

BOLIVIA

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A. Regulation on sources

Source of lead	Relevant legislation/regulation	Government agencies	Data source
1. Mining	<ol style="list-style-type: none"> Supreme Decree N°1451, January 4th, 2013: Formulate, execute, evaluate and supervise development policies regarding prospecting, exploration and exploitation, concentration, smelting, industrialization, and commercialization of metallic and non-metallic minerals, and supervise their compliance; and propose standards, prepare and approve regulations and instructions for the development of the mining and metallurgical sector, and control their compliance. No other standards found at this time for lead. 	<ol style="list-style-type: none"> Minister of State in the Office of Mining and Metallurgy 	<ol style="list-style-type: none"> Supreme Decree N°1451, Bolivia

B. International Agreements

Agreement	Year Ratified
1. Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal	1996
2. Rotterdam Convention on the Prior Informed Consent Procedure for certain hazardous Chemicals and Pesticides in international trade	2003 (a) ¹
3. Minamata Convention on Mercury	2016
4. Stockholm Convention on Persistent Organic Pollutants	2003

¹ Accession (a)

C. Blood lead-level monitoring programs

Details	Data source
1. No details of a national or regional level structured program for blood lead level testing found. However, published studies point to some presence of testing programs at the local level.	1. Refer to section E on scientific papers that perform blood lead-level sampling

D. Inventory of toxic sites (Toxic Sites Identification Program (TSIP), Pure Earth)

Site	Province/Region	Details (all data comes from the TSIP website)
Mining activities, Santa Rita, Municipio de Oruro	Municipio de Oruro	Mining operations in the municipality of Oruro were carried out in two sectors, San José and Itos, and during the mining operations (approximately 4 centuries), large volumes of debris were generated from the development of the mine. Among the most important deposits of waste is Santa Rita, which is currently considered a mining liability that contains different minerals associated with the deposit (pyrite, marcasite, limonite, quartz, chalcopryrite and stibnite). Santa Rita contains high concentrations of heavy metals, has a surface area of approximately 41 541,460 m ² , although the area of interest of the evaluation is 0.5 hectare corresponding to a hillside adjoining homes. The wind disperses the waste as particles suspended in the "air" (migration / exposure route) that reaches the population through inhalation and cutaneous contact.
Jallpa Socabon, Municipio de Oruro	Municipio de Oruro	The mining exploitation in the municipality of Oruro was carried out in two sectors, San José and Itos, and during the years of operations of the mine (approximately 4 centuries), large volumes of clearings have been generated from the activities of the mine development, and glues from milling and processing operations. Among the most important deposits of waste is Jallpa Socavón, which is currently considered a mining passive that contains different minerals associated with the deposit (pyrite, marcasite, limonite, quartz, chalcopryrite and stibnite), it is presumed that these residues contain high concentrations of lead and other heavy metals (especially Pb, As, Cd, Zn, others).

