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METHODS

Mining landscape: A cultural tourist opportunity or an environmental problem?

The study case of the Cartagena–La Unión Mining District (SE Spain)

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ABSTRACT

Abandoned industrial sites have traditionally constituted an important source of environmental problems. However, such sites are considered in many cases a historic heritage, and in this way, have been protected with different legal dispositions. Mining activities can be considered a special type of industrial site in that they encompass not only architectural but also landscape elements related to geology or topography. The necessity of developing new economic opportunities in these places, whose economy has been traditionally based on the “mining monoculture”, has resulted in the creation of a cultural revival in some mining sites. Nevertheless, these new economic potentials must be compatible with the obligation to maintain a low environmental risk in sites where the heavy metal concentrations are very high. The Cartagena–La Unión Mining District in Southern Spain is an example of such a case. This paper reviews the environmental situation in that area and the initiatives for establishing a cultural tourism. The goal of this paper is to incite the public debate about the balance between environmental risks, cultural safeguarding and economic development.

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1. Introduction

Mining activities in the Cartagena–La Unión Mining District constituted during more than 2000 years the most important economic activity in this small area belonging to the Murcia Region (Southeast Spain) (Fig. 1). Related industries developed a socio-economic fabric based on metal mining and its subsequent processes: refining centers, smelters, etc. The Cartagena range mountain, called Sierra Minera (Mining Range), crosses the Mining District from West to East, parallel to the Mediterranean coast, and belongs to the eastern part of the Betic Ranges that were generated by alpine folding. The

terrain is low-lying (<400 m), but with high slopes because of its proximity to the coast. The ore deposits of this zone have iron, lead and zinc, as the main metal components. Iron is present in oxides, hydroxides, sulfides, sulfates, carbonates, and silicates; lead and zinc occur in galena, sphalerite, carbonates, sulfates, and lead- or zinc-bearing (manganese, iron) oxides (Oen et al., 1975). The area is characterised by a semiarid Mediterranean climate, with an annual rainfall of 275 mm, concentrated during spring and autumn. The annual average temperature is 17 °C and the evapotranspiration rate is 857 mm per year (Jiménez-Cárceles, 2006). The vegetation is mainly based on small formations of *Pinus halepensis* and

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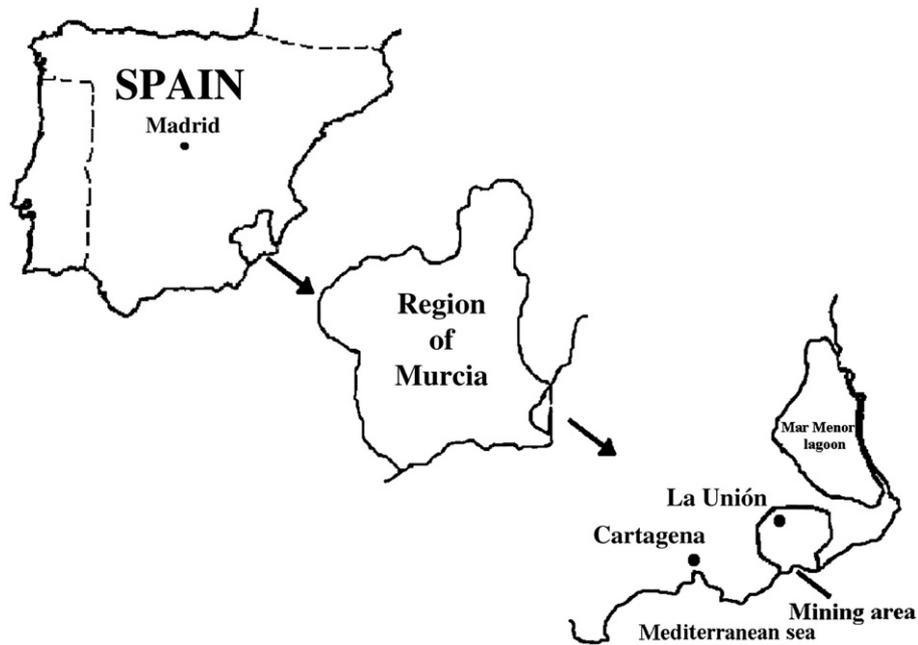


Fig. 1—Location of the Cartagena–La Unión Mining District in Southeast Spain.

thicket plant species with xerophitic characteristics. Some of these species are endemic of this zone and therefore have high botanic interest (Martos-Miralles et al., 2001). The area of the Mining District is around 50 km², including five population nuclei with around 20,000 total population. The surroundings of the mining area have a population of more than 200,000 inhabitants, including the city of Cartagena and the rest of its Municipality. During summer the population dramatically increases because of tourists who come to the Mar Menor lagoon and Mediterranean Sea beaches.

