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Museums: A palliative or solution for declining historical mines?

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Declining historical mining districts have obtained large profits from mineral and metal extraction. However, at present, in addition to cash problems which usually lead to mass unemployment, they are suffering their own environmental problems (acid lakes, metal contamination, deforestation, dangerous pits, etc.) and the pressure of environmental laws to minimize these disasters. It is often left to tourism to palliate these situations. However, the creation of interesting recreational activities (in-mine trips and visits to historical mining-museums) run into problems such as the geomechanical instability of old mines and the frequent scarcity of local historical objects. The resource-exhausted and overpopulated mining districts of Europe provide many examples. Consequently, we propose changes in the environmental mining laws for historical mining districts to include these new points: the preservation of an in-mine space which will be safe for visitors and the storage of a good collection of historical mining objects.

Mines, tourism and the environment

Few papers have been published concerning both mining and tourism (e.g. Editorial, 1996). Nevertheless, historical mines, mining activities and their products (e.g. gemstones, transparent crystals, rare minerals) can be interesting targets for tourism. However, many scientific journals do publish material concerning a large number of different environmental impacts caused by modern mining activities (Reeves and Brooks, 1983; Shankar et al., 1993; Thornton, 1996; Garcia-Guinea and Huascar, 1997; etc.). The introduction of heavy machinery and the increasing scale of operations have led to a correspondingly larger environmental impact. The use of explosives, road haulage and aggressive chemicals (used in mineral processing) creates chemical, dust and noise pollution, potentially leading to local health problems, e.g. silicosis, hydrargyrisms and saturnism. Mining is patently incompatible with natural ecosystems; in the management of natural parks, one of the first steps taken is the closure of all mining activities in the area (e.g. Anderson, 1989). Tourist activities are often of social value to an area (Haulot, 1985; Butler, 1991), but it is important that they take into account that specific natural areas and the fauna in them are very sensitive to tourism (Kenchington, 1989; Joshi and Pant, 1990; Shackley, 1992; Stephenson, 1993). It is also clear that cultural tourism in urban settings can also revitalize declining industrial areas (McNulty, 1985). Therefore, the transformation from mining to cultural tourism (e.g. mineralogical-mining museums, in-mine visits, etc.) in historical mining-industrial areas, can

only be of benefit, both to flagging economies and damaged ecosystems.

Apart from cash problems, the only other general difficulty is the lack of tourism expertise of mining workers and technical staff. In Silesia, an exhausted coal mining area of South Poland and one of the most beautiful mountainous areas of Northern Europe, one can stay at luxurious modern hotels which, nonetheless, only have staff that can communicate in German and/or Polish. If one travels to Potosí in South Bolivia, a classic ex-colonial silver-mining district with hundreds of historical monuments, one will have trouble getting a cup of white coffee, let alone a nice hotel room! It is of course difficult for declining historical mining areas to assuage their economic problems with revenue produced by mining museums; these are often just palliatives. However, in some favourable cases (technologically advanced countries, areas with good accessibility, educated populace, etc.), museums can be — and, in places, have been — a viable solution.

The WTO Cerro Rico in-mine Museum Project, Potosí, Bolivia

The World Tourism Organisation (WTO) carried out a specific action in Potosí (Bolivia) to improve social conditions; projecting a historical mineralogical-mining museum in the Cerro Rico mine which, since 1545, has produced vast quantities of silver. The mineralogical and Mining Museum 'Diego Huallpa' of Cerro Rico was the brainchild of Victor Villanueva, an ex-miner of the Corporación Minera de Bolivia (COMIBOL) and Dr. Garcia-Guinea (WTO mission ref. BOL/86/034/F/01/49, see Garcia Guinea, 1995). The project included a list of exhibits in a disused explosive storeroom on level 0 'Pailaviri' inside the mine. The design is shown in Fig. 1. The 48 intended exhibits cover the past and present of the Mitayo Indians and miners of Potosí. Owing to the limited space in the old explosives store it was deemed necessary to build a new building near the level 0 'Pailaviri' mine entrance which would become the Cerro Rico background centre. As shown in Figure 1, this building would have an area of 469 m² with craft stalls selling souvenirs, a snack-bar, a video hall, a changing room (where protective clothing and helmets would be provided), a balcony affording a panoramic view of Potosí, and 31 chronologically ordered display panels, starting from the geological episodes millions of years ago and finishing with more recent historical events.

The 450 years of continued and anarchic mining in Cerro Rico and the Andes seismicity have created doubts about the general geomechanical stability of the area. Engineer Coca, in charge of mine safety, stated that the only zone of the Cerro that would be stable enough to allow extensive work to be carried out in relative safety is the disused explosives storeroom on level 0 'Pailaviri'. The antiquity, complexity and intensity of Cerro Rico mining create difficulties in mapping the galleries, tunnels, shafts, etc. The WTO project included plans for digging of a 57 m long gallery, concrete paving and the reinforcement of the gallery and the disused explosives storeroom with torque bolts that would be fixed in the roof rock with resin and an anchoring mechanism.

Figure 1 Proposed layout of the Potosí in-mine Museum and the interpretation centre near the mine entrance. Including 48 museum exhibits concerning Bolivian mining, history and geology.