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		Jallpa Socavón has an approximate area of 2 hectares. The wind that in the dry season goes from South to North and vice versa in the wet season, disperses the waste particles suspended in the "air" (route of migration / exposure) that reaches the population through inhalation and skin contact (route of exposure).
Bahia de Cohana	La Paz	This town receives heavy metals from a riverbed that flows from La Alta, where a mix of industries pollute the waterway. Aquatic plants absorb the metals and are used by farmers as fertilizer for their crops.
Cooperativa Minera Aurífera Yani Ltda., Municipio de Sorata	La Paz	About 1000 grams of mercury are added per day during the ore milling and 400 grams of mercury are added per day for the amalgamation, during the process of gold concentration. Water and waste (tailings) that result in the process (contaminated with mercury) are deposited in small ponds. When the ponds are filled, the tailings are transferred and accumulated outdoors in a place nearby. The vapor of mercury (produced during the amalgam burning) and the mercury attached to suspended particles reach the population through the air. The principal pathways are inhalation and skin contact; however, it is possible the ingestion of mercury through the use of cookware for the amalgam burning or through the food contamination. E
Cooperativa Minera Aurífera Ingenio Ltda., Municipio de Sorata	La Paz	About 400 grams of mercury are added per day during the ore milling and 20 grams of mercury are added per day for the amalgamation, during the process of gold concentration. Water and waste (tailings) that result in the process (contaminated with mercury) are deposited in small ponds. When the ponds are filled, the tailings are transferred and accumulated outdoors in a place nearby. The vapor of mercury (produced during the amalgam burning) and the mercury attached to suspended particles reach the population through the air. The principal pathways are inhalation and skin contact, however it is possible the ingestion of mercury through the use of cookware for the amalgam burning or through the food contamination.
Cooperativa Minera Aurífera 24 de Junio Ltda., Municipio de Sorata	La Paz	Between 800 to 1200 grams of mercury are added per day during the ore milling and 50 grams of mercury are added per day for the amalgamation, during the process of gold concentration. Water and waste (tailings) that result in the process (contaminated with mercury) are deposited in small ponds. When the ponds are filled, the tailings are transferred and accumulated outdoors in a place nearby. The vapor of mercury (produced during the amalgam burning) and the mercury attached to suspended particles reach the population through the air. The principal pathways are inhalation and skin contact, however it is possible the ingestion of mercury through the use of cookware for the amalgam burning or through the food contamination.

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Cooperativa Minera Aurífera Coronación Ltda., Municipio de Sorata	La Paz	This cooperative uses the gravimetric concentration process for gold recovery. This method uses a lot of water contaminated with mercury coming from Cooperative “24 de Junio Ltda”. Water and waste (tailings) that result in the process (contaminated with mercury) are deposited in small ponds. When the ponds are filled, the tailings are transferred and accumulated outdoors in a place nearby. The vapor of mercury (produced during the amalgam burning) and the mercury attached to suspended particles reach the population through the air. The principal pathways are inhalation and skin contact, however it is possible the ingestion of mercury through the use of cookware for the amalgam burning or through the food contamination.
Municipio de La Paz - Hampaturi. Mina La Solución (Nivel Cero)	La Paz	The Hampaturi macrodistrict is rich in deposits of non-metallic minerals, among which granites, slate, quartzite, gypsum and limestone can be mentioned. The mining in this macrodistrict is a permanent activity, varying in extraction intensity due to the fluctuation of prices in international markets. Mining areas are usually traditional, with little exploration of new sources of these metals. The most important metallic minerals deposits of economic interest in the macrodistrict of Hampaturi are tin, wolfram (tungsten) and gold -- associated the first two include other elements such as Lead, Zinc, Iron, Bismuth and Silver (Pb, Zn, Fe, Bi and Ag). In the macrodistrict of Hampaturi are the New High Hampaturi Dam, the Hampaturi Dam that reaches a reservoir of 3.2 million m ³ of water and the Ajuankhota Dam, both of which supply the Pampahasi water purification plant, which is responsible for the supply of drinking water to the south and east side of the city of La Paz. The evaluation area that is the mine site of the abandoned La Solución mine (level zero), is located downstream of the Hampaturi dam, specifically in a main entrance that is the source of acid mine drainages. Arsenic was chosen as Key Pollutant since it is the contaminant with levels above those recommended in most samples taken. This and other pollutants reach the population through the "air," migration route is inhalation / ingestion mainly.
Municipio de La Paz - Hampaturi. Mina La Solución	La Paz	The most important deposits of metallic minerals of economic interest in the macrodistrict of Hampaturi are tin, wolfram (tungsten) and gold associated the first two with other elements such as Lead, Zinc, Iron, Bismuth and Silver (Pb, Zn, Fe, Bi and Ag). Additionally, arsenic occurs naturally in this site and the mining activity disperses it in the population. The La Solución mine is located at an altitude of 4700 m.s., in the Hampaturi macrodistrict; in it lead, silver and zinc were exploited. La Solución mining company ceased operations at the end of 2008, this would have been a consequence of the fall in the prices of minerals, especially zinc. This company has left exposed mining liabilities,

