

FROM FAILURE TO ACHIEVEMENT: THE RELATIONSHIP BETWEEN THE PORTUGUESE GEOLOGICAL SURVEY AND THE MINING SECTOR, IN THE 20TH CENTURY

Teresa Salomé Mota

Inter-university Centre of History of Science and Technology; Museum of Science of the University of Lisbon,
Rua da Escola Politécnica 56, 1250-102 Lisboa, Portugal.
salome.teresa@gmail.com

Abstract. In the early 20th century, the Portuguese mining sector faced a difficult situation, which the State tried to overcome through regulations. The context seemed encouraging to the development of geological studies and it was expected that the State would support the Portuguese Geological Survey (PGS). Nonetheless, that did not happen. The limited resources ascribed to the PGS in the years bridging the two world wars show that the Portuguese State was quite unaware of the role of a Geological Survey, and it was only in the 1940's that the situation began to change. After the Second World War, the pace of the country's economic growth brought about optimal conditions for the development of the mining sector, a source for many of the raw materials used in industry. Geological maps were crucial for the survey of mineral resources and as a consequence the PGS could now count on enlarged resources intended for their production and publication. The continuing difficult situation faced by the institution changed because geological mapping became considered as a key instrument in the development of the mining sector. Therefore, the change took place regardless of the significance of the PGS as a scientific institution; for the Portuguese State it was only the 'useful' aspects of geology that really mattered.

1. INTRODUCTION

In the early 20th century, the mining sector was a source of concern for the Portuguese State. One of the main features of the underdevelopment of Portuguese economy was a large primary sector and negligible industrialisation. Mining, in particular, was rudimentary despite a period of greater activity, during the Regeneration (*Regeneração*) (c. 1851-1868) (note: The *Regeneração* was a period during the 19th century that enabled the rise of embryonic capitalism in Portugal, based on a set of policies focused on the development of public works).

The most important mining concessions were in foreign hands; those owned by Portuguese companies were but a few exceptions (note: It is the case, for example, of the São Domingos mining (pyrite, copper and zinc) and the São Pedro da Cova coal mining). The majority of mining concessions was small and scattered all over the country and their activity was irregular or even non-existent. In the few mines actually working, their owners did not resort to geological data or specialised personnel. National entrepreneurs did not invest in the mining sector because large sums were needed and financial risk was too high. This state of affairs did not grant any efficient and proper exploitation of mineral resources, and therefore the significance of the mining

sector and related activities in Portugal's economy was negligible (Medeiros, 1978; Cabral, 1979; Direcção Geral de Geologia e Minas, 1990; Guimarães, 1995).

The succeeding regimes in Portugal between the two world wars – the First Republic, followed by a military dictatorship, and finally the *Estado Novo* (note: The *Estado Novo* was a dictatorship led by António de Oliveira Salazar, formally established in 1930 and over by 1974) – took some legislative measures in order to reverse – or at least, improve – the situation, but these measures were not always successful. Some of them assigned a role to the Portuguese Geological Survey (PGS) (*Serviços Geológicos de Portugal*) in the resolution of some of the problems faced by the mining sector.

2. THE PORTUGUESE MINING SECTOR IN THE YEARS BETWEEN THE TWO WORLD WARS

2.1 Mining legislation

The First Republic (note: The First Republic was established in Portugal in 1910, after the fall of Monarchy. It ended abruptly in 1926 with a military *coup d'état*) tried to solve the problem of Portuguese mining chiefly by introducing a considerable amount of legislation (Note: not all legislation introduced will be considered in this article. Only the legal measures which issued guiding lines for the mining sector together with those in which the role of the Portuguese Geological Survey is considered relevant will be taken into account.). Particularly significant is Act 4 641, issued in 1918, which created the General Directorate of Mines and Geological Survey (GDMGS) (*Direcção Geral de Minas e Serviços Geológicos*), of which the PGS was a part. This Act emphasised the need of the PGS for a better organisation, an indispensable precondition to the development of the mining sector: 'geological surveys and mines have an intimate relationship, as it is recognised in countries where geological science and mining are more advanced' (Act 4 641, 14 of July 1918). As a result, the PGS would be in charge of the 'preparation of geological maps' and the survey of mineral resources (Act 4 641, 14 of July 1918).