The regional mining history started during the Iberian period and continued with Phoenicians, Carthaginians, etc., reaching a crucial point during the Roman domain (209 b.C.). The old Cartago-Nova (nowadays Cartagena) was one of the most important Roman cities in the old Hispania. The Romans improved the extraction of iron, lead and silver. This Roman extractive activity was so intensive that after its decline, the generated wastes were used during centuries as a source of minerals.

After the Roman decline, the mining activity decreased among others reasons due to the depopulation of the region (Manteca and Berrocal, 1997) but a low level of activity was maintained in the following centuries.

The middle of the XIX century marked an inflexion point in this region because of some official dispositions that favoured mining activities (SMMPE, 1983). In addition, the development of metallurgy, new smelting techniques and the synergistic effect of the discovery of the “Jaroso” vein in the neighbouring Almería province provoked a “boom” of mining activities in Southeast Spain (Egea-Bruno, 2003). This mining was based on a lot of small underground exploitations in galleries. Thousands of people came to this zone from different regions, generating a diverse cultural mix. The social and working conditions of these workers were deplorable: overexploitation of manpower, use of

children to work, unsafe working conditions, low salaries, absence of sanitary health cares, etc. These factors exacerbated the fast growth of a strong class conscience that generated an organized proletariat (Egea-Bruno, 2003).

The mining activity acquired a new dimension in the middle of the XX century due to the concentration of the mine properties that did the multinational Peñarroya España S.A., the new big open cast mines (more efficient for the mining of the low metal ores) and the new refineries applying differential flotation processes (that allowed processing more quantities of material). In this last period of fifty years from 1940 to 1990, one third of the total reserves of the Sierra were extracted (Manteca and Ovejero, 1992; Manteca and Berrocal, 1997). This is the same amount that was mined during the more than two thousand preceding years. This highlights the great impact that the new techniques had and the quantitative jump that transformed the local mining activity.

The total metal production increased until the early 1980s when the exhaustion of ore reserves, the low metal prices in the international market, the progressive elimination of the public protectionism to the mining sector, and the growing awareness of the environmental problems resulted in a deep crisis of the local mining sector (Egea-Bruno, 2003). The definitive closing of the mines came in November 1991 when the Portmán Golf S.A. (that had bought the mining exploitations from Peñarroya España S.A. in 1988) decided to stop the last open cast mine, forced by the economic crisis and the conflicts with some nearby towns that were threatened by the proximity of the mine works to their homes.

In the La Unión Municipality, which is located in the middle of this mining District, the mines constituted the only economic activity during hundred of years. This reason has conditioned the socio-economic situation of this council that was tied to the up and downs of the mining activity throughout the years. In

spite of this “monocultural” character, economic alternatives to mining were not proposed by successive governments. This “mining-dependence” caused a lot of population fluctuations with a decline from 30,000 citizens in 1900 to 13,900 in 1991 when the mining activity ceased. These aspects left a strong mark in the idiosyncrasy and character of La Unión’s citizens, in addition to the aforementioned strong proletarian conscience.

The ending of the mining activity at the turn of the last century brought a socio-economic crisis to this Council, manifested in one of the highest unemployment ratio in the Murcia Region (more than 20%) and resulting in the loss of population by emigration. This situation has persisted during one decade until now when the nearby mass tourism area of “La Manga del Mar Menor” has stimulated the local economy. The future of La Unión and its surroundings implies the environmental restoration of the mining legacies and the generation of new economic opportunities. The tourism is seen as a new source of richness that this region has in order to overcome the crisis (La Verdad de Cartagena, 2003a, 2005a). Now it is necessary to establish which kind of tourism has to be developed.

2. The environmental question

Mining activities are well known by their deleterious effects on the environment, above all due to the presence of high concentrations of heavy metals such as copper, zinc, cadmium, lead, or arsenic that are widely known by their adverse effects on the environment and human health.

The negative effects of mining and its associated activities (refining, smelting) were already noted during the 19th century when the wastes covering riverbeds formed deposits with more than 3 m thickness (Vilar and Egea-Bruno, 1990). The wastes from the refining process were traditionally dumped into the waterstreams that drained the Sierra. Some of these waterstreams flow into the Mar Menor lagoon (the largest salt lagoon in Spain with 180 km², only connected to the Mediterranean Sea through a natural salt marsh and two recent artificial channels). Due to the high quantities of wastes in the waterstreams of the Sierra, occasionally flooding spread the wastes to croplands and shores. Marín-Guirao et al. (2005a) studied the metal sediments of this lagoon reporting high metal concentrations (up to 3000 mg/kg zinc, 1.5 mg/kg cadmium and 750 mg/kg lead) that have affected the benthic communities of the lagoon. Auernheimer et al. (1984, 1996) found high metal concentrations in bivalve shells from the lagoon (up to 300 mg/kg zinc and 218 mg/kg lead). Álvarez-Rogel et al. (2004) reported the presence of high concentrations of zinc and lead in some beaches of the lagoon (Point “b” at Fig. 2 and Table 1). These authors concluded that these sites are strongly polluted and pose a high risk of spreading the pollution to nearby agricultural and recreational areas.

