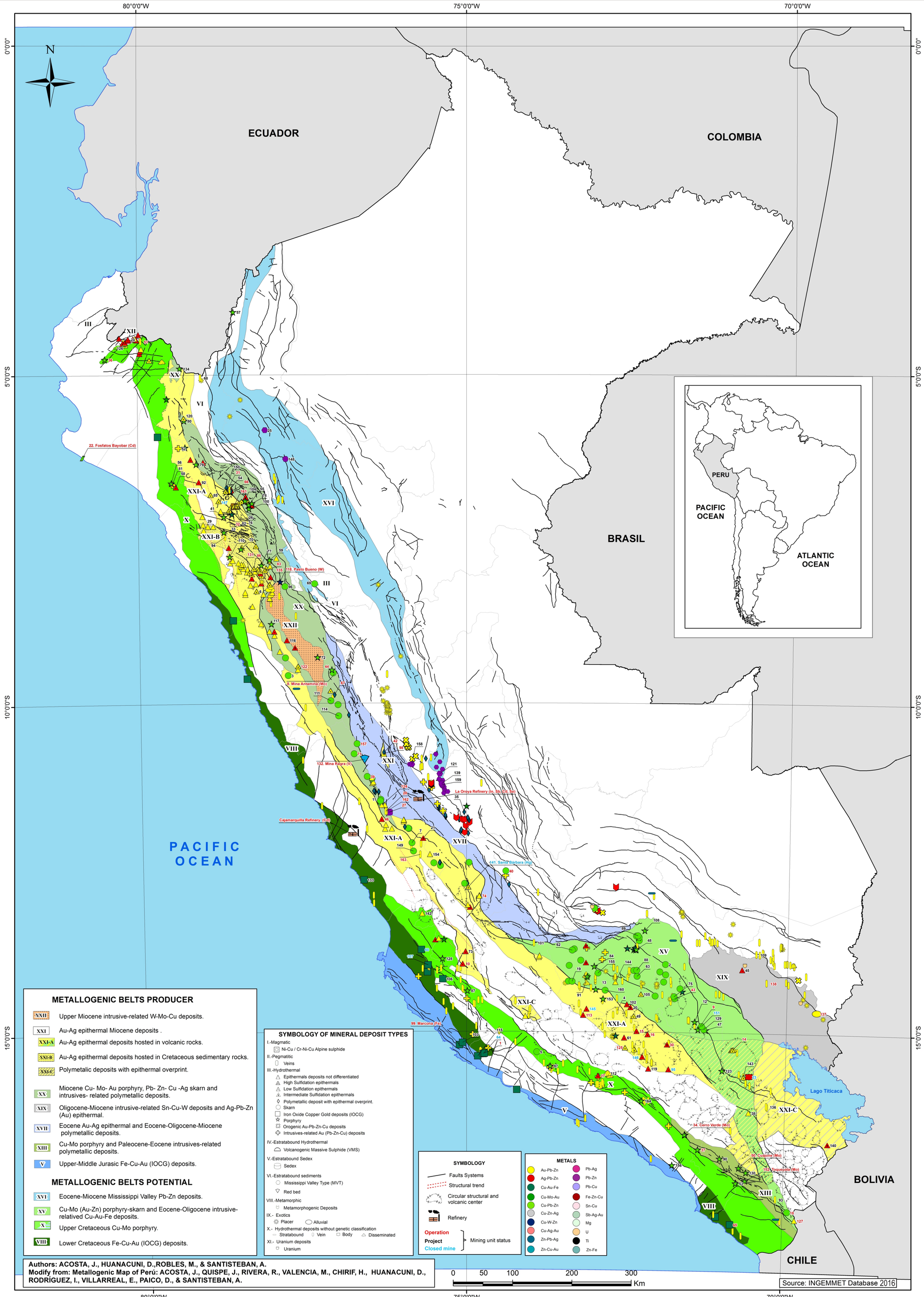
METALLOGENIC MAP OF ELEMENTS Fe, Sn, W, Sb, Se, Hg, Cd, Bi, Mo OF PERÚ

