The situation of the Geo-mining heritage in the region of Murcia and mining tourism as a sustainable alternative for its protection. Regional and national Current Status

/ José Ignacio Manteca Martínez

Department of Mining, Geological and Cartographic Engineering. Universidad Politécnica de Cartagena. Pº Alfonso XIII 52, 30203 Cartagena (Murcia). nacho.manteca@upct.es SEDPGYM, FSM

Abstract

The geo-mining heritage of the Murcia region is in a deplorable state of neglect and disrepair. Though the patrimonial assets have been declared Property of Cultural Interest, this has not meant in practice an effective protection, and degradation process keeps going on. The experience from others mining districts in Spain and in other European countries, point out that its preservation will be impossible unless it comes with a sustainable economic activity which involves the social base, as it is the Mining Tourism. Therefore the Autonomous Community of the Murcia Region created in 2005 the Sierra Minera Consortium, focused on boosting the economic activity of the Sierra de Cartagena via mining tourism. Its most importance action have been the creation of the Mining Park of La Unión. In present work, results of this Mining Park are analyzed and compared to those who are obtained in other zones of mining tourism in Spain.

Resumen

El patrimonio geo-minero de la región de Murcia se encuentra en una situación de abandono y deterioro. Aunque los elementos patrimoniales han sido declarados Bien de Interés Cultural, ello no ha supuesto en la práctica una protección efectiva y el proceso de expolio y degradación continúa. La experiencia de otras regiones mineras en España y en Europa, indica que su protección sólo será posible si va de la mano de una actividad económica sostenible que implique a la base social, como es el Turismo Minero. Por ello la Comunidad Autónoma de la Región de Murcia creó en 2005 el Consorcio Sierra Minera para potenciar la actividad económica de la Sierra de Cartagena a través del turismo minero. Su actuación más importante ha sido el Parque Minero de La Unión. En este trabajo se analizan los resultados de este Parque y se comparan con los de otras zonas de España con ofertas de turismo minero.

Key-words: *Geo-mining heritage, mining tourism, La Unión Mining Park.*

1. Geo-mining heritage in the province of Murcia

1.1. Introduction

The Geological Heritage is defined as the geological resources as a whole, whether they are rock

Depósito legal: CA-602-2004 / ISSN: 1698-5478

Fig. 1. Mining landscape of Los Perules (Mazarrón)

formations, structures, reliefs, landscapes, springs, mineral or palaeontological sites and so on, whose content and presentation is especially appropriate to recognise, study and interpret the geologic history of a region. The Mining Heritage, on the other hand, is a value which appears when the mining activity ends. It consists on the set of elements, both real estate and furniture, as well as landscape elements, which can be used to recognise and interpret the mining history of a region and its technological evolution, sociological impact, etc.

These two types of heritages, Geological and Mining, are usually so closely linked in mining areas that sometimes it is not possible to separate them. In these cases we use the term Geo-mining Heritage.

The Mining Landscape is the landscape expression of the Geological Heritage and is an element with great value for representing the identity of the mining areas. This is the case of the areas of Mazarrón and Cartagena-La Unión, which stand out among the several mining districts of the province of Murcia thanks to their heritage wealth.

Referring to Mazarrón, in sites such as Cabezos de San Cristóbal and Los Perules it is where the mining landscape is most predominant. The nature of this landscape is determined both by its geological context of hydrothermal alterations of igneous rock and by the extraordinary variety of mineral waste which have been altered by weathering. If we add to this mineral waste, with their colours, the remains of mining structures, we obtain a space of an extraordinary appeal. A main part of our interest in this patrimony is focused on the old mines of alunite or alum stone, which were the basis of an important mining activity on the area which began on the Roman era.

Referring to the Mining sierra of Cartagena-La Unión, even though there are elements of patrimonial interest all over the site, there are specific sectors where the mining landscape looks strongest. Such are the cases of the area of Cabezo Rajao, similar to the already mentioned

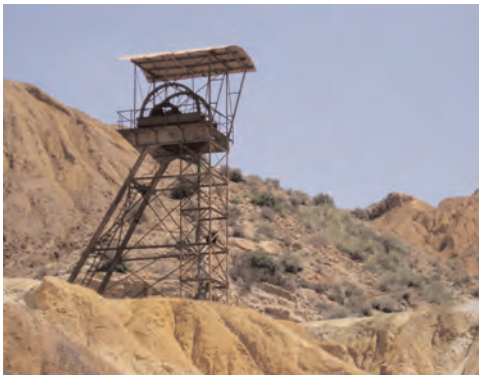

Fig. 2. Shaft capstan at San Cristobal mountain (Mazarrón)

sector of Mazarrón, the sector of La Crisoleja (the Cabárceno from Cartagena); an iron oxide great overburden or gossan, which was exploited on the 19th century as an open pit iron mine on the Southern side of the mountain range; as well as Sancti Spiritu and Cuesta de Las Lajas, the great open pit mines, such as Emilia, Brunita and so on.

Both districts, thanks to their great scientific value as models of geological and methalogenial contexts, combined to the remains of a millennial mining activity, are examples of unrivalled geo-mining heritage and mining landscapes, both nationally and internationally.