In 1955 the Government prohibited the mining companies from dumping wastes on the ground to form mining tailings (Vilar et al., 1991). Nevertheless, with the recurrent torrential rains typical of the Mediterranean climate, the tailings that remain in the mountains continue to be eroded and washed into the lagoon (Marín-Guirao et al., 2005b).

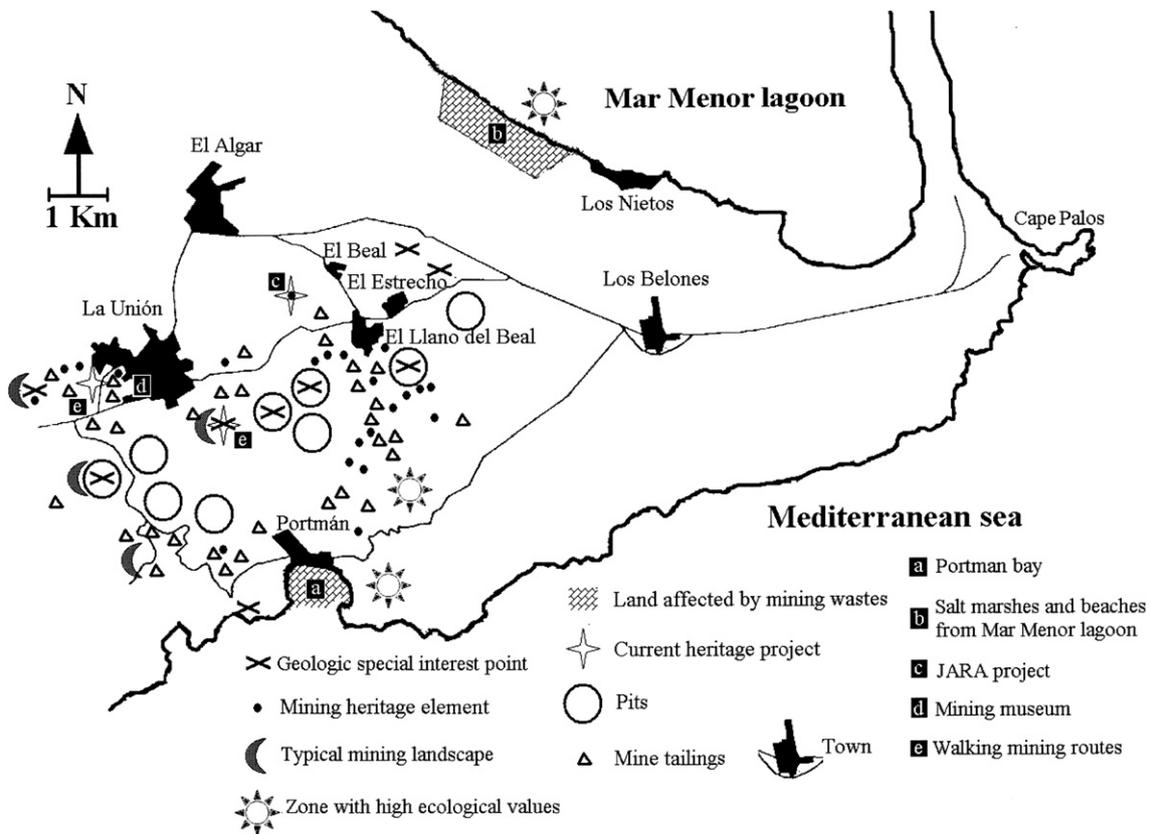


Fig. 2—Some of the most important mining structures in this mining District.

Table 1 – Metal concentrations reported in some sites from the Cartagena–La Unión Mining District and comparison with reference levels

		Reference	Lead	Copper	Zinc	Arsenic	Cadmium
Cartagena–La Unión sites affected by mining wastes	Mine tailing “Belleza”	Conesa (2005)	7000	380	5400	1900	8.8
	Mine tailing “El Gorguel”	Conesa (2005)	5200	84	9100	350	34
	Menor Sea Salt marsh	Álvarez-Rogel et al. (2004)	8016	110	6940	n.a.	n.a.
	Portman Bay (Mediterranean coast)	García et al. (2003a)	8000	150	20,000	n.a.	n.a.
Near zones to La Unión town not affected by mining wastes	Crop land near mine tailing	Pérez-Chacón (2002)	156–1060	8–25	179–1391	n.a.	n.a.
	Agricultural soil near mining zone not affected by mining wastes	Conesa (2003)	28	77	93	n.a.	n.a.
Some reference legislation	Maximum metals levels allowed in soils after Aznalcollar accident (Spain)	BOJA (1999)	500	500	1200	100	10
	Average concentration found in soils affected by the Aznalcollar toxic spill	Simón et al. (1999)	361	152	642	121	2.3

All data are in mg/kg; n.a.: no data available.

