MINERAL RESOURCES OF PORTUGAL

2012

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Text prepared by

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GOVERNO DE PORTUGAL
MINISTÉRIO DA ECONOMIA E DO EMPREGO

Direcção Geral de Energia e Geologia

CONTENTS

PREAMBLE

A complex and diversified geology endows Portugal with a considerable mineral potential, leading to the occurrence of considerable number of ore, industrial and ornamental stone deposits.

Mineral exploitation has a present considerable high level originated from world class deposits, as Neves-Corvo (Cu, Sn) and Panasqueira (W), but also from a lot of some other deposits producing salt, feldspar, kaolin, ball clay and fire clay, ornamental stones and some other mineral substances. Portugal is presently one of the main UE producers of copper, tin and tungsten concentrates and an important world producer of ornamental stones.

Exploration activity is also at a high level considering the relative small extent of the territory (roughly 90 000 Km2). Several international companies conduct exploration mainly focused on base and precious metals.

Portuguese territory covers half of the Iberian Pyrite Belt (IPB) which is considered the main metallogenic province of the European Union, where occurrences of polymetallic massive sulphide deposits like Neves-Corvo and Aljustrel, in Portugal, Rio Tinto, Sotiel, Los Frailes, Las Cruces, etc., in Spain. The IPB is the main primary source of base metals in the EU.

Hesperian granites and associated metamorphics in the north and central part of the country are associated with tungsten and tin mineralisations.

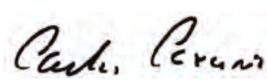
The potential in precious metals is well known since ancient times and is spread out geographically all over the country, occurring in diverse forms and different geological settings (veins, skarns, shear zones, placers, etc.).

The general framework of the activity has favourable characteristics, which is considered one of the reasons, linked with the recognised mineral potential, of the present level of activity. Institutional stability, mineral rights granting mineral property, good infrastructure, incentives to investment, affordable qualified work for European standards, a light fiscal burden are several others reasons why activity is so interesting.

This publication lies in the framework of the public mission of the Direcção-Geral de Energia e Geologia of promoting corporate investment, both national and foreign, which may be complemented to all those interested with the provision of all the basic information about geology, hydrogeology, geophysics, geochemistry and drilling data in archive or assistance in defining exploration targets and strategies.

You are welcome!

Carlos A. A. Caxaria



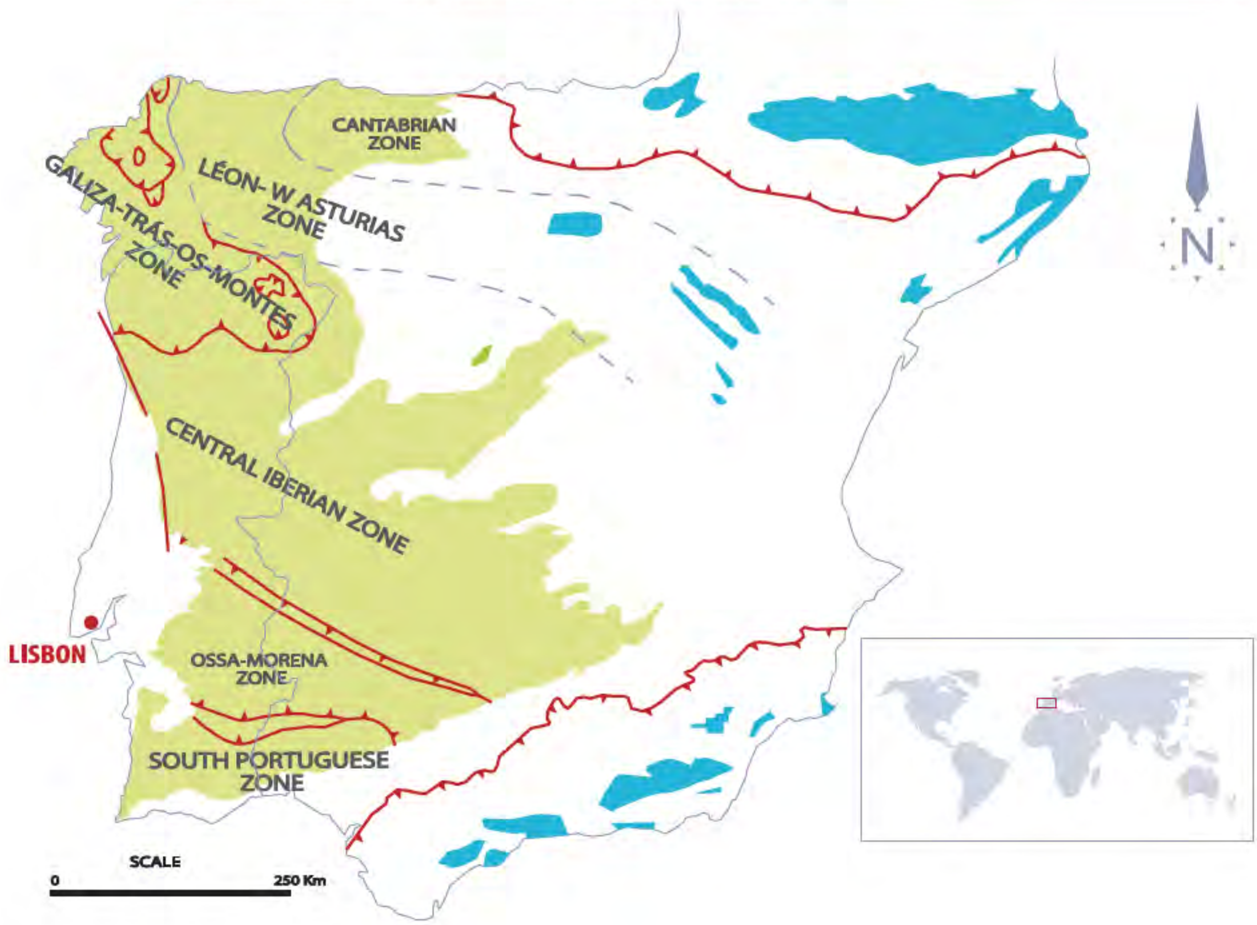
Deputy General Director
Area of Geological Resources

GEOLOGICAL AND MINING BACKGROUND

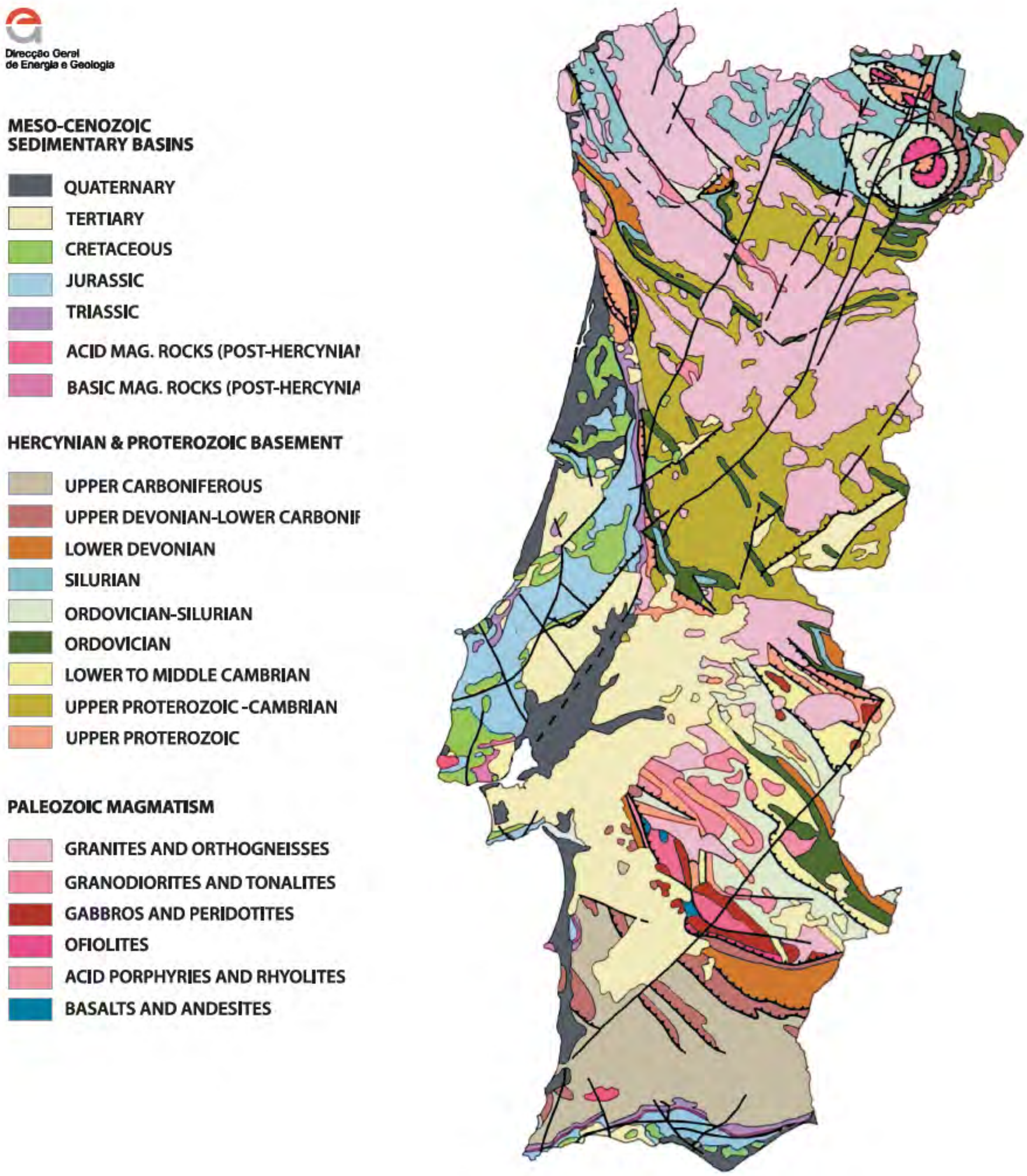
From a geological viewpoint, Portugal is a considerably diverse and complex country, these characteristics providing it with important potential in various mineral resources.

The territory can be subdivided, in geological terms, into 2 large groups: the Hesperian Massif and the Epi-Hercynian Covering, the latter including the western and southern Meso-Cenozoic borders, and also the basins of the Tagus and Sado rivers.

GEOTECTONIC UNITS (ADAPTED FROM QUESADA, 1992)



GEOLOGICAL MAP OF PORTUGAL (LNEG)



The Hesperian Massif, in which predominantly metallic mineral resources occur, can in turn be divided into various geotectonic units, as described below (Ribeiro et al., 1979; Quesada, 1992):

Galicia - Trás-os-Montes Zone - This is characterised mainly by the existence of two mafic and ultramafic polymetamorphic massifs known as Bragança and Morais. The surrounding formations date chiefly from the Silurian period and are characterised by the existence of acid and basic volcanic rock, which make contact with the massifs via larger thrust systems. Binary granite, "alkali" and porphyritic granite, biotite and "calcalkali" granite also occur. The chrome, platinum and, possibly, copper, nickel and cobalt potential of the Morais and Bragança massifs is worth stressing, as is the potential for tungsten, tin, precious metals, uranium and, probably, polymetallic sulphides in the surrounding formations (Goínhas et al., 1992).

Central Iberian Zone - This is mainly characterised by the predominance of the formations of the so-called Schist-Greywacke Complex, consisting of a flysch-type series dating from the Cambrian and Late Precambrian period. There are also large areas of "alkali" and "calcalkali" granitoids, in which various types of granite can be distinguished. Worth highlighting is the occurrence, in the Douro-Beiras sector, of continental formations from the Carboniferous period, where various coal mines have been exploited (Douro Carboniferous Belt).

Also worth mentioning in this geotectonic unit are important mineralisations of tungsten and tin, normally associated with the contact between the granite and the metasediments, and the existence of precious metals, frequently associated with arsenic and antimony, as in the Valongo/Gondomar Gold-Antimony Belt, for example. There are also important mineralisations of uranium, many of which have been exploited, related with late tectonic and metallogenetic phenomena that have affected the post-tectonic "calcalkali" granite.

Ossa - Morena Zone - This is an extremely complex and diverse unit which begins with a polymetamorphic Precambrian, followed by Cambrian and Silurian formations, and ends with a flysch sequence from the Late Devonian period.

Contact with the Central Iberian Zone is carried out via an important shear zone which stretches from Oporto to Cordoba in Spain (Blastomylonitic Belt).

With regard to magmatism, the NE sector has a predominance of granitic rocks, chiefly "calcalkali", porphyritic, biotitic, similar to those in the north and centre.

To the south, the basic character of the intrusions gradually increases, with "calcalkali" becoming predominant: gabbros, diorites, serpentinites and anorthosites (which form the recently named Beja ophiolite complex), various different porphyries, and later intrusions comprising gabbrodiorites, granodiorites, tonalites and granites (which constitute what is known as the Évora Massif).

The most important mineral occurrences are base metals, which are associated with the Cambrian-Ordovician volcanic sedimentary complex, precious metals, chiefly related with the Precambrian formations, and tungsten and tin in the Sta. Eulália granitic complex, not to mention the potential for chrome, nickel, cobalt and platinum in the basic and ultrabasic rocks on the north and south margins of this zone.

With regard to non-metallic minerals, this geotectonic unit is rich in ornamental rocks, particularly marble.

South Portuguese Zone - The Ossa - Morena Zone and this unit are joined by the Ferreira - Ficalho thrust (partially over the Beja-Acebuches complex), which runs approximately E-W to the east and NW-SE to the west.

The South - Portuguese Zone is characterised by the existence of a volcanic sedimentary complex (VS) from the Late Devonian - Early Carboniferous period, overlain by a Culm flysch sequence; underlying this complex is the so-called "Phyllite-Quartzite Group". The oldest formations in this zone date from the Early Devonian period and belong to the "Pulo de Lobo" Formation, which includes phyllites, quartzites and rare acid and basic volcanic rocks. The acid volcanic rocks in the volcanic sedimentary complex constitutes the metallotect of the massive polymetallic sulphides that are characteristic of the Iberian Pyrite Belt, the most important metallogenetic province in Portugal in which the Lousal, Aljustrel, Neves Corvo and S. Domingos mines are located.

We shall not go into the geological aspects of the Epi-Hercynian Covering, but shall touch on its non-metallic resources, namely sands, gypsum, clay, kaolin, limestone, diatomite and salt, further on.

HISTORICAL OVERVIEW OF MINING IN PORTUGAL

The mining of mineral resources in Portugal was initially carried out by the Phoenicians, but was intensely and mainly developed by the Romans.

The first mining operations would have taken place in "gossan" type oxidation zones (for copper, zinc, lead, gold and silver) and gold-bearing placers (Carvalho, 1994). The Romans would later intensely exploit gold and polymetallic sulphide vein deposits. To better comprehend the size of the work involved, one need look no further than Três Minas, to the north of Vila Real, from which approximately 10 million tons of material was extracted; and in Aljustrel (southwest of Beja), mine shafts reached a depth of 120 metres.

Then followed a lengthy break in the mining of mineral resources in Portugal which was only occasionally interrupted, the exploitation of alluvial gold in Adiça near Lisbon during the XII century is one example of this.

From the middle of the last century, coinciding with the start of the industrial revolution, mining once more became an important industry in Portugal, with the first mining concessions being granted in 1836.

By the end of the X1X century, approximately 300 concessions had been awarded, the main substances exploited being polymetallic sulphides (Aljustrel, S. Domingos), tungsten and tin (Panasqueira), and antimony and gold (Valongo/Gondomar).

At the start of the XX century, there was a marked increase in coal annual production.

The two world wars, particularly the Second World War, led to a great demand for tungsten, which in turn led to increased exploration and exploitation of not only this element but tin as well, as these two elements are generally related spatially and/or structurally. Production of the concentrates of these substances peaked during 1942 at 5700 tons for tungsten, the main producing mines being Panasqueira, Borralha, Argozelo, Montesinho, Vale das Gatas and Ribeira.

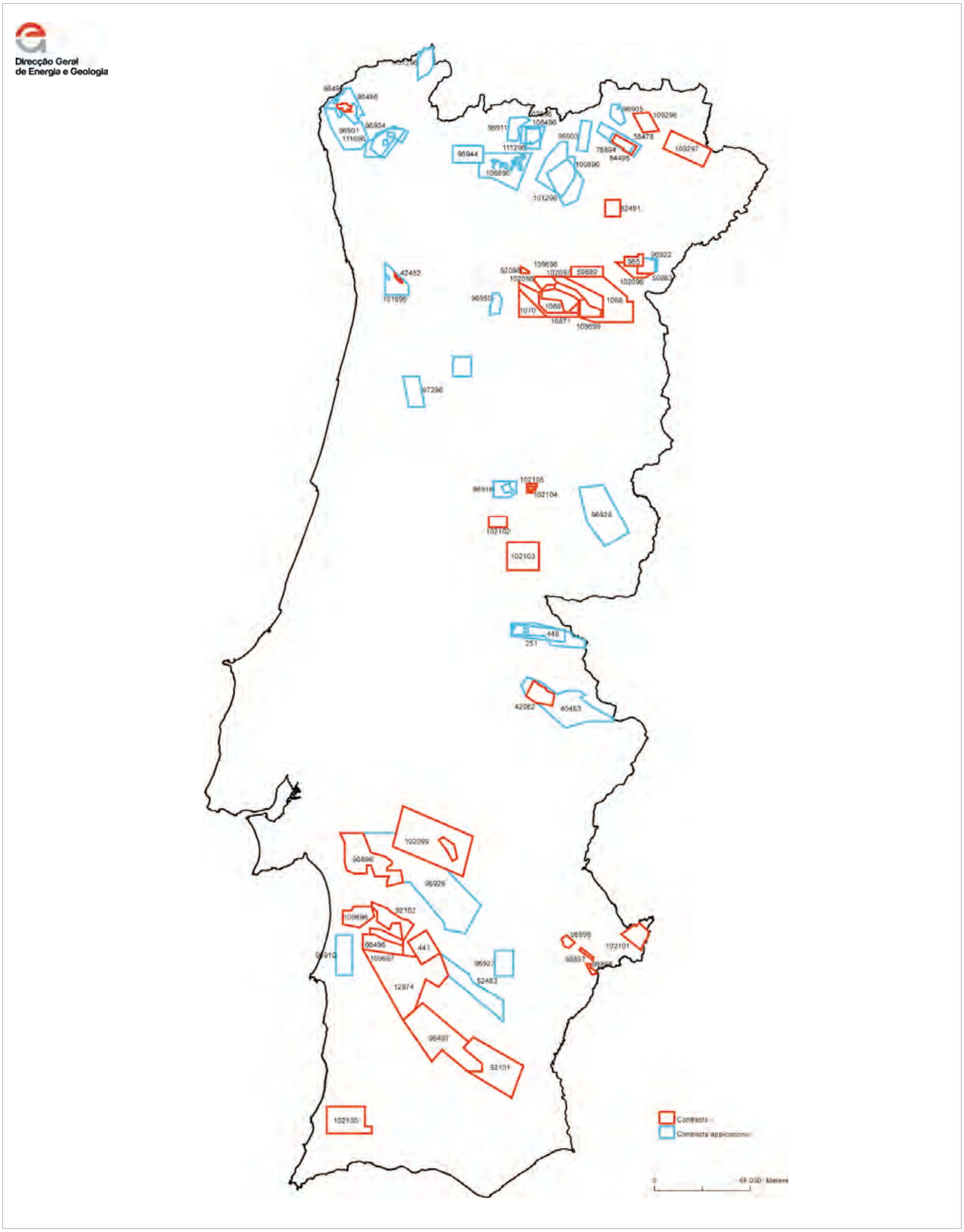
The country also possesses important uranium deposits, with approximately 4200 tons of U3O8 produced between 1950 and 1990.

From the start of the fifties but mainly in the eighties, exploration underwent somewhat of a boom in Portugal, at first including tungsten and tin in the centre and north of the country and later concentrating to precious metals and base metals, the latter sought principally in the Pyrite Belt in the south, where a remarkable number of mineral masses have been discovered: Moinho (1955), Feitais (1963), Estação (1968), Gavião (1970), Salgadinho (1974), Neves Corvo (1977) and Lagoa Salgada (1992).

The most important of these discoveries was the Neves Corvo deposit: since the mine came into operation, Portugal has become one of the most important producers of copper (1988) and tin (1990) in Europe as well as tungsten from the last operational mine (Panasqueira).

Portugal is also an important producer of ornamental rocks, particularly marble, even at the international level.

