Exploration Review

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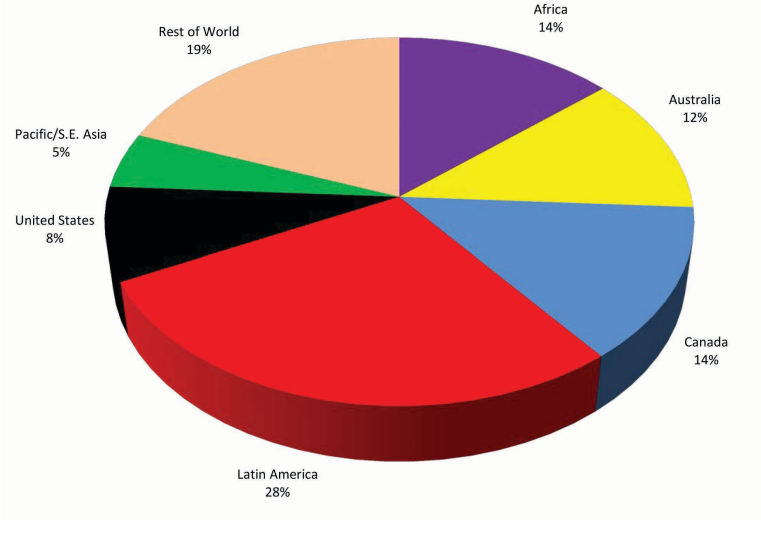
This summary of international mineral exploration activities for the year 2015 draws upon information from industry sources, published literature, SNL Metals & Mining (SNL) (Charlottesville, VA) database and specialists in the U.S. Geological Survey (USGS) National Minerals Information Center. The summary provides data on exploration budgets by region and mineral commodity, identifies significant mineral discoveries and areas of mineral exploration, discusses government programs affecting the mineral exploration industry, and presents analyses of exploration activities performed by the mineral industry.

Three types of information are reported and analyzed in this annual review of international exploration: budgetary statistics expressed in U.S. dollars provided by SNL; regional and site-specific exploration activities that took place in 2015 as compiled by the USGS; and regional events that affected exploration activities including economic, social and political conditions, which were derived from published sources and discussions with USGS and industry specialists. Commodity and regional compilations are presented in this summary. Because multiple sources were used to develop commodity and regional compilations, statistics may vary depending on the source and type of data that are being reported.

Figure 1

Planned worldwide exploration budgets for analyzed nonfuel mineral commodities by region for 2015 (1,798 companies' budgets totaling US$8.8 billion). Source: SNL Metals & Mining, 2015.



The SNL data summarize planned company budgets for worldwide exploration activities in 2015 for 24 nonfuel mineral commodities and metal alloys and are based on company surveys. Surveys focused on precious metals (gold, platinum-group metals and silver), base metals, (cobalt, copper, lead, molybdenum, nickel, tin and zinc), bulk commodities (bauxite, chromite, iron ore, manganese, phosphate and potash), and other commodities (diamond, graphite, heavy-mineral sands, lithium, niobium, rare-earth elements (REE), tantalum, tungsten and uranium).

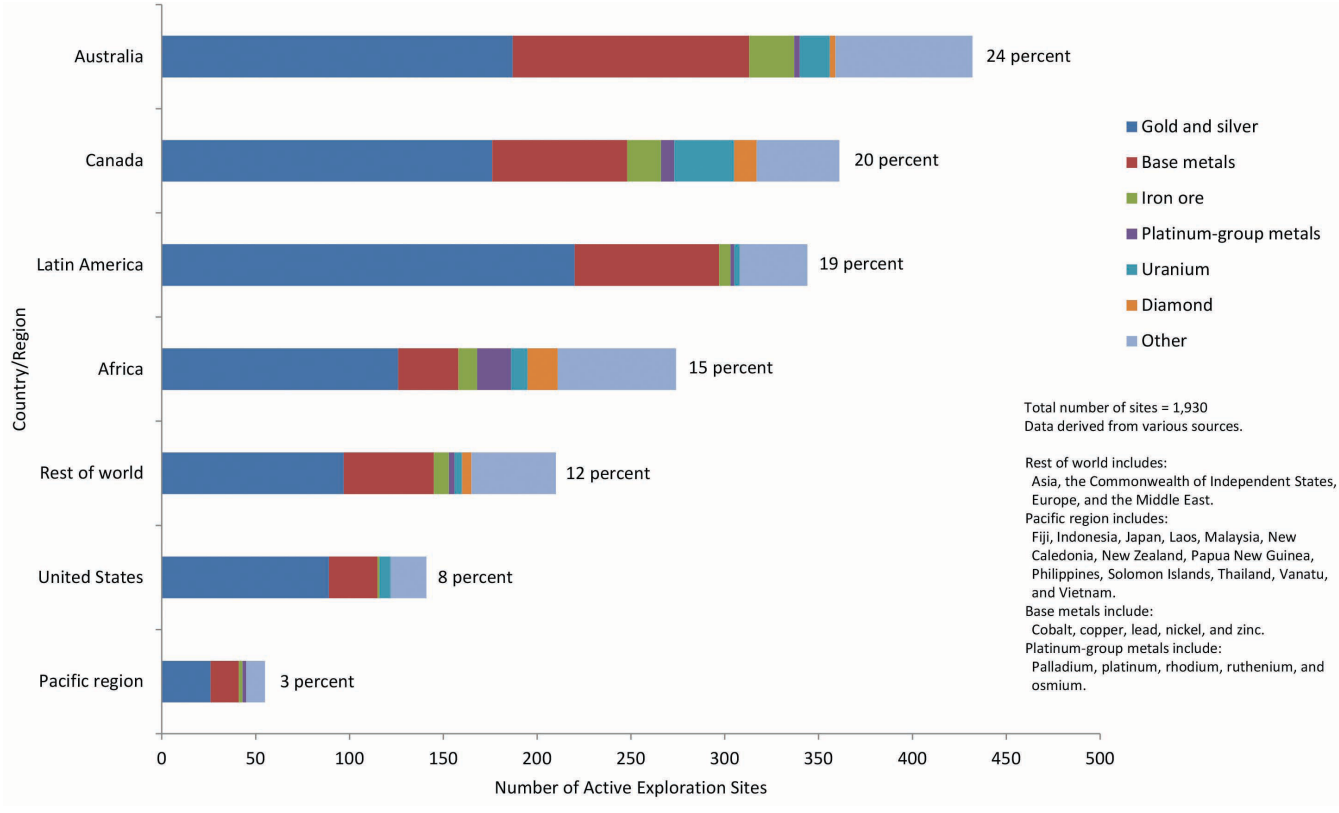
USGS data compilations and analyses are based on information provided by USGS mineral commodity and country specialists, as well as industry contacts and published trade journals. The USGS data summarize exploration site data collected for more than 80 minerals and materials, with a focus on base metals, diamond and precious metals. The USGS analyzed available information to assess the level of exploration activity in 2015 and to report trends in mineral exploration activity for the period 2005 through 2015. These analyses identify where mineral exploration is occurring by commodity and region and the intensity of activity that is taking place in each region for selected mineral commodities, and determines those factors that most affect changes in exploration activity.

Certain limitations apply when comparing value estimates from year to year because, as worldwide exploration allocations have changed, so too have factors such as energy, labor, material and service costs associated with mineral exploration. Consequently, an exploration budget of $1 million allocated in 2015 would generally yield less exploration activity than a corresponding budget in 2005. Fluctuations in currency exchange rates and the value of trading currencies over time can influence the business pattern of companies conducting business in other countries. Unless otherwise specified, this analysis expresses worldwide exploration activity in U.S. nominal (current) dollars to simplify comparisons by commodity and region. The level of exploration investment may also be influenced by the scale of the planned operation; development of a large-scale operation usually requires a greater exploration investment than a small-scale operation with a shorter project life.

Temporal interpretations of the exploration

Figure 2

Number of active exploration sites by region in 2015 as compiled by the U.S. Geological Survey.



data, such as trend analyses, may be limited by changes in survey parameters. SNL survey data and USGS compiled site data can vary based on the level of information reported by companies, the number of surveyed companies and their response rates, and fluctuation of currency exchange rates affecting the relative value of budget estimates from year to year. Mineral commodity and country coverage may differ from year to year as corporate restructuring within the mining industry has taken place.

Global mineral exploration activity and trends from 2005 through 2015

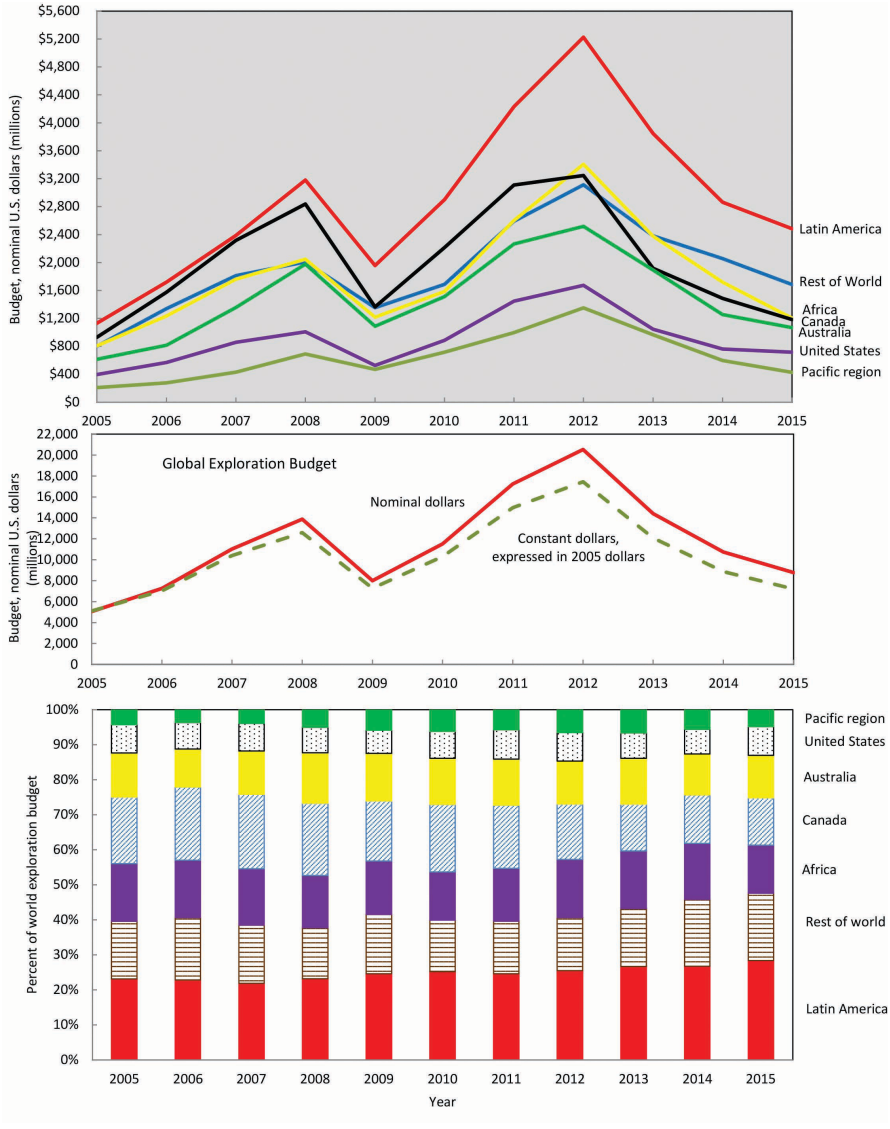
According to SNL, the total estimated worldwide budget allocation for nonferrous mineral exploration decreased by 18 percent in 2015 to about $8.8 billion (on the basis of data from 1,798 companies, excluding iron ore) from the 2014 budget allocation of about $10.7 billion (based on 1,961 companies, excluding iron ore). The exploration budget for iron ore projects, first compiled in 2011, was not included in the nonferrous budget data. The estimated budget for iron ore exploration in 2015 was reported by SNL as $939 million, a decrease of about 35 percent from the $1.4 billion estimated for 2014. SNL annual survey estimates reflect budgeted expenditures rather than actual dollars spent. When SNL includes estimates for exploration budgets for non-respondents, the global nonferrous exploration budget for 2014 was about $9.2 billion. Lower commodity prices, in large part owing to an economic slowdown in China and a relatively strong U.S. dollar, market instability and the reduction in available funding for mining projects in 2015 likely resulted in exploration budget cutbacks and reduced the number of junior companies conducting minerals exploration.