The new extractive techniques that were introduced at middle of the 20th century modified the traditional way of working. Open cast mines were built and higher quantities of material could be processed in this way. As a consequence, higher quantities of wastes were generated. The refining center called “Lavadero Roberto”, established in 1957, was the most important refining unit in Europe. During the operation period from 1957 to 1990, more than 57 million tons of wastes were dumped into the Mediterranean Sea. Of these, 30 million completely filled the Portman Bay (Point “a” at Fig. 2) (that originally had more than 10 m depth at its center) and the remainder was distributed on the continental platform ([Martos-Miralles et al., 2001](#)). [Martínez-Frias \(1997\)](#) considered the Portman Bay “the most contaminated bay in the entire Mediterranean, and a perfect example of ecotoxic pollution of a coastal environment by mine tailings”.

Other authors investigated the pollution of the surface- and groundwaters from the zone and found them unsuitable for irrigation or drinking ([Robles-Arenas et al., 2006](#); [García-García, 2004](#)). In some parts of the nearby towns the occurrence of acid waters (acid mine drainage) in the streets after raining is a common feature ([La Verdad de Cartagena, 2004](#)).

The situation of the Sierra after the ceasing of the mining activities (Fig. 2) can be summarised according to [Martínez-Orozco et al. \(1993\)](#) as follows:

- 160 ha covered by mine tailings
- 600 ha are covered by spoil piles (non-refined wastes from open cast mines)
- 220 ha are affected by open cast mines.

Because the mining district has an area of 50 km², we can affirm that almost the 20% of its surface is directly affected as a consequence of the mining activity. Not included in this percentage are the surroundings and other affected zones (continental platform, beaches, riverbeds).

[Martínez-Orozco et al. \(1993\)](#) alerted about the situation of the mine tailings near urban zones and the possibility of

collapsing due to their weak structural stability. In the year 1972 the mine tailing “Brunita” collapsed as consequence of strong rainfalls, spreading the materials in the surrounding and killing one person. According to [Ortega et al. \(1993\)](#) there are 48 mine tailings in the region. Some of them which are more than 20 m in height and cover an average area of 40,000 to 80,000 m², are unstable and difficult to eliminate. [Conesa \(2005\)](#) reported high concentrations of zinc, lead and arsenic in one acid mine tailing near two children schools. [García et al. \(2003b\)](#) alerted about the possibility that the dust suspended from the mining wastes may affect the population and the natural local flora and fauna.

A comparison between the reported metal concentrations in the region (Table 1) and some reference levels from legislation or the Aznalcollar accident (South Spain in 1998) shows the high metal content that the soils from this zone have: zinc and lead are more than ten times higher than the levels found by [Simón et al. \(1999\)](#) in soils affected by the toxic spill in Aznalcollar, which is considered as one of the most important pollution episodes in Europe in the last years. The legal dispositions proposed by the “Junta de Andalucía” to determine the intervention levels after the Aznalcollar accident are widely surpassed: more than ten times for zinc, five times for lead and three times for arsenic and cadmium.

Agricultural soils affected by mining wastes show high contents of zinc (four times) and lead (ten times) in comparison to nearby non-polluted crop lands. Pollution of crop lands with heavy metals has been shown by [Pérez-Chacón \(2002\)](#) who reported the presence of elevated metal content in the soils from crop lands near mining wastes (Table 1).

The remediation of these sites or soils has been restricted to punctual revegetations and the removing of some tailings ([Ortega et al., 1993](#); [La Verdad de Cartagena, 2003b](#)). Mining companies operated with official permissions to dump and place wastes under regulations and laws established prior to the European legislation. The environmental question always was placed in the second place because the mining was considered such a strategic economic activity for the country. Nowadays, there is an agreement between the local, regional and national

governments to finance the regeneration of the Portman Bay and to excavate the mine wastes that fill it and bring them to the nearby pits (*La Verdad de Cartagena*, 2005c,d, 2006). In addition, the attitude of the owners of the former mining companies seems to be positive and they would collaborate in the environmental restoration of the area if they obtain permission to develop tourist projects in the area.