PROSPECTING AND EXPLORATION CONTRATS AND APPLICATIONS (27-12-2011)
METALLIC MINERALS



LEGEND

CONTRACTS

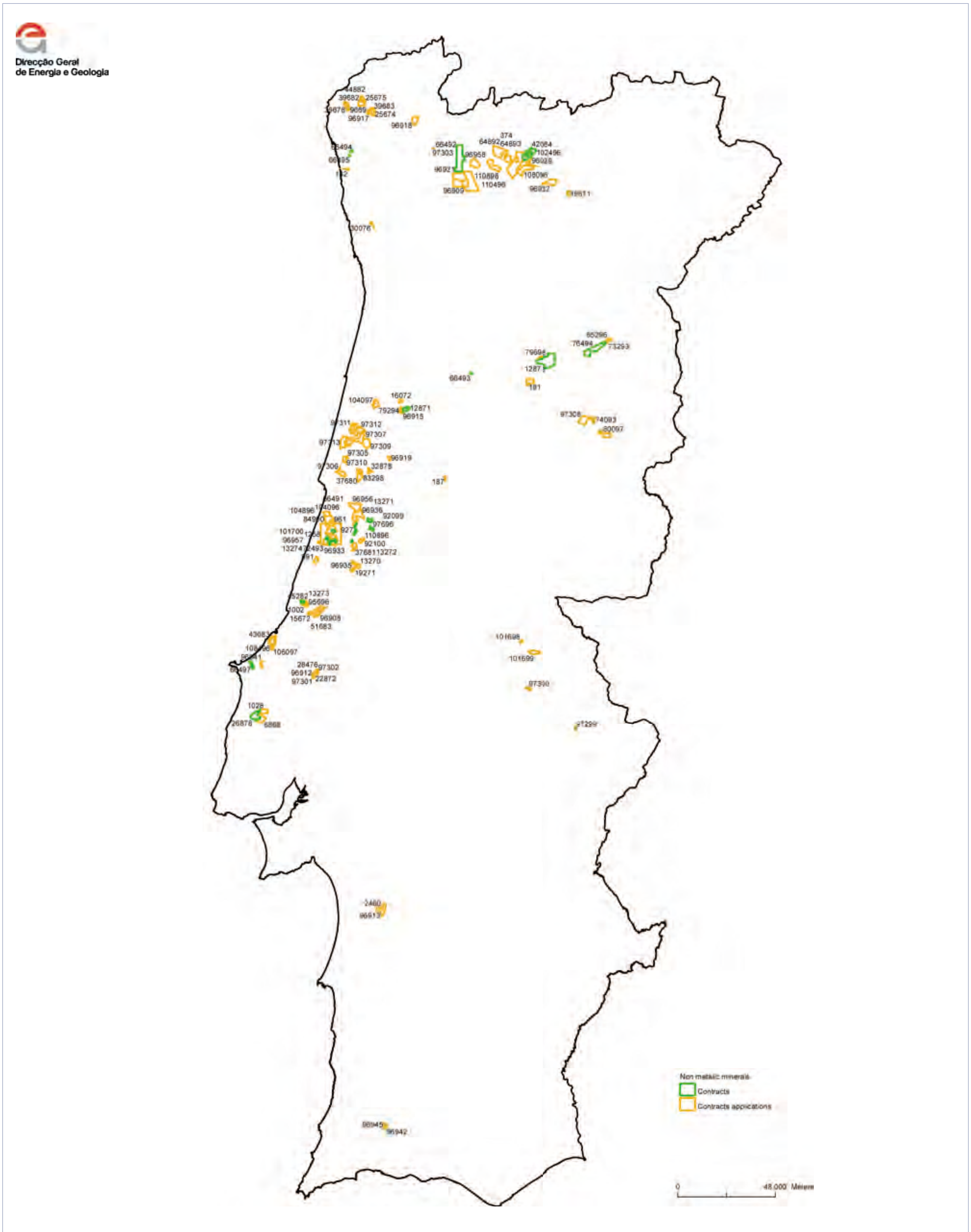
Nº	Owner	Minerals
441	MAEPA	Cu, Pb, Zn, Au e Ag
965	MTI - FERRO DE MONCORVO	Fe
1068	COLT RESOURCES INC	Sb, As, Be, Bi, Pb, Co, Cu, Sn, Li, Mo, Nb, Ni, Au, Ag, Ta, W e Zn
1069	COLT RESOURCES INC	Sb, As, Be, Bi, Pb, Co, Cu, Sn, Li, Mo, Nb, Ni, Au, Ag, Ta, W e Zn
1070	COLT RESOURCES INC	Sb, As, Be, Bi, Pb, Co, Cu, Sn, Li, Mo, Nb, Ni, Au, Ag, Ta, W e Zn
12874	MAEPA	Cu, Pb, Zn, Sn, Au e Ag
16871	COLT RESOURCES INC	Au, Ag, Cu, Zn, Pb, Sb, W, Mo, Ta, Nb e Sn
38478	MTI - MINEIRA DE VINHAIS	Sn e W
42082	IBERIAN RESOURCES PORTUGAL	Au, Ag, Cu, Ni, Pb, Zn e minerais associados
42482	AM - ALMADA MINING	Au, Ag, Cu, Pb, Zn, Sn, W, Li e Pirites
59689	MINAPORT	Au, Ag, Pb, Zn, Cu, Sb, Sn e W
62491	MINAPORT	Cu, Pb, Zn, Au e Ag
66496	MAEPA	Cu, Pb, Zn, Au e Ag
90896	MAEPA	Cu, Pb, Zn, Au e Ag
92098	IBERIAN RESOURCES PORTUGAL	W, Sn, Au, Cu e minerais acessórios
92101	AGC	Cu, Pb, Zn, Au, Ag, In e Sn
92102	REDCORP	Cu, Pb, Zn, Au, Ag, Sn, Mn, Ba e Pirites
96497	SOMINCOR	Cu, Zn, Pb, Sn, Ag, Au e Metais associados
96498	MAEPA	W, Sn e Au
96896	NORTHERN LION GOLD	Zn, Pb, Cu, Ag, Au, Sb, Ge, Ga e In
96897	NORTHERN LION GOLD	Zn, Pb, Cu, Ag, Au, Sb, Ge, Ga e In
96898	NORTHERN LION GOLD	Zn, Pb, Cu, Ag, Au, Sb, Ge, Ga e In
102096	CPF	Fe e minerais associados
102097	EUROCOLT RESOURCES UNIPESSOAL	Sb, As, Be, Bi, Pb, Cu, Sn, Li, Mo, Nb, Au, Ag, Ta, W e Zn
102098	EUROCOLT RESOURCES UNIPESSOAL	Sb, As, Be, Bi, Pb, Cu, Sn, Li, Mo, Nb, Au, Ag, Ta, W e Zn
102099	EUROCOLT RESOURCES UNIPESSOAL	Au, Ag, Cu, Pb, Zn e metais associados
102100	MAEPA	Au, Ag, Cu, Pb e Zn
102101	MINAPORT	Cu, Pb, Zn, Au e Ag.
102102	MINAPORT	Cu, W, Sb, Au e Ag
102103	MINAPORT	Cu, W, Sb, Au e Ag
102104	PANNN	Li, Sn, Ta, Nb, W, Rb, Cu, Pb, Zn, Au, Ag e pirites
102105	PANNN	Li, Sn, Ta, Nb, W, Rb, Cu, Pb, Zn, Au, Ag e pirites
109296	EDM	Pt, Pd, Rh, Ru, Ir, Os, Re, Au, Ag, Ni, Co, Cu e Cr
109297	EDM	Sn, W, Au, Ag, Cu e sulfuretos associados
109696	COLT RESOURCES INC	Ba, Pb, Co, Cu, Sn, Fe, Mn, Ni, Au, Ag, Zn e pirites
109697	COLT RESOURCES INC	Ba, Pb, Co, Cu, Sn, Fe, Mn, Ni, Au, Ag, Zn e pirites
109698	COLT RESOURCES INC.	Sb, As, Be, Bi, Pb, Co, Cu, Sn, Li, Mo, Nb, Ni, Au, Ag, Ta, W e Zn
109699	COLT RESOURCES INC.	Sb, As, Be, Bi, Pb, Co, Cu, Sn, Li, Mo, Nb, Ni, Au, Ag, Ta, W e Zn

LEGEND

APPLICATIONS

Nº	Owner	Minerals
251	IBERIAN RESOURCES PORTUGAL	Au, Cu, U e minerais associados
448	BERALT TIN & WOLFRAM	U, Th, Sn, W, Li, Ba, Cu, Pb, Zn, Au, Ag e P
40483	IBERIAN RESOURCES PORTUGAL	Au, Ag, Cu, Pb, Zn, terras raras e minerais acessórios
50883	FRD - FERRO DOURO	Fe
52483	MAEPA	Cu, Pb, Zn, Au e Ag.
65691	MAEPA	Au, Ag, W e Sn
76894	EDM	Sn, W, Au, Ag, Cu e sulfuretos associados.
78494	MINERÁLIA	W, Sn, Cu, Pb, Zn, Au e Ag
84496	REFERENCES & COORDINATES CONS.	Sn, W, Cu, Zn, Ta, Ni, Ag e Au
86496	LUSORECURSOS ARG	W, Sn, Au, Ag, Nb e Ta
96901	LUSORECURSOS ARG	W, Sn, Au, Ag, Nb e Ta
96903	MAEPA	Au, Ag e W
96904	MAEPA	W, Pb, Zn, Cu, Au e Ag
96905	MAEPA	Pb, Zn, Cu, Au e Ag
96910	MINERÁLIA	Au, Ag, Pb, Zn e Cu
96911	LUSORECURSOS	W e Sn
96916	SOJITZ BERALT TIN AND WOLFRAM	Sn, W, Li, Cu, Pb, Zn, Au, Ag, e Pirites
96922	CPF	Fe e minerais associados
96926	MAEPA	Cu, Pb, Zn, Au, Ag, Ni, V, Mo e Sb
96927	MINERÁLIA	Fe, Cu, Sb, Au e Ag
96928	MINERÁLIA	Sn, W, Au e Ag
96944	MINERÁLIA	W, Sn e Mo
96950	IBERIAN RESOURCES PORTUGAL	W, Sn, Au e Cu
97296	MINAPORT	Au e Ag
100896	MINERÁLIA	W e Sn
101296	LUSORECURSOS TMG	W, Sn, Au, Ag, Pb, Zn e Cu
101696	AM - ALMADA MINING	Sb, Au, Ag, Cu, Pb, Zn, Sn, W e Pirites
106496	REDCORP	Au, Ag, Cu, Pb e Zn
106896	LUSORECURSOS ARG	W, Sn, Au, Ag, Ni e Ta.
107296	LUSORECURSOS ARG	W, Sn, Au e Ag.
107696	EDM	Au, Ag, Sn, W, Cu e sulfuretos associados
111296	MEDGOLD RESOURCES	Minerais metálicos
111696	LUSORECURSOS ARG	W, Sn, Au e Ag.

PROSPECTING AND EXPLORATION CONTRATS AND APPLICATIONS (27-12-2011)
NON METALLIC MINERALS



LEGEND

CONTRACTS

Nº	Owner	Minerals
927	SORGILA	Caulino e Qz
12871	RODRIGUES & RODRIGUES	Caulino
12873	GRALMINAS	Qz e Feld.
13270	J. A. LAGOA & FILHOS	Caulino
13271	J. A. LAGOA & FILHOS	Caulino
13272	J. A. LAGOA & FILHOS	Caulino
13273	J. A. LAGOA & FILHOS	Caulino, Qz e Feld.
13274	SORGILA	Caulino e Qz
26878	J. A. LAGOA & FILHOS	Caulino
42084	FELMICA	Feld, Qz e Li
66491	ARGILIS	Caulino
66492	FELMICA	Feld. e Qz
66493	FELMICA	Qz e Feld.
66494	IMNP	Caulino
66495	IMNP	Caulino
66497	MOTAMINERAL	Caulino e Qz
76494	GRALMINAS	Qz
92099	CORBÁRIO	Caulino e Qz
92100	CORBÁRIO	Caulino e Qz

APPLICATIONS

Nº	Owner	Minerals
181	FELMICA	Qz e Feld
182	CAMPADOS	Caulino
187	SORGILA	Qz e Caulino
374	IMERYS CERAMICS PORTUGAL	Qz, Feld. e Li
891	J. A. LAGOA & FILHOS	Qz, Feld. e caulino
961	ADELINO DUARTE DA MOTA	Caulino, Qz e Salgema
1002	ARGILIS	Qz
1028	INERLENA	Caulino e Qz
1258	REN	Salgema
2460	SIFUCEL	Qz e caulino
6868	INERLENA	Qz e caulino
9669	J. A. LAGOA & FILHOS	Qz, Feld e Li
15672	ADELINO DUARTE DA MOTA	Caulino
16072	RODRIGUES & RODRIGUES	Caulino
19271	ADELINO DUARTE DA MOTA	Caulino
19671	FELMICA	Qz
22872	SIBELCO PORTUGUESA	Caulino e Qz
25674	J. A. LAGOA & FILHOS	Qz, Feld e Li
25675	J. A. LAGOA & FILHOS	Qz, Feld e Li
28476	SIFUCEL	Caulino
30076	MINAS DE BARQUEIROS	Caulino
32878	SORGILA	Qz e caulino
37680	J. A. LAGOA & FILHOS	Caulino e Qz
37681	J. A. LAGOA & FILHOS	Caulino
39678	FELMICA	Qz, Feld. e Li
39682	FELMICA	Qz, Feld. e Li.
39683	FELMICA	Qz, Feld. e Li.
43683	ZIDANIS	Caulino e Qz
44882	J. A. LAGOA & FILHOS	Qz, Feld e Li

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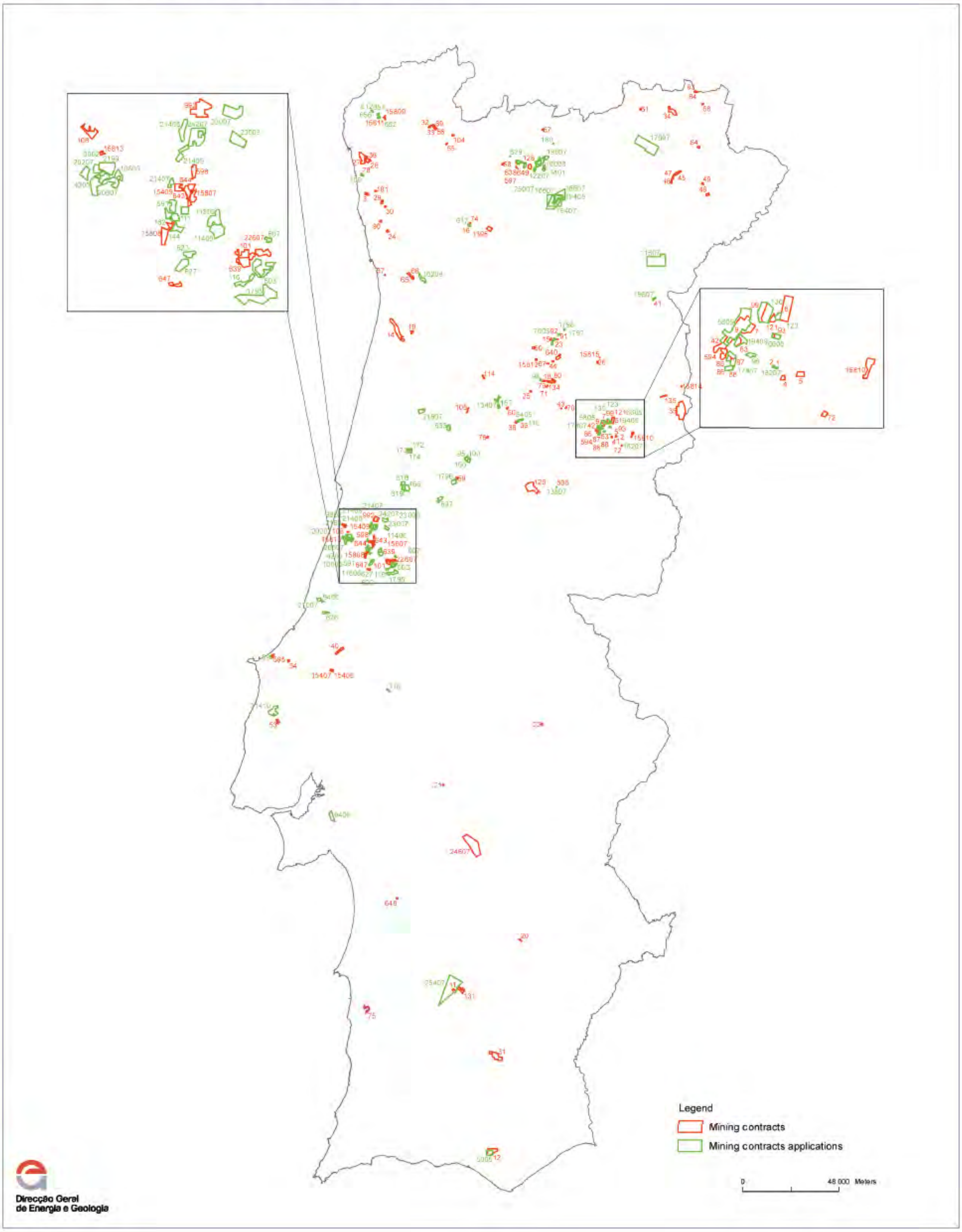
64892	ALDEIA & IRMÃO	Qz, Feld. e Li
64893	ALDEIA & IRMÃO	Qz, Feld. e Li
72493	ALDEIA & IRMÃO	Caulino
73293	GRALMINAS	Qz
74093	ALDEIA & IRMÃO	Qz, Feld. e Li.
79294	SOCASCA	Caulino
79698	GRALMINAS	Qz e Feld.
80097	ALDEIA & IRMÃO	Feld. e Qz
83298	SORGILA	Qz e caulino
84900	ZIDANIS	Caulino, Salgema e Qz
85296	SILICALIA PORTUGAL	Qz
95696	RUI M S MARTINS	Qz e caulino
96908	J. A. LAGOA & FILHOS	Caulino e Qz
96909	ALDEIA & IRMÃO	Qz e Feld.
96912	SIBELCO PORTUGUESA	Caulino e Qz
96913	ZIDANIS	Qz e caulino
96915	FARIA LOPES & ALDEIA	Caulino
96917	ALDEIA & IRMÃO	Feld, Qz e Li.
96918	ALDEIA & IRMÃO	Qz e Feld.
96919	J. A. LAGOA & FILHOS	Caulino
96920	J. A. LAGOA & FILHOS	Feld. e Qz
96921	FARIA LOPES & ALDEIA	Qz e Feld.
96929	ALDEIA & IRMÃO	Qz, Feld. e Li
96932	ALDEIA & IRMÃO	Feld, Qz e Li.
96933	ALDEIA & IRMÃO	Caulino
96935	ALDEIA & IRMÃO	Caulino
96936	J. A. LAGOA & FILHOS	Caulino
96941	MOTAMINERAL	Caulino e Qz
96942	FELMICA	Feld.
96945	SIFUCEL	Feld.
96956	J. A. LAGOA & FILHOS	Caulino
96957	LUSOSILICAS	Qz e caulino
97302	SIFUCEL	Caulino e Qz
97303	FELMICA	Feld. e Qz
97305	CORBÁRIO	Caulino
97306	CORBÁRIO	Caulino
97307	CORBÁRIO	Caulino
97308	J. A. LAGOA & FILHOS	Qz, Feld. e Li
97309	MOTAMINERAL	Caulino e Qz
97310	MOTAMINERAL	Caulino e Qz
97311	MOTAMINERAL	Caulino e Qz
97312	MOTAMINERAL	Caulino e Qz
97313	MOTAMINERAL	Caulino e Qz
97696	ALDEIA & IRMÃO	Caulino
101698	SIFUCEL	Qz e Feld.
101699	SIFUCEL	Qz e Feld.
101700	LUSOSILICAS	Qz, Feld. e caulino
102496	IMERYS CERAMICS PORTUGAL	Feld e Qz

LEGEND

104096	ZIDANIS	Caulino, Salgema e Qz
104097	J. A. LAGOA & FILHOS	Caulino
104896	ALDEIA & IRMÃO	Caulino
106097	LUSOSILICAS	Qz e caulino
108096	ALDEIA & IRMÃO	Qz, Feld. e Li
108496	MOTAMINERAL	Caulino e Qz
110496	ALDEIA & IRMÃO	Qz e Feld.
110896	J. A. LAGOA & FILHOS	Caulino
110898	UNIZEL	Feld., Qz
96958	ALDEIA & IRMÃO	Qz e Feld.
97299	SIFUCEL	Qz e Feld.
97300	SIFUCEL	Qz e Feld.
97301	SIFUCEL	Caulino e Qz

MINING CONTRACTS AND APPLICATIONS (27-12-2011)



LEGEND

CONTRACTS

Nº	Owner	Minerals
1	FELMICA	Qz e Feld.
2	FELMICA	Qz e Feld.
3	MIBAL	Caulino
4	FELMICA	Qz e Feld.
5	FELMICA	Qz e Feld.
6	J. A. LAGOA & FILHOS	Qz e Feld.
7	J. A. LAGOA & FILHOS	Qz e Feld.
9	SOC. MINEIRA CAROLINOS	Li e Sn
11	EDM	S, Fe, Cu, Pb, Zn, Ag e Au
12	CUF	Salgema
14	MOTAMINERAL	Caulino
15	SOBAL	Qz, Feld. e Be
16	UNIZEL	Feld. e Qz
18	PEGMATÍTICA	Caulino
19	MOTAMINERAL	Caulino
20	GRALMINAS	Qz e Feld.
21	QUARTEX	Qz e Feld.
22	GRALMINAS	Qz e Feld.
23	GRALMINAS	Qz e Feld.
24	CAULINALVA	Caulino
25	SOC. MINEIRA CAROLINOS	Gl, Li, Sn, W, Ta, Qz e Feld.
26	SOC. MINEIRA CAROLINOS	Qz
27	IMNP	Caulino
28	MOTAMINERAL	Caulino
29	IMNP	Caulino
30	IMNP	Caulino
31	SOMINCOR	Cu, Zn, Pb, Au, Ag, Sn e Co
32	MINAS DA PEDRA MOURA	Qz e Feld.
33	ROCÁVIA	Qz e Feld.
34	COMITAL	Talco
35	PORSTIN	Sn e Ti
36	MOTAMINERAL	Caulino
37	EMP. CERÂMICA DO FOJO	Caulino
38	MCS	Sn e Ti
39	MINAS DE CASSITERITE SOBREDA	Sn e Ti
40	SIFUCEL	Caulino
41	FELMICA	Feld. e Qz
42	PEGMATÍTICA	Feld.
43	FELMICA	Feld. e Qz
44	PEGMATÍTICA	Qz e Feld.
45	MITALCO	Talco
46	MITALCO	Talco
47	MITALCO	Talco
48	MITALCO	Talco
49	MITALCO	Talco
50	FELMICA	Sn, Feld. e Qz
53	SOLVAY PORTUGAL	Salgema
54	SOLVAY PORTUGAL	Salgema
55	A. J. DA FONSECA, LDA.	Qz e Feld.
56	A. J. DA FONSECA, LDA.	Qz e Feld.
57	JOÃO CERQUEIRA ANTUNES	Qz e Feld.

