

The lower and upper coal seams of the Candiota Coalfield, Brazil – Geological setting, petrological and chemical characterization, and studies on reactivity and beneficiation related to their combustion potential

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ABSTRACT

In the Candiota Coalfield, RS, Brazil the Candiota Superior and Inferior coal seams are at current time being mined for power generation. The current study characterizes the other seams of the deposit, which include the upper (S2–S9) seams, the Banco Louco (BL) seam and the lower (I1–I5) seams, which up to date have not been considered for power generation. The analytical techniques applied in this study include: sequence stratigraphic analysis of the coal-bearing interval, petrographical and chemical analyses of the coal seams, reactivity tests based on thermobalance experiments and studies on beneficiation.

Sequence stratigraphic analyses: Sedimentological analyses identified four depositional systems in the study area: alluvial fan, fluvial, lagoon-barrier and shallow marine, with coal seams developed in Transgressive Systems Tract, Highstand Systems Tract, and Lowstand Systems Tract.

Petrographical and chemical analyses: The petrographical analyses showed that the most abundant maceral in the coals is vitrinite, followed by inertinite and liptinite. The average vitrinite reflectance is indicative of sub-bituminous rank (0.41 % R_r). The values for ash yield range from 29.0 to 74.2 wt.% (average 49.1 wt.%), and for volatile matter contents vary from 13.5 to 29.5 wt.% (average 19.9 wt.%). Sulfur contents range from 0.4 to 8.1 wt.% (average 1.9 wt.%). The gross calorific values, as received basis, range from 841 to 3727 cal/g (average 2632 cal/g). Based on X-ray diffraction analysis the most abundant minerals in the coal seams are quartz, kaolinite, illite and k-feldspar.

Reactivity studies: Thermogravimetric analyses carried out on fourteen seam channel samples showed differences in the combustion behavior of the seams, in particular for the inertinite-rich seams S8 and Banco Louco. The I2 seam analyzed from four of the eight exploration wells indicated very similar combustion properties based on the thermogravimetric analyses.

Beneficiation tests: From the sink-float tests and proximate and ultimate analyses, washability curves were prepared for all upper, lower and BL seams (> 20 cm thick). These curves were plotted showing ash distribution and total sulfur content for a grain-size between 25.4 mm and 2.0 mm (Fraction A, – 25.4 + 2.0 mm) and for a grain-size between 2.0 mm and 0.1 mm (Fraction B, – 2.0 + 0.1 mm). These curves provided important information to a possible gravimetric beneficiation for both size fractions. However, the performance of such beneficiation mainly depends on both the Near Gravity Material (NGM) value and separation density of each seam, which are the main parameters analyzed. In addition, these curves showed low values of total sulfur content in any separation density. However, the densest fractions were not taken into consideration.

Conclusion: The results of the chemical and petrological analyses as well as the studies on combustion and beneficiation characteristics suggest that the seams investigated in this study (S1–S9, BL, I1–I5) do have the potential for being used in power generation.

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1. Introduction

In Brazil, major coal deposits of Permian age occur in the Paraná Basin (Fig. 1A). Measured reserves are in the order of 32 billion tonnes

(bt) of coal (Informativo Anual da Indústria Carbonífera, 2000), of which 89% are located in the state of Rio Grande do Sul (Fig. 1B).

The Candiota Coalfield is located in the southern part of Rio Grande do Sul (Fig. 1B and C) and represents the largest coal occurrence in the country, with measured reserves of 1.7 bt of coal (Informativo Anual da Indústria Carbonífera, 2000). The coal-bearing strata comprises up to 17 seams (Fig. 2), of which the Candiota Inferior (CCI) and Superior (CCS)