Site	Province/Region	Details (all data comes from the TSIP website)
		among these stand out the tails, mining residues that can be subject to dispersion by winds, runoff (the area has a high rate of precipitation, therefore, the greater the degree of runoff) and acid drainage of mines (DAM). Arsenic was selected as Key Pollutant because it is the contaminant with levels above those recommended in most soil samples taken. The results show that the main migration of the contaminant is through soil and the pathway to the population is Inhalation/ingestion.
Ingenio San Antonio La Joya. Municipio de La Paz	La Paz	In the Zongo macrodistrict of the Municipality of La Paz, the main mining activity is destined to the extraction and / or collection of gold, this can be from alluvial and colluvial sediments or a mixture of them. In the district Hampaturi, the different rivers drag gold in different concentrations, one of the most important areas is Chuquiaguillo. The exploitation of gold in this area is carried out by individuals, associations and cooperatives that operate through mining mills, whose gold concentration process is semi-mechanized and using mercury, the management of their waste (tailings and tailings) and discharges (of water) apparently are not yet efficiently controlled. The water discharges from the process are discharged to a nearby stream and the resulting residues (tailings) of the concentration (contaminated with mercury) are deposited in the surroundings and in the open. The mercury in the vapor state (product of the burning of the amalgam) and the mercury adhered to the particles suspended in the air whose origin is the dispersed waste, reach the population through the "air" migration route through inhalation and skin contact, mainly; although the "water" migration route (for downstream populations) is not ruled out, since the tailings are in contact with a nearby stream.
Ingenio El Progreso. Municipio de La Paz	La Paz	In the Zongo macrodistrict of the Municipality of La Paz, the main mining activity is destined to the extraction and / or collection of gold, this can be from alluvial and colluvial sediments or a mixture of them. In the district Hampaturi, the different rivers drag gold in different concentrations, one of the most important areas is Chuquiaguillo. The exploitation of gold in this area is carried out by individuals, associations and cooperatives that operate through mining mills, whose gold concentration process is semi-mechanized and using mercury, the management of their waste (tailings and tailings) and discharges (of water) apparently are not yet efficiently controlled. The water discharges from the process are discharged to a nearby stream and the resulting residues (tailings) of the concentration (contaminated with mercury) are deposited in the surroundings and in the open. The mercury in the vapor state (product of the burning of the amalgam) and the mercury adhered to the particles suspended in the air whose origin

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		is the dispersed waste, reach the population through the "air" migration route through inhalation and skin contact, mainly; although the "water" migration route (for downstream populations) is not ruled out, since the tailings are in contact with a nearby stream.
Ingenio Triunfo Somet. Municipio de La Paz	La Paz	Google translate: In the Zongo macrodistrict of the Municipality of La Paz, the main mining activity is destined to the extraction and / or collection of gold, this can be from alluvial and colluvial sediments or a mixture of them. In the district Hampaturi, the different rivers drag gold in different concentrations, one of the most important areas is Chuquiaguillo. The exploitation of gold in this area is carried out by individuals, associations and cooperatives that operate through mining mills, whose gold concentration process is semi-mechanized and using mercury, the management of their waste (tailings and tailings) and discharges (of water) apparently are not yet efficiently controlled. The water discharges from the process are discharged to a nearby stream and the resulting residues (tailings) of the concentration (contaminated with mercury) are deposited in the surroundings and in the open. The mercury in the vapor state (product of the burning of the amalgam) and the mercury adhered to the particles suspended in the air whose origin is the dispersed waste, reach the population through the "air" migration route through inhalation and skin contact, mainly; although the "water" migration route (for downstream populations) is not ruled out, since the tailings are in contact with a nearby stream.
Municipio de Potosí - Distrito 11	Potosi	Currently several mining companies (mining mills) are operating in different districts of the Municipality of Potosí, the minerals that are being worked by the cooperative are antimony, copper, tin, silver, lead and zinc. Most mining mills are located in residential areas very close to schools, hospitals, sports fields, recreation and public spaces in general. Pollution by dust (containing heavy metals) from the mining mills is one of the main problems and could be affecting the health of the population that is in close proximity to these mills; likewise, these powders could be deteriorating the architectural assets with historical significance, leaving at risk cultural and intangible heritag. Arsenic was chosen as Key Pollutant since it is the contaminant with levels above those recommended in most samples taken. This and other pollutants reach the population through the "air" migration route through inhalation / ingestion mainly.
Municipio de Potosí - Distritos 5 y 9	Potosi	Currently several mining companies (mining mills) are operating in different districts of the Potosí Municipality. The minerals being extracted by the cooperative are antimony, copper, tin, silver, lead and zinc. Most mining mills are located in residential areas very