Competition for assaying, drilling and geophysical services; higher taxes in some countries; and increasing costs associated with environmental regulation and labor have resulted in an increase in the total cost of exploration over the past decade. In 2015, many companies cut their exploration expenditures, reduced their level of activity and restricted drilling to key projects. Lower prices for many mineral commodities experienced during the past several years, increased environment awareness resulting from a series of mining-related environmental problems, and higher costs for mineral exploration have reduced investor interest and the level of exploration activity.

Figure 1 shows the 2015 worldwide nonfuel minerals exploration budgets allocated by region, based on SNL data. SNL "regions" reflect a mixture of individual countries, continents and other groupings, but they are reported consistently on an annual basis

Figure 3

Trends in reported exploration budgets in selected regions, 2005 through 2015. Source: SNL Metals & Mining, 2015.



and provide a means of assessing the flow of budgeted exploration expenditures from year to year. The 2015 exploration budgets, in decreasing order, were reported for Latin America, Africa, Canada, Australia, the United States and the Pacific region. Exploration taking place in countries included in the "Rest of World" accounted for 19 percent of the global exploration budget, of which China and Russia accounted for about 57 percent of the regions' budget total. The exploration budget in 2015 in all regions was lower than the corresponding budget in 2014. The largest decreases took place in Africa (with a 30-percent decrease), the Pacific region (28 percent decrease) and Canada (20 percent decrease). The smallest decreases took place in the United States (6 percent decrease), Latin America (13 percent decrease) and Australia (15-percent decrease). Latin America remained the region with the largest mineral exploration budget, expressed either in nominal dollars or percent of the global exploration budget.

For 2015, information on 1,930 exploration sites was gathered by USGS specialists from published literature and industry sources. The regional distribution of these exploration targets is represented in Fig. 2 by principal commodity target, based on the number of projects reported for each region. Australia became the top destination in terms of active exploration sites in 2015, followed by Canada, Latin America and Africa. The number of sites that are actively being explored does not correlate directly with exploration budget estimates, but both are indicators of activity in the region of interest.

Based on mineral exploration drilling data collected by SNL, the number of exploration drill holes completed in 2015 increased by about 9 percent from the number of holes drilled in 2014. The number of holes drilled in 2015 increased in Australia and the United States, decreased in Latin America and remained stable in other regions. Since 2012, drilling for copper and gold as the primary target has decreased, while drilling for lead, nickel and zinc targets has increased because of generally high demand

[1] As defined by SNL, Latin America includes countries in the Caribbean, Central America, Mexico and South America. The Pacific region includes Fiji, Indonesia, Japan, Laos, Malaysia, New Caledonia, New Zealand, Papua New Guinea, Philippines, Solomon Islands, Thailand, Vanuatu and Vietnam. Africa includes countries on the African subcontinent. The rest of the world includes China, Europe, India and Pakistan, the Middle East and republics of the Commonwealth of Independent States (Azerbaijan, Armenia, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Turkmenistan, Uzbekistan and Ukraine). Australia, Canada and the United States are treated separately.

Table 1

Prices for selected base and precious metals, 2005 through 2015.

Commodity	Average nominal price for specified year, expressed in U.S. currency										
	2005[1]	2006[1]	2007[1]	2008[1]	2009[1]	2010[1]	2011[1]	2012[1]	2013[1]	2014[2]	2015[2]
Copper[3]	1.73	3.15	3.28	3.19	2.41	3.48	4.06	3.67	3.40	3.18	2.57
Gold[4]	446	606	699	874	975	1,228	1,572	1,673	1,415	1,269	1,163
Lead[5]	0.61	0.77	1.24	1.20	0.87	1.09	1.22	1.14	1.15	1.07	0.91
Nickel[6]	6.69	11.00	16.88	9.57	6.65	9.89	10.38	7.95	6.81	7.65	5.35
Palladium[7]	204	323	357	355	266	531	739	649	730	810	695
Platinum[8]	900	1,144	1,308	1,578	1,208	1,616	1,725	1,555	1,490	1,388	1,056
Silver[9]	7.34	11.57	13.41	15.00	14.69	20.20	35.26	31.21	23.80	19.35	15.71
Uranium oxide[10]	27.93	47.68	99.24	64.18	46.67	45.96	56.24	48.90	38.92	33.50	36.76
Zinc[12]	0.63	1.49	1.47	0.85	0.75	0.98	0.99	0.88	0.87	0.98	0.88
Neodymium oxide[12]	3.36	6.81	13.10	12.26	7.03	22.62	106.26	51.81	31.55	28.57	21.94

[1] Price reported in U.S. Geological Survey (USGS), Minerals Yearbook series for the years 2005 through 2013.
[2] Price reported in U.S. Geological Survey, Minerals Commodity Summaries series for the years 2014 and 2015 or updated based on oral and written communications, USGS mineral commodity specialists.
[3] U.S. producer cathode (minimum 99.99% pure), reported in $/lb.
[4] Englehard Corporation industries quotation, reported in $/oz.
[5] North American producer price, delivered (minimum 99.97 percent pure), in $/lb. In 2015, the North American market price in $/lb is reported.
[6] London Metal Exchange cash price for primary nickel (minimum 99.80 percent pure), in $/lb.
[7] Unfabricated palladium, reported in $/oz.
[8] Unfabricated platinum, reported in $/oz.
[9] Handy and Harmon quotation, reported in $/oz.
[10] Nuexco exchange spot price, reported in $/lb by the International Monetary Fund.
[11] London Metal Exchange cash price, reported in $/lb.
[12] Metals Pages price, 99% pure, as reported by Arafura Resources Ltd., in $/lb.

for these metals by China. SNL does not report aggregated information on the total length of drilling conducted in a region or country.

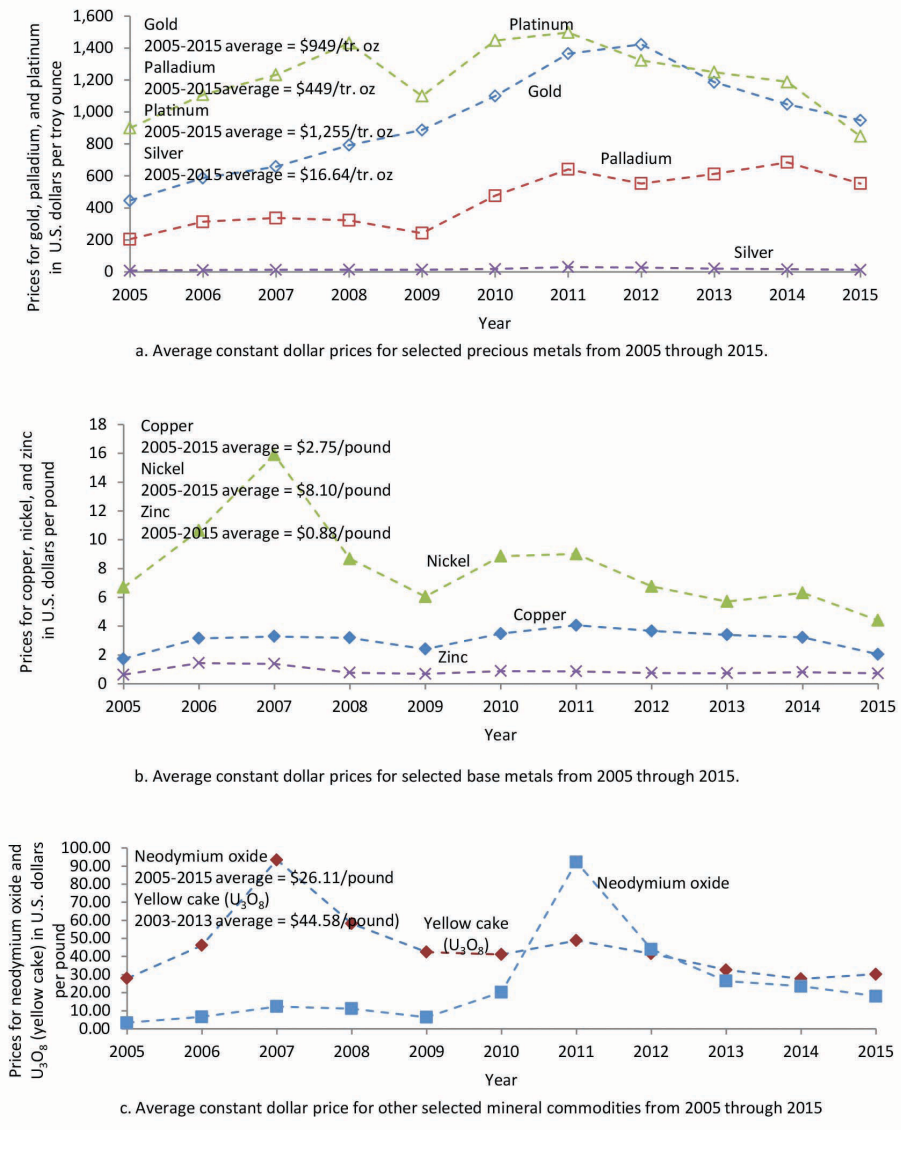
Figure 3 summarizes SNL budget data by region for the period 2005 through 2015. The top chart of Fig. 3 shows that exploration budgets for 2015 decreased from 2014 budget levels in all regions of the world. The largest regional budget reduction from 2014 to 2015 took place in Africa (decrease of $500 million), followed by Latin America (decrease of $380 million) and the Rest of World region (decrease of $370 million). The regions with the smallest decrease in exploration budget were the United States (decrease of $44 million), the Pacific region (decrease of $170 million) and Australia (decrease of $190 million). The middle chart of Fig. 3 shows the trend in global exploration budgets in terms of both nominal (actual) dollars and real (constant) dollars. The bottom chart of Fig. 3 shows that the percentage of the world exploration budget increased slightly in 2015 from the 2014 percentage for Australia, Latin America and the United States on a global basis even though the total exploration budget for these regions was lower in 2015 than in 2014.

The SNL mineral exploration survey data suggest that budgeted expenditures for sites at a late stage of exploration accounted for about 37 percent of the total global exploration budget in 2015. Exploration associated with established mine sites accounted for about 34 percent, and early-stage sites accounted for about 29 percent, compared with the 2014 values of 39, 31 and 30 percent, respectively. Since 2005, the percentage of total global exploration budget attributed to mine site exploration has generally increased while early-stage exploration has decreased. Larger companies shifted their exploration focus toward projects requiring less capital as a less expensive means of replacing or adding reserves. Between 2012 and 2015, the amount spent on early-stage exploration decreased by 60 percent to a level last seen during the economic downturn that took place in 2009. Traditionally, major companies leave early-stage exploration to junior companies. Since 2014, however, many junior companies have had difficulty securing sufficient financing to conduct extensive exploration, often requiring more than $500,000 for an initial drilling program. Consequently, larger companies contributed a greater share to early-stage exploration, accounting for about 48 percent of the early-stage exploration allocation in 2015.