3. The economic opportunities from mining heritage

For the UNESCO (2005a) the cultural landscapes “are illustrative of the evolution of human society and settlement over time, under the influence of the physical constraints and/or opportunities presented by their natural environment and of successive social, economic and cultural forces, both external and internal”. According to Fowler (2003) “all types of landscape can be considered, including urban and industrial ones, and inscribed on the World Heritage List as cultural landscapes if they are of outstanding universal value and meet the criteria”. Bridge (2004) affirms that “as a cultural landscape, the mine sits at the nexus of history politics, and culture, the focal point of a contested moral landscape”.

According to the TICCIH (2003) – The International Committee for the Conservation of the Industrial Heritage – “industrial heritage consists of the remains of industrial culture which are of historical, technological, social, architectural or scientific value. These remains consist of buildings and machinery, workshops, mills and factories, mines and sites for processing and refining, warehouses and stores, places where energy is generated, transmitted and used, transport and all its infrastructure, as well as places used for social activities related to industry such as housing, religious worship or education”. Antrop (2006) includes the mining and industrial landscapes in the category *fossil and relict landscapes*.

Some mining landscapes and their related elements are considered a part of the human heritage because of their historic values. In this way some old mining sites have been included in the world heritage list (UNESCO, 2005b): the city of Potosí in Bolivia that was the largest industrial complex in the 16th century; the Wieliczka Salt Mine in Poland; the Völklingen Ironworks in Germany; the Blaenavon Industrial Landscape in the United Kingdom; the mining area of the Great Copper Mountain in Falun (Sweden) and the old gold mines of “Las Medulas” in Spain.

The possibility of “re-using” the old industrial and mining structures in a cultural point of view have favored the development of an economic opportunity to the recession that affected most industrial regions in Europe after the 1960’s. In this way, the industrial heritage is converted to an element able to generate employment. Moreover, “this heritage represents the own identity and idiosyncrasy of these local communities, it is the testimony, signs, emblems from one prosperous and glorious past that help to strengthen the image and self-esteem of these populations” (Carvajal et al., 2002). Nowadays, the possibilities of generating new socio-economic dynamics and, at the same time, performing actions to conserve the heritage and the cultural identity, are based on the exploitation of the potential of the cultural tourism (Padró-Werner, 2000). The

trend is to reconstruct sites, buildings and instruments in situ, protecting the natural and cultural environments and showing the elements in their context. The recreation of an authentic “community” for external visitors is an essential issue (Cameron and Gatewood, 1994). In some of these sites the tourism constitutes an important role for the economic development and the local restructuring (Fernández and Guzmán-Ramos, 2004; Edwards and Llurdés i Coit, 1996; Mansfeld, 1992).

At the moment, initiatives in this context are being carried out in the U.K., Germany, The Netherlands, Belgium, Austria, France, Spain and Italy (Hospers, 2002). In Spain, the case of Riotinto in the Southern region of Andalucía is the best example of a mining heritage tourist project. The development of this project has been carried out by the Fundación Río Tinto and is based on the “heritagization” of the area: mining museum, restoration of a mining railway, rehabilitation of urban areas and archeological sites, and the organization of trips through the mining area (Hernández-Ramírez and Ruiz-Ballesteros, 2005).

Nevertheless, this mining heritage tourism has four problematic points according to Edwards and Llurdés i Coit (1996): i) the low attractiveness for people due to a different standard of beauty, ii) the huge size of the mining exploitations which makes them very expensive to restore, iii) the degradation of the environment associated to most mining sites and iv) in most cases a location far from traditional tourist circuits. The same authors (Edwards and Llurdés i Coit, 1996) mention two additional factors that affect cultural tourism in Spain: the traditional mass tourism in Spain has been based mainly in the traditional offer of sun/beach and the scarcity of political interest to support mining heritage projects. However, traditional heritage areas have advantages over the new ones in which industrial and mining can be included because of the higher symbolic and aesthetic signals that accumulated (Richards, 1996).

According to Cameron (1999) four issues have to be overcome in the development of industrial heritage projects: a selection of the suitable heritage elements for presentation; to determinate to whom belongs the “ownership” of the industrial heritage; if heritage can attract a sufficient number of visitors; and finally, what is the time scale of the heritage making.

In many cases these cultural-heritage projects have serious flaws that arise from the theoretical and methodological inadequacies (Prats, 2003). The “heritagization” in this case, is “artificial” and the local population feels out of this process.

4. Restoration of mining heritage in the Cartagena–La Unión Mining District

The Cartagena–La Unión Mining District is situated near the important tourist focus “La Manga del Mar Menor”, based on sun/beach activities. This proximity allows taking advantage of the presence of high numbers of tourists and complementing the tourist offer with some cultural remarks.

