

New contributions to the analysis of the environmental and social effects of mining in Southern Europe¹

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Introduction

Since the mid-1990s, the global economy has experienced a true re-birth of mining, which has contributed to enabling the process of globalisation and growth over the last few decades (Reichl, Schatz, Zsak, 2016). In fact, the global economy has demanded all types of mining products, particularly those known as “critical minerals”, which has triggered the reopening of existing mining basins and the search for new deposits (Pérez-Cebada and Beltrán Muñoz, 2020). The mining industry has responded to this challenge and, taking advantage of the scientific, technological and organisational innovations, has committed to increasing production, first in the peripheral areas of the global economy and, subsequently, even in some areas of western Europe, although this has fallen since 2000 if we take the continent as a whole into account (Humphreys 2010; Tiess, 2010; Xu et al., 2020). Of course, the trade liberalisation policies implemented during this globalisation process have contributed to this phenomenon of remineralisation (García de la Cruz, 2008; OECD, 2010; Rodrik, 2011; Michie, 2019; Requeijo, 2021). The result of this process is an increase in world mineral production from 9,332,929,816 metric tonnes in 1984 to 17,209,977,985 me-

tric tonnes in 2020 (18,016,028,649 in 2019)², and the prices have multiplied by 1,56 in real terms during the same period (World Bank Database, see Figures 1 and 2).

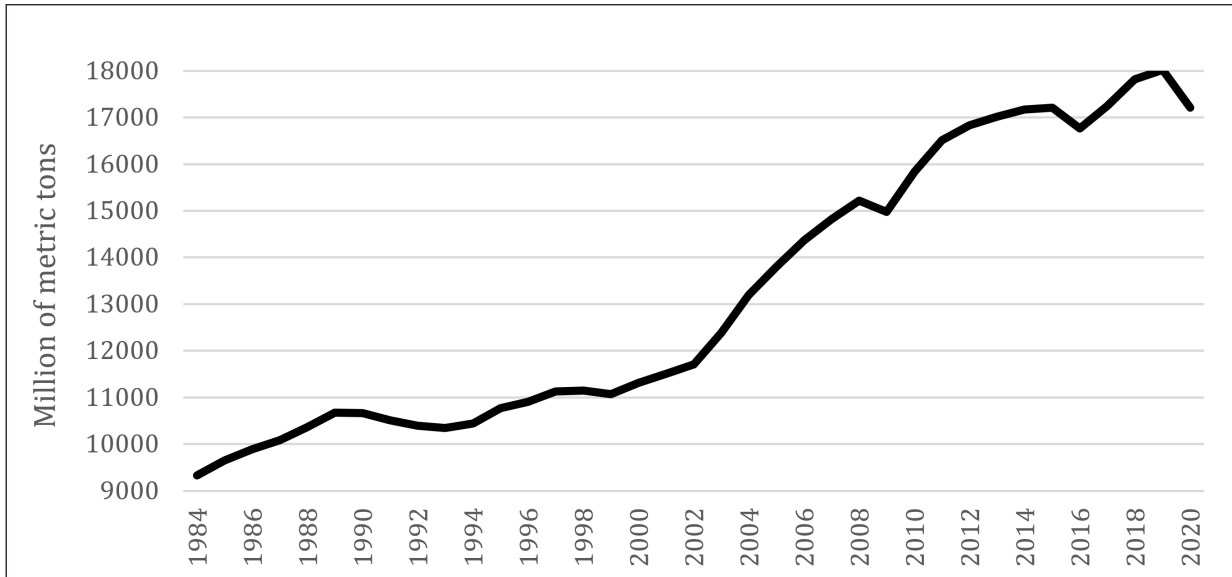
However, this increase in global mining production has increased social, political and environmental conflicts derived from the impact of mining activities, not only in developing countries, but also in advanced nations (Suárez Llanos, 1996; Bridge, 2004; Pérez de Perceval, López-Morell, and Sánchez Rodríguez, 2006; De Echave et al., 2009; Bebbington, 2012; Scheidel and Sorman, 2012; Bebbington and Bury, 2013; Saade Hazin, 2013; Kirsh, 2014; Sánchez, Espinosa and Eguiguren, 2016; García Viniegra, 2017, Falletti and Riofrancos, 2018; Gudynas, 2018, Temper et al., 2018; Villamayor-Tomas and García-López, 2018; Valderrey Villar, and Lemus Delgado, 2019; Scheidel et al., 2020; Arboleda, 2020). Furthermore, the consequences of the mining activity are not only short term, but its effects, both from a physical-environmental point of view and a social and economic perspective, and even an anthropological one (culture), are usually extended in time and leave deep scars on the territory, some positive but many others negative (Le Cain, 2019; Mononen et al., 2022).