Changing mineral commodity prices and commodity demand, relative currency exchange rates and increased exploration costs were among the considerations used by companies in determining exploration targets and development plans for 2015. Lower prices make it more difficult for smaller junior companies to obtain financing in a tight economy, so companies have been focusing available capital on fewer exploration projects. A study conducted by PricewaterhouseCoopers reported that the leading 100 junior miners raised 25 percent less total funds in 2015 than they were

Figure 4

Figure 4. Average constant dollar prices for selected (a) precious metals, (b) base metals, and (c) other selected mineral commodities from 2005 through 2015. Nominal dollar prices from various sources were indexed using the Consumer Price Index with a base year of 2005.



able to raise in 2014, and that 86 percent of the 2015 value was raised by 15 companies. One consequence of the decline in early-stage exploration in the last decade is that the number of viable, large-scale assets available for potential development has declined.

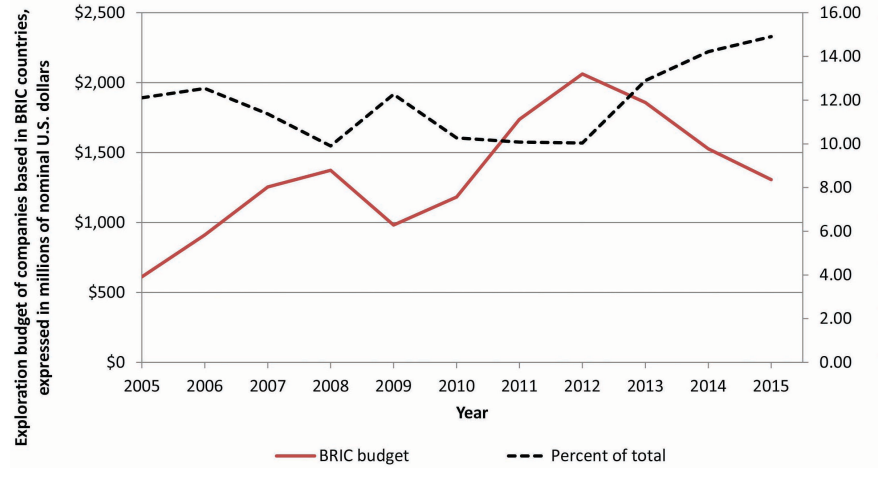
Recent and anticipated mineral commodity prices contribute to exploration budget development and the amount of activity planned by mineral exploration companies. Table 1 shows the average annual prices in nominal dollars for selected metals for the years 2005 through 2015. However, because of metal price variation, reporting just the average prices for the year does not provide enough information to assess the effect of price changes on the level of exploration. Figure 4 shows the annual prices in 2005 constant U.S. dollars for selected mineral commodities shown in Table 1 for 2005-2015. Using constant dollar values based on the Consumer Price Index reduces the effects of inflation on prices of mineral commodities being considered over time. When expressed in terms of constant dollars, the average price for eight of the 10 selected commodities was lower in 2015 than the 2005-2015 average price of that commodity.

The 2015 average constant-dollar price for gold was slightly higher (0.4 percent) than the average 2005-2015 constant-dollar price for gold. Similarly, the 2015 constant dollar palladium price was 21 percent higher. The 2015 average constant-dollar price for the other commodities shown in Fig. 4 ranged from 22 percent to 84 percent lower than the average 2005-2015 constant-dollar price for the commodity. As shown in Fig. 4, the 2015 average constant dollar prices for nine of the 10 selected commodities were lower in 2015 than in 2014. Of the commodities selected for evaluation, only the average constant-dollar price for uranium oxide was higher in 2015 than in 2014.

Historical and future trends of metals prices are considered, along with projections of supply and demand that underpin prices, when determining where and what commodity target to spend available capital on exploration and development. Commodity price movements can also alter calculation of known reserves and decisions on exploration expenditures and targets. During the period of increasing gold price that took place from 2005 through 2012, the major gold miners increased the recovery of gold from lower ore grades and were able to maintain a satisfactory profit level, and some exploration companies re-evaluated deposits with historically lower ore grades. The average gold price in 2015 was 8 percent lower than the average gold price in 2014 and 31 percent lower than the peak gold price in 2012. This continued a trend where some producers lowered the prices they used to calculate year-end reserves

Figure 5

Exploration budgets of companies based in BRIC countries and their share of annual global exploration budgets, 2005-2015. Source: SNL Metals & Mining, 2015.



in order to comply with regulator's definitions of what defines an allowable reserve estimate. In response to low prices, some companies are reducing costs by cutting capital expenditures and exploration spending, reducing overhead costs, and delaying development or scaling back mine plans to focus on extracting higher-grade ore. Exploration activity at some sites is being curtailed and operations at some marginal mines are being suspended until prices increase.

Currency movements were an important consideration for the minerals exploration and mining sector in 2015. The U.S. dollar continued to strengthen against all other major currencies in 2015. A strong U.S. dollar makes U.S. mining-related exports more expensive for other countries and increases the costs associated with foreign projects that purchase goods or supplies using U.S. dollars. With most commodities priced in U.S. dollars, however, a stronger dollar may reduce or partially mitigate costs incurred in local currencies. Lower fuel prices have positively affected the cost of exploration in 2015. Staffing levels also played an important role, as more than half (55 percent) of the employers in the mining industry reduced their workforce in 2015.

Ernst & Young Global estimated the greatest business risks for the mining and minerals exploration industry in 2015, in order of importance, as the need to consider growth options, productivity, capital sourcing, resource nationalism, the social license to operate, price and currency volatility, capital projects, access to energy, cyber security and the need for innovation.

During the past few years, declining metals prices, massive write-offs and languishing earnings made investors wary of the mining sector. While the major companies and junior companies lowered their planned exploration spending, restricted access to investor funds affected the junior companies more than larger companies with other sources of revenue. Data suggest that the junior companies' share of exploration budgets decreased to a 13-year low of 29 percent in 2015 while the major companies' share increased to a 12-year high of about 49 percent. Improved reporting by Chinese entities has resulted in an increased share of survey data collected by SNL are from government-controlled companies in China.

The lack of available capital targeted for preproduction assets made it difficult for some junior companies to obtain sufficient capital to sustain exploration activities. There was a general trend in declining merger and acquisition activity in 2015. Most activity involved the sale of marginal or noncore assets, to reduce capital expenditure or to service debt. Some junior companies turned to engineering and construction companies or private equity investment entities as potential sources of funding. Some major companies looked internally for growth opportunities, while others divested some holdings to separate unprofitable assets.

Resource nationalism is a policy initiated by some countries to balance promoting investment

Figure 6

Worldwide exploration budgets for selected mineral commodity targets, 2011-2015. (Other minerals include iron ore, lithium, molybdenum, niobium, phosphate, potash, rare-earth elements, silver, tantalum, tin, and uranium. Expressed as percentage of nominal dollar budget.) Source: SNL Mining & Metals, 2015.

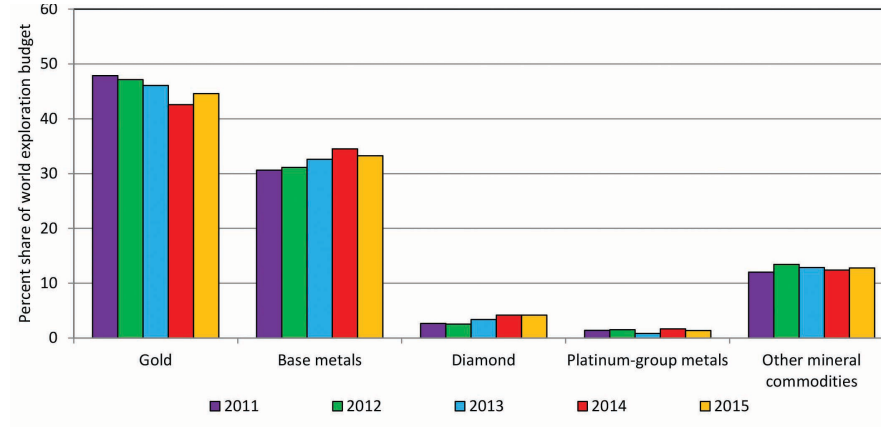


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Table 2

Selected noteworthy exploration sites for 2015.