At the present time some ideas and efforts are being developed in relation to preserve the heritage values. Some of them are directly related with the land use. These proposals deal with the recuperation of some old mines and factories and with their use for teaching and visiting. Berrocal (2003) proposed three groups of activities: 1) those zones that allow a

complete contextualization of the mining elements with their surroundings without modern interferences, offering great landscape and museistic possibilities; 2) mining elements in good conservation state but not in a unique context with a landscape and surrounded by contemporary elements; and 3) elements in bad conservation state which need to be evaluated for their possibility for restoration or elimination.

Manteca and Berrocal (1997) related the mining elements with archaeological and geological value in order to justify the creation of a geo-mining and archaeological park in the region. According to those authors the mining heritage elements in the Cartagena–La Unión Mining District have two components regarding their value: 1) an educational value to raise public awareness about cultural, natural and historic resources, and to a didactic tool for researchers and 2) their socio-economic value, since they can constitute an important tourist attraction because of their geographic situation near an important tourist focus. A summary of the most representative mining and geological elements in this region can be seen at Fig. 2. However, from the ceasing of the mining activity in 1992 until today some of these elements have been damaged (Manteca, 2003). For this reason, the legislators of the Murcia Region are in process of declaring the local mining heritage as “sites of historic interest” (BORM, 2006). Therefore, there is legal protection for business and other organizations that work with historical mining areas.

Rodríguez-Estrella et al. (2003) proposed the use of mine tailings in didactic works because in these structures it is possible to identify sedimentary structures very similar to old rocks although the age of the tailings is less than one hundred years. As a consequence, these authors consider these tailings like “natural laboratories with high didactic and scientific interest”.

Some walking routes through the mining lands are being created (Point “e” in Fig. 2). Also some old mines are being prepared for visits and the creation of interpretation centers in those places has started (CARM, 2004).

Some local social organizations have been created in order to canalize the economic efforts of the public associations and to give the citizens the opportunity to participate in the new socio-cultural projects. The “Sierra Minera” Foundation (<http://www.fundacionsierraminera.org>) was created with this purpose and integrates citizens from the local towns of the old Mining District. This Foundation works in three fields: i) social insertion of citizen sectors with socio-economic problems, ii) projects related to the environmental education and iii) generation of employment opportunities using the cultural values of the region centering in the local historic mining heritage. As an example the project “JARA” can be highlighted, a European LIFE project, (see <http://www.fundacionsierraminera.org/proyectos/jara/index.htm>) that has been managed by the “Sierra Minera” Foundation. In this project two mines have been restored including actions to decrease the environmental risks of the surroundings (Point “c” in Fig. 2). Therefore, in addition to the historic-cultural values of the mining heritage, the environmental remediation also has didactic values. Such projects are positive because they preserve the cultural legacy and decrease the environmental risks, although the number of employments created is low and the time for development is too long in relation to the necessities of the local community

(the project started in 2000 and the official inauguration was in July 2005).

But without any doubt, the most important proposal is based on the creation of a thematic park about mining in the “Cabezo Rajao” (La Verdad de Cartagena, 2005b) that is considered the local mining heritage site with highest historic interest.

There are also efforts not related with the land use. These projects are based on cultural and social aspects. In this context we would like to mention the recently restored mining museum of La Unión (Point “d” at Fig. 2), the flamenco (typical Spanish folk music and dancing) Festival of “Cante de las Minas” (which is celebrated on August and which is considered one of the most important flamenco festivals in Spain) and all the conferences and colloquiums about mining culture that are organized in the area.

5. Confrontation mining-environment

For the analyses of the mining elements and their interaction with the environment some steps should be followed as shown in Fig. 3. With the term “mining element” we refer to two different objects (Table 2): architectural elements and small points with geological interest that we define as *small-scale elements*. Their relation with the surrounding environment is punctual and they have an area of less than 1 ha. Landscape areas or *large-scale elements* involve a larger visual context (area larger than 1 ha) due to their significance within the landscape, because their cultural meaning needs a larger visual scale to be perceived. Sometimes several *small-scale elements* together can constitute a *large-scale element* or may be included in a bigger *large-scale element*.

In a first step it is necessary to know if the heritage value of each element can justify its conversion to a “cultural” focus. Historians, archeologists, geologists, tourism and economic analysts, etc., may be the most adequate professionals to carry out this step.

If the outcome of the evaluation is that a certain element represents an interesting cultural value, then that element has to be adapted to be suitable for leisure activities. This is the moment to carry out the evaluation of the environmental risks associated with the element (Fig. 3). It is the time for environmental engineers, biologists, chemists and/or toxicologists to be involved. This evaluation has to include aspects related to the exposure of humans, flora and fauna to the pollutants but also has to take into account other risks related to their geology and structure (collapsing). According to the risks that are present, different remediation or attenuation techniques can be applied. In all cases the element that should be conserved has to be safeguarded, but at the same time the coherence of the landscape has to be maintained. For this reason an interaction between the working group that plans the environmental remediation and the group that determined previously the “heritage” value of the element is necessary.