PERU Energy and Mining Sector

ENERGY AND MINING SECTOR INGEMMET GEOLOGICAL, MINING AND METALLURGICAL INSTITUTE



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N°	MINE / PROJECTS	DEPOSIT TYPE	Metal Content
1	Acari	Óxidos de Fe-Cu-Au (IOCG)	Au-Cu
2	Acchia (Titiminas)	Skarn	Pb-Zn
3	Adriana	Skarn	Ag-Cu-Pb-Zn
4	Agua Verde	Vetas	Au
5	Aguas Verdes	Skarn	Cu
6	Alto Dorado	Epitermales de alta sulfuración	Au-Cu
7	Anocvilca	Skarn	Ag-Au-Cu-Pb-Zn
8	Antamina	Skarn	Ag-Cu-Mo-Pb-Zn
9	Antapaccay	Pórfidos de Cu-Au	Ag-Au-Cu-Mo
10	Antapite	Epitermales de baja sulfuración	Ag-Au-Mo-Pb
11	Antares	Skarn	Ag-Au-Cu-Zn
12	Antay	Pórfidos de Cu-Mo	Cu-Mo
13	Antilla	Pórfidos de Cu-Mo	Cu-Au
14	Arani	Epitermales de alta sulfuración	Ag-Au
15	Arcata	Epitermales de baja sulfuración	Ag-Au-Zn
16	Aries	Epitermales de baja sulfuración	Ag-Au
17	Arinahua	Epitermales de baja sulfuración	Ag-Au
18	Ataspaca	Skarn	Ag-Cu-Pb-Zn
19	Aucapampa	Skarn	Au-Cu
20	Azúcia	Epitermales de intermedia sulfuración	Ag-Au
21	Azulcocha	Epitermales de intermedia sulfuración	Ag-Au-Cu-Zn
22	Bayovar	Fosfatos	Fosfatos
23	Berenguela	Cuerpos	Ag-As-Cu
24	Bodua Del Diablo	Epitermales de baja sulfuración	Au
25	Bongará	Mississippi Valley (MVT)	Ag-Pb-Zn
26	Carachugo -Yanacocha	Epitermales de alta sulfuración	Au
27	Carahuacra	Sedex en rocas carbonatadas	Ag-Cu-Pb-Zn
28	Casapalca	Vetas	Ag-Au-Cu-Pb-Zn
29	Cascabamba	Pórfidos de Cu-Au	Au-Cu
30	Caylloma	Epitermales de intermedia sulfuración	Ag-Au-Cu-Pb-Zn
31	Cerro Corona	Pórfidos de Cu-Au	Au-Cu-Mo
32	Cerro Negro-Yanacocha	Epitermales de alta sulfuración	Au
33	Cerro Quillish	Epitermales de alta sulfuración	Au
34	Cerro Verde	Pórfidos de Cu-Mo	Ag-Cu-Mo
35	Cerro Verde	Polimetálicos con superposición epitermal	Pb-Zn
36	Chancadora	Skarn	Cu
37	Chapi	Pórfidos de Cu-Mo	Cu-Mo
38	Chucapaca	Epitermales indiferenciados	Au
39	Chungar-animón	Skarn	Ag-Au-Cu-Zn
40	Cobriza	Skarn	Ag-Au-Cu
41	Colpayoc	Pórfidos de Cu-Au	Au-Cu
42	Coluguirca Distrito Minero	Polimetálicos con superposición epitermal	Ag-Au-Cu
43	Constancia	Skarn	Ag-Au-Cu-Mo
44	Contonga	Pórfidos de Cu-Mo	Ag-Cu-Pb-Zn
45	Corani	Epitermales de baja sulfuración	Ag-Cu-Pb-Zn
46	Coricancha	Epitermales de baja sulfuración	Ag-Au-Pb
47	Corocochuayco	Pórfidos de Cu-Mo	Ag-Au-Cu-Mo
48	Cotabambas	Pórfidos de Cu-Au	Au-Cu
49	Crespo	Epitermales de alta sulfuración	Au-Ag
50	Cuajone	Pórfidos de Cu-Au	Ag-Au-Cu-Mo
51	Cuchicorral	Vetas	Au
52	Cueva Blanca	Au (Pb-Zn-Cu) relacionados con intrusivos	Au
53	El Chorro	Pórfidos de Cu-Mo	Cu-Mo
54	El Dorado	Vetas	Ag-Au-Cu-Pb-Zn
55	El Galeno	Pórfidos de Cu-Au	Au-Cu