Location	Type[1]	Site	Commodity	Company	Resource[2] notes
Africa					
1 Burkina Faso	F	Banfora	Au	Gryphon Minerals Ltd.	826,000 oz Au (R)
2 Burkina Faso	E	Batie West	Au	Centamin plc.	2 Moz Au (D)
3 Burkina Faso	P	Bissa	Au	Nord Gold NV	1.7 Moz Au (R)
4 Burkina Faso	P	Essakane	Au	Iamgold Corp.	3.9 Moz Au (R)
5 Burkina Faso	P	Mana	Au	SEMAFO Inc.	2.2 Moz Au (R)
6 Burkina Faso	F	Natougou/Boungou	Au	SEMAFO Inc.	1.1 Moz Au (ID)
7 Cote d'Ivoire	P	Agbaou	Au	Endeavor Mining Corp.	926,000 oz Au (R)
8 Eritrea	P	Bisha	Cu, Au, Ag, Zn	Nevsun Resources Ltd.	363,000 t Cu, 587,000 oz Au, 35.1 Moz Ag, 1.2 Mt Zn (R)
9 Ghana	F	Bibiani	Au	Resolute Mining Ltd.	1.3 Moz Au (D)
10 Ghana	P	Prestea (Bogoso)	Au	Golden Star Resources Ltd.	469,000 oz Au (PR)
11 Guinea	P	Siguiri	Au	Anglogold Ashanti Ltd.	2.6 Moz Au (R)
12 Mali	D	Fekola	Au	B2Gold Corp.	3.7 Moz Au (PR)
13 Mali	LP	Kalana	Au	Avnel Gold Mining Ltd.	2.7 Moz Au (D)
14 Mali	D	Tabakoto/Segala	Au	Endeavor Mining Corp.	1.1 Moz Au (R)
15 Mozambique	D	Balama	Graphite	Syrah Resources Ltd.	13 Mt graphite (R)
16 South Africa	E	Waterberg	Pt, Pd, Au, Rh	Platinum Group Metals Ltd.	3.8 Moz Pt, 7.8 Moz Pd, 950,000 oz Au; 374,000 oz Rh (D)
17 Sudan	E	Block 14 (Galat Sufar)	Au	Orca Gold Inc.	1.6 Moz Au (D)
Australia					
18 New South Wales	P	Long	Ni	Independence Group NL	22,000 t Ni (R)
19 Northern Territory	E	Tennant Creek	Cu, Au	Evolution Mining Ltd.	61,000 t Cu, 134,000 oz Au (D)
20 Queensland	P	Cracow	Au	Evolution Mining Ltd.	248,000 oz Au (R)
21 Queensland	P	Pajingo	Au	Evolution Mining Ltd.	98,000 oz Au (R)
22 Victoria	P	Fosterville	Au	Newmarket Gold Inc.	307,000 oz Au (R)
23 Western Australia	P	Carosue Dam	Au	Saracen Mineral Holdings Ltd.	587,000 oz Au (R)
24 Western Australia	P	DeGrussa (Doolgunna)	Cu, Au	Sandfire Resources NL	376,000 t Cu, 456,000 oz Au (R)
25 Western Australia	P	Duketon (Moolart Well, Garden Well, Ertisoun)	Au	Regis Resources Ltd.	530,000 oz Au (R)
26 Western Australia	P	Jaguar	Zn, Cu, Au, Ag	Independence Group NL	88,000 t Zn, 20,000 t Cu, 27,000 oz Au, 4.7 Moz Ag (R)
27 Western Australia	P	Jundee	Au	Northern Star Resources Ltd.	595,000 oz Au (R)
28 Western Australia	P	Kanowna Belle	Au	Northern Star Resources Ltd.	168,000 oz Au (R)
29 Western Australia	P	Nova Bollinger	Ni, Cu, Co	Independence Group NL	299,000 t Ni, 121,000 t Cu, 11,500 t Co (PR)
30 Western Australia	F	Pilgangoora	Li, Ta	Pilbara Minerals Ltd.	469,000 t Li_2O, 3,255 t Ta_2O_5 (ID)
31 Western Australia	P	Savannah	Ni, Cu, Co	Panoramic Resources Ltd.	76,500 t Ni, 39,000 t Cu, 5,300 t Co (IF)
32 Western Australia	P	Sunrise Dam	Au	Anglogold Ashanti Ltd.	1.3 Moz Au (R)
33 Western Australia	D	Thunderbox	Au	Saracen Mineral Holdings Ltd.	897,000 oz Au (PR)
34 Western Australia	P	Tropicana	Au	Anglogold Ashanti Ltd.	3 Moz Au (R)
35 Western Australia	F	Yamarna belt	Au	Gold Road Resources Ltd.	4.5 Moz Au (D)
Canada					
36 British Columbia	D	Brucejack	Au, Ag	Pretium Resources Inc.	7.5 Moz Au, 31 Moz Ag (R)
37 British Columbia	E	Kerr-Sulphurets-Mitchell (KSM)	Au, Cu, Ag, Mo	Seabridge Gold Inc.	38 Moz Au, 4.5 Mt Cu, 190 Moz Ag, 96,000 t Mo (R)
38 British Columbia	E	Premier	Au, Ag	Ascot Resources Ltd.	2.5 Moz Au, 21 Moz Ag (D)
39 Northwest Territories	P	Kennady Lake No.	Diamond	Kennady Diamonds Inc.	Data not released.
40 Nunavut	E	Amaruq	Au	Agnico-Eagle Mines Ltd.	2 Moz Au (IF)
41 Nunavut	D	Hope Bay	Au	TMAC Resources Inc.	3.5 Moz Au (R)
42 Ontario	P	Black Fox/Grey Fox	Au	Primero Mining Corp.	424,000 oz Au (R)
43 Ontario	E	Borden Lake	Au, Ag	Goldcorp Inc.	3.9 Moz Au, 2.1 Moz Ag (D)
44 Ontario	P	Cochenour	Au	Goldcorp Inc.	3.5 Moz Au (IF)
45 Ontario	P	Detour Lake	Au	Detour Gold Corp.	16.4 Moz Au (R)
46 Ontario	E	Hasaga	Au	Premier Gold Mines Ltd.	Data not released.
47 Ontario	LP	Phoenix	Au	Rubicon Minerals Corp.	106,000 oz Au (D)
48 Ontario	P	Timmins West (144)	Au	Lake Shore Gold Corp.	492,000 oz Au (R)
49Quebec	E	Malartic CHL	Au	Agnico-Eagle Mines Ltd.	Data not released.
50 Quebec	P	Casa Berardi	Au	Hecla Mining Co.	1.3 Moz Au (R)
51 Quebec	E	Coulon	Zn, Cu, Ag, Au	Osisko Gold Royalties Ltd.	133,000 t Zn, 47,000 t Cu, 4.4 Moz Ag, 30,000 oz Au (D)
52 Quebec	E	LaMaque	Au	Integra Gold Corp.	1.2 Moz Au (ID)
53 Quebec	E	Marban Block	Au	Niogold Mining Corp.	1.5 Moz Au (D)
54 Quebec	P	Westwood	Au	Iamgold Corp.	539,000 oz Au (R)
55 Saskatchewan	E	Patterson Lake South	Uranium, Au	Fission Uranium Corp.	36,800 t U_3O_8 , 38,000 oz Au (D)

Location	Type[1]	Site	Commodity	Company	Resource[2] notes
56 Saskatchewan	E	Rook 1	Au	NexGen Energy Ltd.	Data not released.
57 Saskatchewan	P	Seabee/Santoy	Au	Claude Resources Inc.	299,000 oz Au (R)
58 Saskatchewan	E	Wheeler River	Uranium	Denison Mines Corp.	31,800 t U_3O_8 (D)
59 Yukon Territory	F	Coffee	Au	Kaminak Gold Corp.	2.2 Moz Au (R)
60 Yukon Territory	E	Kudz Ze Kayah	Zn, Cu, Pb, Ag, Au	BMC Minerals Ltd.	1.4 Mt Zn, 185,000 t Cu, 436,000 t Pb, 102 Moz Ag, 981,000 oz Au (IF)
Latin America					
61 Argentina	P	Cerro Vanguardia	Au, Ag	Anglogold Ashanti Ltd.	1.3 Moz Au, 25 Moz Ag (R)
62 Argentina	E	Chinchillas	Ag, Zn, Pb	Silver Standard Resources Inc.	65 Moz Ag, 172,000 t Zn, 171,000 t Pb (D)
63 Brazil	P	Ashanti Mineracao	Au	Anglogold Ashanti Ltd.	1.8 Moz Au (R)
64 Brazil	E	Fazenda Brasileiro	Au	Yamana Gold Inc.	145,000 oz Au (R)
65 Brazil	P	Pilar	Au	Yamana Gold Inc.	1.4 Moz Au (R)
66 Brazil	E	Serra Grande	Au	Anglogold Ashanti Ltd.	497,000 oz Au (R)
67 Brazil	P	Tucano	Au	Beadell Resources Ltd.	1.3 Moz Au (R)
68 Chile	P	Candelaria	Cu, Au, Ag	Lundin Mining Corp.	2.6 Mt Cu, 1.9 Moz Au, 31 Moz Ag (R)
69 Chile	P	El Penon	Au, Ag	Yamana Gold Inc.	1.7 Moz Au, 58 Moz Ag (R)
70 Chile	P	Escondida	Cu	BHP Billiton Group	50.6 Mt Cu (R)
71 Chile	E	Salares Norte	Au, Ag	Gold Fields Ltd.	3.1 Moz Au, 34 Moz Ag (IF)
72 French Guiana	F	Paul Isnard /Montagne d'Or	Au	Nord Gold NV	3.9 Moz Au (ID)
73 Mexico	E	Cerro las Minitas	Ag, Cu, Zn, Pb, Au	Electrum Global Holdings LP	Data not released.
74 Mexico	E	El Barqueno	Au	Agnico Eagle Mines Ltd.	253,000 oz Au (IF)
75 Mexico	P	Mercedes	Au, Ag	Yamana Gold Inc.	648,000 oz Au, 7 Moz Ag (R)
76 Mexico	P	Mulatos/Cerro Pelon/ La Yaqui	Au	Alamos Gold Inc.	1.7 Moz Au (R)
77 Mexico	P	Palmarejo	Ag, Au	Coeur Mining Inc.	46 Moz Ag, 707,000 oz Au (R)
78 Mexico	P	San Dimas	Au, Ag	Primero Mining Corp.	818,000 oz Au, 51 Moz Ag (R)
79 Peru	P	Pallancata	Ag, Au	Hochschild Mining plc.	14 Moz Ag, 73,000 oz Au (R)
80 Peru	E	Zafranal	Cu, Au	Teck Resources Ltd.	2.5 Mt Cu, 1.6 Moz Au (D)
81 Suriname	P	Rosebel	Au	Iamgold Corp.	3.2 Moz Au (R)
Pacific (Including Southeast Asia)					
82 Cambodia	E	Kou Sa	Cu	Geopacific Resources Ltd.	Data not released.
83 Philippines	P	Co-O	Au	Medusa Mining Ltd.	427,000 oz Au (R)
United States					
84 Alaska	P	Pogo	Au	Sumitomo Metal Mining Co. Ltd.	5 Moz Au (R)
85 Colorado	P	Cripple Creek & Victor	Au	Newmont Mining Corp.	3.8 Moz Au (R)
86 Michigan	E	Copperwood/ White Pine North	Cu, Ag	Highland Copper Co.	481,000 t Cu, 4.2 Moz Ag (D)
87 Nevada	P	Cortez /Goldrush	Au	Barrick Gold Corp.	Cortez-11 Moz Au (R); Goldrush-8.6 Moz Au (D)
88 Nevada	E	Eastside	Au	Columbus Gold Corp.	Data not released.
89 Nevada	P	Goldstrike	Au	Barrick Gold Corp.	8.5 Moz Au (R)
90 Nevada	P	Mineral Ridge	Au	Scorpio Gold Corp	131,000 oz Au (R)
91 Nevada	D	Pumpkin Hollow	Cu, Au, Ag	Nevada Copper Corp.	2.3 Mt Cu, 761,000 oz Au, 28 Moz Ag (R)
92 Nevada	E	Relief Canyon	Au	Pershing Gold Corp.	739,000 oz Au (D)
Rest of the World					
93 China	P	Ying	Ag, Pb, Zn, Au	Silvercorp Metals Inc.	83 Moz Ag, 380,000 t Pb, 127,000 t Zn, 29,000 oz Au (R)
94 Ireland	E	Curraghinalt	Au, Ag, Cu	Dalradian Resources Inc.	1 Moz Au, 374,000 oz Ag, 2,400 t Cu (D)
95 Russia	P	Buryatzoloto	Au	Nord Gold NV	464,000 oz Au (R)
96 Russia	E	Tomtorskoye	REO, Nb, Sc, Y	ICT Group	114,000 t REE, 82,500 t Nb_2O_5, 576 t Sc_2O_3, 7,140 t Y_2O_3 (IF)
97 Serbia	E	Timok	Cu, Au	Freeport-McMoRan Inc.	1.7 Mt Cu, 3.1 Moz Au (IF)