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		close to schools, hospitals, sports fields, recreation spaces and public spaces in general. Pollution by dust (containing heavy metals) from the mining mills is one of the main problems, and could be affecting the health of the population that is in close proximity to these mills; likewise, these powders could be deteriorating the architectural structures with historical significance, leaving at risk an area of important cultural patrimony. Arsenic was chosen as Key Pollutant since it is the contaminant with levels above those recommended in most samples taken. This and other pollutants reach the population through the "air" migration route, primarily through inhalation / ingestion.
Cantumarca - Potosi	Potosi	Mineral mills and mining waste are polluting the area around Cantumarca by releasing particles into the air.
Municipio de Potosí - Distrito 4	Potosi	Currently several mining companies (mining mills) are operating in different districts of the Potosí Municipality. The minerals being extracted by the cooperative are antimony, copper, tin, silver, lead and zinc. Most mining mills are located in residential areas very close to schools, hospitals, sports fields, recreation spaces and public spaces in general. Pollution by dust (containing heavy metals) from the mining mills is one of the main problems, and could be affecting the health of the population that is in close proximity to these mills; likewise, these powders could be deteriorating the architectural structures with historical significance, leaving at risk an area of important cultural patrimony. Arsenic was chosen as Key Pollutant since it is the contaminant with levels above those recommended in most samples taken. This and other pollutants reach the population through the "air" migration route, primarily through inhalation / ingestion.
Pilcomayo River	Chuquisaca	Mining activity has lead to the contamination of the Pilomayo River's waters and sediments with heavy metals, specifically arsenic. Communities downstream rely on the river water for irrigation and drinking.

E. Scientific papers on lead exposure (Please contact info@gahp.net for information on studies not in the public domain)

Topic	Authors	Year	Title	Abstract/ description
Lead contamination	Villarroel, Lionel; Miller, Jerry; Lechler, Paul; Germanoski, Dru	2006	Lead, zinc, and antimony contamination of the Rio Chilco-Rio Tupiza drainage system, Southern Bolivia	Abstract: An intense, but localized rainfall event in February 2003, led to the severe erosion and failure of a tailings disposal impoundment at the Abaró a Antimony Mine in southern Bolivia. The failure released approximately 5,500 m ³ of contaminated tailings into the Rio Chilco-Rio Tupiza drainage system. The impacts of the event on sediment quality are examined and compared to contamination resulting from historic mining operations in the headwaters of the basin. Of primary concern are contaminated floodplain soils located along downstream reaches of the Rio Tupiza which were found to contain lead (Pb), zinc (Zn), and antimony (Sb) concentrations that locally exceed Canadian, German, and Dutch guidelines for agricultural use. Spatial patterns in sediment-borne trace metal concentrations, combined with Pb isotopic data, indicate that Pb, Zn, and S are derived from three tributary basins draining the Abaró a, Chilcobija, and Tatasi-Portugalete mining districts. Downstream of each tributary, geographical patterns in trace metal concentrations reflect local geomorphic changes throughout the drainage system. Trace metal concentrations within the Rio Chilco decrease rapidly downstream as a result of dilution by uncontaminated sediments and storage of metal enriched particles (e.g., sulfide minerals) in the channel bed as a result of ongoing aggradation. Storage in the floodplains is limited. These processes significantly reduced the dispersal and, thus, the relative environmental effects of tailings eroded from the Abaró a Mine during the 2003 flood. In contrast, storage of Pb, Zn, and Sb in flood-plains along the Rio Tupiza is significant, the majority of which is derived from historic mining operations, particularly mining within the Tatasi-Portugalete district
	Miller, Jerry; Lechler, Paul; Hudson-Edwards, Karen; Macklin, Mark	2002	Lead isotopic fingerprinting of heavy metal contamination, Rio Pilcomayo basin, Bolivia	Abstract: Waste materials from mining of the Cerro Rico de Potosí precious metal-polymetallic tin deposits of southern Bolivia have been released to the headwaters of the Rio Pilcomayo for the past 450 years, resulting in extensive contamination of water, sediments and soils along the upper reaches of the river. This study uses isotopic data to identify the primary sources of Pb to the aquatic environment, and the relative contributions of each source to pre and post-mining alluvial deposits. Prior to the onset of