Of course, these effects are not exclusive to contemporary mining, but have been generated throughout the history of the sector. In fact, many environmental historians consider that there is a significant connection between the problems arising from these types of activities in the past and those of the present (Guimaraes, 2013; Pérez Cebada, 2014; Guimaraes and Pérez-Cebada, 2016; Pérez-Cebada, 2016; Machado, 2020).

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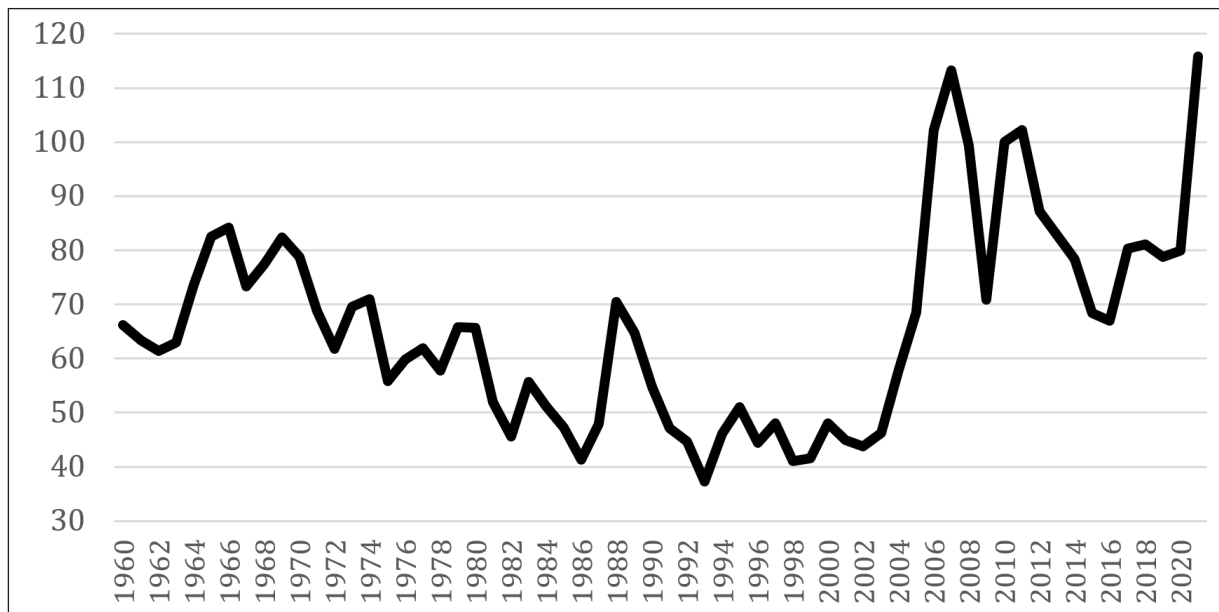
² https://www.world-mining-data.info/?World_Mining_Data___Data_Section.

Graph 1. World Mining Production, 1984-2020 (million of metric tons)



Source: Own elaboration from World Mining Data (https://www.world-mining-data.info/?World_Mining_Data___Data_Section).