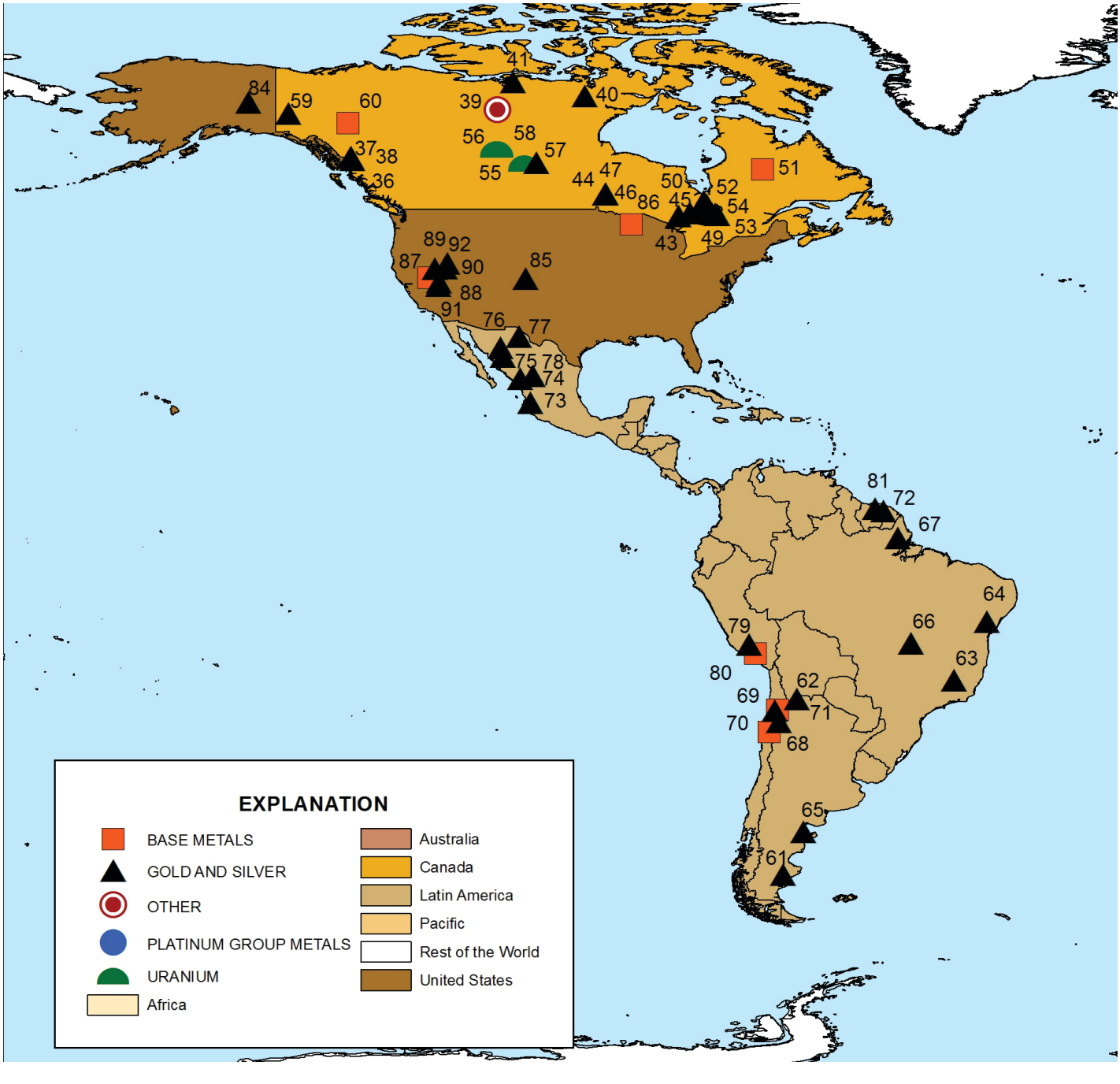
Moz--million troy ounces; Mt--million metric tons; t--metric tons; oz--troy ounces;
Ag--silver; Au--gold; Co--cobalt; Cu--copper; Li-lithium; Mo--molybdenum; Nb--niobium; Ni--nickel; Pb--lead; Pd--palladium; PGM-platinum-group metals; Pt--platinum; REE-- rare-earth elements; Rh-rhodium; REO--rare-earth oxide; Sc-scandium; Ta-tantalum; U_3O_8-uranium oxide; Y-yttrium; Zn--zinc.
[1] D--Approved for development; E--Active exploration; F--Feasibility work ongoing/completed; LP-Limited production; P--Exploration at producing site. [2] Resource estimate as of end of 2015 derived from various 2015 sources: D--measured + indicated; ID--indicated; IF--inferred; PR--probable; R--proven + probable.
Data were not verified by the U.S. Geological Survey. Where resource data were not released, the site was considered noteworthy by the authors based on the level of exploration activity or regional significance.

and maximizing in-country benefits. Resource nationalism can take many forms including imposing a resource tax, amending royalty or tax rates, establishing greater controls on foreign participation, establishing state ownership or control or mandating in-country value-added processing and/or limiting exports. Exploration and mining companies have recognized the need to increase their level of engagement with indigenous peoples and local governments as a means of reducing the risk of disruption of their activities.

Since the beginning of the 21st century, the global landscape for mineral exploration and development has changed. At the end of the 20th century, the bulk of global mineral

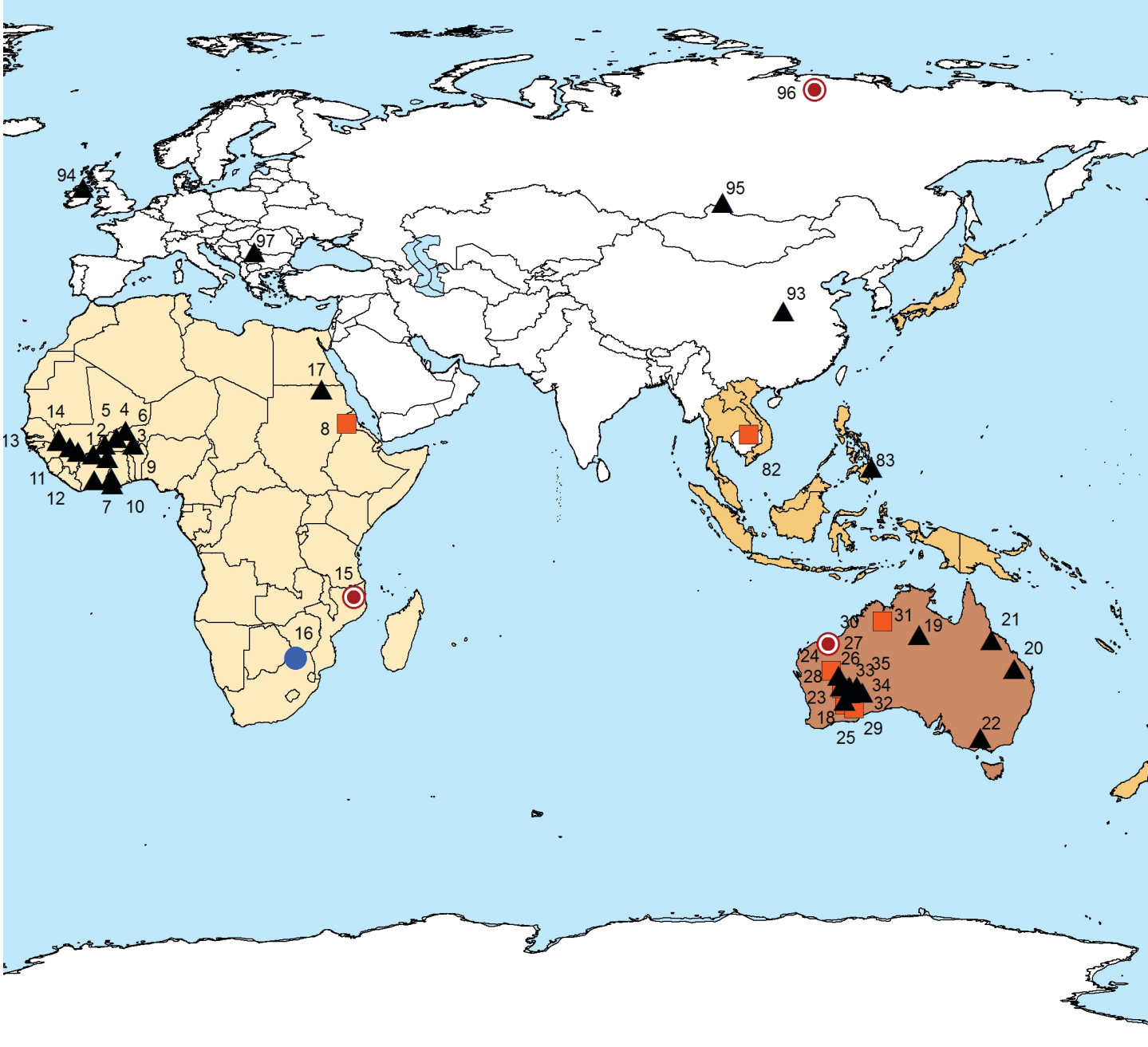
Figure 7

Map showing the location of 97 noteworthy sites and their principle commodity. Figures reflect site numbers as shown in Table 2.



exploration was conducted by Australian, Canadian and U.S. companies. Companies headquartered in these countries continue to explore globally and generated the greatest exploration budgets in 2015. SNL data suggest that the share of companies headquartered in these three countries has since declined. These countries each host a large number of junior companies that have decided to reduce or curtail their spending for exploration since 2014.

Exploration and mining investment has shifted from traditional jurisdictions to virtually all countries. The exploration budget for the BRIC countries (Brazil, Russia, India and China) increased from about $600 million in 2005 to more than $2 billion in 2012. In 2012,



BRIC countries accounted for 12 percent of the global exploration budget and 11 percent during the 2005 through 2012 period in nominal dollar terms. For the period from 2012 through 2015, the overall exploration budget from BRIC countries decreased, but at a lower rate than other countries, such that the global share from BRIC countries increased to about 15 percent. Figure 5 shows this global trend.

Many exploration projects are becoming increasingly more costly and difficult to develop. There is a growing trend toward exploring for deeper deposits as shallower reserves are depleted. The Resolution copper deposit in Arizona, the Cukaru Peki copper deposit in Serbia and the Cascabel copper deposit in Ecuador are all examples of high-grade ore deposits that are deeper extensions of active or previously-mined sites. In South Africa, older, high-cost mines that do not lend themselves to mechanization are being phased out in favor of highly mechanized mines. In 2015, more than 30 percent of the country's platinum-group metals (PGM) production originated from mechanized mines. In Australia, exploration companies are looking for high-grade deposits under covered terrain. Although the country's historical success rate for locating minable deposits in covered terrain has not been high, depletion of known shallow deposits has driven exploration companies to look in areas that have traditionally been more cost intensive and technically challenging.

Competing demand for energy and water have increased risks related to energy and water access. As exploration was taking place in more remote locations, countries such as Chile, Mongolia, Peru and South Africa were focusing on increasing access to or development of energy and water resources. In Chile, for example, the copper industry consumed 4.4 percent more energy in 2014 than in 2013. The amount of desalinated seawater used by the Chilean copper industry has increased from 0.2 m^3/sec in 2010 to 2.4 m^3/sec in 2014. Some mining companies considered more prudent use of water and greater use of renewable energy as part of a strategy to lock in long-term energy prices and minimizing exposure to regulatory changes, market pricing, and the rising demand for energy.

As global demand for natural resources continues to grow, there is increasing attention to exploring the ocean floor for its resource potential. In 2007, Nautilus Minerals began exploration for massive sulfides off the coast of Papua New Guinea. Construction of a production support vessel is ongoing and the company signed a three-year offtake agreement with a Chinese smelting company to process copper ore from the operation. As of July 2015, the International Seabed Authority (ISBA), an autonomous international organization established under 1994 provisions of the United Nations Convention on the Law of the Sea, has signed 27 contracts for seafloor exploration in the Atlantic, Indian and Pacific oceans. China announced a gold discovery off the coast of China in the Bohai Sea. The Geological Survey of Brazil announced plans to invest $11 million to conduct exploration off the coast of Rio de Janeiro. India has commenced exploration of polymetallic sulfides in the southern Indian Ocean.