Environmental restoration of small-scale elements will involve less tools since its spatial impact is smaller. Even directly covering the area with non-polluted materials or removing the polluted material can be considered a good

Fig. 3 – Scheme of the steps to analyze the restoration of mining heritage elements.

alternative since the volumes to be handled are small and therefore the economic efforts are low. In this case environmental risks cannot only be minimized but even deleted.

However, large-scale elements will often need longer studies and larger economic efforts because of the area and because the further actions are more appreciable. In this situation the actions would be directed to minimize the environmental risks and not to eliminate them. Using low cost technologies such as phytostabilization (the use of plants to stabilize the polluted soil (Ernst, 2005)), may be a good option. Native plant species that are adapted to the local climate and are integrated into the landscape would be the preferred option for such a revegetation. Some studies in the Cartagena–La Unión Mining District have identified plant species that are able to grow on mine tailings (Conesa et al., 2003, 2006) or riverbeds and shores with polluted wastes (García et al., 2003c; Álvarez-Rogel et al., 2004). These plant species are therefore adapted to metal pollution and perfectly integrated into the semiarid ecosystem. The use of these plant species to revegetate polluted soils would allow decreasing some of the environmental risks that mining wastes pose, since plants can protect the soil against water and wind erosion. Conesa et al. (2006) showed that the plant species that grow on mine tailings from the Cartagena–La Unión mining District do not accumulate high concentrations of heavy metals. It is important to use plants for revegetation that do not accumulate metals in the shoots in order to avoid metal accumulation in the food chain. Nevertheless, the use of phytoremediation techniques is restricted to the characteristics of the contaminants and the reduction of the pollution risk that we aim for. Large areas with low levels of pollutants

will be the most adequate sites to apply these techniques. However if the pollution level of is high, phytoremediation techniques are not adequate and we have to opt for more expensive techniques. Three considerations have to be made in relation to the environmental restoration.

- 1) The environmental restoration may be seen by the local authorities or local cultural associations as a barrier that can strangle the economic development. Usually, the environmental or restoration actions that have to be carried out are expensive and local administrations are not able to cover these expenses. Therefore, regional, central or European funding is generally the only option for a financial support of such projects. The political and social repercussion of the local communities and the power of local associations

Table 2 – Some examples of small-scale and large-scale elements from the mining landscapes

Small-scale elements (<1 ha)	Large-scale elements (>1 ha)
Chimneys	Pits
Furnaces	Large geological formations
Elevators	Tailings (wastes from refining)
Underground galleries	Smelters (>1 ha)
Railways	Refining centers (>1 ha)
Smelters (<1 ha)	Landscapes
Refining centers (<1 ha)	Quarries (materials without refining processes disposed in slopes)
Wells	
Geological points (<1 ha)	

therefore plays an important role. If money plays an important role, then only small-scale elements and those large-scale elements conducive to low-cost remediation may represent viable sites for development. The costs of remediation, in case they continue being an important constraint, could be shared by national or European funding agencies and by the legal owners of the land, who may benefit from public goodwill. These areas are not public-owned, belonging instead to the owners of the former mines. The public should see the benefit of remediating this land rather than the perception that the landowners are receiving a handout. The public expropriation of contaminated land may be another option but may result expensive and unpopular.

- 2) According to a recent Spanish law there is an obligation to decontaminate those soils that previously have been classified as “contaminated” (BOE, 2005). In our case, as expressed above, there is a large area covered by polluted materials. This law is deficient, in that it contains no reference levels for heavy metals, which are the main pollutants in the area. Nevertheless, there are enough objective criteria to consider some local sites as environmentally hazardous and to legally justify the need for remediation. The law states that the remediation technology should be used depending on the future uses of the soil. The question that remains is which kind of uses (urban, agricultural, forest, tourist, no-use land...) should be established for each part of the area and consequently, to which extent remediation must be carried out.
- 3) On the other hand there is the possibility of private initiatives (probably more efficient in terms of time response than the public initiatives) but in this case the “cultural tourism” does not seem to be an attractive option because of its low yield. It is clear that the mining heritage is not going to generate high amounts of economic benefits since it will never be an attraction for mass tourism but a complement to it. This is the great opportunity in the Cartagena–La Unión mining District because of the proximity of the mass tourism center of La Manga del Mar Menor that focuses mainly on the activity of private investments. The ratio area per tourist is generally higher in the “landscape tourism” than in a sun-beach tourism simply due to the spatial nature of the landscape elements. It is known that one of the limiting factors of preserving the industrial heritage is the low economic impact in the regional employment (Edwards and Llordés i Coit, 1996; Hospers, 2002). However, under a correct leading, the success of the projects may be reached in a middle term, like it was shown in some old mining areas in the United Kingdom or in the Rio Tinto area (Southwest Spain). In addition, the intervention of regional and central governments along with funding from the European Community, are essential elements to understand the development of heritage tourism in former Europe’s mining areas (Ruiz-Ballesteros and Iglesias-García, 1999). In the Spanish region of Andalusia (where Rio Tinto belongs to) both, heritage protection and the development of tourism, are priority areas for the regional government (Ruiz-Ballesteros and Hernández-Ramírez, 2007). The effective development in Rio Tinto came from the synergistic collaboration between regional and local governments and the old mining companies whose, anticipating the economic crisis of the mining