1.2. Current status of the Geo-mining heritage in the province

Overall, the geo-mining heritage of the province is in a deplorable state of neglect and disrepair, and it is about to die out, especially regarding devices and mining facilities. After the mines were closed, a generalised process of destruction of the mining facilities and devices began. These devices and facilities had in some cases a great archeo-industrial value. Machinery houses, head frames, chimneys, washers and so on are about to die out. The same is happening to the mining sites this mining was linked to, such as mineral outcroppings, open cat mines and so on, some of them with great scientific value. They are also about to die out due to several reasons.

Referring to the area of Sierra de Cartagena, the mining area, as well as its patrimonial elements, was declared in 1986 a Property of Cultural Interest (BIC) with the designation of historical site by the General Department of Culture of the Autonomous Community of Murcia. Nevertheless, this record has been modified several times since then in relation to the subsequent resources and the physical limits of the BIC area. In fact, the BIC area declaration is currently on hold until a new record is ready. Anyhow, though the patrimonial assets are inventoried and have been declared of cultural interest, this has not meant in practice an effective protection. The constant pillage and degradation process keeps going on nowadays 22 years after the end of the mining activities in the area.

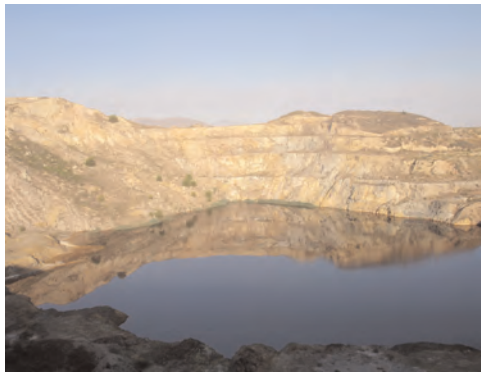

Fig. 3. Brunita open cut mine. Sierra de Cartagena

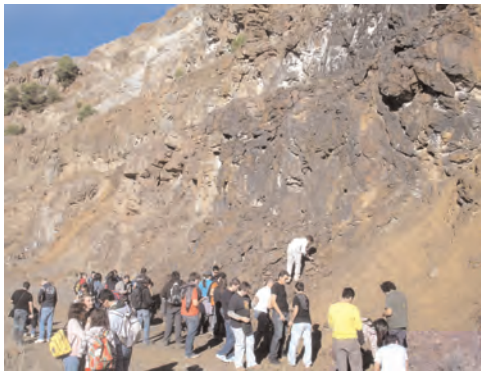

Fig. 4. Emilia open cat mine. Sierra de Cartagena

The BIC declaration from Mazarrón has been in force since 2005. 43 years after the end of the mining activities, there is little remaining from the mining devices and industrial constructions due to the systematic pillage of scrap merchants and other people who retrieve materials. Even though most of the mining facilities have disappeared, there is still a very impor-

Depósito legal: CA-602-2004 / ISSN: 1698-5478

tant mining heritage consisting on geologic and geomorphologic elements, such as lode veins, open cat mines, dumps and mining waste deposits which are full of incredible colours, thus creating a magnificent landscape.

In a nutshell, the status of the geo-mining heritage is distressing. You can tell that, until very recently, little has been done for this mining heritage, except leaving it to its fate, at the hands of time, rapine and pillage.

Fortunately, on the last few years, some sectors from society have begun to become aware of the value of the geo-mining heritage, which has provoked the Regional Government getting involved about it.

We should highlight the establishment of the Sierra Minera Foundation, a non-profit organisation for the protection of the heritage of the area. We do also believe the heritage divulgation work by the UPCT has played an important role, especially when this university held in Cartagena in 2002 an International Congress on Mining Heritage, which has helped spread the word about this heritage and demand its protection. As a result of the increasing social demands, the Autonomous Community (CARM) created in 2005 the Sierra Minera Consortium, focused on boosting the social and economic activity of the area via cultural tourism and based on its mining heritage.

2. Protection of the Geo-mining heritage and socioeconomic dynamisation: mining tourism

We cannot deny the importance of preserving the geo-mining heritage as the historic and cultural heritage of an area. Thanks to our experience, we know that its preservation will be impossible unless it comes with a sustainable economic activity which involves the social base. The inhabitants of the region should be thus the most interested ones in protecting these resources. This sustainable economic activity is without a doubt Mining Tourism.

Mining Tourism can be considered as belonging to Cultural Tourism, but it can be considered also as part of Geotourism or tourism mainly based on the geological heritage. *(Luján, 2012)*. Mining Tourism is thus more like a bridge connecting Cultural Tourism and Geotourism.

Cultural Tourism, along with Geotourism, represents an economic activity which is becoming increasingly important thanks to several current trends, such as the interest in rural areas and the environment, active leisure activities for seniors and so on. Mining Tourism fits perfectly among these types of tourism, and it is currently a very important source of income for various towns and districts.

If we want this mining tourism to develop, we need to increase the value of the Geo-mining Heritage by creating specific tourism offers which should become part of the general tourism offer from that area: Mining museums, mines adapted to work as museums, mining parks, geo-mining roads or routes, Interpretation Centres and so on.

3. Actions for the recovery and enhacement of the geo-mining heritage in sierra minera of la Unión-Cartagena

3.1. Actions performed

The recovery and enhancement of the mining heritage for its incorporation to the tourism offer in the Sierra de Cartagena-La Unión area performed so far are as follows:

- Mining Museum of La Unión: It was inaugurated in December 1986 by the Town Council of La Unión. It is currently placed at an emblematic building of this town, the former Liceo Obrero, built in 1902. The museum displays tools and mining equipment from different eras, as well as models, photographs and drawings, and a large exhibition of minerals. They all help the visitor learn about the technological evolution of mining in the area, as well as the social and working conditions and representative minerals from the mines.