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58	JOÃO CERQUEIRA ANTUNES	Qz e Feld.
59	CAULICENTRO	Caulino
60	ENU	U
61	EMP. MINEIRA DA SERRA DO CERCAL	Au e Ag
63	J. A. LAGOA & FILHOS	Qz e Feld.
64	MARCOLINOS	Sn e W
65	COMP. S.PEDRO DA COVA	Carvão
66	COMP. S.PEDRO DA COVA	Carvão
67	FELMICA	Qz e Feld.
68	COMITAL	Ba
70	J. A. LAGOA & FILHOS	Qz e Feld.
71	ENU	U
72	ENU	U
74	UNIZEL	Feld. e Qz
75	EMP. MINEIRA DA SERRA DO CERCAL	Fe e Mn
76	ENU	U
78	CAMPADOS	Caulino
79	FELMICA	Qz e Feld.
80	FELMICA	Qz e Feld.
83	SOC. MINEIRA DE FRANÇA	Sn
84	SOC. MINEIRA DE FRANÇA	Sn
85	SOPRED	Sn
86	SOPRED	Sn
87	SOPRED	Sn
88	SOPRED	Sn
89	A. J. DA FONSECA, LDA.	Qz e Feld.
90	EMP. PORT.CAULINOS DE PARADA	Caulino
91	FELMICA	Qz e Feld.
92	FELMICA	Qz e Feld.
93	FELMICA	Qz e Feld.
99	J. A. LAGOA & FILHOS	Qz e Feld.
101	ARGILIS	Caulino
104	A. J. DA FONSECA, LDA.	Qz e Feld.
105	J. A. LAGOA & FILHOS	Qz e Feld.
108	RENOESTE	Salgema
114	J. A. LAGOA & FILHOS	Qz e Feld.
121	ALDEIA & IRMÃO, S.A.	Feld. e Qz
128	IMERYS CERAMICS PORTUGAL	Feld. e Qz
129	BERALT TIN & WOLFRAM	W, Sn, Cu, Ag, Zn e As
131	PIRITES ALENTEJANAS	S, Cu, Zn, Pb e Ag
134	FELMICA	Qz e Feld.
135	FELMICA	Qz e Feld.
181	MINAS DE BARQUEIROS	Caulino
594	FELMICA	Feld. e Qz
595	IMERYS CERAMICS PORTUGAL	Caulino
596	UNIZEL	Feld. e Qz
597	FELMICA	Feld., Qz e Li
598	J. A. LAGOA & FILHOS	Caulino
638	FELMICA	Feld., Qz e Li
639	ARGILIS	Caulino
640	GRALMINAS	Gl, Feld. e Qz

LEGEND

640	GRALMINAS	Gl, Feld. e Qz
643	ADELINO DUARTE DA MOTA	Caulino e Qz
644	ADELINO DUARTE DA MOTA	Caulino e Qz
647	ALDEIA & IRMÃO, S.A.	Caulino
648	SIFUCEL	Qz e caulino
649	J. A. LAGOA & FILHOS	Feld. e Qz
992	MOTAMINERAL	Caulino e Qz
1395	(ESTADO)	Sn, Ta, Qz e Feld.
15407	SIBELCO PORTUGUESA	Caulino e Qz
15408	SIFUCEL	Caulino e Qz
15409	ADELINO DUARTE DA MOTA	Caulino e Qz
15807	ADELINO DUARTE DA MOTA	Caulino e Qz
15808	ADELINO DUARTE DA MOTA	Caulino e Qz
15809	FELMICA	Feld., Qz, Li e Ta
15810	FELMICA	Feld. e Qz
15811	FELMICA	Feld., Qz e Li
15812	GRALMINAS	Qz
15813	LUSOSILICAS	Caulino e Feld.
15814	SILICÁLIA PORTUGAL	Qz
15815	SILICÁLIA PORTUGAL	Qz
22607	J. A. LAGOA & FILHOS	Caulino
24607	IBERIAN RESOURCES/COLT RESOURCES INC.	Au, Ag, Cu, Pb, Zn e minerais associados

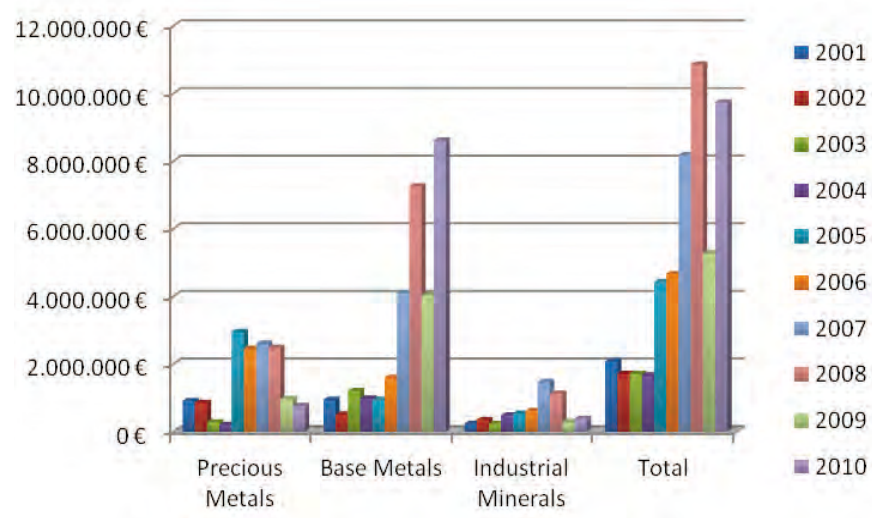
LEGEND

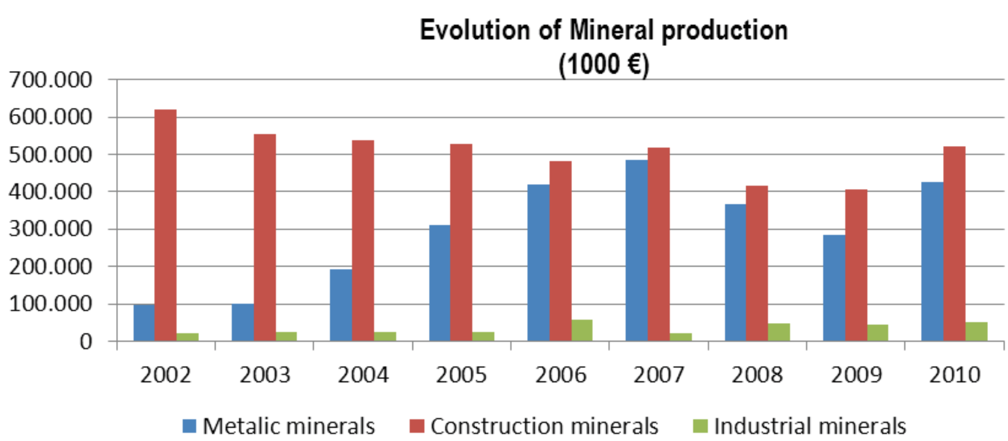
APPLICATIONS		
Nº	Owner	Minerals
69	FRANCO, LDA.	Qz e Caulino
95	ARGILIS	Qz, Feld. e Caulino
96	FELMICA	Qz e Feld.
98	FELMICA	Qz e Feld.
100	J. A. LAGOA & FILHOS	Qz, Feld. e Caulino
109	CAMPADOS	Caulino
111	ADELINO DUARTE DA MOTA	Caulino
115	MCS	Sn e Ti
116	ARGILIS	Caulino
118	SOC.AGRÍC. GOUXA E ATELA	Turfa
123	ALDEIA & IRMÃO, S.A.	Qz e Feld.
130	J. A. LAGOA & FILHOS	Qz e Feld.
144	ADELINO DUARTE DA MOTA	Caulino
157	J. A. LAGOA & FILHOS	Qz e Feld.
160	FELMICA	Qz e Feld.
166	LAGOASOL	Caulino
172	ADELINO DUARTE DA MOTA	Caulino
173	ADELINO DUARTE DA MOTA	Caulino
174	ADELINO DUARTE DA MOTA	Caulino
180	SILICÁLIA PORTUGAL	Qz
182	ADELINO DUARTE DA MOTA	Caulino
591	ADELINO DUARTE DA MOTA	Caulino
603	ARGILIS	Caulino
607	CAULIAREIAS	Caulino
612	FELMICA	Qz, Feld. e Li
617	UNIZEL	Feld. e Qz
618	LAGOASOL	Caulino
619	LAGOASOL	Caulino
623	SORGILA	Caulino
626	ALCOAREIA	Caulino
627	SORGILA	Caulino
629	FELMICA	Qz, Feld e Li
633	MOTAMINERAL	Caulino, Feld e Qz.
637	CAULIAREIAS	Caulino
651	FELMICA	Feld., Qz e Li
652	FELMICA	Feld., Qz e Li
656	FELMICA	Feld., Qz e Li
1795	SORGILA	Caulino
1796	SORGILA	Caulino
1797	FELMICA	Feld. e Qz
1798	FELMICA	Feld. e Qz
2199	ARGILIS	Caulino
3401	FELMICA	Qz, Feld e Li
3802	SULAREIAS	Qz
4203	SORGILA	Caulino
5005	CUF	Salgema
5405	MINAS DE CASSITERITE SOBREDA	Sn e Ti
5805	SOC. MINEIRA CAROLINOS	Li e Sn
6605	FELMICA	Qz e Feld.
7005	GRALMINAS	Qz e Feld.
9405	SALCAVE	Salgema

LEGEND

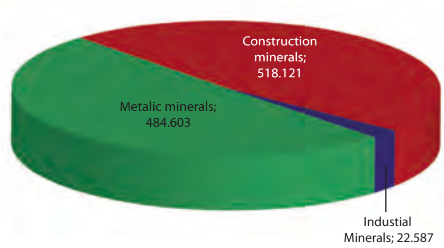
9406	SARBLOCO	Qz e caulino
10606	J. A. LAGOA & FILHOS	Qz e caulino
11406	SORGILA	Caulino
11806	J. A. LAGOA & FILHOS	Caulino
11807	MTI - FERRO DE MONCORVO	Fe
12207	IMERYS CERAMICS PORTUGAL	Feld., Qz e Li
13407	J. A. LAGOA & FILHOS	Qz e Feld.
13807	UNIZEL	Qz, Feld. e Li
16208	A.M. - ALMADA MINING	Au e Ag
16607	EDM	Au, Ag, Cu, Pb, Zn e min. associados
17407	SOPRED	Feld. e Qz
17807	MTI - MINEIRA DE VINHAIS	Sn e W
18207	FELMICA	Qz e Feld.
18607	IBERMIN	Au, Ag, Cu, Pb, Zn e min. associados
19007	FELMICA	Feld., Qz e Li.
19008	FELMICA	Feld., Qz e Li.
19407	AM - ALMADA MINING	Au, Ag, Cu, Pb, Zn e minerais associados
19408	REDCORP	Au, Ag, Pb, Zn e Cu
19409	J. A. LAGOA & FILHOS	Qz e Feld.
19807	FELMICA	Feld. e Qz
20207	SORGILA	Caulino e Qz.
20607	SORGILA	Caulino e Qz.
21007	J. A. LAGOA & FILHOS	Caulino
21407	J. A. LAGOA & FILHOS	Caulino e Qz.
21408	J. A. LAGOA & FILHOS	Caulino e Qz.
21409	J. A. LAGOA & FILHOS	Caulino
21410	J. A. LAGOA & FILHOS	Caulino
21807	RODRIGUES & RODRIGUES	Caulino
23007	CORBÁRIO	Caulino
23008	CORBÁRIO	Caulino
24207	CORBÁRIO	Caulino
25007	J. A. LAGOA & FILHOS	Qz e Feld.
25407	EDM	S, Fe, Cu, Pb, Zn, Ag e Au

INVESTMENTS IN EXPLORATION (2001-2010)

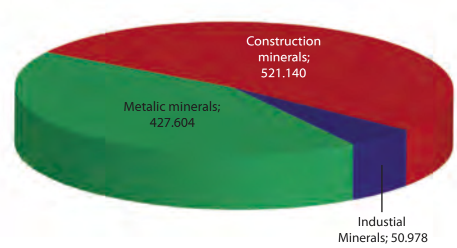




Mineral Production in 2007 (1000 euros)



Mineral Production in 2010 (1000 euros)

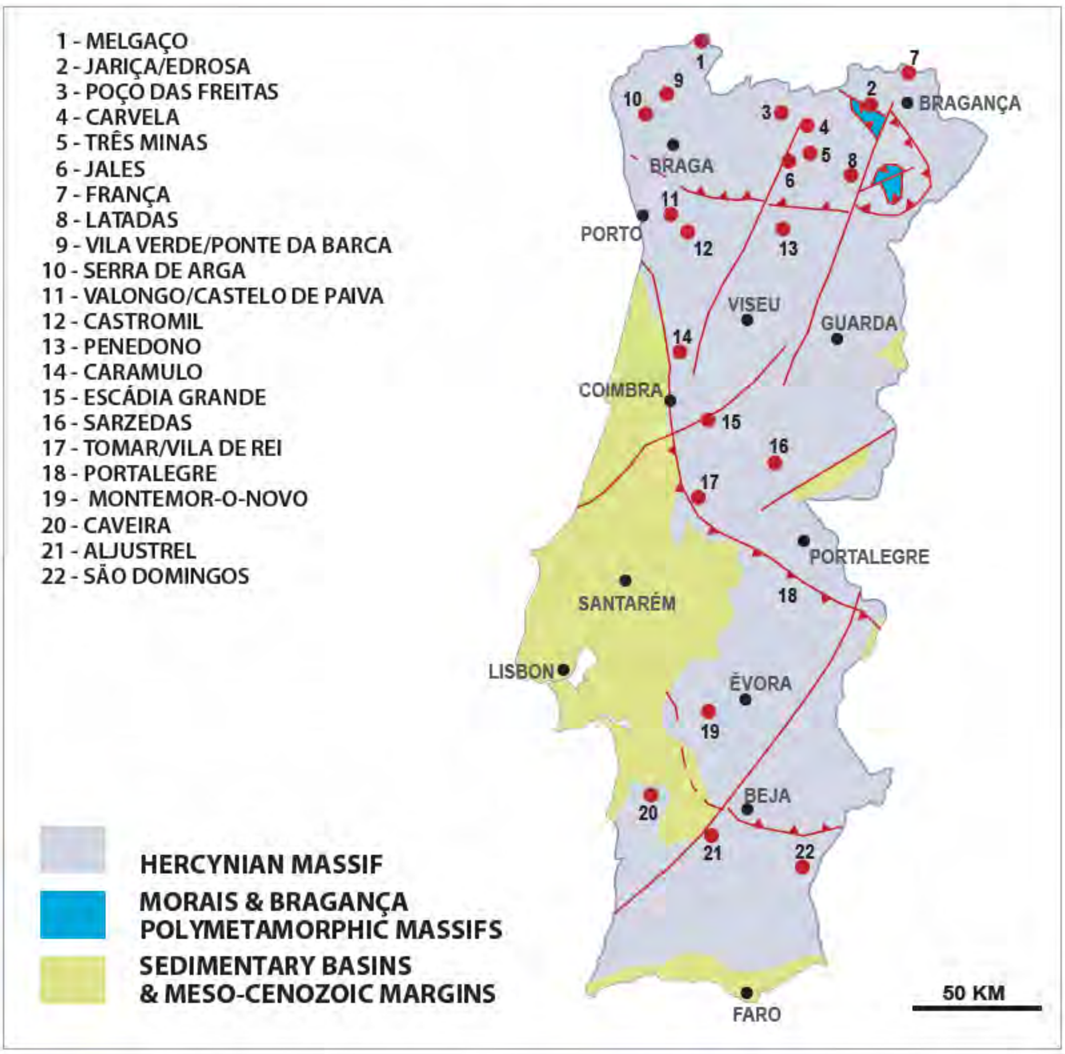


PRECIOUS METALS

As mentioned earlier, it has always been known that the Iberian Peninsula is rich in precious metals, and these are to be found the length and breadth of Portugal. We shall begin with a description of the various occurrences and deposits, citing the most recent exploration results obtained. We shall also briefly describe the areas that show potential for these metals so as to provide a short to medium term forecast for this mining sector in Portugal.

A description of the most important deposits follows, then, grouped by location within the geotectonic units referred to above:

MAIN GOLD OCCURRENCES AND DEPOSITS



Galicia - Trás-os-Montes Zone

ARIÇA/EDROSA - Auriferous mineralisation occurs associated with sulphides (arsenopyrite, pyrite, sphalerite, galena and chalcopyrite) and embedded in a Silurian volcanic sedimentary complex, clearly controlled by the Hercynian orogeny (Knopf et al., 1990), which causes an alignment of the mineralised structures (quartz and porphyry veins) in a NNW-SSE direction.

POÇO DAS FREITAS/LIMARINHO -The mines in this area date back to Roman times and have left behind a series of small open pits, the largest of which is roughly 100 metres long and 80 metres in width. Mineralisation, which is associated with stockworks of quartz veins, occurs embedded in granitic rocks, running parallel to the large Régua/Verin fault and corresponding to a possible shear zone.

In Limarinho the existence of possible reserves of 2.07 tons of gold with an average grade of 2.8 g/t was pointed out.

TRÊS MINAS - This was the largest Roman mine in Portugal, and consists of three open pits running WNW-ESE, two of which are of an impressive size (Ribeirinha and Covas), the largest approximately 500m long, 100m wide and 80m to 100m deep. There are also numerous shafts and galleries (the largest of which is 250 metres in length with a 5 x 1.5m cross-section). It is estimated that 10 millions tons of material have been mined here.

As in the NW of Spain, the Romans employed the "ruina montium" mining technique, which was usual practice for low grade, high tonnage deposits. Gold occurs associated with arsenopyrite and pyrite, in quartzite lenses interstratified with Silurian shales, and appears to be of syngenetic (paleoplacers) and epigenetic (tectonic control) origin.

JALES/GRALHEIRA - The first mining operations carried out in this zone also date back to Roman times, and has become this century the largest gold mine in Portugal. Hydrothermal gold-bearing quartz veins occur here in two main directions (NE-SW and WSW-ENE), coincident with sub-vertical fractures embedded in Hercynian granites and schists, greywackes and quartzites from the Schist-Greywacke Complex, and mainly from the Silurian age. These lodes are sometimes as long as 2.5 kms and although their thickness varies, they never exceed 1 metre width. The two main lodes, which run in a NE-SW direction, are known as Campo and Desvio. Gold and electrum occur associated with quartz and sulphides (arsenopyrite, most common, pyrite, pyrrhotite, chalcopyrite, sphalerite, tetrahedrite, galena). Grade is fairly irregular, although figures of 30-40 g/t Au were frequently found. Since 1933, the mine has produced approximately 25 tons of gold and 100 tons of silver; at the time of its closure in 1992, it had reached a depth of 620 m. Recently was determined that the Campo lode continues approximately 600 m south of the old mining works, in a structure known as the Horta vein, although mineral grade is highly variable. In the Gralheira structure - a shear zone with several veins, running in a WSW-ENE direction, embedded exclusively within metasedimentary Silurian rocks and located NE of the Campo and Desvio lodes - the existence of a mineralised zone that extends for at least 1850 metres and is roughly 15 metres thick was determined. Recently, measured and indicated resources of 363 000 tones, with a grade of 6,47 g/t of gold (2346,7 kg) and

27,12 g/t of silver (9482 kg), with a cut off of 4 g/t, were defined for this area.