Graph 2. World Metals and Mineral Real Prices Index, 1960-2020 (2010=100)



Source: Own elaboration from World Bank Database (<https://www.worldbank.org/en/research/commodity-markets>).

This monograph explores the social, economic, political and environmental consequences at different times in history of the mining activity, which was a sector with enormous relevance for the economy as a whole. It originated in the session that the Working Group “Labour in Mining”, forming part of the European Labour History Network (ELHN), and the coordinated research projects titled “Historia social de la minería española contemporánea” (PGC 2018-097817-B-C31, PGC 2018-097817-B-C2 and PGC 2018-097817-B-C33), financed by the Ministry of Science, Innovation and Universities of the Spanish Government, organised in the 3rd European Labour History Network Conference, held in Amsterdam in 2019. In this double for-

mat session, ten papers were presented, six of which are published in this special issue in the form of research articles.

Although the time frame and geographical scope of the session was open to any period of history and any geographical area, the majority of the papers and, therefore, the articles in this issue refer to European basins during the nineteenth and twentieth centuries. They address the changes, conflicts and relations between the mining activity and the spaces in which they were developed, the labour markets that it generated, the resulting labour relations, the urbanisation processes surrounding it, the forms of production and organisation of the companies,

etc. Of course, these interactions and phenomena were also present in the places in which the mining output was processed, giving rise to inputs for other economic sectors and even those that, in turn, used or provided the latter. In other words, these problems were transferred to the rest of the economic system. This matter, however, is not contemplated in this issue and will form the basis for future lines of research.

In this case, broadly speaking, the negative consequences of mining in the area of extraction have historically been concealed by the benefits that the activity and mining products generated for the economy as a whole. However, from the 1990s, there has been a proliferation of studies investigating these problems and this is the field in which the papers presented here are framed³.

Mining and economic development

Since Neolithic times, mineral, metallic and non-metallic substances have been basic inputs, providing the economic system first with tools and utensils and later with machinery, enabling it to accumulate capital, with the subsequent effects on productivity and the living standards of people. In this way, the natural resources in general and the mining products in particular have constituted a fundamental element of growth and economic development and, also, to some extent, social, cultural and political development throughout the history of humankind (Hornborg, McNeill and Martínez Alier, 2007; Wrigley, 2010). The existing correlation in the long and short term between the economic climate and this sector reinforce the idea of the importance of mining for development (Martínez Alier and Schlüpman, 1991).

In fact, many authors have considered that, on a global level, mining has influenced economic growth and development, particularly since industrialisation (for example, Deane, 1965, Braudel, 1973, Wright, 1990, Escudero, 1998, or, more recently, Pérez de Perceval, López-Morell and Sánchez Rodríguez, 2006; Allen, 2009 or van der Ploeg, 2011). Others, on the other hand, claim that the role of the mining products has not been so important and that other factors have been more decisive (Mokyr, 1976, 2009; McCloskey, 2010). The contribution of the sector to the development of the areas in which it is carried out has been the object of a long academic discussion. On the one hand, having natural resources that are essential for the production of consumer goods and capital broadens the possibilities of increasing well-being in the short term, and on the other hand,

their role as inputs of technological development would contribute to the increase in productivity and well-being in the long term (Chandler, 1972. More recently, Keay, 2007; Allcott and Keniston, 2014 or Fernihough and O'Rourke, 2021). Furthermore, the mining activity would increase wages in the area, it would generate employment, attract workers and knowledge and increase the demand for goods and services (Black, McKinnish, and Sanders, 2005). Finally, the mining growth in an area would contribute to the attraction of investments and the implementation of infrastructures, the diffusion of technology and forms of organisation and production, increasing inter-industrial productivity and boosting the effects of agglomeration (Michaels, 2011).

