CBM Potential in the carboniferous zones of Cundinamarca, Boyacá y Santander, Colombia

Direction of Minerals Resources
Research and Exploration of Energy Mineral Resources Group

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Themes

1. Background CBM in the SGC
2. Evaluated areas for CBM
3. Work methodology
4. Results
5. Projections
1. Background CBM in the SGC

- **Legal:** In the document Conpes 3517 of May 12/2008, whose objective is to set “Policy guidelines for the allocation of the rights of exploration and exploitation of methane gas in coal deposits and the development of technical standards for their exploitation”, It is recommended that the Ministry of Mines and Energy supported by the ANH and Ingeominas (today SGC) issue technical standards for the exploration and production of this resource and coordinate the management and provision of technical information.

- **Mining Safety:** Accidents registered in coal mines caused by methane gas explosion, especially in the departments of Boyacá, Cundinamarca, Norte de Santander y Antioquia.

- **Environmental:** Methane gas is considered a Greenhouse gas, 21 times more powerful than CO₂ and at the same time a gas that influences the global warming of the planet.

- **Geoscientific Knowledge:** The SGC, since 2010, has been conducting exploration studies of Methane Gas Associated to Coal (GMAC), to obtain information on the origin, accumulation and potentiality of this resource, as another source of energy for the country, characterizing coal seam in regards to your GMAC content.
Carboniferous Potential of Colombia

In the country 12 carboniferous zones has been defined.

Potential 16.678 MT (SGC, 2016)
2. Areas evaluated for CBM

1400 Km²

- 2011 Checua-Lenguazaque (Cundinamarca)
- 2012 Checua-Lenguazaque (Boyacá)
- 2013 Tasco-Socotá (Boyacá)
- 2014 Umbita-Rondón (Boyacá)
- 2015 Carmen de Chucurí (Santander)
- 2016 Landázuri-Vélez (Santander)
- 2017 Guaduas Caparrapí (Cundinamarca)
Geographic location CBM study areas

Republica de Colombia

Departamento de Boyacá

Áreas de estudio

1 y 2: Área Checa - Lenguazaque (2011 - 2012)
3: Área Tasca - Socotá (2013)
4: Área Umbita - Rondón (2014)
5: Área El Carmen de Chucurí (2015)
7: Área Guaduas - Caparrápi (2017)
Geological structures of interest

Areas 1 y 2. Sinclinal Checua-Lenguazaque

Area 3. Sinclinal Rucú

Area 3. Anticinal Socotá

Area 4. Sinclinal Úmbita
3. Work methodology

- **Stage 1**
  Information diagnosis

- **Stage 2**
  Project socialization
  Surface geology
  Mining activity review

- **Stage 3**
  Subsurface geology

- **Stage 4**
  Physical – chemical characterization of coal
  CBM potential calculation
  Final report
Stage 1 Diagnosis of geological information of carbons

Review of geological studies of coal exploration in the sectors of interest.

- Geological cartography
- Stratigraphy
- Coal seams
- Qualities
Stage 2  Project Socialization

- Civil authorities
- Military authorities
- Communities
Stage 2. Surface Geology and Mining

- Cartography review in the field. (continuity in the seams, inclination angles of the layers).


- Evaluation of the topographic characteristics of the sector (acces roads, water sources present, etc).

- Determination of perforation points.
Stage 3 Subsurface geology

• Perforation with core recovery
• Sampling for physicochemical measurements and analysis

Pozo Carmen de Chucurí-1. Santander

Registros de pozo
- Gamma Ray
- Resistivity
- Density
- Temperature
Stage 4 Characterization and calculation of the CBM potential

Sampling and measurement of CBM contents

a. Preparation of canister

b. Muestreo

c. Sealed, hermetic seal
d. Measurement of lost and desorbed gas in the field

e. Measurement desorbed and residual gas in the laboratory
Sampling and measurement of CBM contents

f. Preservation and storage of cores

The final destination of the cores is the litoteca of the SGC
Sampling and measurement of CBM contents

g. Information processing - software Terragam

Introduction of basic data about the well and simples.

Filling of measurement data for each sample, gas lost and desorbed

Obtaining graphs of desorption and value of gas lost more desorbed.
Physical - chemical characterization of coals

- Close analysis (residual moisture, volatile matter, ash and fixed carbon)
- Elemental Analysis (carbon, hydrogen, nitrogen and total sulfur)
- Ash chemistry (ten major elements)
- Minor elements
- Calorific power
- Mercury
- Swelling index
- Plastometry
- Petrography
- Chromatography

- Thermochronology – fission traces and stable isotopes
  (Research group and Nuclear and Geochronological applications)
Calculation of CBM resources

Map of Structural Contours. Sector GMAC Carmen de Chucurí. 2015
4. Main Results

- Realization of 15 exploratory drilling in Cundinamarca, Boyacá y Santander, with depths between 300 a 600 m. In total 7235 m have been drilled with cores recovery.
- Coal characterization and GMAC potential evaluation.
- Obtaining coal samples with methane gas contents up to 730 ft3/ton. The highest values of GMAC were registered in the Departament of Santander in type coal Bituminous low to high volatile and Semi - anthracite.

<table>
<thead>
<tr>
<th>Año</th>
<th>Área</th>
<th>Pozos</th>
<th>Prof. Metros</th>
<th>Contenidos CBM (Pies3/ton)</th>
<th>Potencial (Bcf)</th>
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<tr>
<td>2011</td>
<td>Checua-Lenguazaque</td>
<td>Sutatausa 1</td>
<td>400</td>
<td>11 - 73</td>
<td>3.46</td>
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<tr>
<td></td>
<td></td>
<td>Cucunubá 3</td>
<td>300</td>
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<td>2012</td>
<td>Checua- Lenguazaque</td>
<td>Ráquirá 1</td>
<td>400</td>
<td>2 - 37</td>
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<td>(Gachetá-Samacá)</td>
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<td>2013</td>
<td>Tasco-Socotá</td>
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<td>425</td>
<td>23 - 253</td>
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<td></td>
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<td>Socotá 2</td>
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<td>2014</td>
<td>Umbita-Rondón</td>
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<td>520</td>
<td>13 - 308</td>
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<td></td>
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<td>Chinavita 1</td>
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<td>2015</td>
<td>El Carmen de Chucurí</td>
<td>Carmen de Chucurí 1</td>
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<td>15 - 662</td>
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<td>Carmen de Chucurí 2</td>
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<td>2016</td>
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<td>Guaduas 1</td>
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Fuente: Datos del estudio
Products

- Methodologies and standards *(shared with ANH and UPME)*
- GMAC technical reports and resources calculation of geological maps.
- Structural contour maps
- Stratigraphic columns
- Drilling reports
- Electrical and temperature records
- Delivery of drilling cores to Litoteca SGC

Informatión:

- Stored on the basis of information EXPLORA of the DRM
- Available for online consultation [www.sgc.gov.co](http://www.sgc.gov.co)
5. Proyecciones

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<tr>
<th>No.</th>
<th>ZONA CARBONIFERA</th>
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<td>CORDOBA- NORTE DE ANTOQUIA</td>
<td>ALTO SAN JORGE</td>
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</table>

Areas projected for the study of CBM
Projections

- Determine the incidence and prioritization of parameters in the CBM exploration.

- Add complementary analyzes (Isotherms, Pyrolysis, permeability, etc.).

- Review existing methodologies on calculation of CBM resources and reserves.

- Prepare map of CBM potential for the country.

- Gas measurements in the development in mining exploration activities.