LATADAS/FREIXEDA/PEDRA DA LUZ - Mineralisation occurs in quartz veins embedded in the Trás-os-Montes volcanic-siliceous and quartz-phyllite Silurian complexes, which are occasionally intruded by alkali granites. The veins that run predominantly in a NE-SW and E-W direction, in a shear zone, were also worked by the Romans. The gold is mostly associated with W, As, Cu, Pb, Zn and Sb polymetallic sulphides. Recently, a drilling campaign developed on the Pedra Luz sector show the existence of a sulphides level, embedded on acid volcanic rocks, with high grades of precious, base and other metals: 2,13 % W in 4,75 m, including 0,35 m with 15,88 g/t Au, 296 g/t Ag, 1,45 % Cu, 1,22 % Pb and 4,65 % Zn.

VILA VERDE/PONTE DA BARCA - Prospecting carried out at the end of the eighties uncovered a NE-SW alignment that had gold-bearing potential, the following areas being the most important:

Marrancos - mineralisation is related with a shear zone which affects the Silurian metasediments, these transformed into hornfels by contact metamorphism. In the zone affected by this shearing, breccias and silicifications are to be found accompanied by sulphide mineralisations (arsenopyrite and pyrite) with gold.

Godinhaços - mineralised structures (gold + arsenopyrite) are located exclusively in the granite of Vila Verde. There appears to be lithological control of the mineralisation, the veins running predominantly in an NE-SW direction.

Grovelas - characterised by the occurrence of a dense network of joints filled with arsenopyrite and running predominantly N 25º - 40º E and N 50º - 70º E. There appear to be two mineralised axes, the intersection of which could prove to be an enrichment zone. Also worthy of mention is the existence of old Roman mining works.

Central – Iberian Zone

VALONGO/GONDOMAR - This gold-antimony belt is situated in Baixo Douro region, north-east of Oporto and stretches from Esposende to Castro Daire in a distance of 90km. Besides Sb-Au occurrences exist also Au-As, Pb-Zn (Ag) and Sn-W mineralisations, which are located in the large Valongo anticline and in the Carboniferous syncline, embedded in metasedimentary formations dated from Precambrian and/or Cambrian to Carboniferous and more rarely in hercynian granites.

In remote times, initially the Phoenicians, later and chiefly the Romans, exploited gold in this mining district. At the end of the XIX century, this belt was extensively mined for antimony; and, as a sub-product, gold contained in quartz veins. We can remark the production from the ancient mines of Ribeiro da Igreja (Sb-Au), Montalto (Sb-Au) and Banjas (Au-As) not forgetting the silver Terramonte mine that during the sixties was one of the most important in Europe. Lead and zinc were also mined here.

Studies undertaken by several operators, indicated the occurrence of gold-antimony mineralisations of stockwork type in Alto do Sobrido and of saddle reefs type in Banjas. More recent works show that gold is not restricted to the quartz veins but pervades, within shear zones, the pores and fractures of their host rock; in consequence of this discovery quartz stockworks and silicified mineralised bodies with gold and antimony were found in Alto do Sobrido and these orebodies illustrate the excellent mineral potential of the area. In Alto Sobrido, the definition of 1 069 354 tones with a grade of 1,07 % of Sb, is worth mentioned.

CASTROMIL - This area, which was first mined in Roman times, is located within a Hercynian granite near its contact with Silurian metasediments, part of the Eastern flank of the Valongo anticline. The latter is characterised by the occurrence of various gold/antimony deposits, as mentioned earlier. Two important orthogonal fault systems occur in this zone: NW-SE and NE-SW. The latter, which is more recent, is of great metallogenetic importance and appears to represent the hydrothermal conduits. Gold is essentially disseminated along veins in the silicified granite, running NW-SE, related with a shear zone and frequently associated with sulphides (arsenopyrite and principally pyrite). Besides the silicification, other alteration phenomena, such as sericitisation and kaolinisation, also play an important role. In paragenetic terms, three stages of mineralisation are considered: ferro-arseniferous (quartz + arsenopyrite I + pyrite I + pyrrhotite + bismuth?), zinciferous (sphalerite + chalcopyrite), and remobilisation (arsenopyrite II + galena + gold).

Two fields were defined: Covas de Castromil and Serra da Quinta, separated by the Sousa river and the Oporto-Pocinho railway. For the first of these fields, proved reserves of 2,147,000 tons have been determined with an average grade of 1.9 g/t Au (cut-off of 0.5 g/t) and probable reserves of 270,000 tons with 1.8 g/t Au. For Serra da Quinta, probable reserves are put at 743,000 tons with 2.8 g/t Au.

PENEDONO - In this area, also worked by the Romans, various gold-bearing quartz veins occur. These are sub-vertical and run predominantly in a NE-SW direction. Gold is chiefly to be found in the arsenopyrite and it does appear that values are not disseminated between veins which are not spaced closely enough to allow for open pit mining. However it also occurs in heavily sericitised fractures within the Hercynian granite near the contact with the Cambrian metasediments of the Schist-Greywacke Complex. Around 50 years ago, this area produced gold (Stº. António mines) with an average grade of 14 g/t. Prospecting studies are currently being carried out on Santo António–Vieiros, Paredes–Dacotim and Turgueira sectors, where a potential geological resource of more than 500.000 ounces of gold is delineated.

CARAMULO - Another area worked by the Romans where gold occurs associated with pyrite and arsenopyrite in quartz lenses. There is a tectonic control, suggesting the existence of a NNW-SSE shear zone, parallel and related to the Oporto-Tomar thrust system with a maximum width of 500 metres and a length of several kilometres. Taking both this and the geochemical mapping of gold obtained from soil samples into account, it is likely that mineralisation also occurs in the schist -greywacke wall rocks.

ESCÁDIA GRANDE - At this old mine, that was also worked by the Romans, there was gold production during the forties. Mineralisation occurs associated with quartz vein structures running NW-SE, dipping SW, probably related with the Oporto-Tomar thrust system, and consists of polymetallic sulphides (pyrite, arsenopyrite, sphalerite, galena and chalcopyrite) in which the gold is finely disseminated. The wall rock belongs to the Schist-Greywacke Complex and is frequently altered by silicification and carbonisation phenomena, with which the mineralisation is associated.

PORTALEGRE - This area is located within the Tomar-Badajoz Blastomylonitic Belt. Gold occurs predominantly associated with silicified, chloritised and carbonated metavolcanic sedimentary levels of the Precambrian Série Negra in the Mosteiros and S. Martinho (Alter do Chão) sectors. In the latter, the existence of Plio-Pleistocene covering deposits (gravel) bearing secondary gold mineralisation is also worthy of mention. Drilling executed in the S. Martinho sector have provided extremely positive results (2m with 49 g/t Au, 4m with 12.7 g/t Au and 33.43m with 1.2 g/t Au).

The gold is usually accompanied by pyrite, pyrrhotite and arsenopyrite.

MONTEMOR-O-NOVO -Gold-mineralisations are concentrated in tabular zones, normally characterised by heavy silicification and embedded in a Precambrian volcanic sedimentary sequence along a belt over 30 kilometres in length. Research undertaken has determined the existence of various deposits with marked lithological and tectonic control, the most important of which are located in the SE sector of the area: Banhos, Casas Novas, Chaminé, Ligeiro, Caras, Covas and Braços. Some free gold occurs, but normally it is associated with grains of arsenopyrite and loellingite.

Recently, indicated resources of 1,23 Mt were defined for the Casas Novas, Chaminé and Braços deposits, with a grade of 4,45 g/t Au and a cut off of 1,5 gt/ Au.

South – Portuguese Zone

CAVEIRA, ALJUSTREL and S. DOMINGOS - Gold has been mined here since Roman times in gossan zones of polymetallic sulphide deposits, embedded in a volcanic sedimentary complex dating from the Late Devonian - Early Carboniferous period.

Secondary Deposits

Despite the fact that they have been intensely exploited in Roman times, they are not properly studied.

The most important are the deposits of Alva (Arganil), Arouce (Ceira River), Monfortinho (Erges River), Penamacor (Águeda River), Milreu and Martinchel (Zézere River), Rosmaninhal and Constância-Abrantes (Tagus River). The volume of sand and gravel extracted from these sites has been calculated at several million cubic metres. Some of them also contain channels that have been hewn in the bedrock to help concentrate the gold.

Based on the above considerations and the metallogenetic characteristics of the country, we can define the following areas as being potentially rich in precious metals: Vila Verde/Germil(2), Valongo/Gondomar(6), the Blastomylonitic Belt (1), the Alentejo GoldArsenic -Antimony Belt(13) (Au,Ag), Caminha/Braga(l), Gerês/Mogadouro(3), Ervedosa/Argozelo (4), the Douro Scheelitic Belt (5), the Paiva Tungstiniferous Belt(7) , Arouca/S. Pedro do Sul(8), Trancoso/Figueira de Castelo Rodrigo(9), Gois-Segura(10) (W, Sn, An), Sousel/Barrancos(12), Magnetitic-Zinciferous Belt(14) and Porphyries of Beja(15) (Zn, Cu, Pb, Ag, An).

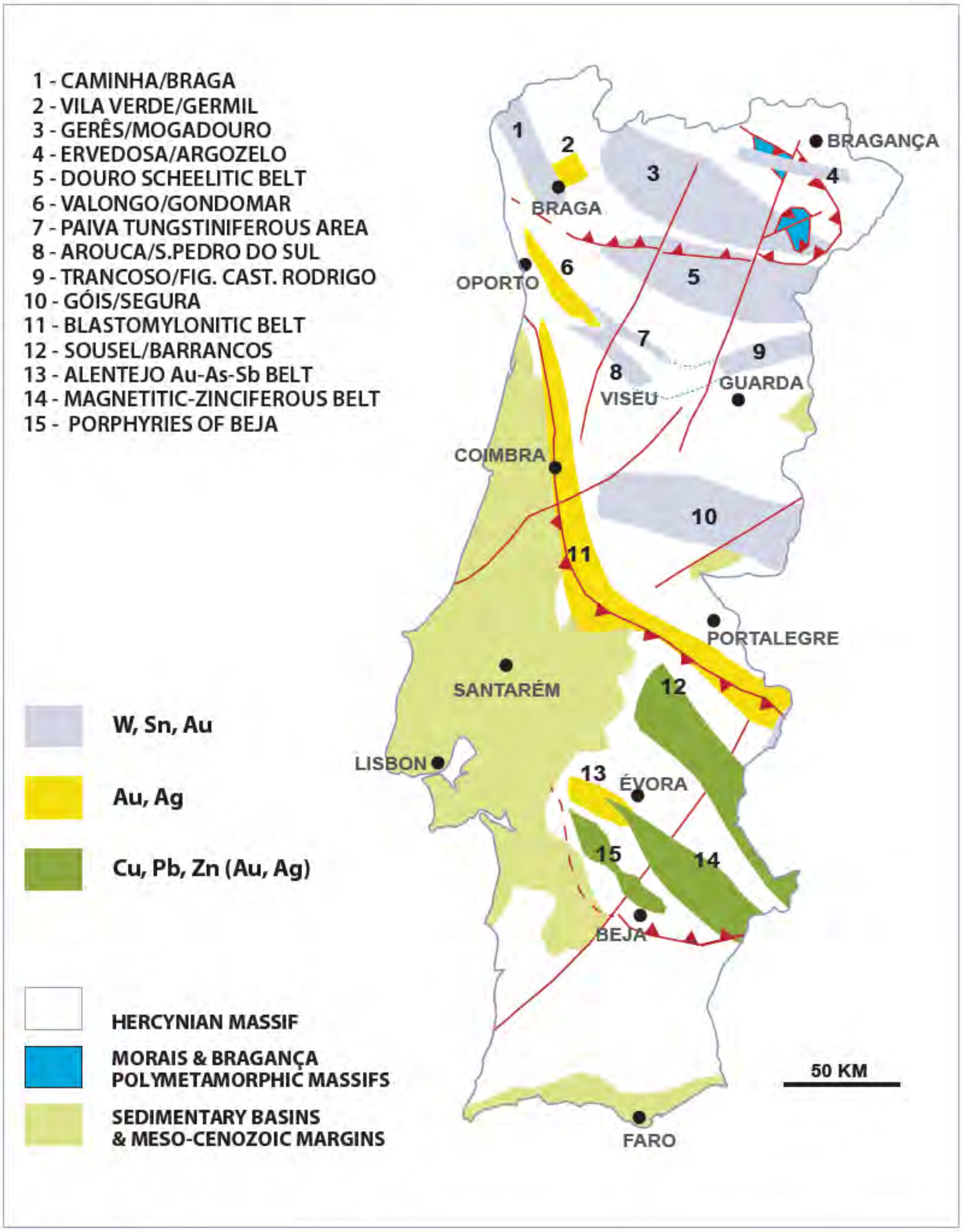
We feel that in the future special attention should be given to three metallogenetic scenarios (Viegas et al., 1992):

a) The mineral deposits occurring in the Blastomylonitic Belt(11) or its dependent areas, characterised by b tectonic control, frequently in shear zones as equally happens in the Galicia-Trás-os-Montes and Central-Iberian Zones, related with the Régua-Verin and Vilariça faults.

b) Gold-bearing mineral deposits associated with granitic intrusions and occurring within it or in the contact with the wall rock (especially skarns) and as a result potentially existing in belts also favourable to W and Sn mineralisations, probably in geochemical spatial relationship with these elements (1, 3, 4, 5, 7, 8, 9, 10).

c) Mineralisations occurring in the surrounding formations (Silurian volcanic sedimentary complex) of the Morais and Bragança massifs, characterised by their association with polymetallic sulphides and/or shear zones.

POTENTIAL AREAS FOR PRECIOUS METALS



BASE METALS

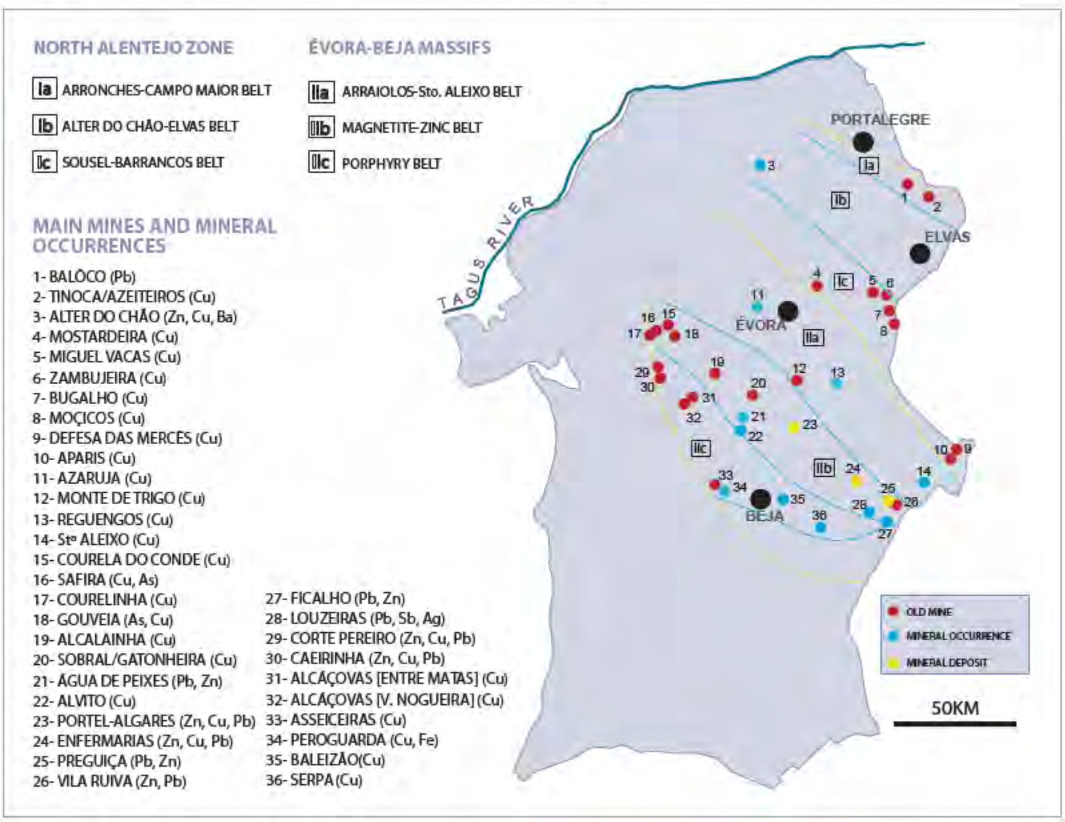
Portugal's main base metal resources are located in the south of the country in the Ossa Morena and South Portuguese zones, the Pyrite Belt in the latter being the most important.

Given the different metallogenetic characteristics of these two geotectonic units, we shall sub-divide our presentation in the same manner.

Ossa Morena Zone

Below is a summary of the primordial geological and mineral characteristics of the different "Belts" that occur in the Ossa-Morena Zone, together with a description of the most important mineral occurrences which may in some way reflect the metallogenetic models that are representative of each Belt.

OSSA MORENA ZONE
MAIN OLD MINES, DEPOSITS AND OCCURRENCES OF BASE METALS



I - NORTH ALENTEJO AREA

Given the nature, typology and regional geological setting of the mineral occurrences, this area is split into three belts:

Arronches – Campo Maior Belt

Alter do Chão – Elvas Belt

Sousel – Barrancos Belt

IA – ARRONCHES – CAMPO MAIOR BELT

This belt basically consists of Late Precambrian formations belonging to the Tomar -Badajoz Blastomylonitic Belt.

Occurrences of copper and, more rarely, lead are represented by the old Tinoca, Azeiteiros and Balôco mines. Stratiform mineral occurrences, with disseminated sulphides, are located near the contact between different types of gneiss and associated with a felsic volcaniclastic formation.

The existence of high metamorphic gradients, related with important tectonic accidents and consequent hydrothermal activity, resulting in silicification, chloritization and muscovitization phenomena, appears to have significantly contributed to the concentration of mineralisations of pyrite, chalcopyrite, pyrrhotite, magnetite and, more rarely, argentiferous galena.

IB – ALTER DO CHÃO – ELVAS BELT

This belt essentially corresponds to Cambrian formations. Occurrences of Cu, Pb and Zn are mainly related with intermediate-acid Cambrian metavolcanics, sometimes with associated agglomerated tuffs. Small occurrences of Pb-Zn are also known to exist in the Early Cambrian carbonated formation, particularly where this is more fractured and silicified.

IC - SOUSEL - BARRANCOS BELT

This basically corresponds to Cambrian, Ordovician, Silurian and Devonian formations.

There are essentially three types of mineralised structure here: vein, stratiform and disseminated types.

In the first, which basically consists of copper mineralisations, there exist subconcordant veins and veins that are completely discordant from the formations in which they are embedded. The most important of the sub-concordant veins are perhaps Miguel Vacas and Moçiços ore-bodies, situated at the base of the Silurian, and Urmos, located in basic metavolcanics (spilites) from the Mid Cambrian.

The most important of the discordant veins are Minancos, from the base of the Silurian, Bugalho Mine, in Silurian formations not far from its base and near the Messejana fault, and Zarnbujeira, in Ordovician formations. The Mostardeira, Aparis and Botefa veins are also discordant, and all are situated on the SW flank of the Terena syncline, which is essentially made up of flysch formations from the Devonian period.

With regard to stratiform mineralised structures, these are closely related to a Cambrian-Ordovician discordance. Mineralisations basically include pyrite, sometimes massive and rare chalcopyrite, sphalerite and galena. Mineralisations of pyrite, sphalerite and galena also occur in dolomitic limestones from the Early Cambrian, in microfractures and particularly in brecciated facies.

The disseminated mineralisations formed essentially of pyrite and chalcopyrite are associated with post-Silurian, intermediate-acid, sub-volcanic structures and constitute the cement of eruptive breccias. Mineralisation is more intense when the elements of these breccias are predominantly of a carbonated nature.

II - ÉVORA - BEJA MASSIFS

In view of the nature, typology and regional geological setting of the mineral occurrences, 3 belts have been defined in these massifs:

Arraiolos – St. Aleixo Belt

Magnetitic – Zinciferous Belt

Porphyry Belt

IIA – ARRAIOLOS – STº. ALEIXO BELT

Various occurrences of copper, mainly of vein type, are known to exist here, some of which have been exploited on a small scale (Azaruja, Monte do Trigo, Reguengos and S. Aleixo). These mineralisations are related with both granodiorite intrusions and basic volcanics commonly spilitized.

IIB - MAGNETITIC - ZINCIFEROUS BELT

This basically comprises Cambrian, Ordovician and Silurian formations, intruded by several Hercynian granitic massifs such as Pias and Pedrogão.

The most important deposits in this belt are Algares (Cu, Pb, Zn) and Balsa (Pb, Zn) in the Portel region, Enfermarias (Zn, Cu, Pb) and Preguiça (Zn, Pb), in Moura and Sobral da Adiça regions respectively, and other occurrences of Pb, Sb, Ag, Zn in the Ficalho-Moura-Vale de Vargo triangle.

The Balsa and Preguiça deposits are associated with dolomitic limestone; those at Algares and Enfermarias are related with an intermediate-acid volcanic episode which occurred at the base of the Early Cambrian, contemporaneous with a carbonated sedimentation, with which an important hydrothermal system is associated.