In 1926, a *coup d'état* replaced the First Republic for a military dictatorship but the way the latter dealt with the issues in the mining sector did not differ much from their predecessors. New legislation was introduced, that related to fossil fuels being particularly relevant: Portugal depended heavily on foreign energetic resources and this was one of the most troubling aspects of the country's economy (Vianna, 1928; Guimarães, 1995).

A Commission for the Use of Domestic Coal (CUDC) (*Comissão de Aproveitamento dos Carvões Nacionais*) was created with the aim of studying domestic fossil fuels, coal in particular. The CUDC operated in close relation with the GDMGS, especially with the PGS, which carried out geological studies and geological mapping of fossil fuels outcrops. The legislation also established a minimum mandatory annual production of fossil fuels. If concession owners had no financial capability to comply with such resolution, they could expect some help from the State such as government-subsidized loans (Act 11 852, 6 July 1926).

When the *Estado Novo* was established in 1930, it dealt with the problematic situation of the mining sector in a less traditional way: fewer laws were issued, but they were more efficient.

In August 1930, Act 18 713, which regulated mining was published. It established the State as the sole owner of all mineral deposits in the Portuguese territory, but they could be exploited by private mining companies (Decree 18 713, 1 August 1930). In other words, private entrepreneurship was now put in charge of the development of the mining sector, but under the control of the Portuguese State.

In 1933, the CNAC was replaced by a new institution, the Portuguese Institute for Fuels (PIF) (*Instituto Português de Combustíveis*), whose mission was investigating the availability of all kinds of fossil fuels, and

the gathering of a multitude of scattered institutions associated with their research and use (Act 22 788, 29 July 1933). It was expected that PIF might take the right measures in order to attract private entrepreneurship, improve mining management, and develop connections between mining and other economic sectors such as electricity and metallurgy (Act 22 788, 29 of July 1933). As its predecessor, PIF continued to work in tight association with the PGS, especially in geological surveying and prospecting of coal deposits (Ministry of Trade and Industry, 1936).

All these circumstances seemed favourable to the success of geological research, which was now oriented to the mining sector. In this context, it was expected that the Portuguese State would support its Geological Survey, as it was common in other countries (Wilson, 1985; Rabbitt, 1989; Vodden, 1992), but despite all good intentions expressed in the legislation issued between the two world wars, the PGS had never faced such difficult times.

2.2 The situation of the PGS and its relationship with the mining sector

Act 4 641 placed the PGS in a situation of almost complete dependence on the GDMGS. Most of its technical staff had to be civil servants belonging to the corps of engineers and mining technicians, but many of them were not fully prepared to carry out the majority of geological tasks, fieldwork and geological mapping, in particular. As the PGS' staff was much limited, it was unable to accomplish all required tasks (Mota, 2007a,b; Carneiro and Mota, 2007).

The PGS was also financially dependent on the GDMGS, and was ascribed a meagre annual budget. It struggled with severe financial difficulties and even current expenses such as the acquisition of scientific books or topographic maps, had to be authorized by the GDMGS (Mota, 2007a,b; Carneiro and Mota, 2007).

The PGS staff spent most of its time doing administrative and bureaucratic tasks as it had to respond to countless requests from various public and private institutions; consequently, there was not much time left to carry out their primary task, geological surveying and scientific research. The institution's autonomy was so restricted that it did not allow for the establishment of a plan with clearly defined aims and working priorities, by articulating the normal tasks of a civil service with the production of scientific work (Mota, 2007a,b; Carneiro and Mota, 2007).

The difficult situation of the PGS was greatly due to the State's inability to fully understand the role that this institution could play in surveying and prospecting mineral resources. The measures concerning the geological study of the Portuguese territory present in mining legislation seem to be no more than good intentions or even mere rhetoric. The laws passed determined that geological mapping had to be carried out, but no specific information about the scales of the maps and deadlines were given, and nobody seemed to know how the expenses involved would be paid. There was not a clear, detailed, and precise policy concerning the geological survey of the country and its mineral resources. The relationship between the PGS and the mining sector can be summed up to a few timely tasks requested by the GDMGS. The PGS had no conditions to perform any particular role in the resolution of the difficult situation the mining sector was facing.

In the years bridging the two world wars, geology and the PGS seemed to be almost irrelevant to the Portuguese State but those were also the years when Portugal was striving with serious political, social and financial problems, and with three different political regimes coming one after another. In a time of crisis, the importance of geology and of the PGS was certainly a minor problem among those faced by the successive political leaders.