Exploration activity by mineral commodity

The amount budgeted for gold exploration ($3.9 billion) based on SNL data for 2015 is 14 percent lower than that budgeted for gold in 2014. Figure 6 illustrates the 2011 through 2015 global percent share distribution of reported mineral exploration budget estimates by mineral commodity grouping (excluding uranium). The percent share attributed to global gold exploration relative to exploration for all nonfuel minerals decreased for the years 2011 through 2014 then increased from 2014 to 2015. In terms of percentage of worldwide nonfuel exploration budget, exploration for gold accounted for 45 percent in 2015, compared to 43 percent in 2014 and 48 percent in 2013. The apparent increase from 2014 to 2015 likely reflects a greater decrease in exploration budget for other commodities than the decrease in budget for gold. So on a relative scale, the percent allocated to gold increased. Latin America remains the leading region for gold exploration based on SNL data, accounting for about 27 percent of gold budget allocations. The budget for gold exploration in Canada accounted for about 15 percent of the global gold exploration budget. Australia accounted for about 13 percent. The United States accounted for about 11 percent in 2015. Other countries with significant gold exploration, in descending order by 2015 budget, include Mexico, China, Chile, Russia, Peru, Colombia, Burkina Faso, Brazil, Ghana and Argentina, which, together, account for an additional 37 percent of the 2015 gold exploration budget. Major mining companies accounted for 49 percent of the gold exploration budget, junior companies accounted for about 29 percent, intermediate companies accounted for 16 percent, and governments and other entities accounted for 6 percent.

Exploration budgets for base-metal projects decreased 22 percent to $2.9 billion in 2015 from $3.7 billion in 2014. In terms of percentage

of total worldwide nonfuel exploration budget, the estimated base-metal exploration budget decreased to 33 percent in 2015. The percent allocation for base-metal exploration appeared to increase from 2011 through 2014, then dropped in 2015. Exploration for copper accounted for about 71 percent of the base-metal budget for 2015, zinc exploration accounted for about 16 percent and nickel exploration accounted for 13 percent. Latin America retained the greatest percent share for base metals exploration of 34 percent. Countries with the largest exploration budgets for copper in 2015, in descending order by budget, were Chile, Peru, Australia, the United States, the Democratic Republic of the Congo, Canada, China, Brazil, Zambia, Russia, Mexico and Papua New Guinea. Countries with the largest exploration budgets for lead/zinc in 2015 were China, Canada, Australia, Peru, Mexico, India, Namibia, the United States, Sweden, the Democratic Republic of the Congo, Brazil and Bolivia. Countries with the largest exploration budgets for nickel in 2015 were Australia, Canada, the United States, Russia, Indonesia, Brazil, China, Finland, Colombia and the Solomon Islands.

The budget for diamond exploration decreased 18 percent in 2015 from 2014. The diamond exploration budget of about $367 million in 2015 represented about 4 percent of the global exploration budget, about the same as its share in 2014. Principal locations for diamond exploration, in descending order by 2015 budget, were Russia, Canada, Angola, Botswana and South Africa.

The exploration budget estimate in 2015 for PGM of $120 million was 33 percent lower than its 2014 budget estimate of $179 million, and represented about 1 percent of the global exploration budget for 2015. Principal areas for PGM exploration, in descending order by budget, were South Africa, Canada, Russia, the United States and Zimbabwe.

The estimated 2015 global budget for other mineral commodity targets was 18 percent lower ($1.1 billion) in 2015 than the $1.3 billion budget reported for 2014. Mineral commodities considered in this category include heavy-mineral sands, lithium, molybdenum, niobium, phosphate, potash, rare-earth elements (REE), silver, tantalum, tin and tungsten. Exploration for lithium, potash and REE has increased as demand for and concerns related to supply of these commodities has risen. Concern about China being the sole source of supply and its policies related to export quotas for REE has led to increased exploration for REE at projects in Australia, Canada, South Africa and the United States.

The budget estimate for uranium exploration decreased from about $504 million in 2014 to about $334 million in 2015. The global nuclear industry has not yet returned to its pre-Fukushima level, as safety concerns remained high, and there was an increased focus on renewable energy sources. Principal locations for exploration of uranium in 2015 in descending order by budget were Canada, Australia, Kazakhstan, Mongolia, Uzbekistan, the United States, India, China and Argentina.

Based on global exploration site data compiled by the USGS, gold was the principal target at 46 percent of the sites explored in 2015; copper was the target at 15 percent of the sites; silver was the target at 5 percent of the sites; iron ore, nickel and uranium each represented about 4 percent of the sites; diamond, graphite, PGM and zinc each represented about 2 percent of the sites; and potash, REE and tungsten each represented about 1 percent of the sites. Approximately 11 percent of the sites were being explored for other minerals. Both the SNL and USGS data support the conclusion that there is continued interest in exploration for graphite, lithium, potash, REE and tungsten, but the number of companies exploring for these commodities has declined from the 2012 peak.

2015 exploration highlights

Table 2 presents selected noteworthy exploration sites based on the amount of exploration activity conducted in 2015. The USGS does not assume responsibility for errors or omissions in the source materials used to compile the table. A combined total of more than 4.5 Mm of drilling took place in 2015 on the sites included in Table 2. The following criteria were used as a basis for site inclusion:

- The high level of exploration interest at a site, determined either by intensity of drilling activity or level of capital investment. When drilling was used as the principal indicator, a site qualified if a minimum of 15,000 m of drilling (usually a combination of diamond or reverse-circulation drilling) took place during 2015 along with ancillary exploration activities. Where budget was used as the principal indicator, a site qualified if a 2015 budget of at least $4 million was planned and executed for exploration and drilling activities. These criteria may eliminate early-stage projects (where the level of drilling was

below cutoff) or development projects (where planned expenditures include costs for development or infrastructure). Owing to a decrease in exploration activity, the minimum drilling cutoff was reduced to 15,000 m beginning in 2012 from 20,000 m in 2011 and the minimum expenditure cutoff was reduced to $4 million in 2012 from $8 million in 2011.
- The magnitude of resource delineated when compared to prior resource estimates.
- The high potential of near-term development, based upon reported tonnage and grade estimates derived from company announcements.
- The regional significance of an activity based on economic or social needs of the locality.
- The project targets a new source of mineral supply that may be recoverable as a result of advances in extraction technology.

Sites where significant exploration activity and expenditures occurred prior to 2015 were not included in Table 2 if the reported level of 2015 activity did not meet the selection criteria. Except where indicated, similar criteria have been applied to previous exploration summaries reported annually in the *USGS Minerals Yearbook* series and in exploration summary articles prepared by USGS staff and reported in *Mining Engineering*.

Gold continued to be the commodity generating the greatest exploration intensity by number of projects based on the list of noteworthy exploration sites for 2015 as reported in Table 2. Of the sites selected for Table 2, the primary targets were gold or silver at 77 percent of the sites, base metals at 16 percent of the sites, uranium at 2 percent of the sites, PGMs at 1 percent of the sites and other mineral commodities at 4 percent of the sites. Determination of the primary commodity was based on consideration of commodity value of the contained resource at each site.

The estimated resources reported in Table 2 reflect various stages of verification, different methodologies, and multiple sources of information based on company data. Should these reserves/resources be confirmed, however, they would contribute about 66 Mt of copper, about 19 Mt of combined REE, about 13 Mt of graphite-bearing ore, about 10 Mt of niobium-bearing ore, about 2 Mt of lead and zinc, about 470 kt of lithium, 400 kt of nickel, 96 kt of molybdenum, 69 kt of U_3O_8, 22.8 kt (733 million oz) of silver, 16.8 kt of cobalt, 238 million oz of gold, about 3.3 kt of tantalum, 82 million oz of PGM, to the identified world resources for these mineral commodities. It is likely, however, that only a portion of the listed resources may be converted to reserves as exploration continues.

Figure 7 shows the locations of those sites included in Table 2. Site numbers shown in Table 2 are reflected in Fig. 7 to allow the reader to identify each site. Sites have been classified by their primary commodity target.

The cost of doing business in a country can change based on many factors, including economic and environmental conditions, legislative actions, political activity and attitude, and social receptivity to mining. These factors all determine the perceived 'risk' profiles of a country. The Fraser Institute of British Columbia, Canada annually publishes a survey assessing the effects of perceived "investment attractiveness" which combines geologic attractiveness and the perceptions of public policy on attitudes toward exploration investment around the world. The 2015 survey (published March 1, 2016) includes data from 449 respondent companies with an aggregated exploration budget of $2.2 billion in 2015, down from $2.5 billion in 2014.

According to the Fraser Institute survey, the top 10 destinations for mineral exploration based on overall investment attractiveness in 2015, listed in descending order, were Western Australia (Australia), Saskatchewan (Canada), Nevada (United States), Ireland, Finland, Alaska (United States), Northern Territory (Australia), Quebec (Canada), Utah (United States) and South Australia (Australia). The top 10 destinations for mineral exploration based on their mineral potential independent of policy restrictions and listed in descending order, were Wyoming, (United States), Sweden, Saskatchewan (Canada), Finland, Ireland, Western Australia (Australia), Minnesota (United States), Nevada (United States), Manitoba (Canada) and Northern Territory (Australia). The top 10 destinations for mineral exploration based solely on policy attractiveness and listed in descending order, were Ireland, Wyoming (United States), Sweden, Saskatchewan (Canada), Finland, Nevada (United States), Alberta (Canada), Western Australia (Australia), New Brunswick (Canada) and Portugal.

Exploration activity and related legislation by region

Exploration-related activities and events within each region are summarized. The order of regional and country discussions is based on

the amount budgeted for exploration in 2015 from highest to lowest. Areas not included in the regions discussed have been aggregated as 'Rest of World' and are discussed separately at the end of this section.

Latin America. Latin America continued its position as the leading destination for global exploration activity based on exploration budget data collected by SNL since 1994, but was listed third after Canada and Australia by the USGS when the number of active sites was considered. The 2015 exploration budget for Latin America decreased 13 percent to about $2.5 billion from the $2.9 billion budget estimated for 2014. On the basis of data compiled for this review by the USGS, Latin American countries with the greatest exploration activity, in descending order by number of sites for which data were compiled, were Mexico (100), Peru (66), Brazil (47), Chile (45), Argentina (27) and Colombia (16).

Approximately 64 percent of the deposits actively explored or considered by the USGS in 2015 in Latin America contained gold or silver and 22 percent contained base metals, or some combination of precious and base metals based on the sites considered in the USGS compilation. Activity in 2015 was primarily used to further define early-stage discoveries (46 percent), conduct exploration at a producing site (31 percent), conduct prefeasibility and feasibility studies of economically promising prospects (13 percent) and further explore for resources of deposits under development (10 percent).

Based on SNL data, major companies accounted for about 64 percent of the Latin American exploration budget, junior companies accounted for about 20 percent, intermediate companies accounted for about 10 percent, governments and other types of companies accounted for 6 percent. Approximately 34 percent of the Latin American exploration budget was targeted for activity near an existing mine site, 38 percent for late stage and feasibility activity and 28 percent for grassroots or early stage activity.

Latin America has been considered the leading region for mineral exploration by many companies for the past decade owing to its promising geology, its long history of world-class discoveries, the perception of its mineral policies, and its successful historical record of mineral production and development. Although the overall trends of budget expenditures have declined for all regions since 2012, Latin America remained the leading region for exploration. The amount of drilling in Latin America also has declined since 2012, following the worldwide trend.

According to the 2015 Fraser Institute survey, Chile was the most attractive Latin American country for mining investment, ranking it 11 out of 109 jurisdictions. Venezuela was listed last among Latin American countries. These same countries were also considered the best and worst Latin American countries for economic freedom, based on governmental size, legal structure, access to money, freedom to trade and regulations of credit, labor and business. A study conducted by Business News Americas (BN Americas) listed Chile as the top country in Latin America for mining investment in 2015, followed by Peru, Mexico, Argentina, Brazil and Columbia.