The Enfermarias "hidden deposit", located essentially by gravimetry and confirmed by drilling, illustrates nicely base metal prospecting in the Magnetitic - Zinciferous Belt. Deposits of Zn and Pb are also represented in paleokarsts, which contain very high levels of these elements, an example of which is the old Vila Ruiva mine.

The geological resources estimated for the Preguiça deposit on the sixties were of 1 million tones with 8% Zn and 2% Pb. More recently, 4,6 million tones with an average grade of 0,8% Pb were defined for the Enfermarias deposit.

Taking into account that both deposits are open in depth and there is a lot of other lead and zinc geochemical anomalies and occurrences, we can say that in this area we may have potential geological resources of 10 million tones with about 10% of Pb and Zn combined.

IIC - PORPHYRY BELT

This covers a wide area in which sub-volcanic and volcanic rocks - namely rhyodacites, felsites, spilites and basalts - predominate and which are surrounded to the NE and SW by diorites, gabbros and ultrabasic rocks. The most significant mineral occurrences are Corte Pereiro, Caeirinha, Alcáçovas, Peroguarda and Asseiceiras.

South-Portuguese Zone

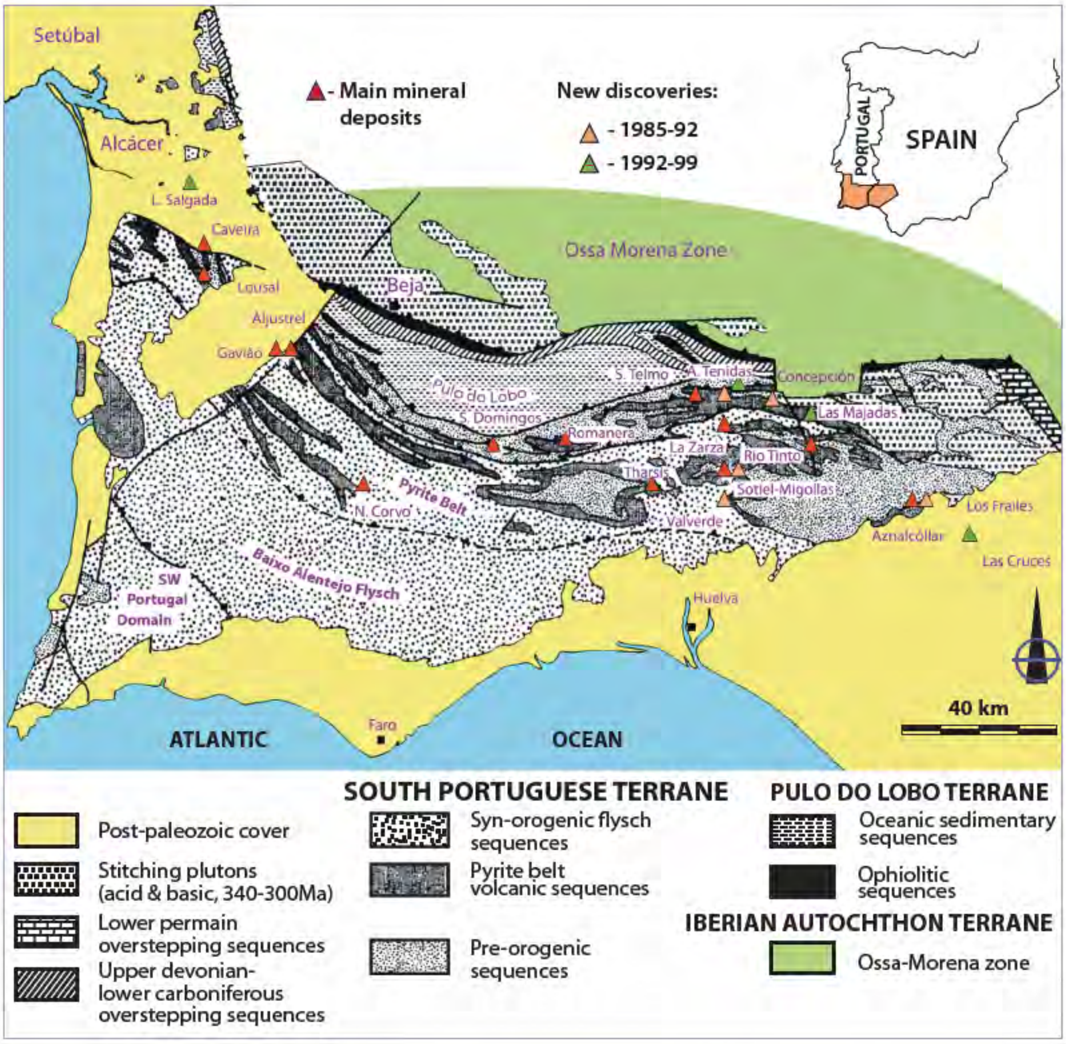
This zone is characterised by the Iberian Pyrite Belt (IPB), which is known around the world for its large deposits of massive polymetallic sulphides and plays an important role in supplying Europe with base metals.

Up until the eighties, the prospecting of massive polymetallic sulphide deposits was mainly carried out in areas where formations of the Volcanic Sedimentary Complex (VS), potential bearers of sulphide masses, outcropped or were expected to lay at depths not significantly exceeding 300 metres (Oliveira et al., 1998).

These areas were thoroughly prospected during the sixties, during which there was a marked turnaround in the methodology that had hitherto been used as a result of the evolution in the geological models related with the formation of these deposits and the introduction of new prospecting techniques and systematic gravimetric coverage, which in turn brought about great improvements in discovering mineral deposits. The changes in both corporate sector and in official departments led to important discoveries being made, most of them situated near mining centres or known occurrences, as referred above.

The Pyrite Belt has been of great interest to private companies in the mining sector for many years, this clearly reflected in the number of prospecting contracts that have been signed with the Portuguese State.

THE IBERIAN PYRITE BELT
(ad. Barriga *et al*. 1997, Carvalho *et al*. & Leistel *et al*. 1998, Matos *et al*. 2000)



The discovery of Neves-Corvo in 1977 allowed a new deposit type to be defined for the IPB, in which the levels of base metals, Cu and Sn in particular, are extraordinarily high. As this type of mineral deposit can be economically exploited at depths of more than 500 metres, there was a change of strategy on the part of several mining companies in respect of the geological- structural characteristics of the areas they wished to explore. From that moment on, prospecting at great depths thus became viable, as the discovery of a deposit with similar characteristics would support the necessary investment.

These facts, coupled with the scientific and technological breakthroughs that took place during the eighties (in respect of both the geology and metallogeny of the IPB, and the geophysical techniques applied - advances in high sensitivity airborne magnetometry and time domain electromagnetics, as well as data processing), meant that prospecting in this metallogenetic province moved into areas where the VS ocurred at great depths bellow the flysch sediments and/or the Tertiary. In recent years this trend continued, the number of companies prospecting in such areas has risen as technological advances and computer data processing have boosted their ability to detect mineral masses at hitherto unreachable depths and/or in particular adverse geological contexts such as conductive overburden.

Targets that might prove of interest in those areas are mostly located at great depth, where potential mineral-bearing horizons occur under a thick covering of flysch or beneath nappes, the thickness of which is often uncertain. The depth of drilling here reach levels that were unthinkable several years ago, these usually around the 600 m and 1000 m mark, occasionally going even further.

Despite those developments, the basic tools used since the sixties - gravimetry combined with specialized geological mapping and magnetometry (with ground vertical component surveys replaced by high-resolution total field airborne surveys and ground follow-up work) - still play a major role.

Other complementary geophysical techniques are also routinely used, mostly in previously detected gravimetric anomalies. Those include vertical electrical soundings, classic and high-resolution (SQUID-TEM) electromagnetic soundings and borehole logging, and other electrical techniques such as induced polarization and magnetotelurics. In a limited fashion, reflection seismics has also been used. Another geochemical technique that has been used is the enzyme leaching of soil samples.

Although a few localized helicopter surveys, namely aeromagnetic and EM (INPUT and frequency domain) had been done in the eighties, a regional airborne high resolution magnetic and 256 channel spectrometric geophysical survey has been developed. Those coverages have greatly contributed towards better geological mapping, defining regional geological structures, tectonic accidents, buried volcanic axes, and conductors, providing information that might indicate the presence of mineral masses deep bellow the surface.

We now move on to the most important mineral deposits and mines in this metallogenetic province (Fig. 6), from NW to SE although other deposits do exist (Caveira, Montinho, Chança, Salgadinho and Cercal, the last currently being mined for Fe and Mn):

LAGOA SALGADA - In this area, located in the Tertiary Basin of the Sado River but included in the NW segment of the IPB, varied exploration work was carried out which, thanks mainly to gravimetry, has uncovered several targets. In one of them, situated roughly 12 km NE of Grândola, a mass of polymetallic sulphides was discovered in August 1992 at a depth of 128 metres under tertiary covering.

Boreholes executed in the central and NW nuclei oft he gravimetric anomaly of Lagoa Salgada have revealed a pyrite-bearing acid volcanic sequence accompanied by polymetallic sulphides, the NW nucleus the richer of the two (Oliveira et al., 1998). Here, the mineral mass is embedded in a volcanic sequence highly altered by an important hydrothermal system. The main volcanic facies are composed of intermediate - acid lavas and autoclastic breccias with abundant feldspar megacrystals, and fine, sometimes porphyrous, chloritic-sericitic volcanics; intercalated layers of possible lapilli are frequent. Note that the enormous tectonic complexity that affects the mineralisation and wall rock makes investigation of the zone extremely difficult.

There are four types of mineralization at Lagoa Salgada: primary massive sulphide mineralization, gossan mineralization resulting from weathering of the primary mineralization, copper-rich stockwork mineralization and gold-rich silicified zones which appear to be structurally controlled. To date the mineralized system has been drill tested over a strike extent of approximately 425 m and appears to be open to the south and east.

The massive sulphide mineralization occurs in steeply dipping to vertical isoclinally folded volcanic rocks.

The mineralised mass begins with an iron hat of variable thickness - never greater than 20m -where there is marked enrichment of precious metals, Sn and some times Pb, preserved as a result of the Tertiary sedimentary rocks covering the paleosurface, in a situation analogous to the Las Cruces copper deposit in Spain. This enrichment in Au and Ag is also visible in the first section of the mass, immediately underlying, due to supergenic phenomena, or next to important thrusts and consequent remobilizations. The gossan has the following paragenesis: goethite, hematite, amalgams of Ag - Hg, chalcocite, neodigenite, covellite, bornite and mimetite. The primary mineralisation is composed mainly of pyrite with the following minerals: sphalerite, arsenopyrite, tetrahedrite, tennantite, galena, lollingite, chalcopyrite, cassiterite, stannite, meneghinite and pyrrhotite.

Copper-rich stockwork mineralization consists of sulphide veins and stringers in chloritic volcanic rocks and represents alteration associated with the feeder system to the massive sulphide mineralization.

The mineral resource estimate for the deposit (December 2011), at 3.5 ZnEQ% cut-off, is as indicated in the following tables:

INDICATED RESOURCE

ZnEQ% Cutt-off	Density	Tonnes (x 000t)	Pb%	Zn%	Cu%	Ag (g/t)	Au (g/t)	ZnEQ%
3.50%	4.43	2,942	2.94	3.40	0.34	54.72	0.82	7.18

INFERRED RESOURCE

ZnEQ% Cutt-off	Density	Tonnes (x 000t)	Pb%	Zn%	Cu%	Ag (g/t)	Au (g/t)	ZnEQ%
3.50%	4.04	1,554	2.50	1.80	0.35	51.00	0.78	5.54

LOUSAL - Old mine situated on the SW flank (inverse) of the Lousal anticline. Mineralisation is found in a deep, narrow syncline, characteristic of the VS occurring here, which is deeply folded within isoclinal structures. Several masses have been recognised with tonnages of 100,000 tons to over 3MT, essentially pyrite, generally lenticular, aligned along the axis of the folds, dipping roughly 80º to the SW and extending several hundred metres with variable thickness.

The ore is relatively poor in Cu (<0.7%) and in Pb + Zn (1.1 - 3.5%), with annual production at the start of the seventies totalling between 230,000 and 250,000 tons. The mine was closed down in 1987.

Recently, two drill holes has intersected: 10.65m @ 0.84% Cu (656.35-667.00m) and 7.85m @ 1.45% Zn (832.15-840.00m) in the first one and 28 m @ 0.92% Cu and 80.2 ppm Ag (615.00-643.00m) and 8.50 m @ 2.97% Zn, 1.12% Pb and 46.9 ppm Ag (687.10-695.60m) on the second one. Some interesting grades were also found for precious metals, maximum of 13.35g/t Au e 120g/t Ag.

ALJUSTREL - Mining at this important mineral deposit dates back to Roman times, the target being the outcropping masses of S. João and Algares. An important archaeological find was made here: two bronze tables inscribed with the mining law of those times.

In this area, the VS occupies the axis of an anticlinorium running in a NW-SE direction and is characterised by the existence of an important sequence of acid pyroclastic rocks, subdivided into lower and upper series(Silva et al., 1997). These rocks are in turn subdivided into two laterally equivalent series. In the central part of the structure there is a sequence which includes the lower unit with tuffs with megacrystals, and the upper with green tuffs; laterally, the lower series is characterised by the existence of volcanics with felsic facies; and the upper, known as the tuffs of the mine formation, is the bearer of masses of massive polymetallic sulphides.

The Messeiana fault has a sinistral displacement of roughly 2.5 km, causing locally a change in the direction of the structures from NW-SE to E-W Later it caused the NW block to lower and be covered by tertiary sediments. Thus, the sector of the Gavião deposit, which constitutes the extension of the Aljustrel structure, presents a tertiary cover of 60 - 90m.

The following masses have been recognised: Algares, S. João, Moinho, Feitais, Estação and Gavião, all occurring in well defined structural positions in the Aljustrel Anticlinorium, running parallel and symmetrical to the alignments of the felsic facies, mine tuffs which are: the S. João Syncline, containing the deposits of S. João, Moinho, Algares and the NE Gavião mass; a second alignment symmetrical to the latter includes the SW Gavião mass; finally, the Feitais and Estação deposits are located on the NE flank of the referred anticlinorium.

S. João and Algares were exploited up until the mid-sixties, the latter now exhausted, Moinho and Feitais were mined in more recent decades, while mining operations have never taken place at Estação and Gavião.

Various types of ore can be distinguished in the Moinho and Feitais deposits: coarse "banded", rich in chalcopyrite; massive, essentially pyritic and fine "banded", rich in sphalerite and galena.

Several evaluation studies were recently developed for the Feitais, Moinho, Estação e Gavião deposits. To date, the following mineral reserves are known for Moinho and Feitais (JORC; cut-off: 1.5% Cu and 4.5% Zn):

Deposit		Reserves	Ton (kt)	Cu (%)	Cu Metal (t)	Zn (%)	Zn Metal (t)	Pb (%)	Pb Metal (t)	Ag (g/t)	Ag Metal (oz)
Feitais	Cupriferous Stockwork	Measured	348.9	1.98	6,902	0.27	946	0.07	240	8.06	87,428
		Indicated	3.559.0	1.72	61,343	0.28	9,796	0.06	2,133	7.46	825,399
		Total	3.907.9	1.74	68,245	0.28	10,742	0.06	2,373	7.51	912,827
	Cupriferous Massive	Measured	508.4	1.65	8,401	1.57	7,963	0.46	2,344	0.00	0
		Indicated	2.797.6	1.78	49,701	1.41	39,513	0.36	10,050	0.36	31,258
		Total	3.306.0	1.76	58,102	1.43	47,476	0.38	12,394	0.30	31,258
	Total		7,213.9	1.75	126,347	0.81	58,218	0.21	14,767	4.21	944,085
Moinho	Cupriferous Stockwork	Measured	84.3	1.79	1,509	0.75	630	0.24	199	14.86	38,942
		Indicated	137.4	1.52	2,092	0.65	887	0.22	308	11.09	47,930
		Total	221.7	1.62	3,601	0.69	1,517	0.23	507	12.52	86,872
	Cupriferous Massive	Measured	1,232.6	1.68	20,695	1.32	16,326	0.45	5,498	0.00	0
		Indicated	1,909.2	1.50	28,648	1.41	26,878	0.53	10,069	0.53	31,318
		Total	3,141.8	1.57	49,343	1.37	43,204	0.50	15,567	0.32	31,318
	Total		3,363.5	1.57	52,944	1.33	44,721	0.48	16,074	1.13	118,190
Total		Measured	2,174.2	1.73	37,507	1.19	25,865	0.38	8,281	1.87	126,370
		Indicated	8,403.2	1.69	141,784	0.92	77,074	0.27	22,560	3.58	935,905
		Grand Total	10,577.4	1.69	179,291	0.97	102,939	0.29	30,841	3.23	1,062,275

Last figures for Gavião deposit are 12,3 million tonnes of inferred resources with 1,47 % Cu, 1,91 % Zn, 0,63 % Pb and 26 g/t Ag with a cut off of 1% Cu. The Algares deposit, which is currently exhausted, should have contained mineral resources greater than 50 Mt.

NEVES CORVO - This important mine is geologically situated at the end of the Neves Corvo - Rosário Anticline, a structure that runs NW-SE, the axis of which dips to SE, with deposits on both flanks (T.Oliveira et al., 1997). Various groups of sub-vertical faults occur which affect the mineral deposits and also low-angled overthrusts, related with repetitions of volcanic sedimentary and flysch units. These deposits are situated in the upper part of a volcanic sedimentary sequence (VS), mainly acid, and composed of three sequences of acid tuffs, separated by shales formations, with a discontinuous level of black shales immediately beneath the mineralised masses. Due to the abovementioned overthrusts, the flysch and volcanic sedimentary units repeat above the top of the mineral mass.

Geological, geophysical and geochemical prospecting work begun by the IGM (Portuguese Geological Survey) and carried on by a Portuguese-French consortium (Sociedade Mineira de Santiago, S.M.M. Peñarroya and SEREM - BRGM) led to the drilling and intersecting in 1977 of the first deposit (Neves). Next, three more important deposits were discovered, Corvo, Graça and Zambujal, with a fifth deposit discovered in 1988 (Lombador). In 1980, the consortium gave way to Somincor (Sociedade Mineira de Neves Corvo, SA).

The mine has been a significant producer of copper since 1989 and in 2006 commenced treating zinc ore. The processing of zinc-rich ore was suspended in November 2008 pending an improvement in zinc prices and the zinc facility was converted to treat copper ore. Zinc production is expected to recommence in 2011 or even this year. Mine access is provided by one vertical five metres diameter shaft, hoisting ore from the 700 metres level, and a ramp from surface. Production targets for 2011 are 77 000 tonnes of Cu and 6 000 tonnes of Zn, contained in concentrates.

These deposits are composed of lenticular masses of massive polymetallic sulphides, also containing stockwork mineralisation in the footwall host rock, and are distinguished from other Pyrite Belt deposits by their high copper and tin contents and a highly metal zonation. This latter fact, related with the segregation of base metals, favours the division into copper, tin and zinc ores, as well as massive "barren" pyrite.

Three main types of ore occur:

a) "Rubané" - occurs at the top of massive sulphide masses, particularly at the Corvo orebody, and is composed of chloritic shales, siliceous shales and chert-carbonate breccia, with sulphide veinlets sub-parallel to perpendicular to the stratification and sometimes with tight lenses and bands of massive sulphides. The sulphides contained here are mostly cupriferous.

b) Massive sulphides - composed of approximately 95% of fine grained sulphides, in which pyrite predominates, followed by chalcopyrite, tennantite and bornite. In the polymetallic lenses the main zinc mineral is sphalerite ; galena occurs disseminated or in millimetric bands in the massive sphalerite. The main tin minerals are cassiterite and minor stannite, normally associated with high grade copper ore, at the base of the deposits in particular but also at its top. This ore can be split into 5 subtypes: cupriferous (MC), characterised by disseminations and bands of variable thickness of chalcopyrite in the massive pyrite and with a Cu content greater than 2%; cupriferous with broad bands of tetrahedrite/tennantite or sphalerite (MH), which introduce high levels of penalty elements, such as As, Sb, Hg and Zn; rich cupriferous ore (MS), with more than 1 % tin and composed of massive or banded chalcopyrite containing elements of massive cassiterite; stanniferous (MT), in which there is abundant cassiterite and a tin content of more than 8%; zinciferous (MZ), rich in sphalerite, which occurs as centimetric bands in the massive pyrite, bands which may contain disseminations of galena.

c) Fissural - stockwork - type mineralisation, including the "breccia" of the base of the Corvo mass, which occurs in the footwall shales and in acid volcanic rocks, usually in discordant veins and veinlets of sulphide minerals. Pyrite and chalcopyrite predominate, although cassiterite and sphalerite also occur, always accompanied by intense hydrothermal alteration of the host rocks.

This mineralisation can be subdivided into three sub-types: cupriferous (FC), with more than 2% Cu, present in veins and veinlets rich in chalcopyrite; stanniferous (FT), with more than 1 % Sn, present in veins rich in cassiterite, together with pyrite and, to a lesser extent, chalcopyrite; zinciferous (FZ), with more than 3.3% zinc, present in veins and veinlets rich in sphalerite.