N°	MINE / PROJECTS	DEPOSIT TYPE	Metal Content
56	El Rosal	Pórfidos de Cu-Au	Au-Cu
57	El Tambo	Pórfidos de Cu-Mo	Au-Cu-Mo
58	El Tigre	Epitermales de baja sulfuración	Au
59	El Toro	Pórfidos de Cu-Au	Au
60	Eliana	Óxidos de Fe-Cu-Au (IOCG)	Cu-Fe
61	Esperanza	Epitermales de baja sulfuración	Au-Cu
62	Ferrum 26	Skarn	Fe
63	Haquira	Skarn	Cu-Mo
64	Hierro Acari	Óxidos de Fe-Cu-Au (IOCG)	Cu-Fe
65	Hierro Morrito	Óxidos de Fe-Cu-Au (IOCG)	Fe
66	Huagayoc	Polimetálicos con superposición epitermal	Ag-Au-Cu-Pb-Zn
67	Huanzalá	Polimetálicos con superposición epitermal	Ag-Pb-Zn
68	Huaquillas	Vetas	Au
69	HuayllBas	Skarn	Cu
70	Igor	Pórfidos de Cu-Au	Au
71	Iscaycruz	Skarn	Ag-Au-Cu-Pb-Zn
72	Jacabamba	Pórfidos de Cu-Mo	Cu
73	Jatun Orco	Epitermales de baja sulfuración	Ag-Au
74	Julcani	Epitermales indiferenciados	Ag-Au-Cu-Pb-Zn
75	Katanga	Skarn	Ag-Au-Cu
76	Kuptertail - Yanacocha	Epitermales de alta sulfuración	Au
77	La Arena	Pórfidos de Cu-Au	Ag-Au-Cu
78	La Cairpa	Pórfidos de Cu-Mo	Cu-Mo
79	La Granja	Pórfidos de Cu-Mo	Au-Cu-Mo-Zn
80	La Huaca	Pórfidos de Cu-Mo	Au-Cu-Mo
81	La Pampa	Au (Pb-Zn-Cu) relacionados con intrusivos	Au
82	La Quinua - Yanacocha	Morrénicos	Au
83	La Virgen	Epitermales de alta sulfuración	Ag-Au
84	La Yegua	Pórfidos de Cu-Mo	Cu
85	La Zanja	Epitermales de alta sulfuración	Ag-Au
86	Lagunas Norte	Epitermales de alta sulfuración	Ag-Au
87	Lara	Pórfidos de Cu-Mo	Cu
88	Las Bambas	Skarn	Cu-Mo
89	Lbcdbtcsa	Skarn	Au-Cu-Mo
90	Los Calatos	Pórfidos de Cu-Mo	Cu-Mo
91	Los Chancas	Pórfidos de Cu-Mo	Cu-Au
92	Los Pircos	Epitermales de baja sulfuración	Ag-Au
93	Lukacha	Vetas	Cu
94	Machasen	Skarn	Fe
95	Madrigal	Epitermales de baja sulfuración	Ag-Cu-Pb-Zn
96	Magistral	Skarn	Au-Cu-Mo
97	Marcahui Maraycasa	Pórfidos de Cu-Mo	Au-Cu-Fe-Mo-Mo
98	Marcapunta	Epitermales indiferenciados	Au
99	Marcona	Óxidos de Fe-Cu-Au (IOCG)	Cu-Fe
100	MichquillAy	Pórfidos de Cu-Mo	Au-Cu
101	Milenio	Vetas	Au
102	Milla La Española	Epitermales de baja sulfuración	Au
103	Mina Justa	Óxidos de Fe-Cu-Au (IOCG)	Ag-Au-Cu-Fe
104	Minas Conga	Pórfidos de Cu-Au	Au-Cu
105	Minaspata (Anabi)	Epitermales de alta sulfuración	Ag-Au-Cu-Mo
106	Moldetambo	Óxidos de Fe-Cu-Au (IOCG)	Au-Cu-Fe
107	Monterrosas	Óxidos de Fe-Cu-Au (IOCG)	Au-Cu
108	Morococha	Pórfidos de Cu-Au	Au-Cu
109	Ollachea	Vetas	Au
110	Pachagón	Pórfidos de Cu-Mo	Cu