(1) formation of the Ordovician schists (500 m.y.), (2) formation of the Andes (190 million years -m.y.-), (3) formation of the Torotoro Cretaceous (120 m.y.) (4) formation of Cerro Rico (16 m.y.) (5) injection of silver, tin and lead veins (16 m.y.), (6) the Poreo ore deposits (16 m.y.), (7) the Andean high plateau (10 m.y.), (8) the Uyuni salt marsh (10 000 years ago, -y.a.-), (9) active volcanism in Bolivia, (10) thermal springs, (11) climatology of Bolivia, (12) arrival of the first humans in America (10 000 y.a.), (13) dispersion of the tribes (8000 years ago), (14) colonization of the Kolla-Aymara Indians (3000 y.a.), (15) development of Incan empire (1000 y.a.), (16) the Mita and the Incan tributes (700 y.a.), (17) the arrival of Francisco de Pizarro (1532), (18) Diego Huallpa discovers the Cerro Rico (1544), (19) the huayra furnaces (1545-72), (20) the arrival of Viceroy Toledo of Peru (1572), (21) imposition of the Mita (1572), (22) introduction of the use of minted coins (1572), (23) the beginning of the use of amalgam (1573), (24) construction of the Kari dams, (25) the silver mills (1660), (26) the destruction of San Ildefonso dam (1626), (27) war between Vascongados and Vicuñas (1610-40), (28) executions of colonial authorities (1810), (29) after independence (1810-55), (30) private mining (1856) and mine nationalizations, (31) Pallira and Canchiri (wax figures of Indian miners), (32) figure of Mitayo Indian, (33) figure of miner, (34) Mitayo clothes, (35) miner clothes, (36) mining tools, (37) Mitayo tools, (38) minerals and rocks of Cerro Rico, (39) minerals from Potosí, (40) Bolivian minerals, (41) metallurgical treatments, (42) religion (wax figures), (43) old chichada (mining drill), (44) new chichada, (45) figure of Diego Huallpa, (46) colonial mural showing Mitayo Indians, (47) revolutionary-miner mural, and (48) mine wagon.

The project, if carried out, would help the area, but it is dubious as to whether it could fill more than just a small hole in the economic wasteland that Potosí has become. Once thriving, the 150,000 inhabitants are now impoverished, the mines only producing tin and negligible amounts of silver. One of the major problems facing this museum project is the location of Potosí—4000 m above sea level, with the only access being via small mountain roads.

The Mercury Mining District of Almaden (Spain)

The Almaden mercury mines are the oldest (2000 years) continuously active mines in the world, playing an important role in the colonial period of Spain's colourful history; mercury was used in the Americas in the amalgam method used in the extraction of silver and gold.

It has been stated by the EU that Almaden (20,000 inhabitants) is a depressed rural area — deforested after 2000 years of intensive mercury mining (furnaces and constructions). The company that controls the mines of Almaden has recently proposed a new plan to help cope with its present financial crisis: a 34% reduction in costs, dismissing 90 people, selling property, diversifying its activities, prospecting for new mercury ore deposits (in 40 mining areas) and attempting to increase sales of mercury (Garcia Guinea and Harffy, 1997).

Recently, in Almaden, two mining museums have been built where visitors would be able to see Roman tools, Arabic amphoras for cooking cinnabar, interior-mine constructions, ancient furnaces, interactive experiences (such as immersing a tissue in mercury and pulling it out dry, floating a steel ball in mercury, using the liquid metal to conduct electricity from a battery to a light bulb, and trying to push one's arm into the very dense mercury, the density of which is $13,596 \text{ kg m}^{-3}$), etc. (Figures 2 and 3). Tourists visiting the mines need not fear breathing in mercury vapour; mercury vaporizes very slowly and for this reason, only workers exposed to it for long periods of time suffer adverse effects (hydrargarism). Sadly however,

Figure 2 Almadenejos mercury quarry (Almaden, Central Spain).

these interesting museums and exhibits are closed to the general public so that mining and metallurgical extraction can proceed normally.

In short, the present production of mined mercury in Almaden is stopping any possible tourism from taking place. This is a pity, as, although the mines are relatively isolated in central Spain (100 kms from the nearest motorway and the Madrid-Sevilla (AVE) high speed train station), these museums could be of great benefit to the local community, and would certainly be more environmentally friendly. Almaden should be included in the framework of cultural tourism in central Spain (churches, Roman sites, castles, natural parks, caves, etc.) which is an ever increasingly popular target for tourism.

The European Union should take into consideration that by helping impoverished mercury mining regions of Europe to diversify their activities (e.g. financial aid for tourism in Almaden, Spain and/or Idrija, Slovenia), not only could the local economy be improved but it would also bring about a huge reduction in global mercury pollution.

Figure 3 Children playing with a steel ball which is floating on mercury (Almaden mercury store).

Big Pit (Pwll Mawr) Mining Museum, Blaenafon, Wales

The South Wales coalfield produced millions of tons of coal from hundreds of pits, in the late 19th and early 20th centuries. Big Pit is situated in the NE part of this coalfield where the seams outcrop at the surface. Big Pit (so-named for the size of its shaft, which is 5.5 m at its widest) was opened in the mid 1800s during the coal mining boom and, at its peak in 1913, employed 1300 men and produced over 250,000 tons of steam coal a year.

In South Wales, however, coalmining went into a slow decline for much of the 20th century and all other deep National Coal Board mines in the Blaenafon area had closed by 1966. In 1980, with only 250 workers left, Big Pit was finally closed down.

In 1983 the mine was reopened as a visitor centre and is now managed by the Big Pit (Blaenafon) Trust Ltd, a company limited by guarantee and a registered charity. It is a non-profit-making organisation which is dedicated to preserving the pit as a living monument to the South Wales coal industry and the people who made it.

Visitors to the mine can look around several of the original buildings and also a museum which contains a reconstruction of a miner's home, a large number of tools and photos and some interactive CD-ROM displays. The highpoint of the visit, however, must be the descent into the pit. Visitors travel 90 m down in the cage with an ex-miner who is their guide for the hour long walk underground. In the mine they visit the stables, see coalface working conditions and

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