On the other hand, a region focused on the exploitation of its natural mining resources could prevent the development of other sectors in the short term and slow their growth in the long term (Muñoz Roldán, Roldán López, and Serrano Martínez-Estélez, 1976; Sachs and Warner, 2001; Glaeser, Kerr and Kerr, 2015). Furthermore, the high costs of the factors of production absorbed by mining, expelled entrepreneurs and the high prices could have affected the well-being of the local population. Many authors have even talked about the existence of a "natural resource curse" (Prebisch 1950; Amin 1974; Ducoing and Perez Cajias 2021).

Some authors indicate the relevance of the role of the institutions in terms of ordering and planning mining. This was fundamental so that society could take advantage of the availability of mining products in its territory in order to develop in the short and long term (Mehlum, Moene and Torvik, 2006). Also decisive were the technologies used in the activity and also the use of the income generated by them.

The relationship between the availability of natural resources and, specifically, mining resources, in the location of industries has given rise to another major debate in economic history. Some specialists in industrialisation affirm that as it depended on mining resources such as coal or iron, it was developed in or close to the basins of these products and that it faced more problems to consolidate in those places where these resources did not exist (Wrigley, 1961; Pollard, 1981; Bardini, 1997; Crafts and Mulatu, 2006; Crafts and Wolf, 2014). Other authors consider that the location of the industries did not depend on the existence of these natural and mining resources (Mokyr, 1976, 1983; Wolf, 2007; Clark and Jacks, 2007; Klein and Crafts, 2012), or only at certain moments (Martínez-Garralaga, 2012). For example, Matheis (2016) affirms that the increase in coal production contributed to the economic growth of the United States in the short term but not in the long term.

Several determining and conditioning factors affected the mining activity. The fact that it was a non-renewable natural resource means that the first factor was the existence of the mineral, its amount (and quality) and the exhaustion rate. The behaviour of the demand and the economy in general have influenced, and still do, the greater or lesser activity in the sector (Lynch, 2002). Until the eighteenth century, the mining activity was conditioned by the availability of energy sources for extracting the product, principally wood, used as a fuel and for constructing

³ States of the question regarding the environmental and social effects of metallic and non-metallic mining in González de Molina and Martínez Alier (1993), Pérez-Cebada, 2014, Aznar-Sánchez, García-Gómez, Velasco-Muñoz and Carretero-Gómez (2018) and in Aznar-Sánchez, Velasco-Muñoz, García-Gómez and López-Serrano (2018).

the structures; water, which moved the machinery and, particularly, animal power and the people who worked in the basins (Wrigley, 1988, 2010). Only when an area could concentrate a sufficient amount of these energy sources to exploit ore mineral deposits on a certain scale did a stable mining region emerge. Evidently, technology also played a highly significant role in the sector, as it defined the feasibility or not of the mine and the extent of the applications of the product and its derivatives. Finally, the capacity to finance the mining projects has traditionally been another determining factor of mining.

Due to their use in precious metalwork and their function as money, gold and silver were widely mined. However, owing to their many applications and alloying possibilities, copper, tin, lead, mercury or iron were the most mined minerals in antiquity (Vázquez de Prada, 1988). Different societies displayed the capacity to mobilise traditional energies in deposits of economic interest, which were mined for centuries (Uadi Hammamat, valle de Timna, Uadi Sikait, Laurion, Rio Tinto, Almadén, Las Médulas, Três Minas, Charterhouse, Mendip, etc.). During the Middle Ages, large mining areas on a global scale exploited in Central Europe (Silesia, Harz, Bohemia, etc.), Serbia, Bosnia, Sweden and Great Britain and, in the Modern Age, in Potosí (among other places in which the European empires constituted colonies). The major change in the sector, as is well known, came about with industrialisation, which led to the shift from an economy based on organic energy to one based on inorganic energy (Landes, 2003; Cipolla, 2020). The application of steam generated energy to mining activities in the draining of the galleries and the transport of the mineral meant the end of the energy strangulation which was characteristic of the previous phase. This, in turn, enabled productivity to be increased, new deposits to be exploited and those already existing to be deepened, and, of course, global production was increased to respond to the rise in demand for minerals that had been generated by the Industrial Revolution. Subsequently, electricity added a twist in this process (McNeill, 2000).

