

# Geoparks, a Unesco-Supported initiative for geoconservation and rural development. The Central Catalonia Geopark.

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## Abstract

In this article we discuss mining in relation to a mining geopark as a mining resource in itself, specifically in relation to the only such proposed park in Spain at present, namely, the Central Catalonia Geopark.

Spain does have geoparks, but the only one with immediate plans to include mining is the geopark currently being developed near the city of Manresa in Central Catalonia. The Sobrarbe Geopark in the Huesca Pyrenees, nonetheless, is also interested in incorporating mining aspects.

We recommend treating the Central Catalonia Geopark as a mining resource, based on our understanding that mining heritage represents a potential for a new mining activity.

## Resumen

En este trabajo, queremos tratar del tema del patrimonio minero en relación con los Geoparques. Es decir como recurso minero con fines turísticos, educativos y científicos. Y en concreto lo vamos a hacer con el único existente en este momento: el Geoparque de la Catalunya Central (Parque Geológico y Minero de la Catalunya Central).

Es cierto que en España existen otros geoparques, pero el único que se califica como Parque Geológico y Minero, es el que se ha creado en torno a la ciudad de de Manresa. También es cierto que el Geoparque del Sobrarbe (situado en el Pirineo de Huesca), ha tenido una clara voluntad de incluir aspectos mineros, lo mismo que el Geoparque de la Sierra Norte de Sevilla.

Nuestra idea es la de valorar este geoparque como un recurso minero, fieles a nuestra idea de entender que el uso del patrimonio minero no es más que una nueva actividad minera.

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**Key-words:** : Mining, geopark, geological heritage, mining heritage.

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## 1. Introduction to the world of Geoparks

In order for a geopark to be recognized by the United Nations Educational, Scientific and Cultural Organization (UNESCO) it must be a well defined territory with an exceptional geological patrimony due to its scientific, educational and aesthetic value. It represents a way of managing and enhancing the local patrimony with a UNESCO-approved work methodology. This is not a new method of protecting the environment, nor does it restrict land usage beyond the current laws of each country. Residents in the area are committed to a strategy of sustainable socio-economic development which includes promotion and conservation of the natural

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and cultural values of the land, so that we can learn from and benefit from this rich resource for many generations to come. Geoparks are the result of linking geoconservation, education and sustainable development under a single concept.

People are starting to recognize the “EUROPEAN GEOPARK” and “UNESCO GLOBAL GEOPARK” brands as true seals of quality.

### 2. The European Network and Global Network of Geoparks

The European Geoparks Network is a voluntary association of territories that share the same work methodology to promote and care for their local patrimony, in particular the geological patrimony.

In June 2000, on the island of Lesvos (Greece), four territories decided to join efforts and established the European Geoparks Network: the Haute-Provence Geopark (France), the Lesvos Petrified Woods Global Geopark (Greece), Vulkaneifel Geopark (Gerolstein, Germany) and the Maestrazgo Cultural Park (Spain). A year later, in April 2001, the European Geoparks Network and UNESCO signed the official agreement of collaboration and by 2009 the organization had 33 member territories.

Finally, through the Madonie Declaration in October 2005 (Sicily, Italy), UNESCO recognized that each European Geopark is part of the Global Geoparks Network recognized by UNESCO. Thanks to this Global Network bridges are established between geologists and all people that care about the environment and who feel curious about the history of our planet.

For more information see:  
<http://www.europeangeoparks.org/>

### 3. Geoparks in the Iberian Peninsula

UNESCO has already recognized 95 Global Geoparks around the world (2008), ten of which are in the Iberian Peninsula: two in Portugal, three in Andalusia, two in Aragón, one in Extremadura, one on the Basque Coast and one in Catalonia which is the youngest of them all.

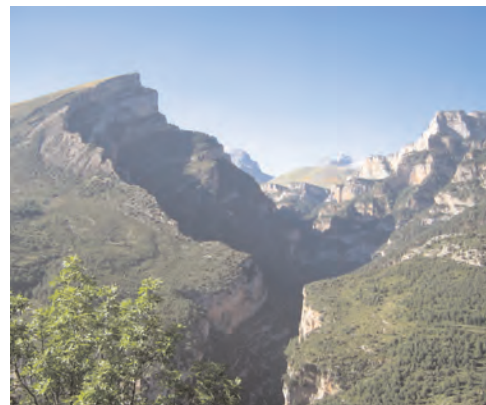
*Figure 1* shows their distribution, while *Photographs 1 and 2* show some of the elements in two of the geoparks, specifically those situated in Aragón.