- Mining route “Carretera del 33”. This is an old service road to the mines placed between the towns of La Unión and Portman. It has been promoted as a hiking route since 2000 by the Town Council of La Unión by

publishing a guide and a leaflet about the geology and mining of the area in collaboration with the UPCT.

- Interpretation Centre of Mining and the Environment of the Las Matildes mine (El Beal- within Cartagena city limits). It was inaugurated in July 2005 by the Sierra Minera Foundation as part of the European LIFE-Environment, with the support and co-financing of the departments of Environment, Tourism and Culture of the Autonomous Community of Murcia, and the City of Cartagena and the Caja Murcia Foundation. Investment: 0.8 million EUR.

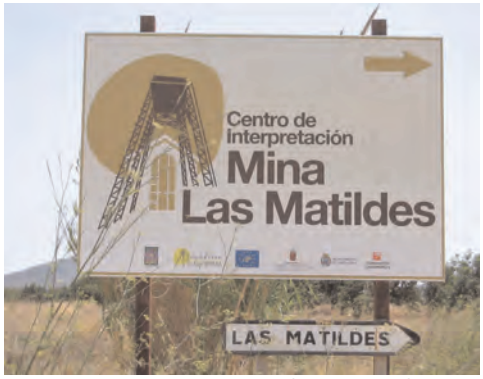

Fig. 5. Las Matildes mine, inerpretation Center (El Beal, Cartagena)

Fig. 6. Las Matildes mine, conjoint (El Beal, Cartagena)

- Creation of the Mining Park of La Unión: Refitting and enhancement of the mine Agrupa Vicenta, the Remunerada washery, the outdoor facilities of the Pablo y Virginia mine and so on. This has been promoted by the Town Council of La Unión and the Tourism Consortium of Sierra Minera. Investment: 2.8 million EUR

- Refitting of the outdoor facilities of the Blanca or San Quintín mine (machinery houses, head frame, and mineral washing facilities). Promoted by the Town Council of Cartagena and the Irrigators Comunnity of El Beal. (Investment unknown. To be inaugurated).

- First phase of the adapting of the mine-cave Victoria for tourist visits. Promoted by the Town Council of Cartagena and the Tourism Consortium of Sierra Minera. (Investment: 0.4 million. To be inaugurated).

Fig. 7. Agrupa Vicenta mine museum

Fig. 8. Agrupa Vicenta: The mine as a didactic area

3.2. Planned future actions

The planned future actions for the geo-mining heritage of Sierra de Cartagena-La Unión are as follows:

- Creation of the Mine Thematic Area of Cabezo Rajao. This is a project for the restoring and enhancement of a significant mining heritage of the said location, which is a symbol of mining in this area. Apart from restoring the heritage, we intend to provide

 Depósito legal: CA-602-2004 / ISSN: 1698-5478

several facilities (restaurants, accommodations and so on) to this area so as to make it attractive for tourism. (Amount: 8.5 million EUR)

- Adapting the underground mine of Pablo y Virginia, located in the Mining Park of La Unión, for tourist visits. (Amount: 0.8 million EUR)

4. The case of the Mining Park of La Unión. results of the two first years of operation and perspectives

The most importance actions among the Geo-mining heritage enhancement actions of the Sierra de Cartagena so far have been the creation of the Mining Park of La Unión. All the other actions, which had far less ambitious investments, have also received a very modest answer referring to tourist results. In fact, the minimal initial success of the Interpretation Centre of the mine of Las Matildes virtually disappeared when the Mining Park was opened. When this park was opened, we found out that visits to an underground mine raised great interest to the public.

During the first two years of operation, the Park has been managed by the Sierra Minera Foundation, organisation that won the corresponding allocation competition. 40,400 people visited the Park during the first year, while the second year it welcomed 33,600 visitors. This is a 17% decrease which may be blamed to the economic problems the country is facing. The monthly average number of visitors was 3,200, but far from being constant. Actually, this number mainly depends on the time of year. In months such as April and August this number increases, while in months such as January and September it decreases. This dependence on the time of year has made us establish a flexible personnel system which adapts to the demand.

The type of the visitors is divided almost at 50% between individual visits and group visits, which come mainly from education centres, schools and colleges, as well as from senior groups. It is no doubt that the economic cuts which have been approved by the government, as well as the impact they are producing on education, social grants and so on, are one of the main causes of this decrease in the number of visitors.

The economic results of these two years have been negative, although losses during the second year have greatly decreased. Without a doubt, this has happened thanks to the experience factor and the solving of some structural problems the facilities suffered since the opening. We should thus expect a third year with balanced results, unless the number of visitors dropped, which is happening, unfortunately. Referring to the Mining Park of La Unión, which has an underground mine that can be visited; the preventive maintenance and control tasks for the mine by mine personnel have greatly raised the costs.