In the new capitalist-industrial model, the core of the global economic system was found in north-west Europe and in the United States. While these countries produced goods for the global market, first, peripheral Europe and then the rest of the world, supplied raw materials to this industrial core (Badía-Miró, Pinilla and Willebald, 2015). In this system, mining products constituted a fundamental element and are, perhaps, the best example of economic border evolution, whereby the mining of these natural resources was carried out increasingly further away from the core and in the successive places of extraction the production, labour and environmental practices used in the preceding mines were replicated (Nadal, 1975; Sánchez Picón, 2001, Martínez-Soto, Pérez de Perceval and Martínez Rodríguez, 2022). Often, the need of the new regions to develop, together with the lower level of control of the authorities over the methods used in them meant that they went to further extremes (Bridge, 2004).

Mining and its environmental and social effects

Throughout the history of pre-industrial mining, energy strangulation determined the evolution of the sector. Therefore, the deposits were mined or not depending on the availability of elements such as wood or water. Accordingly, when the forests surrounding the mines disappeared, the mining activity was usually paralysed. However, the impact on the environment was not a factor that was taken into account if production was not threatened and much less so the social or cultural consequences (Hays, 1959). Many miners of the pre-industrial era were subjected to slavery or semi-slavery and others were convicts (Pérez Sáenz de Urturi, 1985; González Román and Rodríguez Neila, 2000). Those who were workers suffered very harsh working conditions and were only partially compensated by the wages they received (Sánchez Picón, and Pérez de Perceval, 1999; Arenas Posadas, 2006; Escudero, and Pérez Castroviejo, 2010; Pérez de Perceval, Martínez Soto, and Sánchez Picón, 2013; Martínez Soto, Pérez de Perceval and Martínez Pérez, 2017; Pérez de Perceval, Martínez-Soto, García-Gómez, 2020). The communities of the hinterlands of the basins usually lost many of their customs and traditions and incorporated others, which were blended with those that were maintained, so that the original culture became modified (Shifflett, 1991; Escudero, and Barciela, 2012; Escudero, García Gómez and Pérez Castroviejo, 2016). Of course, deforestation advanced with no control around the mining areas, the rivers were polluted by the sub-products that were generated, the miners suffered from deplorable working conditions and the population was overcrowded in the mining towns and villages with no action taken by the public sector to resolve the health problems that arose. These are just a few examples of the environmental, labour and health effects of the mining activity.

There are many indications of the existence of environmental and social problems in mining in ancient times (Hughes, 1975, 2004; Jones, 1980; Vaquerizo, 1994; Ortiz Mateo, 2004; Cano Sanchiz, 2009; Preunkert et al. 2019). However, it was not until the eighteenth century that we have documentary evidence of the existence of a major social reaction to these problems (Clapp, 1994; Newell, 1997; Reynard, 2002; Pérez-Cebada, 2006, 2014; Martínez Alier, 2007; Chastagnaret, 2017).

In this respect, the negative consequence of economic development during industrialisation have been, and continue to be, very well studied in industrial cities, but not so much in mining areas. For the former, there is a certain level of consensus in that industrialisation was positive in the long term, as the population residing in them improved their income and standard of living, while, in the short term, there were problems related to a worsening of well-being due not so much to the chrematistic elements of the standard of living but to non-monetary aspects. The development of industry and the associated urban growth gave rise to a phenomenon known as the "urban penalty", which refers to the worse evolution experienced by the standard of living of the population of the cities compared to that of

the rural areas (Escudero and Nicolau, 2014). This term was used first by Kearns (1988) to refer to the greater mortality rate in the cities with respect to the countryside during industrialisation.