The Bolivian government is planning to invest $1.2 billion toward mining exploration with the possibility of increasing investment of up to $1.8 billion over the next five years. Funding will be directed toward continued exploration, reserve expansion, investment in new projects as well as implementing higher productivity and efficient systems of operation. The Bolivian government introduced a plan to develop salt flats in the south western region for the recovery of lithium at a cost of $925 million.

The Geological Survey of Brazil, after receiving approval from the ISBA, was preparing to explore for cobalt, iron and manganese off the coast of Rio de Janeiro state by planning to invest $11 million in exploration over five years. Brazil's senate created a new subcommittee to discuss issues associated with the mining industry in an effort to encourage an open debate forum to aid in the development of the mining sector and proposing ways to stimulate mineral exploration.

Exploration in Chile was affected by low commodity pricing of copper, high energy costs, social and environmental opposition as well as permitting delays that affected investment in the mineral industry in 2015. Energy and water availability continue to affect the development of mineral production in Chile. Cochilco expects seawater and freshwater consumption to quadruple by 2026 as new copper projects located in the Atacama Desert come into production and water rights continue to be a concern to local communities. There are currently 10 seawater treatment plants online and seven others are being developed. Labor rates are also a factor contributing to lower exploration in Chile. According to BN Americas, mining wages grew by 52 percent from 2007-2012 in Chile whereas in Australia, Canada and

the United States, wages grew only 22 percent over the same period.

In Colombia, mine permitting has become an issue. According to BN Americas, projects considered of strategic interest to the government receive preferential permitting status and are, therefore, advanced through permitting stages in a more efficient manner than other projects going through similar processes. This has affected the amount of early stage exploration, which has slowed down considerably, and equity financing for juniors whose projects are not considered strategic has diminished. Illegal mining continues to plague Colombia's gold industry. The Colombia government reports that close to 80 percent of the gold produced in Colombia comes from illegal miners. As of May 2015, 60 cases of illegal mining were making their way through the Justice Department with more than 1,000 cases being investigated.

In Cuba, the movement toward normalization of diplomatic relations between the United States and Cuba and resultant regulatory amendments between the two countries could improve the mining investment appeal of Cuba. In 2015, the USGS published a fact sheet summarizing recent developments in Cuba's mineral industries.

In Ecuador, legislation passed in 2015 provided for the creation of a Mining Ministry. Legislation also reduced the total tax burden for the mining sector from about 35 percent of profits to about 27 percent, similar to tax rates in neighboring countries. The government planned to open up new mining areas for the exploration of copper and gold in the first quarter of 2016 with investment in mining projected to be $588 million in 2016 and $1.5 billion in 2017.

In Mexico, Fresnillo plc budgeted $55 million for early-stage exploration in Mexico in 2015 and an additional $100-120 million for brownfield drilling near its existing operations. Mexico is thought to represent opportunity for the mineral exploration sector, as 70 percent of its territory is relatively unexplored. However, mineral exploration in Mexico continues to be hampered by security issues, high royalty rates and alleged political corruption at the local and regional levels. According to the *2015 Mining Investing Report* published by Behre Dolbear, Mexico ranked in the number five position globally as it did in 2014 and 2013.

New legislation enacted in 2015 in Peru requiring mining companies to consult with indigenous communities before proceeding with exploration or development has gone into effect. This legislation has delayed the exploration of at least eight projects as they seek consultation with indigenous groups.

The government of Peru announced that they had awarded 2,682 mining exploration concessions in 2014, with an additional list of 7,568 concessions available for staking in 2015. The Peruvian government released a plan in 2015 that would allocate $113 billion over the next six years for infrastructure development. The plan is intended to help modernize the country's transportation network.

Africa. According to SNL, the African exploration budget as of November 2015 was $1.2 billion for 2015, compared with $1.7 billion in 2014. This represents a reduction of about 30 percent. The top 10 African countries with the greatest exploration activity based on their exploration budget as reported by SNL as of November 2015, reported in decreasing order, were the Democratic Republic of the Congo (DRC), South Africa, Burkina Faso, Zambia, Ghana, Mali, Namibia, Tanzania, Angola and Côte d'Ivoire (Ivory Coast). Based on site data compiled by the USGS, exploration was focused primarily in South Africa, Tanzania, Burkina Faso, the DRC, Ghana, Mali, Namibia, Zambia, Botswana, Guinea and Zambia, in descending order based on the number of sites, but activity also took place in a number of other countries. Projects containing a primary target of gold that were actively explored in 2014 accounted for approximately 45 percent of the reported African exploration projects, 11 percent of 2014 projects contained copper, 7 percent of projects contained PGMs, 6 percent of projects contained diamond, 6 percent of projects contained graphite, 5 percent of projects contained manganese, 4 percent of projects contained uranium, 4 percent of projects contained iron ore and the remaining 12 percent of projects were targeting other mineral commodities.

Based on the number of sites, early-stage projects comprised about 52 percent of the 2015 activity in Africa, while producing projects accounted for about 33 percent, feasibility stage projects represented about 12 percent and developing projects accounted for about 3 percent. Approximately 41 percent of the African exploration budget in 2014 was targeted for late-stage and feasibility activity, 32 percent was for activity adjacent to an existing mine site and 27 percent for grassroots or early-stage activity. Based on SNL data for 2014, major companies accounted for about 42 percent of the African exploration budget, junior companies accounted for about 35 percent, intermediate companies accounted for about 15 percent, and

governments and other entities accounted for 8 percent.

In 2014, the mining sector in some African countries was confronted with escalating wage demands, prolonged strikes and intermittent electrical shortages. In 2015, some mineral exploration and mining companies operating in Africa cut exploration activity and workforces, reduced production levels or closed operations. Lower copper prices affected copper operations in the DRC and Zambia while lower PGM prices resulted in planned layoffs of up to 19,000 positions in the PGM industry of South Africa. Because the African mining industry relies heavily on an itinerant labor pool, significant labor cuts become a regional problem and raise concern about increased social unrest. The World Bank announced a plan to initiate a $1-billion program to map African mineral resources beginning in 2014. A World Bank-sponsored program, The African Mining Legislation Atlas (AMLA), is an online platform intended to build indigenous capacity for the creation and implementation of sound legal frameworks in various African countries, promote transparency and accessibility to data, and improve the ability to make resource investment decisions in Africa. The AMLA aims to have data on 53 African countries on the platform by the end of 2015.

Since the government of China launched its "Two Resources, Two Markets" program in 2006, China's investment in the mining sector of Africa has grown. The number of Chinese-based mining and mineral processing assets in Africa, excluding numerous exploration projects, has increased from a handful in 2006 to more than 120 in 2015.

In Angola, in an effort to diversify the economy, a country-wide geological survey (Planageo) was ongoing in 2015. The government of Angola announced plans to create mining development hubs in areas where the survey reveals a higher incidence of minerals. Planageo was due to be completed by the end of 2015. Mining companies holding exploration rights and concessions in Angola were reported to have been given 60 days from Oct. 20, 2015, to ratify exploration rights and pay any royalties that were in arrears.

Burkina Faso's National Transitional Council approved an amended mining code and an anti-corruption law intended to provide greater transparency to the mining industry while increasing state revenues from mining. Under the legislation, a technical commission will be established to oversee the granting of exploration licenses and mining conventions for a 20-year period. Revised mining taxes and royalties will be determined in subsequent regulations.

The DRC continues to experience an energy shortage that may take several years to resolve. In 2015, copper supply was further affected by the redrawing of the boundaries of Katanga province, the leading source of copper in the DRC. Transport of copper from Kolwezi must now pass through two provincial jurisdictions instead of one, which may lead to higher transport costs and more complicated administrative and regulatory requirements, providing a greater degree of risk for future development of its mining industry.

The government of Ethiopia revoked 56 minerals exploration licenses for sites that had not incurred activity for more than one year. In 2011, Ethiopia began construction of the Grand Ethiopian Renaissance Dam (GERD) along the Nile River. In 2015, the government decided against issuing any alluvial mining licenses near the area to be flooded by the GERD.

A new mining code was enacted in Gabon on Jan. 30, 2015 with provisions that change the exploration permitting and concession process to mandate state participation of 10-25 percent, and that promote health, safety and environmental rules. Many of the specific provisions were yet to be promulgated.

In Kenya, the senate passed a mining bill that would establish royalty rates ranging from 1-12 percent of the gross sales value of minerals and give the government a 10-percent stake in new mining projects. The bill, which still must be signed by the president, could reduce interest by foreign companies in exploring in Kenya if the new regulations are not competitive with other countries.

South Africa's mining industry continued to face a number of challenges. Aging infrastructure and technology, energy shortages, labor unrest, permitting delays, regulatory uncertainty and technical constraints resulted in the reduction or curtailment of some exploration and mining and layoffs in the gold and PGM sectors. Illegal mining activities and possible corruption have been reported. In spite of these challenges, a variety of mineral projects continued to be explored and developed. Since 2011, the Chinese have invested in 10 South African resource projects for coal, copper, gold and PGM.

The government of Uganda abolished taxes on oil, gas, and mineral exploration as a means of encouraging investment in the country. Taxes would only be incurred upon production. The Uganda Chamber of Minerals and Petroleum has signed a cooperation agreement with the

Shandong Provincial Bureau of Geology & Mineral Resources to invest in different areas of the exploration and mining sector of Uganda.

Mining companies in Zambia continued discussions with the government during 2015 to modify the increase in royalty rates that became effective Jan. 1, 2015. Effective July 1, 2015, royalties for openpit mining were reduced from 20 percent to 9 percent, royalties for underground mining were reduced from 8 percent to 6 percent, the tax rate on income from mining processing increased from 30 percent to 35 percent and a 30-percent tax on income from mining operations was reinstated. Following the enactment of the new legislation, Zambia suspended the award, renewal and transfer of exploration and mining rights while the government reviews the regulatory framework of the new legislation.

In Zimbabwe, the government imposed a 15-percent export tax on ores and concentrates containing platinum-group metals in January, but suspended it in July after the government agreed to give platinum mining companies two more years to construct in-country processing facilities. The government planned to consolidate the diamond mining industry from seven mining companies to one entity. Under the plan, the government would hold a 50-percent stake in the consolidated company and the other 50 percent would be shared among the existing mining companies. Because of water shortages at Lake Kariba, which is used to provide hydroelectric power to Zambia and Zimbabwe, the government asked mining companies to reduce power usage by 25 percent.

Canada. Statistics as of September 2015 released by the Canadian government show 2015 revised spending intentions at C$1.9 billion (US$1.5 billion), down about 6 percent from an actual expenditure of C$2 billion (US$1.6 billion) for 2014. SNL reported budgeted exploration spending in Canada for 2015 at US$1.2 billion, or about 14 percent of the estimated overall worldwide exploration budget. Natural Resource Canada (NRC) statistics include planned exploration expenditures for a wider variety of minerals than are included in the SNL estimates. As of September 2015, the revised exploration and deposit appraisal budget for precious metals (gold and silver) was C$804 million (US$ 645 million); base metals, C$370 million (US$297 million); uranium, C$172 million (US$138 million); diamond, C$120 million (US$96 million); and iron ore, C$42 million (US$34 million) of the C$1.9 billion (US$1.5 billion) exploration total. When the NRC exploration statistics are reconfigured to make them comparable with SNL statistics, the reported exploration expenditure as of September 2015 by NRC is C$1.53 billion (US$1.22 billion), very close to the budget estimate reported by SNL.