Anyhow, we do not expect that these tourist facilities produce a great direct profitability, due to their characteristics, high maintenance costs, and the high dependence on time and so on. On the contrary, if they were self-sufficient, that would be an achievement. What we rather pursue with this type of tourist structures is an indirect profitability caused by its impact on the local economy (bars, shops, restaurants, hotels and so on) and certainly a sociocultural profitability. We pursue this to the extent that it will allow preserving a heritage and that it will raise the cultural level of the society. In relation to this we should remember this type of tourism should include a great cultural component, by promoting scientific investigation and divulgation activities related to Geo-mining Heritage.

5. Mining tourism in Europe and Spain

In Western Europe, the geology and mining heritage enjoys a great deal of attention. There are countless initiatives for its protection and enhancement. In almost all the former mining districts affected by the decline and closure of mines in Germany, France, England and Portugal, the mining heritage has been recovered thanks to the creation of mine-museums, mining parks, archaeo-industrial routes, all of them being perfectly included into the cultural tourist offer of these countries *(Puche and Mazadiego, 2000)*. These initiatives, which are normally developed by local and regional governments, have resulted in a very important econo-

mic activity which has created lots of jobs.

There are up to 364 tourist mines throughout the European community *(Sanmiquel Pera et al, 2012)*. Their development started on the 1970s. Some of these mines are very interesting, holding 100,000 visitors per year *(Puche and Mazadiego, 2000)*, such as the salt mine of Wieliczka (Poland), with almost 1 million visitors per year *(Carvajal, 2009)*, the carbon mine of Lewarde (France), with 150,000 visitors approximately or that of Kerkrade (The Netherlands), also a carbon mine, with 300.000 visitors per year. We can also add to these the mines of Le Grand-Hornu (Belgium), Blaenavon (United Kingdom), Zollverein (Germany) or the Ecomuseum of Le Creusot-Montceau-Les Mines in France *(Cañizares, 2011)*.

As a general rule, Spain has long lacked the necessary cultural sensitivity. Consequently, in many cases, when a mine was closed, it was exposed to vandalism and looting. And what is more, true treasures of the mining and archeo-industrial heritage of our country have been destroyed and sold as scrap in exchange of a few thousand pesetas.

Reactions aiming for the protection and enhancement of the mining heritage have taken place late, 20 years later in relation to the rest of Europe. Of course, heritage has not experienced the same fate in all the regions of Spain. In a nutshell, whereas in Europe the mining tourism started developing in the 1970s, here in Spain this began in the 1990s.

If it is true that some mining museums, with a more local focus, existed before the 1990s, the first Mining Park truly focused on tourism in Spain was that of Río Tinto, created in 1992. The first mine-museum opened in Spain was the prehistoric mine of Gavá, Barcelona, in 1993. It was followed by the opening of the imaging-mine of El Entrego in Asturias, in 1994. They have been followed by other actions, which have been luckily occurring at an increasing pace. The praiseworthy work for spreading and divulging the Geo-mining heritage by several social and scientific organisations has been essential in order to involve the Government in this type of actions.

In the recent era of economic growth, the investment in mine-museum and mining parks was 7.5 million Euros per year *(Puche and Mazadiego, 2007)*. According to these authors, the number of visitors to these centres would be 2 million people approximately. Amaré and Orche (2011) have prepared a very elaborate inventory of mining exposition areas and mines turned into museums in Spain which includes up to 82 of these centres. According to these authors, only 42 centres did mention on the survey the number of visitors in 2009, totalling 1,736,373. They thus estimate the number of visitors to tourist mines should be higher than 2 millions.

Nevertheless, nowadays we should believe that, due to the economic crisis, these numbers have decreased significantly.

Table 1. Cronology of the development of Mine Parks and Mine Museums in Spain

Mining park/mine-museum	Community	Opening date
Museo Minero de La Unión	Murcia	1986
Parque natural de Las Médulas (León)	Castilla-León	a. 1990
Parque de la naturaleza de Cabárceno	Cantabria	1990
Parque Minero de Río Tinto	Andalucía	1992
Mina museo de Gavá (Barcelona)	Cataluña	1993
Museo de la Minería El Entrego (Asturias)	Asturias	1994
Museo minero de Peñarroya-Pueblo Nuevo	Andalucía	1997
Montaña de sal de Cardona (Barcelona)	Cataluña	1997
Mina La Jayona (Badajoz)	Extremadura	1997
Mina museo de Cercs (Barcelona	Cataluña	1999
Mina museo de Bellmunt (Tarragona)	Cataluña	2002
Museo de la minería del País vasco Gallarta	País Vasco	2002
Cueva-Mina del Hierro(Cuenca)	Castilla-La Mancha	2002
Mina museo de La Escucha (Teruel)	Aragón	2003
Cerro del Hierro (Constantina, Sevilla)	Andalucía	2003