Topic	Authors	Year	Title	Abstract/ description
				<p>mining activities in 1545, alluvial sediments along the Rio Pilcomayo were dominated by Pb from the underlying bedrock and from mineralized rocks exposed at the surface of Cerro Rico. Mining and milling operations at Cerro Rico released a new source of Pb to the river that can be traced downstream for at least 200 km. Simple mixing models suggest that Pb from the mines comprise between 30 and 89% of the Pb in the modern channel bed sediment. However, these estimates may be low because the isotopic composition of the contaminant source was based on samples of ore deposits rather than mill tailings, the latter of which contain fragments of both ore and host rock.</p>
Lead exposure	Stassen, Marinke; Preeker, Louise; Ragas, Ad; van de Ven, Max; Smolders, Alfons; Roeleveld, Nel	2012	Metal exposure and reproductive disorders in indigenous communities living along the Pilcomayo River, Bolivia	<p>Background: The Pilcomayo River is polluted by tailings and effluents from upstream mining activities, which contain high levels of metals. The Weenhayek live along this river and are likely to have elevated exposure.</p> <p>Objectives: To assess whether the Weenhayek have increased risk of reproductive and developmental disorders related to elevated metal exposure in comparison with a reference population.</p> <p>Methods: We assessed reproductive and developmental outcomes, i.e. fertility, fetal loss, congenital anomalies, and walking onset by means of structured interviews. We sampled hair, water and fish to assess the relative exposure of the Weenhayek. Samples were analyzed for Pb and Cd with ICP-MS techniques.</p> <p>Results: The Weenhayek communities studied had a higher prevalence of small families (OR 2.7, 95% CI 1.3–6.0) and delayed walking onset (OR 2.7, 95% CI 1.4–5.1) than the reference population. Median Pb levels in Weenhayek hair were 2–5 times higher than in the reference population, while Cd levels were not elevated. In water and fish, both Pb and Cd levels were increased in the Weenhayek area.</p> <p>Conclusions: We found indications for increased risks of small families and delayed walking onset among the Weenhayek living along the Pilcomayo River. Lactants form a high risk group for lead exposure.</p>