3. THE PORTUGUESE MINING SECTOR IN THE DECADES AFTER THE SECOND WORLD WAR

3.1 A harbinger of change

Up to the 1930's, the Portuguese mining sector did not show any significant improvements (Nogueira, 1941). During this decade an industrialist movement led mainly by engineers began making its voice heard by the *Estado Novo*. They were well aware of national backwardness and considered the weak industrialisation one of the main reasons underlying the nation's economic and social underdevelopment. Science and technology were considered fundamental to reverse the situation, and consequently should be promoted by the State. Among other measures, the industrialists advocated the development of some mineral industries (copper, tin, and wolfram), the nationalisation of mineral resources, the establishment of iron smelting, and the reduction on the price of energy (Rosas, 1986; Brito, 1988; Diogo, 1994).

Most of these measures were not major priorities for Salazar, the dictator who ruled Portugal with a firm hand. Despite the limitations imposed by Salazar's political and economic policies, by the end of the 1930s the regime became interested in the development of industry and the knowledge of Portuguese mineral wealth was considered highly relevant. New legislation intended to improve the mining sector was introduced in 1939; Act 29 725 created the Service for Mining Improvement (SMI) (*Serviço de Fomento Mineiro*) in the context of the GDMGS. The SMI aimed to survey and prospect mineral resources existing in the Portuguese mainland (Act 29 725, 28 of June 1939), and was the culmination of all the measures advocated by the industrialist movement for the mining sector (Mota, 2009).

The GDMGS then outlined a plan for the country's mining survey. The plan stipulated that it was of primary importance to identify gold and iron deposits: the first because its price was less susceptible to market ups and downs, and the second because of its importance in the context of the iron smelting industry that would be established in Portugal. In order to enable the SMI to carry out its tasks, the PGS would have to proceed with the geological survey of the Portuguese mainland and the publication of geological maps was considered a priority (Castro e Solla, 1942/1943).

After the establishment of the SMI and all through the 1940's and the 1950's, several representatives of the Portuguese National Assembly began questioning the lack of attention given to the PGS (Note: during the *Estado Novo*, representatives of the political power were distributed between the Chamber of Corporations and the National Assembly. The latter had legislative purposes and intended to supervise the government and public administration. However, the National Assembly lost its significance at the same time as Salazar's regime became more and more imposing). They criticized the scarce funds allocated to the institution and its subsequent incapacity to accomplish the tasks required, in particular geological mapping, and urged the need to intensify the pace of production and publication of geological maps, which began to be considered chief instruments in the development of the mining sector and, therefore, the country's economy (Diário das Sessões da Assembleia Nacional, 1940–1962).

This shows that something was beginning to change in the way the political power perceived the PGS, geology and, particularly, geological mapping. Their role in the knowledge of the country's mineral wealth, and consequently in its industrial and economic growth, was now being taken into account. It is not a mere coincidence that this change happened as the Portuguese geological community was coming to life and asserting itself (Mota, 2009). This was, however, only a harbinger of change; it was still too incipient to have any significant consequences. In the GDMGS, geological surveying and mapping remained the outcome of a conjunction of circumstances rather than a result of any strategic planning regarding the role of geology in surveying and prospecting mineral resources.

However, the difficult situation the PGS was living for a long time did not change. Although the geological survey of Portuguese mainland and the publication of geological maps had been reinforced, the same happened with the problems and needs of the institution: lack of space in deteriorated facilities, low budgeting, and increasing bureaucracy. The PGS remained underfunded and understaffed and, subsequently, unable to fulfil its renewed functions. Just the opposite of what happened with the SMI, which was endowed with substantial financial and human resources. Most certainly, geology and the PGS were still not considered essential in the context of mining activity (Mota, 2007b; Carneiro and Mota, 2007).

3.2 The golden years

During the Second World War, the process of industrialisation occurring in Portugal slowed down but, as soon as the conflict ended, the industrialists sounded voices once again. A new and strong wave of industrialisation took place, mostly by State initiative, and guided by political and economic measures envisioned in three successive Improvement Plans (*Planos de Fomento*), and carried out between the 1950's and the 1970's (Lima, 1987; Brito, 1989; Rosas, 1990).

During these decades, Portugal underwent deep social and economic change. In the 1970's, the pace of economic growth was the greatest ever and this context was favourable to the development of the mining sector. Mineral resources found and exploited were quite substantial and used in several industrial activities—concrete, glass, pottery—which significantly contributed to the Gross Domestic Product. The exploitation of building stones, clay, and sand, until then not so common, also broadened new economic opportunities in national and international markets.