Cueva-mina de El Soplao	Cantabria	2004
Museo minero de Barruelo de Santullán	Castilla-León	2004
Centro de interpretación minera de Aldea Moret	Extremadura	2004
Museo minero de Andorra-Sierra del Arco (Teruel)	Aragón	2005
Museo minero de Puerto Llano (Ciudad Real)	Castilla-La Mancha	2006
Centro de interpretación de Mina Las Matildes (Cartagena)	Murcia	2006
Museo del Oro de Asturias (Navelgas)	Asturias	2006
Geoparque de Cabo de Gata	Andalucía	2007
Centro de interpretación Paisaje Minero (Linares, Jaén)	Andalucía	2007
Mina museo Esperanza		
La Torre d'en Besora	Valencia	2007
Mina Pastora (Aliseda-Cáceres)	Extremadura	2007
Parque minero de Almadén (Ciudad Real)	Castilla-La Mancha	2008
Museo minero de Sabero (León)	Castilla-León	2008
Complejo Minero de Puras de Villafranca (Burgos)	Castilla-León	2008
Minas de Arditurri (Guipúzcoa	País Vasco	2008
Ferrería de San Blas (Sabero León)	Castilla León	2008
Complejo Minero de Puras de Villafranca (Burgos)	Castilla León	2008
Centro geominero del Cerro del Toro, Motril	Andalucía	2009
Mina Nueva Victoria (Culla Castellón	Valencia	2009
Museo de la Mina Mequinenza	Aragón	2010
Parque Minero de La Unión	Murcia	2010
Mina de Arnao	Asturias	2011
Mina Esperanza (Olmo de Atapuerca)	Castilla León	2013
Mina-cueva Victoria	Murcia	P.I.

If we take a look to this table, we can see that the interest for mining tourism is a relatively recent phenomenon in Spain. The enhancement of the mining heritage and its addition to the tourist offer begins in 1990 and it develops intensely over the last two decades, especially from 2002 to 2010. From 2010 on we see this development has slowed down due to the economic crisis.

The mine of Arnao, whose adapting ended in 2011, has not been inaugurated yet due to the economic problems. Something similar happened in the mine-cave Victoria in Cartagena. Most of the adapting works are completed, but there are no resources to end them and open the mine to the public. In relation to this, the opening of the Esperanza de Olmo of Atapuerca mine is an unimportant exception, since its adapting budget was very low.

Table 2. Visitors to the different Mine Tourist Centres where data are available.

Mining park/mine-museum	Community	Visitors
Parque de la naturaleza de Cabárceno	Cantabria	530.000
Cueva-mina de El Soplao	Cantabria	250.000
Museo de la Minería El Entrego (Asturias)	Asturias	94.000
Parque Minero de Río Tinto	Andalucía	77.000
Montaña de sal de Cardona (Barcelona)	Cataluña	75.000
Parque natural de Las Médulas (León)	Castilla-León	73.000
Parque Minero de La Unión	Murcia	37.000
Mina museo de Cercs (Barcelona)	Cataluña	36.000
Ferrería de San Blas (Sabero León)	Castilla León	36.000
Mina museo de La Escucha (Teruel)	Aragón	29.000
Cerro del Hierro (Constantina, Sevilla)	Andalucía	20.000
Parque minero de Almadén (Ciudad Real)	Castilla La Mancha	18.000
Mina museo de Gavá (Barcelona)	Cataluña	16.000
Museo minero de Barruelo de Santullán	Castilla-León	15.000
Mina La Jayona (Badajoz)	Extremadura	14.000

Minas de Arditurri (Guipúzcoa	País Vasco	14.000
Mina museo de Bellmunt (Tarragona)	Cataluña	12.000
Museo de la minería del País vasco Gallarda	País Vasco	12.000
Museo minero de Puerto Llano (Ciudad Real)	Castilla-La Mancha	10.000
Museo del Oro de Asturias (Navelgas)		5.200
Complejo Minero de Puras de Villafranca (Burgos)	Castilla-León	4.000
Mina museo Esperanza		
La Torre d'en Besora	País Valenciano	4.000
Museo Minero de La Unión	Murcia	4.000
Centro geominero del Cerro del Toro, Motril	Andalucía	2.000
Museo minero de Andorra-Sierra del Arco (Teruel)	Aragón	3.000
Museo minero de Peñarroya-Pueblo Nuevo	Andalucía	1.700
Centro de interpretación minera de Aldea Moret	Extremadura	1.500
Centro de interpretación de Mina Las Matildes (Cartagena)	Murcia	1.000

(These data come from: Amaré and Orche 2011 and self-obtained)

Fig. 9. Mine museum of Sabero (León)

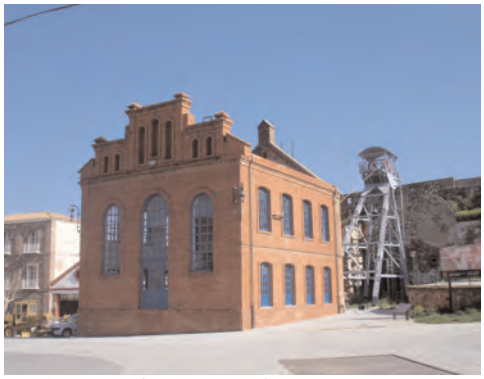

Fig. 10. The Almadén Mining Parck (Ciudad Real)

6. Perspectives and conclusions

As we can conclude by looking to the visitor numbers at the table attached, it is clear that only the 6 first mine tourist interest centres from the list have a great tourism future and, without a doubt, a significant economic impact on the corresponding region. These 6 centres count up for the 50% of that mining tourism market.

On the other hand, there are two phenomena on this list which stand out from the rest: They are the Cabárceno Natural Park and the Mine-Cave El Soplao, both placed in Cantabria, which represent the 39% of mining tourism. We need to admit these greatly successful cases are caused by the presence of other interest factors complementary to the mining heritage, such as the existence of a zoo within the mine area (Cabárceno) and an extraordinary Karstic morphology (El Soplao).

