6.0	157,849	275,419	433,268	YES
37	1.4	10,984	15,559	26,543	NO
35	1.8	28,700	82,420	111,120	NO
30	1.5	29,625	60,549	90,174	NO
26	1.6	11,914	18,466	30,380	NO
25	2.2	66,842	122,292	189,134	YES
20	2.9	82,661	160,466	243,127	YES
15	3.7	106,349	207,425	313,774	YES
10	2.5	80,115	166,888	246,993	NO
5	1.0	32,064	58,663	90,727	NO
0	2.8	80,898	167,677	248,575	YES
Total Measured + Indicated		1,575,297	3,640,459	5,215,756	
Thermal		560,545	1,324,236	1,904,781	
PCI		994,752	2,316,223	3,310,975	

The Cerrejón Fault, which passes through the Cerrejón Formation, runs past the eastern side of the Canaveral opencast pit. It separates the Cerrejón Formation, which lies beneath the Canaveral Pit area, from the up-thrown Cretaceous Cogollo group and Jurassic La Quinta formations to the east. The fault trends south-west to north-east, dips to the south-east at approximately 60° and can have a displacement of more than 400 m.

Table 2. Targeted San Juan Coal Resources

Seam	Average Thickness (m)	Measured (000s tonnes)	Indicated (000s tonnes)	Total (000s tonnes)
120	7.7	43,171	142,221	185,392
116	3.3	16,731	67,812	84,543
115	6.3	47,885	170,763	218,648
110	3.9	33,932	106,142	140,074
105	2.9	36,832	88,444	125,276
100	2.6	37,667	81,957	119,624
95	2.5	37,962	86,157	124,119
90	3.3	45,461	115,337	160,798
85	2.6	36,396	90,968	127,364
75	3.1	51,347	137,876	189,223
60	3.4	40,947	127,027	167,974
55	3.3	75,282	166,168	241,450
50	2.5	71,334	176,673	248,007
45	6.0	157,849	275,419	433,268
40	2.5	60,010	122,593	182,603
25	2.2	66,842	122,292	189,134
20	2.9	82,661	160,466	243,127
15	3.7	106,349	207,425	313,774
0	2.8	80,898	167,677	248,575
Total Measured + Indicated		1,129,556	2,613,417	3,742,973
Thermal		96,842	211,037	307,879
PCI		1,032,714	2,402,380	3,435,094

Table 3. In-Situ Coal Estimates

Seam	Average Thickness (m)	Measured (000s tonnes)	Indicated (000s tonnes)	Total (000s tonnes)
120	7.7	43,171	142,221	185,392
116	3.3	16,731	67,812	84,543
115	6.3	47,885	170,763	218,648
110	3.9	33,932	106,142	140,074
105	2.9	36,832	88,444	125,276
100	2.6	37,667	81,957	119,624
95	2.5	37,962	86,157	124,119
90	3.3	45,461	115,337	160,798
85	2.6	36,396	90,968	127,364
75	3.1	51,347	137,876	189,223
60	3.4	40,947	127,027	167,974
55	3.3	75,282	166,168	241,450
50	2.5	71,334	176,673	248,007
45	6.0	157,849	275,419	433,268
40	2.5	60,010	122,593	182,603
25	2.2	66,842	122,292	189,134
20	2.9	82,661	160,466	243,127
15	3.7	106,349	207,425	313,774
0	2.8	80,898	167,677	248,575
Total Measured + Indicated		1,129,556	2,613,417	3,742,973
Thermal		96,842	211,037	307,879
PCI		1,032,714	2,402,380	3,435,094

Table 4. Reserve Tonnage Breakdown by Seams

Seam	Tonnage (Mt)	Ash % wt. arb	Heat Content kcal/kg arb	Total Sulphur %wt. arb	Total Moisture % wt.	PCI
120	38.0	14.4	5,732	0.29	22.20	Y
116	28.6	11.2	6,126	0.27	21.20	Y
115	44.3	4.3	7,172	0.32	17.20	Y
110	39.1	12.9	6,331	0.30	18.30	Y
105	36.8	17.2	5,924	0.37	16.10	N
100	28.1	4.6	6,569	0.59	19.30	Y
095	28.7	10.2	6,142	0.43	13.60	Y
090	35.7	3.2	6,369	0.33	17.53	Y
085	32.8	5.7	6,141	0.52	17.10	Y
075	52.3	4.2	6,166	0.38	17.89	Y
060	49.7	4.8	6,215	0.38	17.57	Y
055	25.5	5.4	6,251	0.37	16.89	Y
050	11.5	7.6	5,634	0.52	21.55	Y
045	76.2	2.5	6,826	0.39	14.05	Y
040	17.8	6.0	6,631	0.56	12.70	N
025	26.2	7.1	6,570	2.09	12.19	Y
020	31.0	6.0	6,687	0.46	12.59	Y
015	34.7	5.3	6,839	0.72	11.80	Y
000	38.7	5.5	6,987	0.88	10.57	Y