Fig. 1. Distribution of Geoparks in the Iberian Peninsula



Photograph 1. La Porra, Aliaga Geopark (Maestrazgo Geopark)



Photograph 2. The Añisclo Anticline (Sobrarbe Geopark)

#### 4. Characteristics of the Central Catalonia Geopark (The Geological and Mining Park of Central Catalonia)

Earlier papers were dedicated to Spatial Planning within the Bages region (such as *Mata Leonart et al., 2005* and more recently in *Mata Perelló et al., 2006*; as well as *Mata Perelló and Climent Costa, 2013*). In those papers we highlighted the important value of the Geological and Mining patrimony in this region, and also its role for Spatial Planning of the same.

Furthermore, in other papers we have already assessed the fact that exploitation and use of the geological and mining patrimony constitutes a new mining activity. Mining Museums, Geological Parks and, in this case, Mining Geoparks could also be part of this new mining activity.

Additionally, in other papers (especially in *Mata Perelló, 2004*) and in *Mata Perelló et al. (2007)* we have already referred to the Bages Geological and Mining Park. In this paper we established a series of **SGI** (Sites of Geological Interest), **SIMP** (Sites of Interest in the Mining Patrimony) and **SITEG** (Sites of Interest to Teach Environmental Geology) which could form part of this proposed park. At the start these added up to 42 points of interest. On the other hand, in 2007 *the Management Plan for the Bages Geology and Mining Park* was prepared.

Later, in 2008, it was necessary to convert the *Bages Geology and Mining Park into the Central Catalonia Geopark*. The objective was therefore adapted to the opportunities offered by the European Geoparks Network.

Recently, in September 2012, it became the 51<sup>st</sup> European geopark.

The proposed Geopark covers diverse sites in Central Catalonia around the Bages region. This region is fully located in the **Ebro Geological Depression**, between the Cenozoic outcrops that fill it. These sediments are distributed between the Eocene and the Oligocene. Additionally, there are Paleozoic and Triassic outcrops in the southernmost tip of the territory belonging to the *Mediterranean or Catalanid System*.

Within this context, one of the elements is the

abandoned River Calders meander. photograph 3.

Among these tertiary materials, those from the **Cardona Formation** stand out the most (due to their importance both economically and in mining) which are located in the transition from the Eocene to the Oligocene. This formation consists of alternating levels of halitites (with a predominant presence of HALITE) and sylvinites (with SYLVINITE and CARNALLITE as predominant minerals in this rock).

One of the best-known sites is the famous *Cardona Salt Mountain*, one of Catalonia's *Sites of Geological Interest*. Nevertheless, due to restructuring of the Geopark, it is currently not included although work is underway to include it in the next few years. It is currently established as a close agreement of collaboration.



Photograph 3. The abandoned meander of River Calders, one of the elements in the Central Catalonia Geopark

On the other hand, gypsum levels that characterize this formation also have outcrops in other sites such as Súria including in the *anticline of the Mig-Món "fault"*, an interesting asymmetrical fold of Pyrenean origin occasionally faulted in its axial plane. All of these materials are affected by the last convulsions of the Pyrenean tectonics (as well as by quaternary geotectonics), given their extraordinary plasticity. In effect, this basin is within the *Mediterranean (or Catalanid) System* to the south and the *Pyrenean System* to the north. Tectonic accidents are very lax within this group, almost imperceptible, with the exception of tectonics related to saline materials.

On the other hand, detritic outcrops from the *Montserrat Formation* predominate in the more southerly sectors of Bages (forming the impres-

sive reliefs of Montserrat, among others)

### 5. Mining in the Scope of the Geopark

It should be pointed out that saline materials from the *Cardona Formation* are being exploited at various sites in the mining basin, all within the aforementioned Central Catalonia (in the NE of the Iberian Peninsula).

The main exploitation sites are around the towns of Sallent, Súria, Cardona and Balsareny. HALITE is currently being exploited in the third of these; while SYLVINITE is being exploited in the other three to obtain “potash”. Nevertheless, exploitation of common salt from Súria scoria is currently being evaluated.

Some of the geological materials from the mining basin have been known for a long time. Specifically, HALITE (*Common Salt or Rock Salt*), the main mineral from halite rock, was already known and exploited during the Neolithic period. Exploitation continued over the following centuries and later, in the Roman period, Pliny the Elder spoke of the Cardona rock salt and its impressive *Salt Mountain*.