We do also see that many of these resorts have less than 10,000 visitors per year. It is no doubt their economic sustainability should be difficult, unless specific strategies are applied, such as temporary jobs, opening on weekends only and so on. Even so, it is clear that many centres will never be self-financing and obtain a direct profitability, especially in the case of mines-museum, which will inevitably need high maintenance costs.

Consequently, if we want them to work out, they inevitably will need grants from the Government or the sponsoring from commercial businesses, banks and so on for helping these centres via patronage or sponsoring.

We should not forget that the main aim of this mining tourism offers is not really obtaining direct profitability thanks to selling tickets, but specially obtaining an indirect or induced profitability thanks to their impact on the economic activities of the region (hotels, restaurants, bars, shops and so on). All of this will make

society consider the geo-mining heritage as something of their own which affects the economy of the region, thus becoming resolutely implicated in protecting their heritage.

References

Amare, M.P. y Orche, E. (2011). Espacios expositivos mineros y minas musealizadas españolas. XII Congreso Internacional sobre Patrimonio Geológico y Minero, XVI Sesión Científica de SEDPGYM, Boltaña (Huesca).

Cañizares Ruiz, M.C. (2011). Patrimonio, Parques Mineros y Turismo en España. Cuadernos de Turismo, nº 27, (2011); pp. 133-153 Universidad de Murcia ISSN: 1139-7861

Cañizares Ruiz, M.C. (2011). Protección y defensa del patrimonio minero en España.Scripta Nova. Revista Electrónica de Geografía y Ciencias Sociales. Universidad de Barcelona. ISSN: 1138-9788. Depósito Legal: B. 21.741-98 Vol. XV, núm. 361.

Carvajal Gómez, D.J.(2009). Metodología para la gestión de proyectos de puesta en valor del patrimonio minero. Tesis doctoral Universidad de Huelva.

Carvajal, D.J. y González, A. (2003 a) La contribución del patrimonio geológico y minero al desarrollo sostenible. Patrimonio geológico y minero en el contexto del cierre de minas. 27-49. Ed.R. Villas-Boas, A. González Martínez y G.Sa de Alburquerque. CETEM. Río de Janeiro. Brasil.

Cueto, G. (2009). Reutilización turística del patrimonio minero en Cantabria. Cuadernos de Turismo, nº 23, p.69-87.

Jordá Bordehore, R., Jordá Bordehore, L. y Laine San Román, G .(2010). Estado actual de las minas museo en España. En J. J. Durán y F. Carrasco (Eds.), Cuevas:Patrimonio, Naturaleza, Cultura y Turismo, pp. 535-546. Madrid. Asociación de Cuevas Turísticas Españolas.

Jordá Bordehore, L., Jordá Bordehore, R., Laine San Román G. Minas turísticas en España. Blog Speleominas. http://speleominas.blogspot.com.es/p/el-proyecto-speleominas.html.

Luján Blanco, I. (2012). El Geoturismo, un turismo de calidad. XIII Congreso Internacional sobre Patrimonio Geológico y minero. Manresa, 84, pp.765-774. ISBN: 978-99920-1-769-2.

Manteca Martínez, J.I., García García, C. y Berrocal, C. (1996). Sobre la creación de un Parque Geominero y Arqueoindustrial en La Unión (Murcia) como medida de protección y puesta en valor del Patrimonio Histórico-Minero.Edit. Mansilla Plaza y Fernández Barba. Actas I Sesión Científica sobre Patrimonio geológico-Minero. Almadén (Ciudad Real). Universidad Castilla –La Mancha; pp 103-118.

Manteca Martínez, J.I. García García, C. y Ródenas Rozas, F.J. (2000). Ruta Minera Carretera del 33, La Unión (Murcia). Ed. Excmo. Ayuntamiento de La Unión. Concejalía de Turismo y Museos; pp. 1-33. Dep.Legal: Mu-1460-2000

Manteca Martínez, J.I., y García García, C. (2005).Valoración del patrimonio geológico-minero en La Unión- Murcia: Propuesta preliminar de adaptación de la antigua mina Agrupa Vicenta para su uso turístico. Libro de Actas XVI Jornadas de Patrimonio Cultural de la Región de Murcia. Dirección General de Cultura. Servicio de Patrimonio Histórico. pp. 200-206. Murcia 2005. ISBN: 84-7564-318-3

Manteca Martínez, J. I, García García, C., Berrocal Caparrós, C., Jiménez Medina, P., Collado Espejo, P.E y Recio Sevilla, A.(2008). Puesta en valor del patrimonio cultural de la sierra minera de La Unión: El Plan Director de a Cuesta de Las Lajas y Carretera del 33. Aspectos geológico-mineros y medioambientales. Actas de las XIX jornadas de patrimonio cultural de la región de Murcia. Vol. II. pp. 671-682. Edita: Ediciones Tres Fronteras, Consejería de Cultura y Turismo, Dirección general del Libro, Archivos y Bibliotecas. ISBN:978-84-7564-442-4. Cartagena (Murcia).

Martín Aparicio, A. y Puche Riart, O. (2000). Recuperación de minas e instalaciones mineras antiguas. Temas Geológico-Mineros, 31, pp. 491-507- Instituto Geológico y Minero de España, ISBN: 84-7840-419-8

Martos P., Manteca J.I. De Miquel, L., Mouzo, R., Berrocal, C. y García, C. (2005). Creación del centro de Interpretación Minera y Ambiental de la mina Las Matildes (El Beal, Cartagena). Actas del VI Congreso Internacional sobre Patrimonio Geológico y Minero. Edita SEDPGYM. ISBN.978-84-611—8073-8. pp. 369-378. Fabero del Bierzo (León).