The development of the mining sector occurred in the same legal context as before. The mining Act of 1930 and the one that created the SMI, in 1939, were still the main documents orienting this industry (Carneiro, 1959; Carneiro, 1971). But, what actually set the difference were the measures anticipated in the Improvement Plans. Surely, they pressed the need to proceed with the survey of the Portuguese territory and hastened the publication of geological maps but now an appropriate plan was defined and suitable financial means were located and the measures properly implemented (*Planos de Fomento*, 1953-1973).

The implementation of these Improvement Plans proved critical to the PGS as an institution; they caused a significant change in the adverse conditions the institution faced. The PGS was then endowed with significant amounts of money, especially for making of the Geological Map of Portugal (*Carta Geológica de Portugal*) in the scale 1:50, 000, which is then considered a 'key element to the survey and research of mineral resources' (*Planos de Fomento*, 1953-1973). The PGS was able to contract more technical personnel, especially geologists and field assistants. In 1919, there was not a single geologist among the PGS technical staff; in 1940, there was one; in 1974, there were 13 geologists and 10 field assistants. More money and a larger staff meant more fieldwork and a faster pace in the production of geological mapping, in particular maps in the scale 1:50, 000, the most significant taking into consideration the purposes of the Portuguese State. Making and publishing geological maps were then the institution's main aims (Mota, 2007). These new circumstances enabled the PGS to proceed with a consistent plan of geological research. For the first time in a long time, the PGS reasserted itself as a true scientific institution (Mota, 2007).

4. CONCLUSIONS

Contrary to what has been upheld by some authors, the close relationship between the PGS and the Portugue-

se State's mining interests was not the major factor in the institution's poor scientific achievements during the first decades of the 20th century (Teixeira, 1941/1942; Almeida and Carvalhosa, 1974; Neiva, 1998). Even if the overwhelming dependence of the PGS on the GDMGS was the main reason behind many of its problems, it was the importance given to mining issues by the Portuguese State that, in the end, offered the PGS the opportunity, and the means, to overcome its difficult situation and become more than a simple public service.

Geological mapping played a decisive role in this process, as it came to be perceived by the Portuguese State as a crucial instrument in the expansion of some industrial and economic sectors. The GDMGS also acknowledged the importance that geological mapping played in its main task: the survey and exploitation of mineral resources. Geological maps became a kind of 'interface' in which the interests of the Portuguese State, the GDMGS, and the PGS coexisted and were reconciled.

However, it is important to emphasise that the overturn in the PGS situation is not a consequence of the acknowledgment of its intrinsic significance as a scientific institution. It was either a 'collateral effect' of the *Estado Novo's* commitment to industrialisation and of the primacy given to geological mapping in the development of the mining sector. The Improvement Plans clearly stated that the budget ascribed to the PGS should be spent in 'geological applied research', in particular in geological mapping, in order to improve the mining sector. Only the 'applied' or 'useful' features of geology were really important in the acknowledgment of the PGS and this also explains its persistent secondary position in the context of the GDMGS. Even so, the PGS was able to take advantage from the positive circumstances existing in Portugal after the Second World War and hence defend its own interests as a scientific institution.

ACKNOWLEDGEMENTS

The author is grateful to Teresa Lopes for her help in the translation of this paper. The research underlying this paper was carried out in the context of the project 'Das Comissões Geológicas aos Serviços Geológicos (1848-1970): História e Herança Científica', PTDC/HCT/65345/2006, funded by Fundação para a Ciência e a Tecnologia, Portugal, (2007-2011).

REFERENCES

- Almeida, F.M. and Carvalhosa, A.B. 1974. Breve história dos Serviços Geológicos em Portugal. *Comunicações dos Serviços Geológicos de Portugal*, 63, 239-265.
- Brito, J. M. B. 1988. Os Engenheiros e o pensamento económico do Estado Novo. In: Cardoso, J.L. 1988. *Contribuições para a história do pensamento económico em Portugal*. Dom Quixote, Lisboa, 209-234.
- Brito, J.M.B. 1989. *A industrialização portuguesa no pós-guerra (1948—1965). O condicionamento industrial*. Dom Quixote, Lisboa, 65-70.
- Cabral, M. V. 1979. *Portugal na alvorada do século XX*. A Regra do Jogo, Lisboa, 37-40.
- Carneiro, A. and Mota, T.S. 2007. The Geological Survey of Portugal (1857-1948), an overview. *Earth Sciences History*, 28, 85-96.
- Carneiro, F.S. 1959. A riqueza da indústria extractiva metropolitana. *Estudos, Notas e Trabalhos*, 13, 65-216.
- Carneiro, F.S. 1971. *Potencialidades minerais da metrópole, base firme de desenvolvimento industrial do país*. Arquivos da