N°	MINE / PROJECTS	DEPOSIT TYPE	Metal Content
111	Pachapaqui	Skarn	Ag-Cu-Pb-Zn
112	Pallacochas	Diseminados	Au
113	Pallancata	Epitermales de baja sulfuración	Ag-Au
114	Pallica	Skarn	Ag-Pb-Zn
115	Pampa De Pongo	Óxidos de Fe-Cu-Au (IOCG)	Au-Cu-Fe
116	Parón	Epitermales de baja sulfuración	Ag-Au
117	Pashpap	Pórfidos de Cu-Mo	Ag-Cu-Mo-Pb-Zn
118	Pasto Bueno	Pórfidos de W-Cu	Cu-Mo-W
119	Paula	Epitermales de baja sulfuración	Ag-Au
120	Perka Verde	Epitermales de alta sulfuración	Ag-Au-Cu
121	Pichita Caluga	Mississippi Valley (MVT)	Pb-Zn
122	Pierina	Epitermales de alta sulfuración	Ag-Au
123	Pinaya	Pórfidos de Cu-Au	Au-Cu
124	Poderosa	Epitermales indiferenciados	Ag-Au
125	Poracota	Epitermales de alta sulfuración	Ag-Au-Cu
126	Potrobayo	Sulfuros masivos volcanogénicos de Pb-Zn+Cu, tipo	Cu-Pb-Zn
127	Pucamarca	Epitermales indiferenciados	Ag-Au
128	Puquio	Pórfidos de Cu-Mo	Cu-Mo
129	Quechua	Skarn	Au-Cu-Mo
130	Quellaveco	Pórfidos de Cu-Mo	Ag-Cu-Mo
131	Quiruvilca	Epitermales de alta sulfuración	Ag-Au-Cu-Pb-Zn
132	Ragra	Capas Rojas	V
133	Raul-Condestable	Óxidos de Fe-Cu-Au (IOCG)	Ag-Au-Cu
134	Río Blanco	Pórfidos de Cu-Mo	Cu-Mo
135	Rosario De Belén	Epitermales de alta sulfuración	Au
136	San Antonio De Esquilache	Vetas	Ag-Au-Cu-Pb-Zn
137	San Antonio De Poto	Aluviales	Au
138	San Rafael	Vetas	Cu-Sn
139	San Vicente	Mississippi Valley (MVT)	Pb-Zn
140	Santa Ana	Epitermales de intermedia sulfuración	Ag-Pb-Zn
141	Santa Bárbara	Epitermales de alta sulfuración	Hg
142	Santa Beatriz	Epitermales indiferenciados	Ag-Cu-Pb-Zn
143	Santa Bárbara	Epitermales de alta sulfuración	Ag-Cu-Pb
144	Santa Rosa (Vrundo)	Epitermales indiferenciados	Ag-Au
145	Selene	Epitermales de baja sulfuración	Ag-Au
146	Shila	Epitermales de baja sulfuración	Ag-Au
147	Sipán	Epitermales de alta sulfuración	Ag-Au
148	Solcco	Mississippi Valley (MVT)	Pb-Zn
149	Tambomachay	Skarn	Fe
150	Tantahuatay	Epitermales de alta sulfuración	Ag-Au-Cu
151	Tintaya	Skarn	Ag-Au-Cu-Mo
152	Toquepala	Pórfidos de Cu-Mo	Ag-Au-Cu-Mo
153	Trapiche	Pórfidos de Cu-Au	Cu-Mo
154	Tucumachay	Epitermales indiferenciados	Au-Zn
155	Tumipampa	Skarn	Au-Cu-Fe
156	Tía María	Pórfidos de Cu-Mo	Cu-Mo
157	Uchucchacua	Skarn	Ag-Au-Pb-Zn
158	Ulcumayo	Mississippi Valley (MVT)	Pb-Zn
159	Uncush Sur	Mississippi Valley (MVT)	Pb-Zn
160	Utupara	Skarn	Au-Cu
161	Yanacocha Distrito Minero	Epitermales de alta sulfuración	Ag-Au
162	Yauliyacu Casapalca 6	Vetas	Ag-Cu-Zn
163	Yumpacocha	Vetas	Ag-Au-Cu-Pb-Zn
164	Zafranal	Pórfidos de Cu-Mo	Cu-Mo