The mining areas must have doubly suffered the problems of industrialisation. First, they had very high population growth rates in very short spaces of time, which exposed them to the pernicious effects of a chaotic and anarchic urbanisation and, therefore, to the majority of the difficulties of industrial cities. Second, they suffered from environmental, labour, social and health problems generated by the mining-metallurgical production which were more intense than those of urban industries (Clements, 2003; Navarro Ortiz, Martínez Soto and Pérez de Perceval, 2004; Martínez Soto and Pérez de Perceval, 2010; Escudero, García-Gómez, Martínez-Soto, 2019).

The impact of mining on the areas in which the activity was developed, increasingly further away from the economic core, had two main phases during the period of industrialisation, which coincided with the two phases in which the Industrial Revolution is usually divided (Pérez-Cebada, 2014). Therefore, in the first, it was Great Britain and the so-called first comers who would have experienced the problems of the development of mining. In fact, the incipient industries and the growing cities of Great Britain, first, and then France, Belgium or the Netherlands, required products such as coal, iron, copper, lead, sulphur, zinc and others, which were supplied from existing basins in these countries or in others nearby. Therefore, from the end of the eighteenth century and, particularly during the nineteenth century, social and environmental problems arose in places such as the Swansea Valley, Lancashire, the Ruhr, British Colombia or the Rhône valley (Clapp, 1994; Brugge-meier, 1994; LeCain, 2009; Evans and Miskell, 2020). Given the non-renewable nature of the natural resource, the ores were exhausted in these countries or became technically non-viable or unprofitable, which led the mines to move "concentrically" away from the industrial core (Chastagnaret, 1999). In these countries, more economically backward, mining exercised a fundamental role, as it attracted the currencies necessary for acquiring products from the leading countries and, in turn, the technology with which to become industrialised. However, the problems that had arisen in the pioneer countries of industrialisation began to be replicated, often aggravated by the slowness and laxity with which labour and environmental legislation was passed and applied (Silva, 2013; Pérez-Cebada and Guimaraes, 2017). The second phase would have taken place during the second industrialisation and the economic globalisation occurred from circa 1870. In this process, industrialisation spread across Europe and North America and countries such as the United States, Germany or Japan gained positions in the world economic ranking, while the "economic periphery" supplied agricultural products, raw materials and natural raw resources, often with unfavourable real terms of trade (Clark, O'Rourke and Taylor, 2008; Williamson, 2012). The revolution of transports and the technological, organisational, financial and institutional developments taking place from then enabled the mining activity to move even further away from north-west Europe in order to continue satisfying a growing demand

and overcome the exhaustion of the deposits, avoid the technical and/or economic viability problems of the European and North American mines, reduce costs and, also, circumvent the regulations approved in the industrial countries (Harvey, 1981; Dobado, Gómez Galvarriato and Márquez, 2007; Broder, Pérez de Perceval, Sánchez Rodríguez, and Marchán Sanz, 2015). Therefore, during the first globalisation of capitalism, deposits were mined in all of the continents, including Europe, through companies which were often European or North American and "exported" to the new mineral producing countries their ways of organisation, production, technology and, of course, the environmental, labour and social problems (Smith, 1993; Lawrence and Davies, 2014; García-Gómez, and Pérez-Cebada, 2020). The rising demand required mining and its productivity to be increased and this, therefore, required an increase in the exploitation of economies of scale, which, in turn, necessitated technological and production improvements (Derry and Williams, 1986; Mokyr, 1993; Davey, 1996; Bruland, 2004). A growing production and the introduction of new methods and techniques, which were often more harmful than those of previous phases, brought with them a greater amount and increased the scale in the problems faced by places where the environment and the population were less protected (Caudill, 1962. More recently, Green, 2012; Pérez-Cebada, 2014; Hanlon, 2019).