Later, in the seventies, Sallent and Balsareny came together through an exploitation gallery. Exploitation of Cardona potash ceased in the eighties (which was operating at 1,100 m below the ground). Exploitation of Cardona halite began immediately after, through underground routes.

The mines in Sallent-Balsareny, Súria and Cardona are still active. The first two are used by the company IBERPOTASH for extraction of SYLVINE (to manufacture potash) and the last is used by SALINERA DE CARDONA to extract HALITE. Furthermore, as we have already mentioned, HALITE contained in the Súria waste will soon be exploited by the company IBERPOTASH.

There have also been several exploitations of clays, limestone and gypsum. Some have been used as raw material for the so-called *Forns d’Obra or Teuleries* (clay kilns), *Forns de Calç* (lime kilns) and *Forns de Guix* (gypsum furnaces).

We have included some of these elements in the Geopark; as well as a *Pou de Glaç o Gel* (Snow or ice well). On another note, we have not inclu-

ded any *Forn de Vidre* (glass kiln), despite the existence of several which we have not been able to find.

Given the mining characteristics of this geopark, its scope includes various localities whose mineralogical relevance is highly important. Below we highlight some of the various mineralisations:

#### 5.1. Evaporitic mineralisations in the Catalan Potassic Basin

All current exploitation in this evaporitic basin is located in Cardona, within the geopark (only common salt is now being exploited), Balsareny, Sallent and Súria.

Consequently, the following minerals are present in various localities: HALITE, CARNALITE, SYLVINITE, ANHYDRITE and GYPSUM. BISCHOFITE has also been found (in Sallent and in Cardona), POLYHALITE (in the same localities mentioned) and KALIBORITE (in Sallent).

The occasional presence of the blue variety of HALITE should also be highlighted, especially in the localities of Súria and Sallent. Additionally, the presence of a clay mineral should also be mentioned, ILLITE, in all saline traces from the basin.

Nevertheless, the only superficial outcrops of these minerals are located in the locality of Cardona. There are outcrops of the so-called *Cardona Formation*, which extends through wide sectors of the geopark subsoil. Photograph 4.



Photograph 4. Outcrops of HALITE and CARNALITE in the Cardona Salt Mountain. Future member of the Central Catalonia Geopark

### 5.2. Cupriferous mineralisations associated to “Red-Bed”

A **SGI** with these characteristics has been recorded inside the Geopark. It is located in the town of Artés, in Can Vila. The mineralisation there is located in some paleochannels located in the *Artés Formation*. The following minerals are present: CHALCOCITE, COVELLITE, AZURITE and MALACHITE.

Another similar mineralisation was recorded in Can Carreras de Sallent, another of the Geopark’s SGIs. Nevertheless, there it is associated to a fetid lake bed limestone, very rich in organic material and located in the *Artés Formation*. In this case only AZURITE (which predominates) and MALACHITE were found.

### 5.3. Mineralisations associated to karstic phenomena

Within the Geopark we have considered two localities in which such mineralisations occurs, although in different ways.

- Aragonite Mineralisations. There is a locality which sadly is famous, exploited for decades, called Mura Cave. This location has many good examples of ARAGONITE, which appear as flos

ferri, and is one of the most important localities in Catalonia due to the presence of this mineral. *Photograph 5.*

- Brushite Mineralisations. There is a locality within the Geopark where the presence of BRUSHITE has been detected. This is Saltpetre Cave.
- Curiously, we have analyzed different white efflorescence in search of the “saltpetre”, but we never found it. On the contrary, all analyses of the cave efflorescence have shown us that the presence of the aforementioned phosphate.

### 6. Structuring of the Central Catalonia Geopark

Given the Geopark’s characteristics, the drafting team at the time appraised the possibility of established several visitor centres, as well as a central office (located in one of these centres). Within the territory proposed for the Geopark there are currently four centres that are working on the dissemination of geology. In order to minimize infrastructure costs from the start of the Geopark’s activity, it was decided that these would be the main centres of interpretation, attention and channelling of visitors.



*Photograph 5. ARAGONITE in the Mura Caves. Central Catalonia Geopark.*

### 6.1. Súria, as a centre of interpretation for mining and mining patrimony

A large part of the mining interpreting activity would be channelled through this municipality. This is the most important point to mobilize dissemination of this main subject due to its great historical tradition and to the fact that it has preserved an important part of the industrial patrimony associated to production. Furthermore it has an active exploitation of halite, in addition to the historic, architectural and cultural patrimony developed thanks to salt.