Topic	Authors	Year	Title	Abstract/ description
Lead isotopes	Macfarlane, Andrew; Marcet, Pablo; LeHuray, Anne; Petersen, Ulrich	1990	Lead isotope provinces of the Central Andes inferred from ores and crustal rocks	<p>The central Andean Cordillera of Peru, Bolivia, northwestern Argentina, and northern Chile may be divided into three fundamental geologic provinces, based on the age and dominant geology of the exposed rocks. Abstract: We define these provinces as follows: Province I: The coastal volcanic arc, comprising the Jurassic-early Tertiary coastal batholith complex and related volcanic rocks of the Western Cordillera and coastal belt. Based on differences in the isotopic composition of ore lead, province I is further subdivided into subprovince Ia, comprising the coastal volcanic belt of northern and central Chile; subprovince Ib, in central Peru north of 13 degrees S; and subprovince Ic, in southern Peru and northernmost Chile between 19 degrees S and 13 degrees S. Province II: The Jurassic and Cretaceous miogeosynclinal sedimentary belt that dominates the geology of the high Andes of Peru. Province III: The Eastern Cordillera of southeastern Peru, central Bolivia and northwestern Argentina, made up mainly of early Paleozoic clastic sediments. We have also divided this into two subprovinces due to different ore lead isotope characteristics: subprovince IIIa in Bolivia and northern Argentina, and subprovince IIIb in southeastern Peru. These provinces are bordered by noncordilleran units of the Brazil and Guyana Shields, the Arequipa massif, and the metamorphic terranes of southern Chile and central-western Argentina. We present 45 new analyses of ore minerals from 31 mining districts and two of host rocks from province III and summarize our results together with other data available in the literature. Isotopic compositions of ore lead from the above provinces conform to neighboring but distinct fields on Pb isotope covariation diagrams. Lead from province I ores has $^{206}\text{Pb}/^{204}\text{Pb} = 18.21$ to 18.82, $^{207}\text{Pb}/^{204}\text{Pb} = 15.55$ to 15.69, and $^{208}\text{Pb}/^{204}\text{Pb} = 38.11$ to 38.95. Lead from province II ores is less variable, with consistently higher $^{206}\text{Pb}/^{204}\text{Pb}$ and $^{208}\text{Pb}/^{204}\text{Pb}$ than the province I ores and slightly higher average $^{207}\text{Pb}/^{204}\text{Pb}$. We consider the province I and II ore leads to reflect different degrees of mixing between magmatic, upper mantle-derived lead and crustal sources. Most assimilation of crustal lead is probably magmatic and results from incorporation of lead from subducted sediments at the magma source and/or from the crust during ascent of the parent magma from the upper mantle. Province III ore leads are much more variable than those of provinces I and II, having $^{206}\text{Pb}/^{204}\text{Pb} = 17.97$ to</p>

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				<p>25.18, $^{207}\text{Pb}/^{204}\text{Pb} = 15.51$ to 16.00, and $^{208}\text{Pb}/^{204}\text{Pb} = 37.71$ to 40.07; they have consistently higher $^{207}\text{Pb}/^{204}\text{Pb}$ and $^{208}\text{Pb}/^{204}\text{Pb}$ for given values of $^{206}\text{Pb}/^{204}\text{Pb}$ than ore leads from the other provinces. Province III leads indicate more radiogenic, heterogenous source regions and suggest that fusion of continental crust has played an important role in the genesis of magmas and associated ore deposits. This is substantiated by the metaluminous to strongly peraluminous character of much of the magmatism in province III. Detailed comparisons of lead isotope data available in the literature for Andean volcanic rocks with compositions of ores are problematic because analyses are rarely reported from related ores and igneous bodies. Where such data exist, ore Pb isotope compositions correlate closely with those in the associated intrusions.</p>
Lead in mining	Miller, Jerry; Lechler, Paul; Mackin, Gail; Germanoski, Dru; Villarroel, Lionel	2007	Evaluation of particle dispersal from mining and milling operations using lead isotopic fingerprinting techniques, Rio Pilcomayo Basin, Bolivia	<p>Abstract: Mining and milling of ores from the Cerro Rico de Potosí precious metal–polymetallic tin deposits of Bolivia have led to severe contamination of water and sediments of the Rio Pilcomayo drainage system. Lead (Pb) isotopic data were used in this study to first document downstream dispersal patterns of Pb contaminated sediment within the channel of the Rio Pilcomayo, and then to determine the relative contribution of Pb from Cerro Rico within alluvial terrace soils that are used for agriculture. The concentration and isotopic composition of Pb within channel bed sediments differed significantly between 2000, 2002, and 2004. These differences presumably reflect changes in the type of ore mined and milled at Cerro Rico, and alterations in dispersal and grain-size dilution mechanisms associated with interannual variations in rainfall and runoff. Within agricultural terrace soils, both Pb concentrations and the percentage of Pb from Cerro Rico: (1) semi-systematically decrease downstream, (2) were found to decrease with terrace height above the channel, and (3) reflect the use of contaminated irrigation water. In upstream reaches (within 30 km of the mills), Pb from mining represents the most significant Pb source, accounting for more than 80% of Pb in the examined agricultural fields. At Sotomayor, located approximately 170 km from the mills, the relative contribution of Pb from Cerro Rico is highly variable between fields, but can be significant, ranging from approximately 15% to 35%. The analysis demonstrates that Pb isotopic ratios can be used to effectively trace contaminated particles through river systems and into adjacent alluvial</p>