In short, the analysis of the contribution of mining to economic development should take many elements into account. The theories of endogenous development indicate that the growth in mining favoured innovation and business investment, capital accumulation, technological development and the construction of infrastructures, with many externalities and boosted the improvement in human capital (for example, due to the learning related to the use of imported technologies or learning by doing) (Romer, 1986; Lucas, 1988). Other economists (North, 1955) consider that, for the developing regions, the extraction and export of mining products could be a lever for growth, although this would require favourable conditions in order for them to diversify their exports, and this depends on the availability of natural resources of the region (at a given level of technology), the nature of the exporting industry and the changes taking place in technology and on transport costs. Furthermore, the use of the revenue received by the exporting industry, conditioned by the type of mineral and the distribution of the income, also plays a decisive role in the potential growth.

However, other authors consider that the concentration of resources in the production and export of minerals means a transfer to the outside of the multiplying effects of the investment, which leads to the retention of a low added value, the export of profits, the deterioration in exchange relationships, etc. (Emmanuel, 1972). The economy of the mining region would have a large opportunity cost because mining would absorb resources that could have been used in other sectors which would have slowed their development. Furthermore, the producing area would experience inflation and, to a large extent, the qualitative standard of living of the population residing in it would be affected. In the Spanish case, this debate has been known as that of the optimists and pessimists in relation to the

mining boom experienced by the country from the second half of the nineteenth century to the First World War (Escudero, 1996). However, in the majority of these studies the environmental and social issues are not contemplated.

New contributions to global mining history: the social effects of mining

This special issue of the journal *Áreas* seeks to examine in depth the consequences that the mining activity has had on a social, labour, economic, political and, of course, environmental and health level throughout history. The objective is to contribute to the literature with different studies that address this issue for the south of Europe during the nineteenth century and the first half of the twentieth century.

In line with these premises, the first study, signed by professors Aron Cohen and Agustín Fleta and titled "Work and illness: a disputed relationship (20th-century Spain)", analyses a large number of sentences of the Employment Division of the Supreme Court and the extinct Central Labour Tribunal to study the risks to the health and life of the miners during the twentieth century in Spain, and how the justice system applied the legislation at each moment. In the second article, Professor Jesús M^a Martínez Milán examines the evolution of phosphate mining in the province of Cáceres (Spain), focusing on the characteristics and unique features of the companies that exploited these deposits and the relationships between them and the workers of the sector. In the third study of the monograph, Professor Francesca Sanna presents the production and organisation methods of the company Peñarroya in the Italian mines of Pertusola. The article shows how the company redirected its labour strategy to develop methods, practices and techniques that also ended up integrating the health of its workers. The fourth article, written by Paulo E. Guimarães, explains how the Portuguese miners and mining communities in which they lived and worked modified the perception that they had of professional diseases and occupational accidents. This change also brought about an evolution in the institutions that protected the workers from these risks. Leda Papastefanaki studies the institutional framework of Greek mining in the second half of the nineteenth century and the first half of the twentieth century, focusing on aspects related to health and occupational risks. It also examines the medical treatment in Greece of specific lead mining diseases. We can highlight the texts used in this article, particularly the report of Georgios Papadopoulos, written in 1935, which describes the effects of lead pollution from the mining and metallurgic industries of Lavrion. It finishes with a review of the trajectory of the companies and the Government in recognising the diseases caused by lead. The special issue ends with the study

by Adolfo Turbanti, which presents the health and occupational accident problems existing in the mines that were operated by Montecatini in Ribolla (Italy) in the first half of the twentieth century, and how events such as the disaster of 1954, in which 43 workers died, generated a major debate on working conditions. The article studies the role played by the company, the government, the workers unions and how they reacted to the event and the problems that became subject to Italian public opinion and how the resulting debate drove a major change in labour relations in the sector and in Italy's industrial policy.

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