All issues related to mining patrimony would be developed here, including the geological explanation, in all senses, that the different natural resources have generated, and the geological history (paleogeography and sedimentary environments, etc.), as well as the mechanisms and installations created by human beings to access the minerals and rocks, and their evolution throughout history. Some of these elements may be seen in Photograph 6.



Photograph 6. The Mig Món anticline fault, in Súria. Central Catalonia Geopark.

### 6.2. Toll Caves Prehistoric Park (Moià)

This centre, located in a zone with an important karstic morphology, would specifically develop the Geopark's geological patrimony together with a general experience of the park's geology: geomorphology and rock types, regional tectonics, external geological processes, karstification, anthropology (hominoid remains), etc. Part of the cave can be seen in Photograph 7.



Photograph 7. Toll Caves Prehistoric Park in Moià. Central Catalonia Geopark

### 6.3. "Valentí Masachs" Geology Museum, in the UPC (Manresa)

This museum is very useful to explain the minerals and rocks, and from there the associated derivative products due to its important rock and mineral collection, in addition to a complete collection of fossils found in the park zone. The Geopark Scientific Council office is currently located in this museum, which can be seen in Photograph 8.



Photograph 8. "Valentí Masachs" Geology Museum. Central Catalonia Geopark

### 6.4. Saltpetre Caves in Collbató

This space would be almost exclusively dedicated to the Montserrat Mountain and all matters associated to it: origin, morphology, evolution, current dynamic processes, as well as conglomerated karstic systems, among others. Part of the caves can be seen in Photograph 9.

## 7. The Role of the Bages Regional Council (Manresa) in Management of the Geopark

This supra-municipal organization, which has led the process to open the Geopark, presides over the Geopark and offers its technicians to the project, in addition to housing the administrative part and general management in its installations and handling promotion activities together with the Geopark. The municipalities where the various visitor centres are located take care of managing and conserving their own patrimony as well as educational visits and activities.

For more information about the Central Catalonia Geopark see:

<http://www.geoparc.cat/es/>

### References

Climent Costa, F; Mata-Perelló, J.M; Poch, J. and Gual, G. (2011).- *Parque Geológico y Minero de la Catalunya Central*, In *Actas de la IX Reunión Nacional de la Comisión de Patrimonio Geológico (Sociedad Geológica de España) León, 14 - 18 June 2011 (Editors: Esperanza Fernández-Martínez y Rodrigo Castaño de Luis)*, pp. 39 – 43. León

Galera, A. (2005).- *La búsqueda y explotación de la potasa en Cataluña. El Parque Cultural de la Montaña de Sal (Cardona, Bages) y la interpretación de su historia. De Re Metallica*, nº 4, pp. 39-58. Madrid

Mata Lleonart, R; Mata-Perelló, J.M; Mesa Vilchez, C and Restrepo Martínez, C. (2005).- *Una propuesta para la ordenación territorial de la Cuenca Potásica Catalana. Seminario do Ordenamiento do Territorio, Vila Real – 2005. Vila Real*

Mata-Perelló, J.M. (2004).- *Puntos de interés geológico de la Catalunya Central: el Bages. bases para la creación del Parc Geològic i Miner del Bages (Parque Geológico y Minero del Bages)*, (Catalunya Central, Depresión Geológica del Ebro), *Actas del IV Congreso Internacional sobre Patrimonio Geológico y Minero*, 175-160. Utrillas

Mata-Perelló, J.M. (2005).- *Datos para el Ordenamiento Territorial de la Comarca del Bages. Actas del Segundo Simposio sobre la Historia de la Minería y de la Metalurgia en el Mediterráneo Occidental (in press)*. 10 páginas. Mequinzenza

Mata-Perelló, J.M. and Climent Costa, F. (2012).- *El Geoparc de la Catalunya Central. Actas de la Reunión de la RED REUSE – CYTED*, 10 pp. Belo Horizonte

Mata-Perelló, J.M.; Mata Lleonart, R.; Mesa Vilchez, C. and Restrepo Martínez, C. (2006).- *El patrimonio geológico y minero dentro del Plan de Ordenamiento Territorial de la comarca minera del Bages (Catalunya Central, Depresión Geológica del Ebro)*. *Actas del Primer Congreso Internacional sobre Geología y Minería Ambiental para el Ordenamiento del Territorio (in press)*. Utrillas.