Orche, E. (2003). Puesta en valor del Patrimonio Geológico-Minero: El proceso de adaptación de explota-

ciones mineras a parques temáticos. Patrimonio geológico y minero en el contexto del cierre de minas, 27-49. Ed.R. Villas-Boas, A. González Martínez y G.Sa de Alburquerque. CETEM. Río de Janeiro. Brasil.

Orche, E. (2004). Problemática de la seguridad en los Parques Mineros españoles. De Re Metallica. Boletín de la Sociedad Española para la Defensa del Patrimonio Geológico y Minero, 2004, nº 3, p. 55-65.

Pérez De Perceval Valverde, M.A., Manteca Martínez J.I. y López Morell, M.A. (2010). Patrimonio minero de la Región de Murcia. Áreas. Revista Internacional de Ciencias Sociales. Nº 20, pp. 140-147. Editum. Fundación Caja Murcia.

Puche, O. y Mazadiego, L. F. (1997). Conservación del patrimonio minero-metalúrgico español: actuaciones recientes, propuestas y su financiación. Actas de la I Reunión Científica sobre Patrimonio Minero Metalúrgico. Cuenca, Universidad de Castilla-La Mancha, pp. 43-53.

Puche, O. et al. (2004). Evolución histórica: nacimiento, desarrollo y futuro de la conservación del patrimonio minero-metalúrgico. De Re Metallica. Boletín de la Sociedad Española para la Defensa del Patrimonio Geológico y Minero, 2004, nº 2, p. 31-38.

Puche, O. (2006). Paisajes culturales de la minería española. En ARRIBAS, D. (Coord.) Arte, Industria y Territorio 2. Huesca, Fundación Beulas, Centro de Arte y Naturaleza, pp. 142-153.

Puche, O. y Mazadiego, L. F. (2007). Minería, karst y turismo en España. En VV.AA. Patrimonio Geológico, Arqueològico e Mineiro em regiões Cársicas. Batalha, SEDPGYM, pp. 165-170.

Annexed

The XXXIII SEM Scientific Meeting and the X Summer Geological Heritage Course. June, 2013

Trip to the Mining Mountain Range of Cartagena-La Unión: "Tourist Use of the Mining and Mineralogical Heritage" Friday, June 28

Description of the Geo-mining Heritage Sites to be visited

(Visits guided by professor J.I. Manteca Martínez, of the Universidad Politécnica de Cartagena)

The Mining Park of La Unión

The Mining Park of La Unión (Murcia/Spain) is a "land museum", placed just South of the town of La Unión, in an area called Cuesta de Las Lajas, corresponding to the Northern slope of the Cartagena mountain range. This site is one of the more genuine mining landscapes still preserved in the Mining district of Cartagena-La Unión, and probably in the whole country.

Luckily, this environment has remained safe from urban development and from industrial or another kind of activities, so its mining character has not been contaminated and it might be said that its physiognomy is the same as one century ago.

This sector is also very particular from the geological point of view, because of its presence of dikes of igneous rocks, hidrotermal breccias, stratiform and veins type ore bodies, etc., and due too to the fact that is practically the only zone of the mountain where tin mineralisations were present.

The park was promoted by the town council of La Unión and was officially inaugurated in July, 2010. It should be taken into account that the Agrupa Vicenta mine is the central element of this park, and the one that attracts the major tourist interest of the whole.

Agrupa Vicenta mine

Agrupa Vicenta is a former underground mine, placed in the site of Cuesta de Las Lajas, in the municipal area of La Unión, which has been

 Depósito legal: CA-602-2004 / ISSN: 1698-5478

adapted as a “mine museum” for tourist purposes by the town council of La Unión. It is based on a project developed by investigators of the Mining, Engineering department of the Universidad Politécnica de Cartagena in collaboration with the company Gestión y Planificación Minera (G.P.M).

The project was focused on two types of actions. There was a first set of actions grouped as "mining work" and whose aim was to guarantee the stability, safety, accessibility and easy circulation conditions inside the mine. The second set of actions was grouped under the name "musealisation", and it aimed to facilitate the interpretation of the visit to the mine and to provide it with a story content.

A stratiform sulphide mineralisation, mainly pyritic (pyritic mantle) was exploited at the Agrupa Vicenta mine. Mining took place using the traditional method of the mountain range, rooms and pillars. A 45 meters length tunnel with a 2x2 meters section allows the access to the interior of the mine, at 135 on the sea level. The mine has an extension of approximately 4,800 m2, divided in 5 sublevels.

The guided tour along the mine provides the visitors with basic information about the geological and mineralogical characteristics of the site, and about the mining history of the district, and it gives them a quite precise vision of the basis of the mining work and its organisation, the characteristics of the work in the mines, and so on.

Brunita open cut

We arrive to this site via the regional road N-345, which goes from La Esperanza to Portmán, one kilometre after passing the crossing of La Esperanza. It is placed in the limit between the town limits of Cartagena and La Unión.