activities in the area, subsidized small–medium enterprises and promoted the mining heritage. All these efforts were canalized by the Fundación Rio Tinto that in addition developed formation and educational programs (with national and European funding) (Pérez-López, 2003). The increase in the interest in this region is not only supported by the increasing trend in the number of visitors (from 8000 in 1992 to 62,500 in 2005) but also by the development of the social and economic structure in the local community that directly depends on these projects. In comparison, the La Unión–Cartagena area, which started its mining tourist development in the same period as Rio Tinto, receives just 10,000 visitors per year.

An important fact is that the environmental restoration of mine sites is usually expensive due to the large areas that are affected and the huge quantities of polluted materials that have to be handled. This restoration needs, therefore, high economic investments. High economic efforts are only going to be justified if there is an important yield afterwards, and this is more possible with mass tourism (hotels, golf resorts, etc.). More efforts from the public authorities have to be made in order to reconcile the interests of the owners of old mining companies, the local economic development and the safeguarding of the historic identity of the mining populations. The owners of the mines are interested in the transformation of the whole mining area into a mass tourist center. However, we think that historic and social aspects are important and simply valuing the economic benefits and costs of the different development options may result in over-development of the site and the loss of the local identity. The objective should be to reach a sustainable system, rather than the maximize short term financial gains. In relation to the tourist uses that the former mining owners propose, two issues have to be overcome: 1) the growing antipathy in Spain against mass tourism (El País, 2007). This has created the necessity to include historic and heritage values into new tourist projects. Public opinion increasingly states that the social and cultural benefits of these aspects, and not only the economics, should be taken into account in the planning of the local urban design to reach a sustainable system. 2) the classification of land use must be changed by the public authorities, from mining to urban use, including the obligation of remediating the land. Politics based on compensations could be a good tool to reconcile conflicting opinions: if mine owners collaborate in the decontamination of the area they could be allowed to develop urban projects; if they collaborate in the restoration and conservation of the mining heritage they could manage tourist facilities. The collaboration of the former mining companies has been demonstrated to be essential in other cases (e.g. Rio Tinto) but it is much more important in the case of La Unión where they own the land and the mining heritage.

Once that we are sure that the environmental risks have been minimized, it is the moment to carry out the restoration of the element and its adaptation to receive visits. In this step the efforts will be more focused on security and access to people. Some mining elements such as galleries, pits or old mining structures can be dangerous (e.g. steep slopes, risk of collapsing of the structures, toxic seepage waters) and security issues will have to be taken very seriously. This may

compromise the future acceptability as a tourist attraction and the risk perception by tourists.

Another point is the need to maintain some coherence in the different actions to create a coherent heritage that presents a unique setting and not only different isolated heritage spots. The coherence has to be in a double sense: in the space (heritage elements close to each other) and time (representative of the whole local history and idiosyncrasy).

6. Conclusions

The Mining District of Cartagena–La Unión has a high potential to generate economic opportunities at local scale by means of the historic and cultural values of its mining heritage combined with the nearby mass tourism nucleus of La Manga del Mar Menor. A reaffirmation of the local idiosyncrasy and esteem is tied to the consequent social benefits. However, for an optimal yield, the economic dimensions of the environmental and heritage restoration have to be taken into account.

The conservation of this local culture has to be compromised by the maintenance of a low environmental risk level for the population and the tourists. The presence of mine tailings near towns, the spread of polluted materials through riverbeds, the shafts without any warning signals, shores formed by mining wastes or buildings in ruinous state have to be taken into account before carrying out tourist projects of either cultural or conventional character.

A critical study based on cultural and environmental risks and economic values is needed in order to obtain a compromise between heritage conservation and the creation of new economic sources, without forgetting the role of the historic heritage in mining towns in keeping the local idiosyncrasy. A massive urbanization of the La Unión area, obviating historic and idiosyncrasy aspects, would be an error from the social point of view, neglecting the potential for new generations to learn about the past of one of the most important mining areas in Europe.

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