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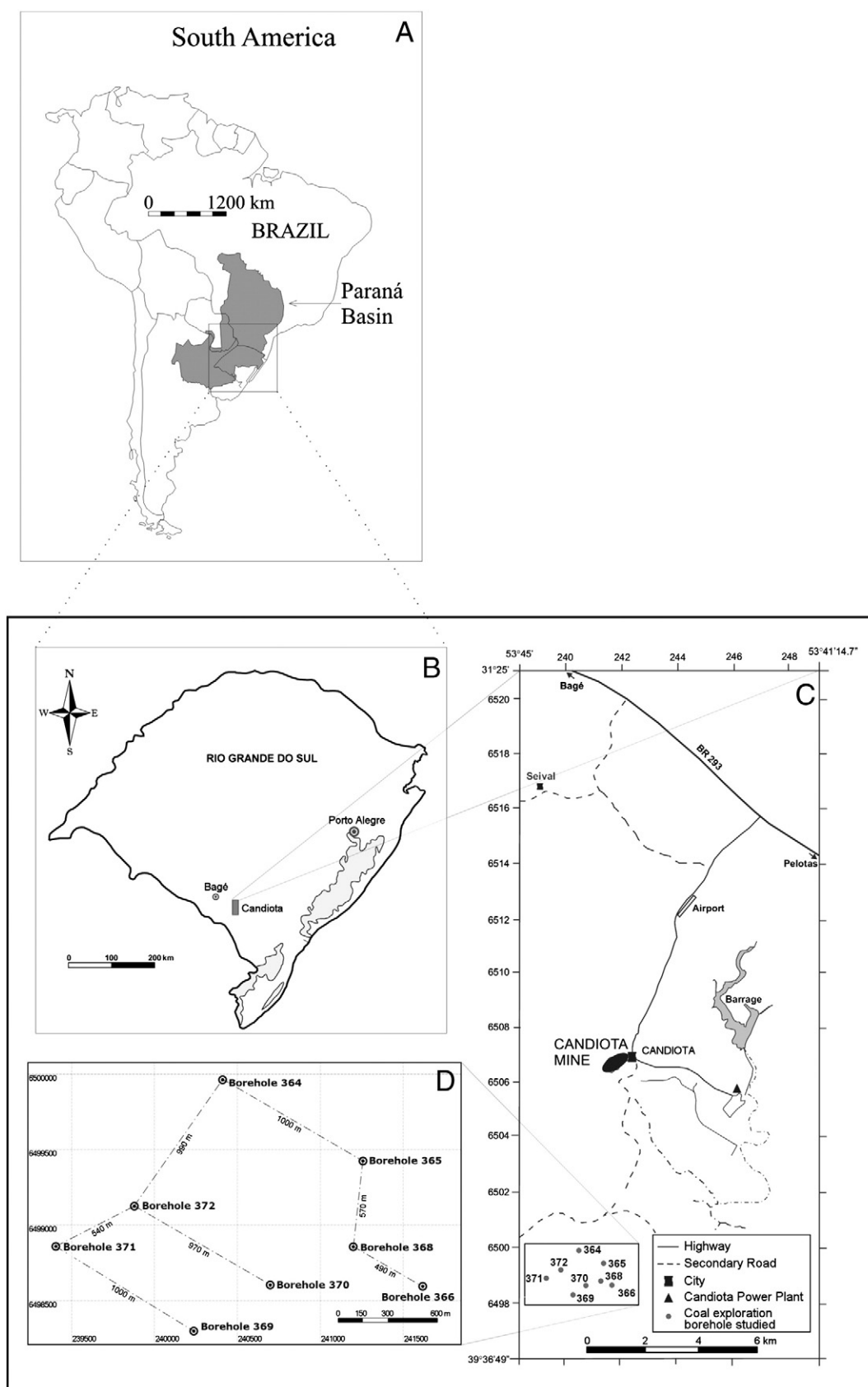


Fig. 1. Map showing A) location of the Paraná Basin in South America; B) location of the Candiota Coalfield in the state of Rio Grande do Sul; C and D) location of boreholes used in this study; modified from Silva and Kalkreuth (2005).

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