Neves Corvo Cu and Zn Mine

Those are today the resources/reserves defined for Neves Corvo:

Neves Corvo Mineral Reserves	Category	000's	Cu	Zn	Pb	Ag
		Tonnes	%	%	%	g/t
Copper	Proven	23,235	3.6	1.0	0.3	44
	Probable	4,508	2.3	0.5	0.4	45
	Total	**27,744**	**3.0**	**0.9**	**0.3**	**44**
Zinc	Proven	19,361	0.4	7.1	1.6	67
	Probable	3,769	0.4	8.0	12.1	64
	Total	**23,130**	**0.4**	**7.3**	**1.7**	**66**

Neves Corvo Mineral Resources (inclusive of reserves)	Category	000's	Cu	Zn	Pb	Ag
		Tonnes	%	%	%	g/t
Copper	Measured	37,621	3.2	1.2	0.4	49
	Indicated	7,688	2.3	0.9	0.5	49
	Inferred	28,490	1.8	0.9	0.4	40
Zinc	Measured	61,252	0.4	6.1	1.4	59
	Indicated	18,094	0.4	6.5	1.7	53
	Inferred	32,985	0.4	4.9	1.2	55

The Mineral Resources are reported above cut-off grades of 1.0% for copper and 3.0% for zinc and the Mineral Reserves at a cut-off of 1.4% for copper and 5.0% for zinc, but not for Lombador deposit, where for phase 1, a zinc cut-off of 6.0% was applied for Mineral Reserve reporting.

In September 2010 a new copper deposit was discovered, Semblana, located approximately one kilometre northeast of the Zambujal orebody.

The Semblana Copper Deposit comprises two zones:

A recently discovered, high-grade massive copper sulphide zone at the southern end of the deposit of 0.64 million tonnes grading 6.2% copper and 62 g/t silver, overlying a stockwork copper sulphide zone. This massive copper sulphide zone measures approximately 150 metres north to south and 100 metres east to west, and is open to the east and west for expansion.

An extensive stockwork-type copper sulphide zone of 5.94 million tonnes grading 2.6% copper and 20 g/t silver. This zone occurs as one continuous zone measuring approximately 700 metres north to south and 250 metres east to west. Given the wide current spacing of drill holes, the zone appears to be open to the east and west.

S. DOMINGOS - The sequence and characteristics of the mineral-bearing volcanic sedimentary complex (VS) in this area are poorly exposed and understood, their structural aspects being particularly complicated. The upper levels of the VS are covered by a fairly thin turbiditic sequence overlain by Phyllite-Quartzite Group formations.

Nevertheless, a volcanic sequence composed of rhyolites, jaspers and diabases can still be observed in old works. This mine was extremely important in the past, and in fact dates back to Roman times. Between, 1858 and 1966, the "Mason and Barry Company" mined around 25 million tons of ore, by open-cast operations going down to a depth of 120m with additional underground work to a depth of 400m (Carvalho et al., 1971).

The ore was composed chiefly of massive pyrite with a maximum grade of 10% copper and 14% zinc-lead, and average grades of 1.25% Cu, 2-3% Zn and 45-48% S.

Given the occurrence of massive polymetallic sulphides in the formations (Silurian volcanic sedimentary complex) surrounding the Morais and Bragança massifs, as well as several geological and metallogenetic similarities with the Pyrite Belt, it is our opinion that the Trás-os-Montes zone is worth investigating.

Nevertheless, the main target will still be the Pyrite Belt, in which exploration will continue to be carried out in zones characterised by (Oliveira et al., 1998):

Areas of high tectonic complexity, where barren allochthonous terranes thrust over more recent geological formations with high mineral potential.

Structural alignments, in which the VS can be found at great depth beneath more recent Paleozoic Flysch formations in Baixo Alentejo.

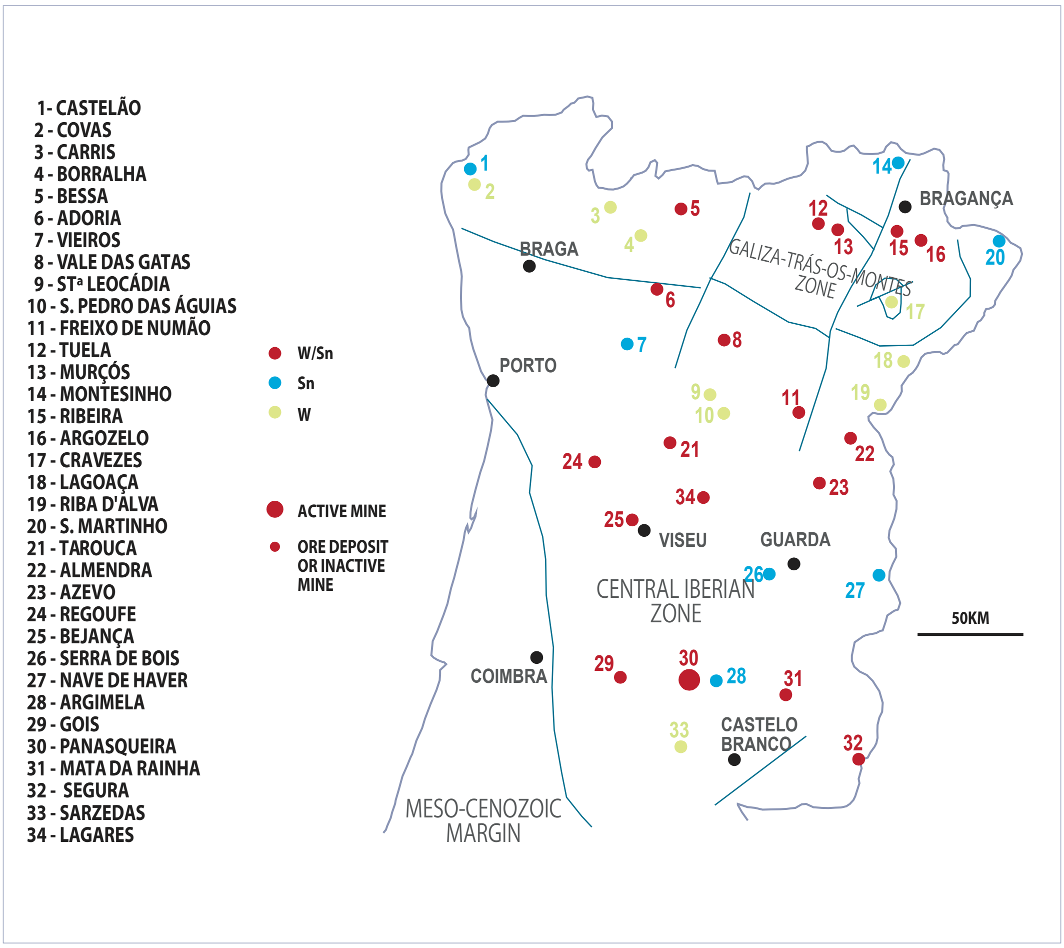
Areas within the Sado River Tertiary Basin, where the VS can occur at depths ranging from a few dozen to several hundred metres beneath Ceno-Anthropozoic formations.

OTHER METALS

Tungsten and Tin

The existence of a tungsten and tin metallogenetic province on the Peninsula, which in Portugal overlays the Galicia - Trás-os-Montes and Central - Iberian Zones, has long been known. In this province, gold and silver occur with a certain zonality at regional scale in relation to tungsten, hence the fact that the potential areas in these two groups of substances sometimes coincide.

GEOTECTONIC UNITS AND MAIN W, Sn DEPOSITS



We shall not cover the tin contained in the polymetallic sulphide deposits of the Pyrite Belt in this chapter as these occur in a completely different metallogenetic context.

The primary deposits or occurrences of W-Sn are for the most part either directly or indirectly linked with granites, with differing typology: aplite-pegmatites (Lagares de Estanho - Queiriga), intra and extra-batholithic stockworks (Bejanca-Vouzela and Fonte Santa - F. Espada à Cinta) and vein type. The latter are more common and account for most production of wolframite in the country (Goínhas, 1987).

They are generally found in contact metamorphic aureoles, sometimes a great distance from the granite outcrops, in which case it is assumed their relationship with fairly deep, non-outcropping granitic domes (Panasqueira, Argemela, Góis, Borralha, Vale das Gatas, Ribeira, Argozelo, etc.).

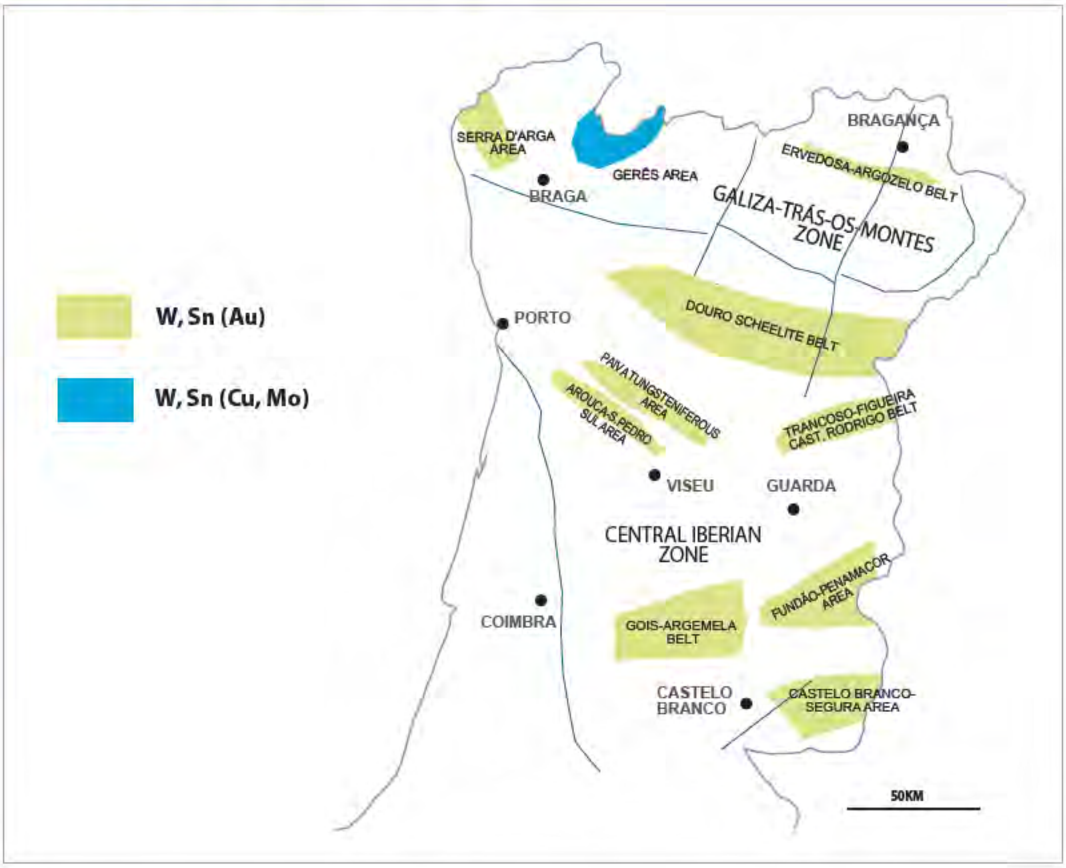
Besides these examples, there is also the special case of the skarns with scheelite, formed by contact metasomatism, which - in accordance with the wall rock structure -some geologists divide into two types: stratoid (Cravezes-Mogadouro, Stª Leocádia-Armamar, S. Pedro da guias-Tabuaço, etc.) and vein type (most of the skams in the Castelo Melhor-Escalhão region, near to the River Águeda and the Spanish border, however the most important ones in the Escalhão - Barca d'Alva sector are from the stratoid type).

The most promising areas for the occurrence of large deposits correspond to various types of geostructural settings:

a) Areas covered by monotonous schist series where the existence of non-outcropping granitic dome is presumed. An example of this is the Schist-Greywacke Complex situated to the south of the Estrela Mountain, and in particular the belt running E-W between Góis and the Spanish border, which covers the Góis, Panasqueira and Argemela mines. In this area, the main model is probably the Panasqueira deposit: mineralised sub-horizontal veins related with a non-outcropping, partially greisenized, leucogranitic dome.

b) Structural alignments of regional dimension containing various types of Sn-W deposits and small outcropping or sub-outcropping dome of differentiated granitoids. An example of this is the extensive WNW-ESE alignment that runs from near Ervedosa, through the Tuela, Agrochão and Murçós mines, and then, after being rejected by the Vilariga fault, continues eastwards towards the Ribeira and Argozelo mines in Trás-os-Montes area. The standard deposit type has not yet been fully defined but could be similar to that of Tuela, with vast stockwork zones with a high density of mineralised veins and remobilisation along strike-slip faults running subparallel to the regional structural alignment. For this deposit, 464 057 tones of measured and indicated resources were recently calculated for "Open Pit W", with 974,86 tonnes of tin, with a grade of 2,10 kg//ton.

POTENTIAL AREAS IN W, Sn MINERALIZATIONS



c) Granitic areas containing multiple intrusions differing in terms of mineralogy, metallogeny and chronology. In some cases, specific parageneses for a certain type of intrusion can be defined, distributed according to specific schemes of zonation, generally accompanied by hydrothermal alteration phenomena.

d) Circumscribed granitic massifs, with differentiated composition from regional granites and its metamorphic aureoles. Outcrops are small in size, circular in shape or slightly elongated along one of the axes and may resemble outcropping domes, the possible metallogenetic models fitting any of the types described in a) and b). The circumscribed massifs in the Arouca region, running in a NW-SE direction, are - in this context - one of the areas with greatest potential for the occurrence of intra- or extra-batholithic stockwork deposits.

A brief mention to the secondary alluvial-type tin and tungsten deposits, of reduced economic interest given their small size. The most important of these, however, are Nave de Haver (Sabugal), Gaia (Belmonte) and, to a lesser degree, Bejanca (Vouzela), Massueime (Pinhel) and Stª Eulália (Elvas), and Vale do Tâmega (Ribeira da Pena) alluvium, amongst others.

In relation to the skarns with scheelite, special mention should be made of the potential of the so-called Douro Scheelite Belt, which includes the whole of the area where the formations of the Schist-Greywacke Complex and the sintectonic granites make contact. This is situated to the north and south of the Douro river between the meridians of Freixo de Espada à Cinta and Régua. Besides numerous occurrences, several interesting deposits have also been recognised: Cravezes (Mogadouro), Stª Leocádia (Armamar) and S. Pedro da Águias (Tabuaço). At this last one, Colt Resources as recently defined indicated mineral resources of 760 kt at a mean grade of 0.58% WO3, which is the equivalent of 4,400 t of contained WO3; and inferred mineral resources of 1,330 kt at a mean grade of 0.57% WO3, which is the equivalent of 7,600 t of contained WO3 (cut-off of 0.3 % WO3 for both indicated and inferred resources).

Another zone or belt of interest from an exploration point of view located in a similar geological context is the so-called Trancoso-Figueira de Castelo Rodrigo Belt.

In the Serra de Arga zone (Minho district) - besides the existence of tin-niobium-tantalum mineralisation- small deposits of scheelite stratoid type occur in skarns, interstratified in Silurian formations and in relation with the post-tectonic granites of Vila Nova de Cerveira and Covas: Cerdeirinha, Covas, Lapa Grande, Argela and Cabração.

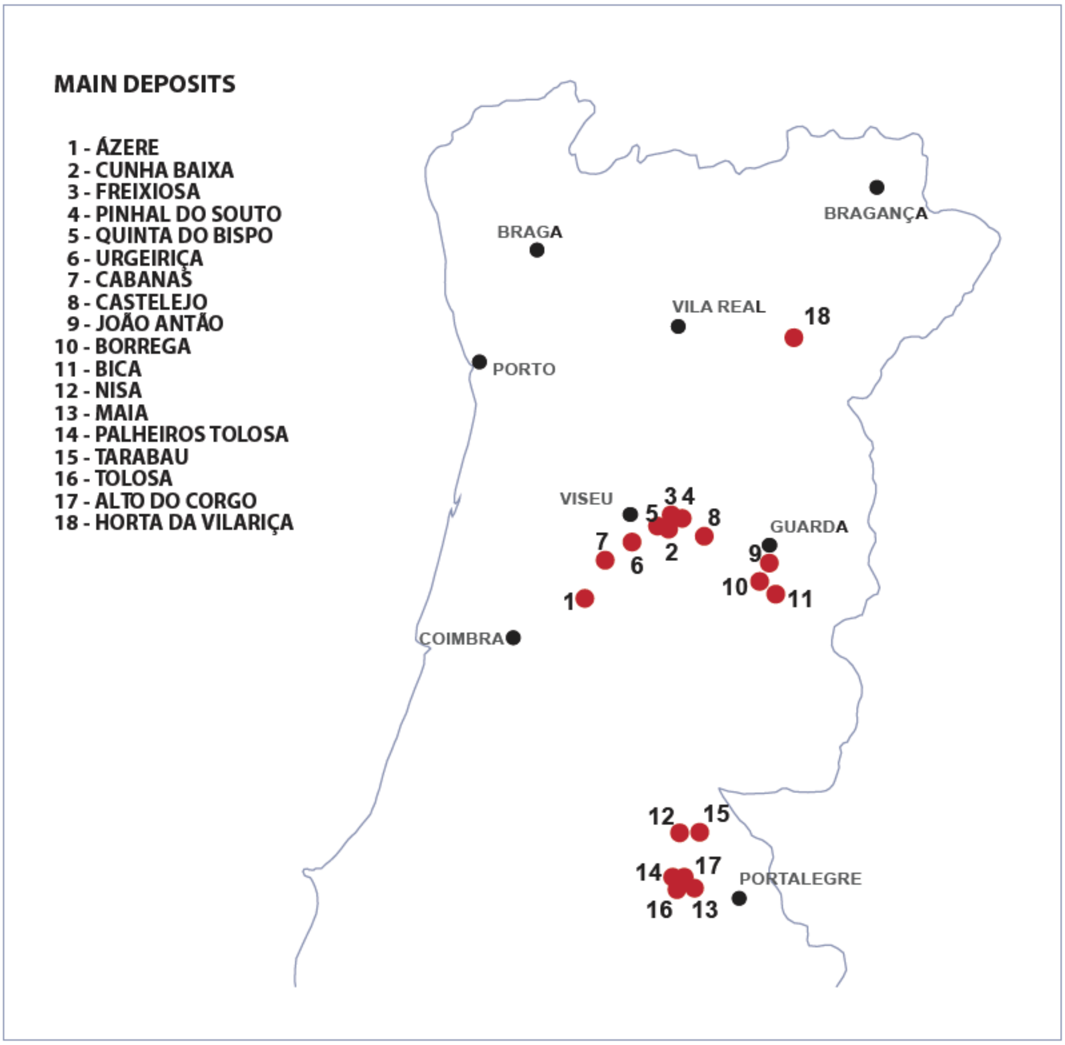
We have already referred to the production of tungsten and tin concentrates, which reached maximum levels during the Second World War and the main producing centres. Of these, only the Panasqueira mine remains in operation. Here, in July of 2011 a total of 18 257 969 tones of resources, with 4 156 835 MTU WO3 and a cut off of 10 kg/m2 were defined.

The mineralised zone consists of series of sub-horizontal quartz veins, which overlap and fill the joints of fractures occurring in schist rock. These veins vary in thickness from 1 to 150 centimetres, the average thickness of the veins currently being mined around the 30-40 cm mark.

Besides the main minerals being mined - wolframite, cassiterite and chalcopyrite - various other minerals occur, such as sphalerite, topaz, apatite, fluorite, triplite, marcasite, siderite, arsenopyrite and muscovite, not to mention many others. The mine is in fact, famous for the occurrence of valuable collection samples.