Strategic Metal	Mineral Associate / Byproduct	Mines & Refinery-Smelter	Region	Metalogenic Belt	Uses	References
Molybdenum (Mo)	Molybdenite (MoS_2)	Cuajone	Moquegua	XIII	It is used into stainless followed by tool and high speed steel, HSLA and carbon steels. Other uses include catalysts, lubricants and pigments. The primary end use sectors include the chemical and petrochemical industries, oil and gas, automotive, mechanical engineering, power generation, construction, aerospace and consumer goods.	1,2,3,5
		Toquepala	Tacna	XIII		
		Cerro Verde	Arequipa	XIII		
		Toromocho	Junín	XX		
		Antamina	Áncash	XX		
Iron (Fe)	Magnetite ($Fe_2+(Fe_3+)2O_4$) - Hematita (Fe_2O_3)	Marcona	Ica	V	Its low cost and high strength make it indispensable in engineering applications such as the construction of machinery and machine tools, automobiles, the hulls of large ships, and structural components for buildings. , It is most commonly combined with alloying elements to make steel.	1,2,3,4,5
Tin (Sn)	Casiterite (SnO_2)	San Rafael	Puno	XIX	In solder. The rest was divided between tin plating, tin chemicals, brass and bronze, and niche uses.	1,2,3,5
Tungsten (W)	Wolframite ($(Fe,Mn)WO_4$) Scheelite ($CaWO_4$)	Pasto Bueno	Huancavelica	XXII	It is used mainly as tungsten carbide and in steel and superalloys, with minor uses in electronics and as catalysts.	1,2,5
Cadmium (Cd)	Greenockite (CdS) Zinc and Lead	Zinc Refinery Cajamarquilla/ Smelter La Oroya/Bayobar Phosphates	Junín	XVII	It is used mainly in batteries and to a lesser extent in electroplating applications. Cadmium is limited in its uses by toxicity.	1,2,3,5
Mercury (Hg)	Cinnabar (HgS) Native Hg	Santa Bárbara	Huancavelica	XXI	It is used to burn fossil fuels, gold cleaning in small-scale mining, the chlor-alkali industry and production of vinyl-chloride monomer, the basis of PVC plastic. Mercury is highly toxic.	1,5
Bismuth (Bi)	Bismuth oxides and bismuthinite (Bi_2S_3)	San Gregorio y Julcani	Pasco/Huancavelica	XXI	Bismuth is used in pharmaceuticals, cosmetics, specialty alloys, solders, and as a non-toxic substitute for lead.	1,3,5
Antimony (Sb)	Stibnite (Sb_2S_3) /Ag-Cu-Pb-Zn	Smelter-Refinery La Oroya	Junín	XVII	Antimony is used mainly in flame retardants and also in lead alloys for ammunition, batteries, and solder. Minor uses include electronics and pigments.	1,3,5
Selenium (Se)	Lead ores, phosphates	Smelter-Refinery La Oroya/ Bayobar Phosphates	Junín	XVII	Solar-cell production. In glass production, selenium is used for infrared technology, ultra-violet lights and as a red colourant. In the production of electrolytic manganese (Mn), selenium is used as an additive, in order to improve efficiency, increase yields and reduce production costs. Due to this, the prices of selenium are closely related to those of manganese.	1,5
Vanadium (V)	Rizopatronita (VS5)	Mina Ragra	Pasco	XVII	In iron alloys and catalysts. Recent speculation on increasing demand focuses on new battery applications.	1,3,5
Indium (In)	Sphalerite ($Zn,Fe)S$ and copper ores	Minas del centro del Perú/ Zinc Electrolitic Refinery La Oroya	Pasco	XVII	It is used mostly in thin film coatings for LCD, LED, and solar cells.	1,3,5