Brunita is an old open cut mine developed by the Peñarroya company in the 80s. We used to exploit a sulphide stratiform mineralisation, or mantle, ere. Sulphide mantle was formed by hydrothermal replacement of Triassic marbles. In the mineralisation pyrite accompanied of pyrrhotite, sphalerite, galena, and locally chalcopyrite predominates. In the oxidation areas a series of secondary minerals appear, some of them very rare, such as the iron phosphates vivianite and ludlamite, and the iron silicate, cronstedtite.

The mining excavation allows the visitors to observe the stratigraphic succession of the different units, and the geological situation of the ore body. Since the excavation penetrated very much underneath the groundwater level, nowadays there is a large lake reaching 30 meters of depth. Therefore this old open cut constitutes nowadays an excellent example of a mine lake of acid water. This acid lagoon presents a great scientific interest as an example of an extremophile environment, where a certain biotic activity exists, comparable to the case of the Río Tinto district in Huelva. The landscape and didactic values of the site are endless, both from the geo-heritage and environmental point of view.

The Avenque creek

We arrive to this site via the regional road N-345, which goes from La Esperanza to Portmán, 3 kilometres after passing the crossing of La Esperanza. It is placed in the limit between the town limits of Cartagena and of The Union.

The configuration of the Avenque creek valley comes determined by a set of parallel faults of direction N-130 º, the most representative being the Anita fault. These faults separate an oriental high block, where Nevado-Filábrides materials outcrop (Gloria open cut mine sector), of a western sunken block represented by the thick Alpujárrides formations.

The mentioned faults are mineralised in depth, both in the intersection with the Alpujárrides limestones and on the underlying Nevado-Filábrides, giving place to veins. The notable veins of this sector were the veins Anita, Francisco Javier, Inocente, Ebraldo, Arresto, etc.

Therefore this is a zone that had an extraordinary mining importance at the end of the 19th and beginning of the 20th centuries. For this reason the landscape is strongly antropisated, marked by mining structures and enormous deposits of mining residues; though the major waste deposits (tailings dumps) are more recent and are the differential flotation concentrators, ins-

talled in the zone in the second half of the 20th centyrt. The territory of the Avenque creek constitutes an extraordinary example of mining landscape, which helps the visitors reconstruct a great part of the Cartagena mountain mining history as well as his technological evolution.

Along the Avenque valley flows an almost permanent small creek, which has his origins in the acid mine drainage from the mining zone placed in the geological elevated block (Gloria area) and which flows into in the bay of Gorguel.

In short, the area of the Avenque valley provides an incomparable example of a very interesting mining landscape, which may be analysed from several points of view, including the mining heritage, geomorphological considerations, environmental problems, and so on.

Mine-cave Victoria

It is placed one kilometre northeast of the village of El Estrecho de San Ginés, in the East slope of San Ginés mountain; within the city limits of Cartagena. This area is considered part of the Protected Landscape and LIC (Site of Cultural Importance) of the open spaces and islands of the Mar Menor.

San Ginés' mountain, where the Victory Cave is situated, is an isolated mountainous relief, , located in the northern side of Sierra de Cartagena, which is formed by Middle Triassic carbonate rocks, limestones and dolomites, belonging to the lower Alpujárride complex or San Ginés Unit. As a matter of fact, it was in this mount where the stratotype of the above mentioned unit was established. The carbonate formation bends towards the East- NorthEast, between 30 and 45 º and its thickness is almost 200 meters. In this rock mass there are abundant iron-manganese lodes that were industrially exploited in the past

The Victoria mine-cave is part of the group of mines that were opened in San Ginés mount. It was exploited from the end of the 19th century up to the decade of the 1950s. In this mine the miners exploited iron and manganese veins and pockets bolsadas inside Triassic limestones.

In fact, it was the mining exploitation of the veins what led to the discovery of a great cavern that was almost completely filled by detrital sediments and manganese mineralisations of karstic origin. The later emptying of the cave by the miners to recover the ore showed there was an enormous quantity of fossil bones, which formed part of the its detritic landfilling.

Nowadays, the Victoria cave is an important example of the presence of African faunae (hippopotamus, elephant, giraffe, zebra, babuino, saber tiger, hyena, etc.) in the south-eastern region of Spain, as well as of the existence of the remains of probably the most ancient hominids in Spain, together with the so called man of Orce, in the province of Granada, dated in 1,200,000 years old and belonging to the Plio-Pleistocene era.

Doctor Josep Gibert Clols, from the Paleontological Museum of Sabadell, was the one mostly in charge of the paleontological study of the Victoria cave. From this investigator's point of view, the geographical situation and the age of the remains point out the possibility that in that era, Strait of Gibraltar was partially closed due to the emersion of intercontinental bridges between Africa and Spain, which could allow the arrival of faunae, including hominids, to the south-eastern area of the peninsula.

In synthesis, in the Victoria mine cave several patrimonial aspects are present: On the one hand, we can find an interesting geo-mining heritage, which includes aspects of karstic morphology, presence of iron and manganese complex mineralisation, mining structures, and an interesting mining history and so on. On the other hand, we can observe a very valuable paleontological heritage, which includes a wide catalogue of Plio-Pleistocene macrofaunae made up by more than 30 species. Among these species we fin very ancient remains of hominids, although the remains mentioned above are subject to controversy in relation to their classification and dating. An excellent exhibition of the fossils founded at cave is available at the Archaelogy Museum of Cartagena.

The Cartagena town council is now carrying out the adaptation of this mine-cave for its future incorporation to the cultural tourism offer of the region.