- Direcção Geral de Minas e Serviços Geológicos, Lisboa, 25-27.
- Castro e Solla, L. 1942/1943. Proposta de plano geral de reconhecimento mineiro do país. *Relatórios do Serviço de Fomento Mineiro*, 1, 3-45.
- Decree 4 641, 14 July 1918, 1290-1305.
- Decree 11 852, 6 July 1926, 698-705.
- Decree 18 713, 1 August 1930, 1237-1250.
- Decree 22 788, 29 July 1933, 723-740.
- Decree 29 725, 28 Jun 1939, 452-479.
- Diário das Sessões da Assembleia Nacional, 1942–1962.
- Direcção Geral de Geologia e Minas, 1990. *Estudos Notas e Trabalhos do Serviço de Fomento Mineiro: Tomo comemorativo do 50º aniversário do Serviço de Fomento Mineiro, 1939-1989*. Direcção Geral de Geologia e Minas, Porto, 15-18.
- Guimarães, P.E. 1995. A intervenção do Estado Novo na indústria mineira: a criação do Serviço de Fomento Mineiro. *Boletim de Minas*, 32, 203-212.
- Planos de Fomento, 1953-1974.
- Lima, M. P. 1987. Contribuição para uma história da organização racional do trabalho em Portugal no contexto da economia sob o Estado Novo (1926-1959). In: Pinto, A.C. (ed.), *O Estado Novo - das origens ao fim da autarcia (1926-1959), volume I*. Editorial Fragmentos, Lisboa, 325-336.
- Diogo, M. P. 1994. *A Construção de uma identidade profissional, a Associação dos Engenheiros Civis Portugueses, 1869–1937*. Ph.D. dissertation (not published), New University of Lisbon, Lisbon, 140 pp.
- Medeiros, F. 1978. A sociedade e a economia portuguesas nas origens do salazarismo. *A Regra do Jogo*, Lisboa, 34-50.
- Ministério do Comércio e Indústria 1936. *Arquivos do Instituto Português de Combustíveis*, Lisboa, 5-15.
- Mota, T. S. 2007a. A mere shadow of an institution: the unhappy story of the Portuguese Geological Survey (PGS) in the period between the two world wars. *Annals of Science*, 64, 19-40.
- Mota, T. S. 2007b. *Os Serviços Geológicos entre 1918 e 1974: da quase morte a uma nova vida*. Ph.D. dissertation (not published). New University of Lisbon, Lisbon, 183 pp.
- Mota, T.S. 2009. Os olhos da Geologia, o discurso dos engenheiros e o saber dos geólogos: o início da utilização de métodos geofísicos na prospecção de recursos minerais em Portugal. *Comunicações Geológicas*, 96, 129-142.
- Neiva, J.M.C. 1998. Comissões e Serviços Geológicos e Carta Geológica de Portugal. *Boletim de Minas* 35, 391-399.
- Nogueira, A.M. 1941. Elementos para o estudo da indústria mineira em Portugal nos anos de 1930 a 1939. *Boletim de Minas* 1, 3-93.
- Planos de Fomento, 1953-1973.
- Rabbitt, M.C. 1989. *The United States Geological Survey, 1879-1989*. United States Geological Survey, 5-7.
- Rosas, F. 1986. *O Estado Novo nos anos trinta (1928-1938)*. Imprensa Universitária/Editorial Estampa, Lisboa, 33-60.
- Rosas, F. 1990. *Portugal entre a paz e a guerra, 1939-1945*. Imprensa Universitária/Editorial Estampa, Lisboa, 43-49.
- Teixeira, C. 1941/1942. Introdução. *Boletim da Sociedade Geológica de Portugal*, 1, 3-5.
- Vianna, A. 1928. Problema dos carvões nacionais. *Boletim de Minas*, 1, 6-18.
- Vodden, C. 1992. 150 years in the history of the Geological Survey of Canada. *Episodes*, 15 (2), 101-108.
- Wilson, H.E. 1985. *Down to Earth*. Scottish Academic Press, Edinburgh, 12-15.