Uranium

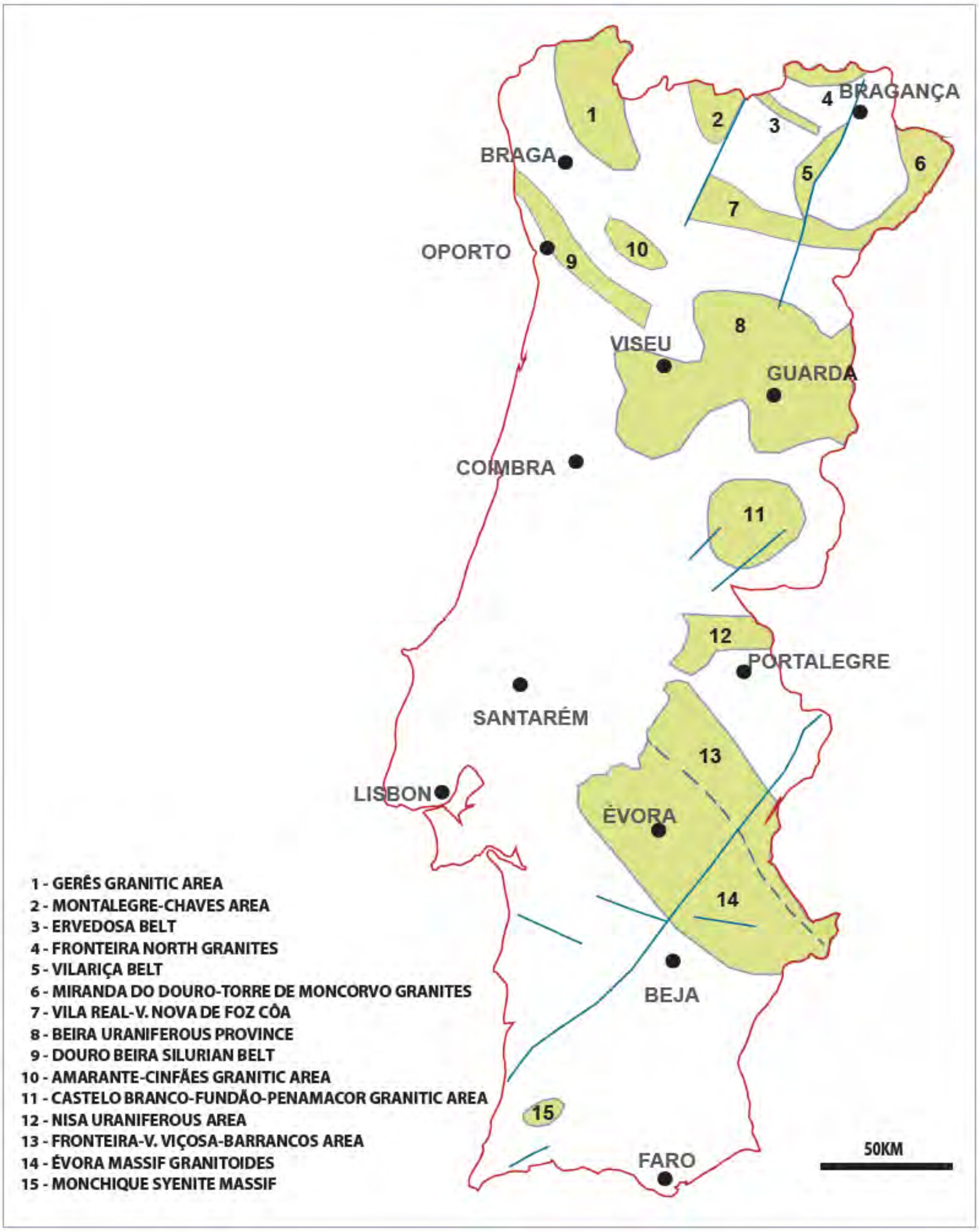
LOCATION OF THE MAIN URANIUM DEPOSITS IN PORTUGAL



The known uranium deposits in Portugal are situated in the Central Iberian Zone. They are located within Hercynian granitic batholiths or in the metasediments of exocontacts and occupy a structurally high position, which can be deduced from the presence of numerous pegmatites and metasedimentary enclaves (Dias et al., 1970).

The granites, occurring in the form of circumscribed massifs, belong to a calcalkaline series, are generally post-tectonic and are heavily fractured, particularly the NNE-SSW to ENE-WSW and NNW-

POTENTIAL AREAS FOR URANIUM MINERALIZATION



SSE to NW-SE systems, pointing to a N-S maximum compression direction (Goínhas, 1987).

In the Beiras region, the largest and most productive area for uranium, the granite is intersected by numerous dykes of basic rock.

In this region, the intragranitic uranium bearing veins can be any of the following types:

- jasperized veins;
- quartz veins;
- basic rock veins;
- granitic breccia, sometimes with limonite;

In the equally productive Alto Alentejo region, intragranitic uranium deposits are of the quartz veins and granitic breccia types.

Jasper type deposits have a characteristic paragenetic association: quartz, hematite, sphalerite, pitchblende, pyrite, galena, ankerite, chalcopyrite and coffinite. The pitchblende dates from the late Hercynian.

Mineral occurrences of all the other types essentially consist of hexavalent uranium minerals (secondary uranium minerals).

Support for uranium mineralisation in peribatholithic deposits, which also occur in the Beiras and Alto Alentejo regions, is provided by the formations of the Schist-Greywacke Complex.

These deposits are also almost totally composed of secondary uranium minerals, with pitchblende fairly rare.

Although this type of uranium dissemination deposit in metamorphic schists that contact with granite represents a very important percentage of total known uranium reserves, its genesis is controversial. Deposits such as Nisa (Alto Alentejo), Azere (Beira Alta) and Horta da Vilariga (Trás-os-Montes) are important examples of this type of mineralisation.

Occurrences related with concentrations of soil-leached uranium have also been detected in the Western Meso-Cenozoic Margin.

Geologically favourable zones for prospecting uranium in Portugal are described below. These are organised by their geological settings and in decreasing order of their potential:

- Hercynian granites in known productive zones (Beiras and Alto Alentejo - CentralIberian Zone) and other interesting vein occurrences (granites from the NE of Trás-osMontes, Galicia-Trás-os-Montes Zone and Évora Massif, OssaMorena Zone): - vein type deposits;

- Metasediments from the Schist-Greywacke Complex and possibly from the Silurian, in particular in the contact metamorphism aureole (exo and endocontact) with productive granites in the Galicia -Trás-os-Montes Zone and the Central-Iberian Zone: - Iberian disseminated type deposits;

- Ampelitic and/or pyritic schists from the Paleozoic, in particular in the Ossa-Morena Zone: - disseminated type deposits in Silurian black schists;

Nepheline syenite from the Serra de Monchique: - deposits associated with alkaline intrusions from the tertiary age;

Continental sediments from the Meso-Cenozoic age from the Western Margin and, possibly, from the Southern Margin: - sandstone type deposits;

Sediments from inland Paleogene basins or from hydrographic basins of large rivers, particularly in the cover zones of productive granites: - sandstone type disseminated deposits.

In the Portuguese uranium metallogenetic province demonstrated reserves in the known deposits in the Beira and Alto Alentejo regions are around 8200 tons of uranium metal.

Today no mines are working, but recently several international companies showed interest in the Portuguese potential, specially in the Nisa deposit, where 2.5Mt with 0.11% U3O8 (cut off of 0.05%) of geological resources are estimated.

Iron and Manganese

Although several deposits were exploited in the past, with a special relevance to Cercal mine, today the Moncorvo deposit, composed of 5 ore bodies, is the most important one. 30 years before the laboratorial tests showed that it's technically possible to obtain concentrates with grades between 64% and 68% in Fe and 0,15% and 0,25% of P. More recently was concluded that it's possible to reduce a little bit the grade in P, using selective mining works and through metallurgical methods we can reach to iron concentrates with less of 0,10 % P. The proven and probable reserves of the Moncorvo deposit, with a total of 550 Mt of ore, are enough for produce 250 Mt of fine sinterized agglomerates with 60% to 65% Fe.

Lithium and High Tech Metals

Portugal occupies an important position in terms of lithium production. This is mainly due to the exploitation of aplite-pegmatite veins, rich in lepidolite, embedded in a late Hercynian granite, porphyritic, monzonitic, in the region of Gonçalo (Guarda).

Lithium-bearing lodes are characterised by a geochemical association of A1-Na-Ca-PRb-Li-B-Sr and occupy a system of sub-horizontal fractures running predominantly NS, with cassiterite, tantalite and beryl also occurring.

Other potential lithium-bearing areas exist: the region between the Barroso and Alvão mountain ranges. The main deposits (Alijó, Veral e Adagói) are associated with aplite-pegmatite veins, rich in spodumene, embedded in Silurian metasediments composed of micaschists and quartziferous schists with intercalations of black schists. with intercalations of black schists.

As we have mentioned, the lithium occurs chiefly in the form of spodumene, but also in amblygonite and, more rarely, petalite, eucryptite and montebrasite, the pegmatite facies clearly the richest in lithium.

The results of regional exploration have led to the reconnaissance of a large extension of the aplite-pegmatite field with spodumene, a NW-SE alignment of more than 20 km identified parallel to the 3rd stage of Hercynian deformation. This type of lithium mineralisation is independent in space and in time from others of Sn-Nb-Ta and W, occurring in the zone.

In Alijó and Veral proven geological reserves of 586.560 tonnes of quartz, feldspar and lithium on the main vein, and more 600.000 tonnes of other veins, totalizing about 1 200 000 tonnes, were defined.

In Adagói proven reserves of 187 000 tonnes of ore were defined on the Lousas sector and 220 883 tonnes on the Gondiães one.

The Iberian Pyrite Belt is known as a relevant source of pyrite ores and associated base metal resources (copper, lead, zinc), having been extensively mined in the past. Its future potential may likely be in the mining of what have been up to now marginal ores and deposits for their high-tech element contents.

Recent sampling developed in a research project show significant contents of several elements with interest for a variety of high-tech applications. Among the most remarkable results, whole-rock analyses have revealed anomalously high contents of:

Indium in ores from the Lagoa Salgada deposit, with 12 samples averaging 29 ppm In;

Selenium in ores from the Lousal mine and the Lagoa Salgada deposit, with 6 samples averaging respectively 48 and 81 ppm Se;

Germanium in remobilized vein deposits, such as in the Barrigão mine, with 10 samples averaging 61 ppm Ge.

The mineralogical and chemical characterization of Lagoa Salgada ores showed that indium is carried by excess-metal chalcogenides and spectroscopic studies using synchrotron radiation at the European Synchrotron Research Facility disclosed singularities of indium binding in the carrier phases. The valorization of indium content strongly contributes to the feasibility of mining Lagoa Salgada copper ores.

Selenium is found mainly in galena and sulphosalts.

Similarly, in Barrigão ores, germanium is present as sub-microscopic inclusions of a copper-tin-germanium phase within chalcopyrite and small vugs therein. Remobilized vein deposits like Barrigão consist of relatively narrow veins and their tonnages are rather small but several such deposits exist and germanium is potentially a relevant by-product in the processing of these ore types.

Rare Earths

Portugal's geostructural characteristics lend it great potential for the occurrence of rare earths. This has been confirmed by mineralometric studies and radiometric surveys.

With the exception of the Alter Pedroso zone, where hyperalkaline rocks have been investigated by an exploration company, this group of elements had never been prospected in Portugal until recently.

Regional exploration was carried out in the Beira Baixa and North Alentejo regions by the Geological Survey, involving geological mapping, alluvial and stream sediment sampling and radiometric surveys, the aim being the selection of targets to investigate at a later stage.

Prospecting is aimed at detecting Rare Earth bearing minerals, such as monazite - nodular monazite in particular - in sedimentary rock areas (more or less metamorphised) and xenotime, without overlooking other minerals such as apatite and allanite.

Mineralometric data on the North Alentejo suggests that, to date, nodular monazite rich in light rare earths has originated chiefly from the disintegration of the ridges of the Ordovician quartzites on the southwest flank of the Portalegre Syncline, even in the case of Reveladas (Marvão), where the alluvial samples were collected in the midst of the Silurian formations, but close to these ridges.

Normal monazite appears to be chiefly associated with granite, as is the case of the Fronteira granite and tertiary gravel, originated from it.

As far as the lithogeochemistry of the Ordovician is concerned, it is the radioactive quartzites interstratified in the schists immediately above the thick base quartzites that are rich in rare earths, and not the schists itself. This finding for the radioactive quartzites, previously known in Alegrete (Portalegre), mapped in detail in the Vale de Cavalos area and also detected in Penha Garcia, goes against existing data on the levels of schists with nodular monazite, rich in rare earths, particularly europium, in other places of Europe and America.

Nickel, Cobalt and Chrome

The occurrence of these metals in Portugal has not been sufficiently investigated, although various metallogenetic scenarios point to their potential existence. These are briefly described below:

a) Morais and Bragança mafic and ultramafic massifs, where in some sectors, like the Alimonde one, chromite-bearing peridotite formations (dunites) occur.

b) Évora Massif of the Ossa-Morena Zone. Parts of this area have geological and metallogenetic characteristics that are similar to those of the Água Blanca zone (Monasterio - Spain), in which an important deposit of Ni was discovered.

c) Basic and ultrabasic complexes occurring on the north and south edges of the Ossa-Morena Zone, particularly in the Alter do Chão, Elvas and Campo Maior massifs and also in the Beja ophiolite complex.

NON METALLIC MINERALS

Non metallic mineral resources - rocks and industrial minerals constitute a sector of large economic relevance in Portugal due to the important volumes produced and processed and the number of workers involved.

This is a very dynamic industrial activity which has progressively been modernised in order to meet the more advanced extractive and processing technologies thus contributing for higher levels of production and quality and for increased competitiveness in the markets.

The activity in this sector includes two main branches:

Rocks

Industrial Minerals

Argemela Quartz Mine

1 - Rocks

1.1 - Ornamental Stones

Marbles, limestones and granites are the dominant materials and are responsible for about 96% of the total production; the remaining includes slate, nepheline syenite, acid porphyry, gabbro, diorite, shale, serpentine and gneiss.

The present production of dimension stones is approximately 2,857,000 ton from which about 48% is exported. Exportation has changed considerably in the last decade due to the increase in the value of the exported products: from the total exportation in 2010, 61 % were processed products, 24 % slabs and only 15% blocks.

Considering the production of dimension stones all over the world, Portugal has lost ground, but maintains on 2009 the 9th rank in the world, after Brazil and Spain.

All the Portuguese dimension stones have a designation of origin to identify the place or region of the product, like a seal of quality related to its great aesthetic value.

Marbles

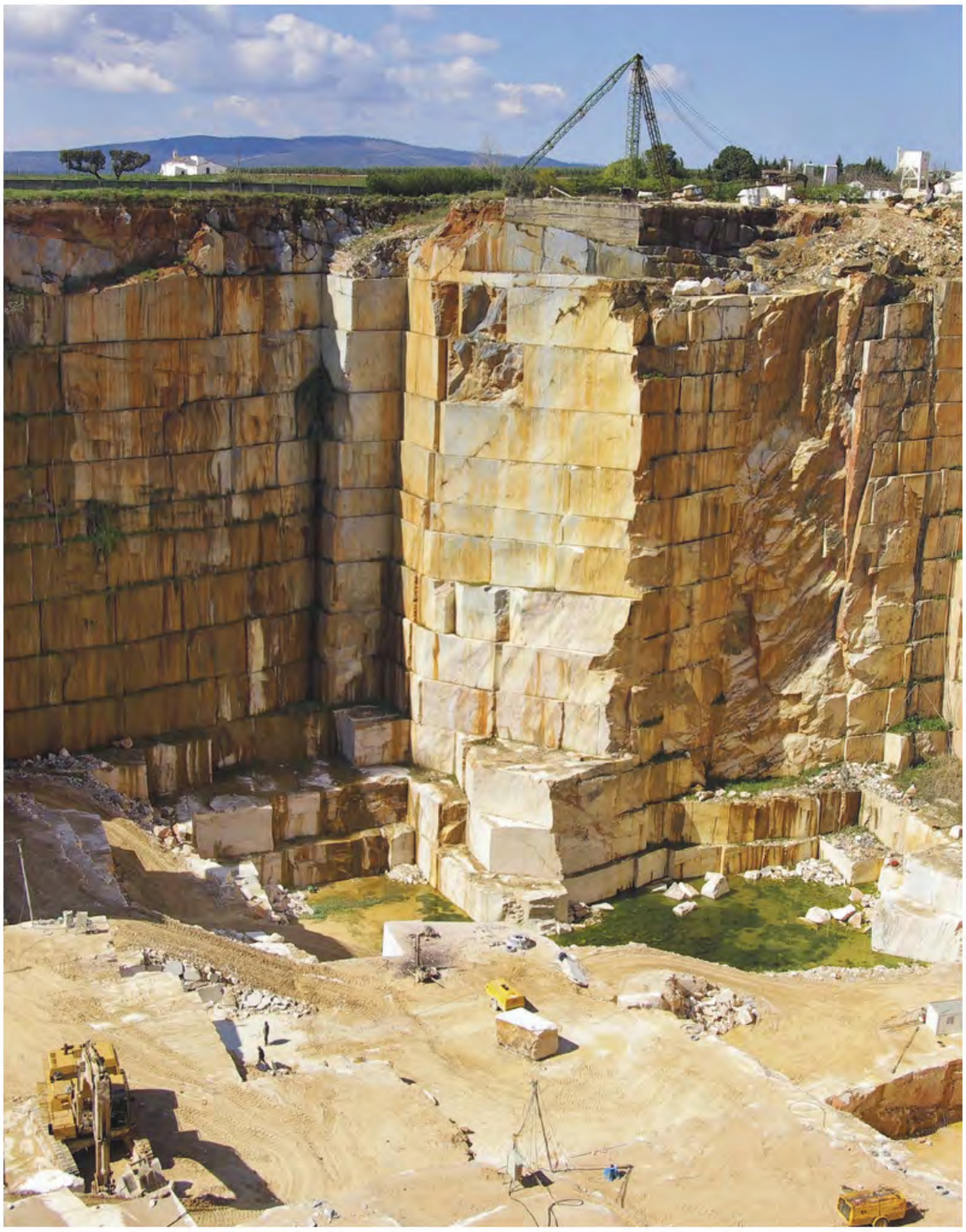
Marbles are mainly produced in the Estremoz anticline and represent approximately 20% of the total production of dimension stones, in value. They have an historical background as they are being exploited for 20 centuries. The pink type, named Rosa Puro, is the most valued.

Other areas, such as Viana do Alentejo, Trigaches and Ficalho, although small, produce very beautiful ornamental types with a variety of colours ranging from greenish and greyish to black and white.

In the anticline, at Borba, there is a technological centre (CEVALOR) for studying, evaluating and promoting dimension stones.

Block Extraction in Marble Quarry

Marble Quarry



Limestones

Limestones are mostly produced in Maciço Calcário Estremenho where several ornamental types occur. They are cream coloured and are differentiated by their texture. “Moca Creme”, “Relvinha” and “Semi Rijo” are the most known and valuable varieties. This region is also the main production centre of the typical “Calçada Portuguesa” – small white and black limestone handcraft cubes used for pedestrian streets paving in many Portuguese towns and cities, which is becoming largely appreciated.

Greenish and pinkish breccia limestones are exploited in the Algarve region.

Microcrystalline limestones are produced at Sintra and exhibit several colour patterns such as white, pink, yellow, red, blue and black. Their production is restricted and at a short-term will be mainly directed for the restoration of the ancient buildings and monuments of Lisbon.

The production of limestones in 2010 was about 791,705 tonnes and represents 27% of the global value production of dimension stones.

Granites

Ornamental granites can be found scattered all over the country although with a higher density in northern areas such as Viana do Castelo, Braga, Viseu, Porto, Braga and Vila Real. In the South this type of granite occurs in Portalegre district.

They show a large diversity of textures and colours with predominance of greyish, being yellowish and pinkish types also found.

Ornamental granites (that includes similar rocks, such as slate, acid porphyry, serpentine, nepheline syenite, witch had a small production) represent the subsector with the highest growth rate in recent years, and the production achieved in 2010 puts it in the first place, ahead of the marbles and limestones, with 52% of the global value production (1,798,508 tonnes).

The global reserves of granites are very large and further detailed studies in some areas are needed.

The production of other ornamental rocks, such as slate, acid porphyry, serpentine, nepheline syenite and others is small. The reserves are small as well.

1.2 - Industrial Stones

All the above mentioned stones can have alternative uses when they are not adequate for ornamental purposes, the most common use being crushed stone for road building and construction and granitic cobblestones for paving. Granite wastes have the highest rate of utilisation. There are however other important industries which depend on this type of resources.

1.2.1 - Use of Quarrying Wastes

From granites and similars

Granite wastes have the highest rate of utilisation. The most common use is the production of cobblestones for paving. This use is an important subsidiary industry with a large incidence in foreign markets. These wastes are also used for masonry and other purposes.

From marbles and limestones

Besides the most common uses, marbles and limestones wastes are also used in several industries, such as production of lime, agricultural correctives, ceramics, animal food, chemical industry, filler and others.

1.2.2 - Quarries for Industrial Uses

Dolomitic limestones

They are mined in several places in the country being the most important producers those localised in Sesimbra and in Maciço Calcário Estremenho. Dolomitic limestones are mainly used for siderurgical, glass and ceramic (refractory) industries.

Limestones

Limestones are mainly exploited as crushed stone for use in road, building construction, lime and cement industries. The main production centers are located in the surroundings of Coimbra (Serra do Sicó), Maciço Calcário Estremenho, Alenquer, surroundings of Lisbon, Serra da Arrábida and Loulé. The annual production in 2010 was about 32 Mt.

Limestones in Portugal are also used in the paper industry. This is a sector that has evolved very quickly and is now using a large space formerly occupied by kaolin. Due to their whiteness, low abrasivity, low cost and abundant reserves, oolitic limestones from Serra do Sicó and Maciço Calcário Estremenho are

Estremoz Marble

replacing kaolin as filler in the paper industry. Some wastes from very white marbles of the Estremoz Anticline are also used in this industry.

Granites

There is a great number of places where granites are exploited for crushed stone as raw materials for the road and building construction industries. Those places are mainly located in northern Portugal at Viana do Castelo, Vila Real, Braga, Porto, Viseu, and Guarda.

The production in 2010 was around 22 Mt.

2-Industrial Minerals

2.1 - Ceramic Raw Materials

From all the Portuguese industrial minerals, ceramic raw materials play an important role as they supply an industry of great economical relevance.