Topic	Authors	Year	Title	Abstract/ description
				soils, even where multiple Pb sources exist and Pb concentrations are similar to background values.
Sources of lead	Kamenov, George; Macfarlane, Andrew; Riciputi, Lee	2002	Sources of Lead in the San Cristobal, Pulacayo, and Potosí Mining Districts, Bolivia, and a Reevaluation of Regional Ore Lead Isotope Provinces	<p>Abstract: New lead isotope data on ores, crustal rocks, and leachates of crustal rocks, combined with data in the literature, provide important new constraints on the sources of ore metals in southwest to south-central Bolivia, including the very large recently discovered silver-zinc deposit at San Cristobal, the Pulacayo polymetallic district, and the giant Potosí silver-tin-base metal deposit.</p> <p>Lead isotope ratios of ores and igneous rocks from the San Cristobal deposit and from Paleozoic and Cretaceous sedimentary rocks are compared with published data on high-grade Middle Proterozoic metamorphic basement rocks. These data constrain the major source of lead, and by inference of other ore metals, at San Cristobal to be the metamorphic basement rocks. Leaching experiments on samples of Paleozoic and Cretaceous sedimentary rocks show that the easily leachable lead from these rocks is much less radiogenic than the whole-rock compositions. However, lead isotope ratios of both whole rocks and leachates of these upper crustal rocks are too radiogenic for them to be major sources of ore lead at San Cristobal.</p> <p>Lead isotope ratios of ores from Pulacayo and Potosí are similar to each other and lie within the range of Paleozoic and Cretaceous sedimentary whole-rock compositions. Leaching of Pb from the sedimentary rocks cannot explain the isotopic compositions of the Pulacayo and Potosí ores, and the isotopic homogeneity of the Potosí ores also argues against mixing of lead from diverse sources in the hydrothermal system. Lead from the sedimentary rocks may have been incorporated by magmatic assimilation followed by extraction of ore metals from the resulting magma.</p> <p>Lead isotope ratios of San Cristobal ores are different from those of Pulacayo, Potosí, and other deposits to the east, but resemble the compositions of ores and volcanic rocks in western Bolivia. On this basis we identify a new ore lead isotope province extending from San Cristobal northward across the eastern Altiplano and into southern Perú. This province is coincident with but smaller than the extent of the proposed</p>

Topic	Authors	Year	Title	Abstract/ description
				Arequipa-Antofalla metamorphic basement craton. The degree of incorporation of ore metals from the metamorphic basement appears to depend on the timing and/or location of the mineralizing event. Ore deposits in the northern part of province IV formed before the thickening of Andean crust, beginning around 20 Ma, and incorporated minor amounts of metals from the metamorphic basement. Younger deposits farther to the south contain major to dominant components of basement lead.

F. Blood testing in National Health Surveys

National Health Survey	Non-Communicable Diseases Risk-Factors Surveillance	Source
Purpose	To provide information to evaluate public health sector policies and establish a baseline for new strategies, plans and programs. To estimate fertility and infant mortality and, on this basis, provide inputs to adjust population projections; to determine the nutritional status of mothers and their children; and to calculate indicators for reproductive health and family planning programs.	Demographic and Health Survey, 2016
Sample size	Women in fertile age (14 to 49 years old); children younger than 5 years old, and men (15 to 64 years old) in a household.	
Blood sample testing	Hemoglobin measurement in women and kids; HIV/AIDS screening in women and men.	
Latest round	2016	
Next round	-	