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Metallogenic Map of Elements
Fe-Sn-W-Sb-Se-Cd-Bi-Mo of Peru
1:3 000 000

Metallogenic Map of Fe-Sn-W-Sb-Se-Cd-Bi-Mo of Peru displays: (1) 11 mineralized belts of base and precious metals (2) location of major mines and mining exploration projects shown by a symbol (3) size of ore mineral deposit (4) main metal content by association.

The strategic metals are produced by product and the map portrays 11 metallogenic belts, which 7 belts correspond to major producer and 4 belts with mining potential.

Ore mineral deposits generally occur in clusters or districts that reflect a common geological setting, source, age and origin. Some areas contain primary deposits formed by fundamentally different mineralizing processes .These have been differentiated into separate with each being represented by symbol according to ore deposit types.

Name of the important major mines within a metallogenic belt are shown in the map and others (mines and mining projects) are shown as symbols with a reference number. These are listed in the accompanying table of deposits considering the name of mine or project and metal content.

A resume table with the list of mines, metallogenic belt, refineries and smelters that produce strategic metals is shown.
For more information on the development of this map please see: Acosta et al 2009. Memoria del Mapa Metalogenético del Perú. Development of the 1:3 000 000 scale. INGEMMET.

Credits

Bibliographical reference: Acosta, J., Quispe, J., River, R., Valencia, M., Chirif, H., Huanacuni, D., Rodriguez, I., Villarreal, E., Paico, D. and Santisteban, A. (2009) Memoria del Mapa metalogenético del Perú. INGEMMET.

Metallogenic belts and mineral deposits data base can be accessed online via http://geocatminapp.ingemmet.gob.pe/apps/geocatmin/

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This map can be downloaded from
http://www.ingemet.gob.pe/metalogenicos

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GEOCATMIN is an upgraded version of the multi-source geo-spatial data management and cadastre information (multiple – targeting version), researched and developed independently by the Geological Survey of Peru (INGEMMET). With the technical system based on ArcGis Server by ESRI, it is a professional Gis software system integrating the processing, analysis, transformation and charting of the information on geography, geology, cadastral mining, restricted areas to mining activities, geophysics, geochemistry, hydrogeology, ore deposit types, technical reports and etc. (more than 130 layers of information). The research and development of GEOCATMIN has not only improved the original system´s ability of solving the geological problems and mining cadastre location, upgraded and perfected the software function, but also has the research and development of a multilingual software version realized, built an international platform for geo-data processing, and met the users demand.

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- It covers geochemical exploration data processing and the geo-scientific GIS spatial analysis and application.
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