Kaolin

Portugal is rich in kaolin for ceramic uses. The origin of kaolin in Portugal is geologically diverse including sedimentary deposits of different ages and pri-

Via Vai Kaolin Mine

mary deposits formed by hydrothermal processes and weathering of granites, gneisses and acid porphyries. Arkoses have recently become a relevant resource due to their content in kaolin - besides k-feldspar and silica sands. The kaolin subsector has shown a great dynamism with the aims of increasing quality levels, diversifying uses and penetrating in foreign markets. Although Portuguese kaolin is essentially appropriate for ceramics it also plays a small role as filler and coating in the paper industry and as a filler in other industries.

Most of the total kaolin Production (285,000 tonnes in 2010) is used by the important Portuguese ceramic industry: sanitaryware, tableware, refractories and wall and floor tiles.

The producing areas are mainly distributed in the regions of Viana do Castelo, Braga, Porto, Aveiro, Coimbra and Santarém. The known reserves are above 50,000,000 tonnes. There are still potential geological formations that need to be better studied.

2.2 - Feldspar

Traditional sources of this raw material used as a ceramic flux are associated to granitic pegmatites from which quartz and feldspar were separated by hand and nowadays also in a modern industrial unit of optical separation located in Mangualde.

Bajoca Quartz and Feldspar Mine

The progressive depletion of this kind of resource made it necessary to search for alternative sources. Presently feldspar is mainly obtained from aplitic and aplitic pegmatites and weathered moscovitic granites. After milling and purification these raw materials are used in the form of feldspathic sands.

The arkoses constitute another important resource in which, more frequently, K-feldspar occur in association with kaolin and silica sands, some with high purity grade. The importance of these raw materials is growing due to the potential uses of arkoses by-products and huge reserves.

At Guarda and Vila Real some pegmatites containing lithium minerals (lepidolite and spodumene, respectively) are being mined as high quality ceramic raw materials.

The occurrences are mostly associated to granitic massifs that are located mainly in the area of Braga, Vila Real, Viseu and Guarda. Important arkosic deposits occur in the region of Coimbra.

The total production of feldspar and feldspathic sands is about 170,000 tonnes.

The potential of Portugal for ceramic products is very large and there is the opportunity for the country to become a great exporter.

2.3 - Common Clays

Common clays are very abundant and they are predominantly distributed in the western and southern mesocenozoic coastal zone. There are many processing plants dispersed by those zones producing bricks, roof tiles, wall and floor tiles and other products for construction industry. Some of these plants belong to important industrial groups but in general they are family companies. This is a sector which has progressively been modernized with advanced technologies. This modernization brought along an important evolution in what concerns the knowledge of the deposits, the control of the quality and the uses of the raw material.

Common clays occur mainly in the areas of Aveiro, Coimbra, Leiria, Lisboa, Santarém and Faro.

Due to their mineralogical and chemical properties some clays are appropriated for manufacturing thermo swelling products used as insulators and for producing light bricks. These clays occur in the area of Ansião in Central Portugal where there is a modern plant in operation.

The reserves of common clays are very important and they can supply the processing sector for a very long time. Besides the reserves already known there are extensive potential areas needing further studies.

2.4 - Ball Clays

Ball clays are illite kaolinitic clays with mineralogical, chemical and technological properties that allow their use in porcelain, sanitaryware, glaze, floor and wall tiles. Ball clays supply a very important processing sector with high economical relevance mainly in terms of exportation.

The deposits are located in a restrict area on the central coastal zone of Portugal: Águeda, Anadia, Redinha, Pombal and Barracão. Although, exploration efforts by private companies are being continuously made. Within this field of the ceramic raw materials the ball clays subsector is the more advanced in what concerns the knowledge about the deposits, extraction technologies, homogenization, quality control and rational utilisation of resources. In order to meet these requirements a careful and very selective exploitation and a continuous chemical, mineralogical and technological control are needed in the quarrying process. With this aim the companies are being equipped with their own laboratories. A plant of atomisation is already established representing an important advance within this subsector.

Some of the ball clays with low quality are used as agglutinants in the production of animal feed, supplying the whole domestic market and also being exported.

It is worth mentioning the fact that this is a pioneer subsector in the environmental recovery of exploited areas.

2.5 - Special Sands

Special sands are very pure silica sands, in general very well sorted.

They have usually a small content of kaolin (up to 6%) and heavy metals. After a process of purification that can include washing, classification, magnetic separation and flotation they are used in ceramics, glass, including crystal glass, and foundry. They are also used in other industries in the form of powders.

The reserves are very large distributed in eolian, fluvial and marine Pliocene deposits from which the more important are situated in the areas of Figueira da Foz, Marinha Grande, Pombal, Leiria, Alenquer, Santarem, Rio Maior and Setubal.

Other source of silica sands is associated to the exploitation of kaolin as a byproduct.

The present production is around 1,1 Mt.

2.6 - Talc

Talc is a raw material presently in great demand in ceramics besides its use as filler in many industries, such as paper, paints and rubber.

Talc deposits occur in the Bragança and Morais ultrabasic and basic massifs in Trás-os-Montes being the reserves not large.

Due to the contamination mostly by iron oxides and chromite, portuguese talc presents greyish and yellowish colour and shows a medium level of quality grade, needing a beneficiation process by magnetic separation. Portugal imports talc for more exigent uses.

The annual production is about 11,980 tonnes.

2.7 - Other Industrial Minerals

2.7.1 - Gypsum

Portugal is self sufficient in black gypsum to supply the cement industry and agricultural uses. The output of white gypsum, some with high grade of brightness is small and there is the need to import large amounts, uncalcined and calcined, for wall-board, plaster, pharmaceutical, ceramics (mould), hydraulic lime and other uses.

The main producing areas are Soure, Óbidos and Loulé.

Annual production is about 336,750 tonnes.

The reserves are large but there are potential areas needing further detailed studies.

2.7.2 - Salt Rock

There are several diapir zones in Portugal from which three areas are in production: Matos do Carriço (Figueira da Foz) and Matacães (Torres Vedras), where salt is extracted by solution, and Loulé, operating by underground mining. These extracting unities supply mainly the chemical industry and also for deicing. Only a small amount is used in food industries.

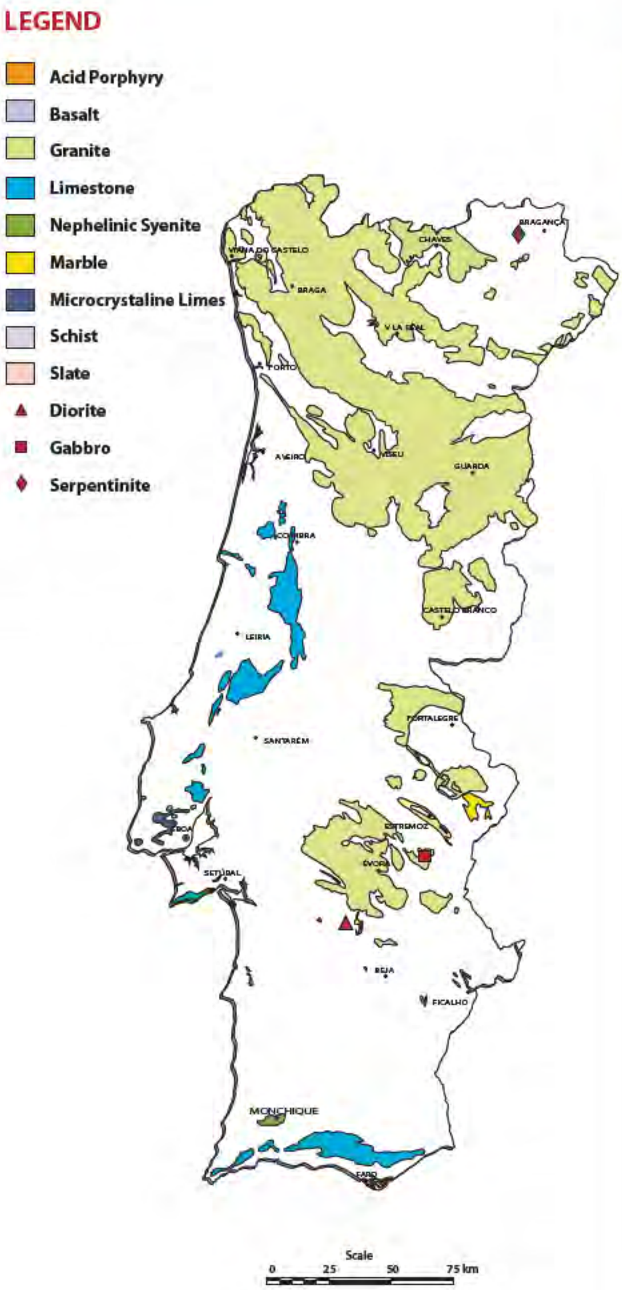
The potential for salt rock production is large in association with extensive diapir zones in the west and south coastal zones.

The production is about 618,960 tonnes.

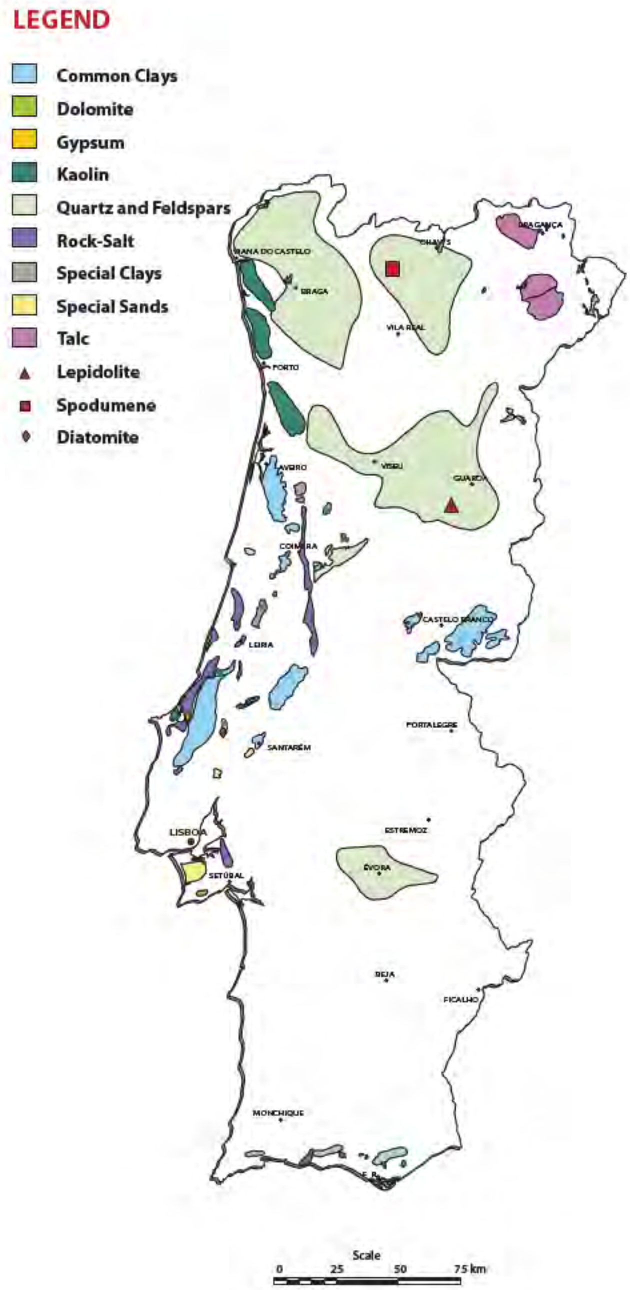
2.7.3 – Barite

Portuguese barite occurs on the north of Portugal, near Bragança. It's a relatively inert mineral with a high density and the primary ore of barium. This material is frequently used as a weighting agent in drilling muds and also like a pigment in paints and in hospital facilities because is opaque to x-rays. The production in 2010 was a little bit more than 15 tonnes.

PRODUCER AREAS OF ORNAMENTAL AND INDUSTRIAL STONES



PRODUCING AREAS OF INDUSTRIAL MINERALS



LEGAL FRAMEWORK

The legal framework governing activity involving the prospecting, exploration and exploitation of geological resources was entirely modernised as from 1990 with the publication of Act nº 90/90 of 16th March which defines the main provisions concerning the discovery and exploration of geological resources (with the exception of oil). This regime is regulated by six other Acts published on the same date, specific to each type of geological resources:

ore deposits (Act nº 88/90);

hydro-mineral resources (mineral and mineral-industrial waters - Acts nºs 86/90 and 85/90);

geothermal resources (Act nº 87/90);

mineral masses or quarries (Act nº 89/90), that was later changed by the Act n. 270/2001 with the text of the Act n. 340/2007;

and spring waters (Act nº 84/90).

In accordance with this legislation and as a result of Constitutional requirements, the following geological resources are State owned:

ore deposits (including all metallic and radio-active ores, coal, graphite, pyrites, phosphates, asbestos, talcum, kaolin, diatomite, quartz, feld-spar, precious and semi-precious stones, potassium salts and rock-salt);

hydro-mineral resources (natural mineral waters and mineral-industrial waters);

geothermal resources.

The remaining resources, as follows, are not State owned and may be privately owned: mineral masses (clays, limestones, marbles, gypsum, granites, sand and in general all the ornamental stones and those used in building not included under the ore deposits category) and spring waters.

Mineral licensing will generally follow in the wake of an application submitted by the applicant for the granting of one of four different mineral licenses in accordance with the type of activity to be undertaken and the type of resource, depending on whether or not it is State owned:

administrative prospecting and exploration contract;

administrative mining contract;

In both cases covering certain resources within those which are State owned (ore deposits, and hydro-mineral or geothermal resources)

quarry operating licence in respect of mineral masses; and

spring-water operating licence.

Applications for prospecting and exploration contracts and mining contracts are addressed to and decided by the Minister for the Economy, Innovation and Development (MEID) (or by his Secretary of State for Industry and Development (SEAID)), submitted to and processed by the Directorate-General of Energy and Geology (DGEG) which will also monitor the exercise of the operations covered by the contracts.

Spring-water operating licence applications are processed and decided by DGEG.

Applications for quarry operating licences are processed and decided by the Regional Delegations of the MEID (DREs) or by the Municipal Authorities, depending on whether the operations are medium/ large or small scale.

In processing these mineral licenses other departments of the Administration involved in the environment and spatial planning are consulted as are the municipal authorities of the area covered by the application. These entities are also responsible for monitoring the matters indicated. The DREs are responsible for inspecting quarry operations.

Although mineral and environmental legislation contains imperative provisions concerning the assessment of the environmental impacts of the activity (mandatory for all operations located in areas of protected landscape identified in the law and for operations covering more than 5 hectares or with a production volume grater than 150,000 tonnes), landscape reconstruction, protection and safety, there are additional specific regulations concerning these matters (noise, dust, underground waters etc,) and specialised departments that supervise their application.

In accordance with the provisions of the law, if the environmental impact assessment (where required under the law) is refused by the Minister of Environment the mining licence should not be granted.

If so requested, DGEG may provide technical and administrative advice concerning the drawing up and submission of the applications, providing drafts and models, information concerning available areas or those licensed, and may allow consultation of technical documentation and maps in the archives. The prospecting and exploration contracts and mining contracts usually follow the form of existing models.

The following summarise the principal features of these two administrative contracts, the regime of which is governed by law.

Prospecting and Exploration Contract, and Mining Contract Regime

Prospecting and Exploration Contracts

Prospecting and exploration rights cover the minerals specified in the contract and the area set forth therein (which, save exceptional cases, may not exceed 1,000 km2).

The total duration of the contract, including prorogations, should not, usually, exceed 5 years (3 years in the case of hydro-mineral and geothermal resources). Contract periods are negotiable and usually include an initial period of 1 to 2 years followed by 3 or 3 one-year extensions, if consistent with the minimum work programme and budget. With the exception of those areas in respect of which a mining contract application has been lodged, the Licensee should abandon a part (usually 50%) of the area contracted for on the occasion of each prorogation to the prospecting and exploration contract.

The contract stipulates the general work programmes and minimum investments as agreed in advance, to be implemented by the Licensee over the duration of the contract in question (balances of investments made larger than the established minimum figures established for a given contract period may, however, be carried forward to the next period). The general schedule is complemented every year by detailed programmes and the respective budget. They are monitored via presentation of half-yearly progress reports the last of which should be drawn up as the final report of the work and investments undertaken, presented together with the main conclusions.

The reports and technical data provided by the Licensee are considered confidential during the duration of the contract.

Non-compliance with these minimum commitments may lead to refusal of prorogation or to cancellation of the contract by decision of the Minister after prior notice to and consultation with the Licensee..

The contract also stipulates payment of an annual mining rights surface fee, fixed or variable, in proportion to the size of the area granted (€/km2). The nature and amount to be stipulated are negotiable.

Pursuant to prevailing legislation, the Sate, in the event of a commercial discovery, guarantees the granting of a mining concession (involving entering into a proper contract) in respect of the resources discovered within the scope of the prospecting and exploration contract provided that the Licensee is not at fault with regard to compliance with legal and contractual obligations, provided always that an application is submitted to the effect, before the prospecting and exploration contract ends, accompanied by the necessary information (including presentation of a mining plan compatible with good mining practice and with environmental protection requirements).

The prospecting and exploration contract also contains provisions concerning the duration of the operating contract and the payment of a royalty (usually a percentage of sales F.O.B./Mining area).

Cancellation of the prospecting and exploration contract resulting from non-compliance with legal or contractual obligations is subject to the rules and procedures established by law. Renunciation of rights or complete abandon by the Licensee of the area under concession is allowed provided that the Licensee's commitments have been complied with or that the justification submitted is accepted.

Assignment of prospecting and exploration rights is subject to the prior consent of the Minister following an application lodged by the Licensee, accompanied by information concerning the capacity of the intended Licensee to continue operations and to meet contractual commitments, particularly those in respect of the schedule of work and investment which must be up to date.

Occupation of land to set up the prospecting and exploration work shall be preceded by the consent of the owners of the land in question, which, if refused without due grounds, may be granted by the courts at the Licensee's request.

Mining Contracts

The concession contract entitles the Licensee the sole right to exploit the specified resources within the area set forth in the contract. The duration of the contract is stipulated on the basis of the estimated duration of the resources under normal operating conditions in accordance with the geological report, preliminary feasibility study and mining plan submitted together with the application. It covers an initial period and 1 or 2 prorogations.

Mining operations shall proceed in accordance with a general plan of work approved or revised (as necessary) and with yearly work programmes, and in a manner consistent with applicable regulations and good mining and environmental practice. For operations larger than 5 hectares or 150,000 tonnes (and all scale of operations if located in areas of protected landscape identified in the law) an environmental impact assessment and a protection plan must be submitted to be approved by the Environment Ministry as a condition for the award of the contract. In accordance with the provisions of the law, if the environmental impact assessment is refused by the Minister of Environment the mining licence should not be granted.

The Licensee shall appoint and register the technical manager in charge of the mining operations.

Notice of suspension of mining operations must be given to the Minister and consent obtained, and the suspension may not last longer than authorised, unless renewal thereof shall have been requested and granted, if justified.

Unauthorised suspension of mining operations may lead to cancellation of the contract if the Licensee, following a reasonable period of notice, shall not have put an end to the suspension or presented acceptable justification.

Cancellation of the contract for non-compliance with legal and contractual conditions is subject to the rules and procedures established by law.

The contract also stipulates annual payment of a royalty, generally in the form of a percentage of the values of the F.O.B./Concession sales. Conditions governing the periodic review (usually every 5 or 10 years) of this percentage and its suspension or reduction whenever justified to ensure continuation of operations are also governed by the provisions of the contract.

Assignment of mining rights is subject to the prior consent of the Minister, as mentioned above in connection with assignment of prospecting and exploration rights.

The Licensee is entitled to apply for expropriation for public service of the land necessary to the mining operations in the event that agreement cannot be reached with the respective land owners.

As in any other industrial activity, exploration and mining operations may be undertaken by natural persons or bodies corporate and, particularly, by companies, the latter being the form usually adopted by operators.

Applicants for prospecting and exploration licences and mining licences must, in accordance with legislation, submit together with their applications full identification and other information confirming their technical and financial capacities and their experience in the operations they intend to undertake.

Applications shall also include, as applicable, a prospecting and exploration work programme and the respective budget, or a mining plan. Following submission of a properly drawn up application the candidate is invited to present a bank guarantee, designed to ensure pre-contractual good faith (the guarantee to be returned to the candidate as soon as the application is accepted or rejected by the Minister). There follows negotiation of the contract and the publication in the press of notice of the application so that any claims may be lodged within 30 working days.

With regard to the candidature of non-residents a local agent should be appointed to simplify contacts with DGEG during the processing of the application and negotiation of the contract.

For non-residents to carry on mining activity (or any other activity) in Portugal several formalities must be complied with, including:

_ commercial registration of the permanent establishment to be set up (usually in the form of a branch) or the incorporation of a local company in accordance with the provisos of the Companies Code.

_ This permanent establishment must be set up if the activity to be undertaken lasts for more than one year;

_ registration of the investment with AICEP - (Agency for Investment and External Commerce of Portugal).

Mining companies are subject to the tax regime applicable to commercial and industrial activity as a whole, including the IRC Code (Corporation Tax Code). Tax law allows an annual provision to be set aside into a fund to pay for future expense incurred in implementing the landscape and environment recovery plan of the site of the operations.

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