Figure 3. Core Samples

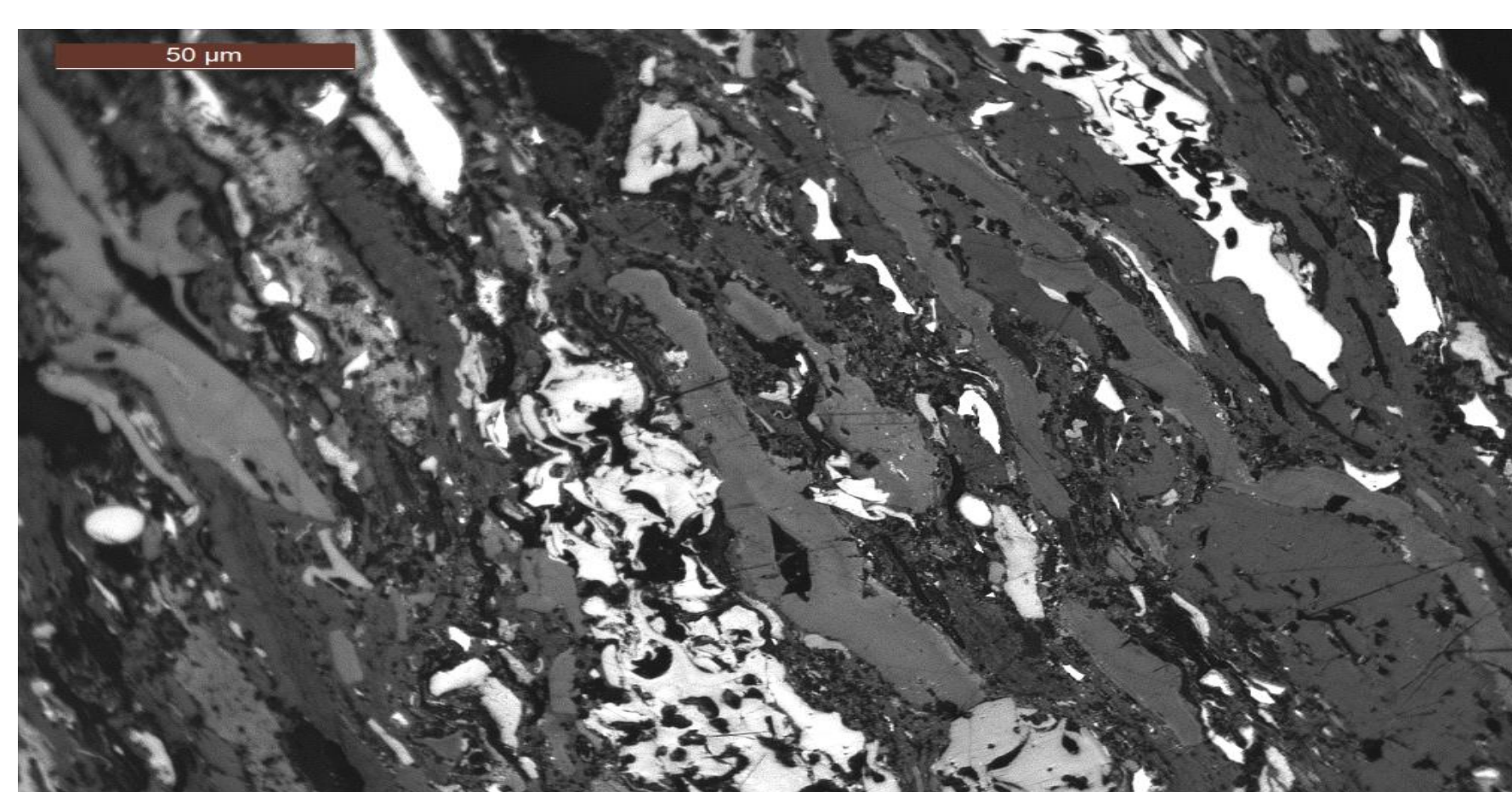


Figure 5. Fusinite and Semifusinite



Figure 4. Corebox: 81 (Drill Hole: 359) El Playon

References

MPX, 2012. San Juan Underground Preliminary Feasibility Study (Colombia-Guajira Thermal Coal Project). Project Number: 11514050003.R002, Golder Associates (1 copy/pdf), CCX Colombia.