Company exploration spending for 2015 as reported by NRC as of September 2015 was greatest in Ontario (21 percent of the total exploration and deposit appraisal spending intentions for Canada), British Columbia (19 percent), Saskatchewan (16 percent), Quebec (15 percent), Nunavut (11 percent), Yukon Territory (5 percent), Northwest Territories (5 percent), Newfoundland and Labrador (2 percent), Manitoba (2 percent), Alberta (2 percent), New Brunswick (1 percent) and Nova Scotia (1 percent).

Canadian provinces with an increase in exploration activity in 2015 from 2014 based on reported budget allocations were Nova Scotia, with a 49-percent increase, primarily attributed to precious metals exploration; Manitoba, with a 30-percent increase, primarily attributed to base metals exploration; Nunavut, with a 28-percent increase, primarily attributed to precious metals and diamond exploration; Alberta, with a 27-percent increase, primarily attributed to iron ore exploration; and Saskatchewan, with a 21-percent increase, primarily attributed to exploration for diamond and other metals, coal, and nonmetals. Canadian provinces with a decrease in exploration activity in 2015 from 2014 based on reported budget allocations were New Brunswick, with a 44-percent decrease, primarily a result of decreased exploration for base metals and other metals, coal and nonmetals; Newfoundland and Labrador, with a 39-percent decrease, primarily a result of decreased exploration for base metals and iron ore; British Columbia, with a 21-percent decrease, primarily the result of decreased exploration for precious metals and other metals, coal and nonmetals; Ontario, with a 15-percent decrease, primarily a result of decreased exploration for base and precious metals; Quebec, with an 11-percent decrease, primarily a result of decreased exploration for diamond and iron ore; Northwest Territories, with a 9-percent decrease, primarily a result of decreased exploration for base metals and other metals, coal, and nonmetals; and Yukon Territory, with a 2-percent decrease.

Major exploration companies accounted for about 60 percent of Canadian exploration spending intentions in 2015, the same as in 2014. In terms of mineral commodities sought country-wide in 2015, precious metals received

the largest exploration spending intention (43 percent), followed by base metals (20 percent), uranium (9 percent), diamond (6 percent), iron ore (2 percent), and other mineral commodities (20 percent).

As of November 2015, Canadaian provinces or territories with the greatest exploration activity, in descending order by number of sites in 2015 as compiled by the USGS, were Quebec, Ontario, British Columbia, Saskatchewan, Nunavut, Manitoba, Newfoundland and Labrador, Yukon Territory, New Brunswick, Northwest Territories, Nova Scotia and Alberta. Based on the site data, 51 percent of Canada's exploration sites targeted precious metals, 21 percent base metals, 9 percent uranium, 4 percent graphite, 3 percent diamond, 2 percent iron ore and 10 percent other mineral commodities. Approximately 74 percent of all reported exploration sites were considered early-stage sites.

The level of nonfuel mineral exploration expenditure in Canada declined about 63 percent in 2015 from a peak in 2012. Since 2013, Canada and Australia have vied for the world's leading destination for mineral exploration expenditures among all countries. The top three issues facing the Canadian mining industry in 2015 were the global mining economy, a lack of critical infrastructure and a complex regulatory environment. A study released in 2015 reported that capital cost to explore and construct a new mine in northern Canada is as much as 2.5 times greater than a corresponding mine in southern Canada, primarily because of the lack of critical infrastructure.

As part of its 2015 budget, the Canadian government extended its 15 percent Mineral Exploration Tax Credit through March 31, 2016. The tax credit has been in effect since 2000. The government also announced plans to include costs related to environmental studies and community consultation required to obtain an exploration permit as Canadian Exploration Expenses and be eligible for an income tax deduction. The budget also included a provision to provide C$22 million (US$18 million) over five years to the Targeted Geoscience Initiative in support of mineral exploration activities and provided C$23 million over five years to address the technical challenges of separating and processing of chromite and REE. The Extractive Measures Transparency Act in Canada, which came into effect June 1, 2015, requires Canadian resources companies to report payments of more than C$100,000 for services such as port fees and royalties.

Since 2011, mineral exploration in Quebec declined about 66 percent. In 2015, the government of Quebec scaled back plans to develop the northern region of Quebec as part of its Plan Nord, but announced plans to spend C$1.3 billion (US$1 billion) over the next five years in developing new roads and other infrastructure in northern Quebec. Mineral exploration in Ontario declined 63 percent since 2011. The number of exploration projects declined as well, with 200 fewer in Ontario in 2015 than in 2013. The Ontario Ministry of Northern Development and Mines announced a C$5-million (US$4-million) investment in a Junior Exploration Assistance Program in support of its revised mineral development strategy.

Australia. Exploration budget allocations reported by SNL as of November 2015 for Australia showed a decrease to about $1.1 billion in calendar year 2015 from $1.3 billion in calendar year 2014.

The Australian Bureau of Statistics (ABS) reports expected mineral exploration expenditures (including coal and excluding petroleum) for their fiscal year from July 2014 through June 2015 of about A$1.6 billion (US$1.3 billion), about a 25-percent decrease from the actual Australian expenditure for fiscal year 2013-2014 of A$2.1 billion (US$1.8 billion). In terms of number of meters drilled for mineral exploration, the ABS reported that about 6.5 Mm were drilled in fiscal year 2013-2014 and 6 Mm were drilled in fiscal year 2014-2015. The 2014-2015 data suggest that about 26 percent of the drilling took place on new projects and about 74 percent took place on existing deposits. The Western Australia Department of Mines and Petroleum reported that the number of prospecting licenses for minerals and coal in Western Australia decreased about 8.9 percent from the 2013-2014 fiscal year to the 2014-2015 fiscal year, and the number of exploration licenses decreased 12.9 percent for the same timeframe. The ABS statistics include expenditures for coal and industrial minerals that are not included in the SNL statistics.

The estimated expenditures for iron ore exploration in Australia accounted for 28 percent of the total Australian expenditure for metals and minerals for fiscal year 2014-2015 (excluding coal and petroleum), compared with 34 percent for 2013-2014, based on data reported by the ABS as of Feb. 29, 2016. Iron ore exploration in Australia decreased about 37 percent in 2015 from the corresponding timeframe in 2014. Gold exploration accounted for about 25 percent of the total nonfuel Australian expenditure for

metals and minerals for fiscal year 2014-2015 and 21 percent in 2013-2014. Gold exploration in Australia decreased about 9 percent in 2015 from the corresponding timeframe in 2014. Base metals accounted for 18 percent of the total nonfuel Australian expenditure in fiscal 2014-2015, compared with 15 percent in 2013-2014. The estimated expenditure for base metals exploration in Australia decreased 13 percent in 2014-2015 from 2013-2014. Uranium and coal are included in the ABS data, but coal statistics have been removed from the statistics reported in this summary. Uranium accounted for about 2.6 percent of the total nonfuel Australian expenditure in fiscal 2014-2015, compared with 2.1 percent in 2013-2014. Heavy-mineral sands accounted for about 1.7 percent in 2014-2015 from about 1.4 percent in 2013-2014. Other minerals (including construction materials, tin and tungsten) accounted for about 8.5 percent in 2014-2015 and 8 percent in 2013-2014. ABS data suggest that early stage exploration based on expenditures accounted for less than one-third of the total exploration budget for Australia in 2015.

Western Australia accounted for 58 percent of the Australian mineral exploration expenditure (excluding petroleum) in 2014-2015. Queensland accounted for about 20 percent. New South Wales accounted for about 8 percent. Northern Territory and South Australia each accounted for about 6 percent. Victoria and Tasmania each accounted for about 1 percent. Western Australia accounted for about 55 percent of the active Australian sites evaluated by the USGS. Queensland accounted for about 13 percent. New South Wales accounted for about 10 percent. Northern Territory and South Australia each accounted for about 8 percent. Tasmania and Victoria each accounted for about 3 percent.

Junior mining companies that conduct the majority of early-stage exploration activity accounted for more than 50 percent of the exploration budget in Australia from 2005 through 2011. But that has decreased to less than half of the Australian exploration budget since 2011. In 2015, junior companies accounted for about 44 percent of the Australian exploration budget. Since the global economic downturn in 2008-2009, junior mining companies have found it more difficult to secure financing, so they have focused exploration expenditures on fewer projects or reduced the exploration budgets at individual projects. Major and intermediate companies effectively increased their share of exploration in Australia from about 47 percent in 2014 to 52 percent in 2015.

Data released by the Australia Bureau of Resources and Energy Economics (BREE) show that lower commodity prices through the second half of 2014 and into 2015 affected the development of mineral projects in Australia. Between October 2014 and April 2015, the number of Australian mineral projects approved for development (committed) decreased from 44 to 39. Since 2011, the number of uncommitted projects has declined from 305 (April 2011) to 180 (April 2015). As of April 2015, there were 81 nonfuel projects at the feasibility stage and 19 nonfuel projects at the committed stage in Australia. Australian exploration expenditures in the April-June 2015 quarter exceeded expenditures for the January-March 2015 quarter by 9 percent. Merger and acquisition activity involving Australian companies increased in the July-September 2015 quarter, suggesting a potential improvement in the Australian mining sector. The decline in the value of the Australian dollar against some other currencies and the decrease in exploration and operating costs at some mines could improve the relative attractiveness of Australia as a low-cost mining destination. One example of how miners are reducing costs is increased use of driverless trucks at Rio Tinto's Hope Downs 4, Nammuldi and Yandicoogina iron ore mines in Western Australia.

The Australian government approved several pieces of legislation in 2015 that were designed to improve Australia's economy and mineral market position. In January, the Japan-Australia Economic Partnership Agreement (JAEPA) was enacted. It was expected to increase investment opportunities in the Australian resources sector with Japan, Australia's second-largest trading partner. A free-trade pact was also concluded with China, Australia's largest trading partner. The Australian senate passed the Exploration Development Incentive (EDI), which will allocate A$100 million (US$75 million) over the next three years to provide tax breaks to junior miners and investors in early-stage mineral exploration projects. The initiative became effective July 1, 2015. The incentive attracted 84 applications from junior exploration companies in 2015. The government also approved an A$74-million (US$56 million) investment program to support funding of two cooperative research centers conducting resource extraction research.

The Western Australia government approved A$10 million (US$7 million) extension of its Exploration Incentive Scheme (EIS) for three years until June 2017. The program refunds up to 50-percent of drilling costs for greenfield projects and provides funding

for additional geophysical and geochemical surveys in Western Australia. The provincial government approved a relief package for struggling junior iron ore miners, which would provide a 50-percent rebate on eligible hematite royalties for up to 12 months if the price of iron ore remains below A$90/t (US$68/t) over the period. Relief would be provided on a case-by-case basis. The provincial government also withdrew the requirement to submit geological evaluations required for approval of iron ore exploration and reduced the approval time from 60 calendar days to 30 days by allowing applicants to submit mining environmental and native vegetation clearing approvals together as a single submission. The Northern Territory government provided A$850,000 (US$640,000) to support drilling and geophysical programs in the Northern Territory where geological information is limited. In 2015, the funding provided partial support for 10 exploration projects. The Northern Territory government outlined a new procedure for establishing land access agreements.

United States. The U.S. nonfuel mineral exploration budget decreased by about 6 percent to about $717 million in 2015 from $760 million in 2014, according to SNL. The U.S. percentage of the world exploration budget was 8 percent in 2015. Gold accounted for about 58 percent of the total amount budgeted for U.S. exploration, base metals (primarily copper) accounted for about 31 percent, uranium exploration accounted for about 1 percent, and the remaining 10 percent was budgeted for the exploration of other minerals. Major companies accounted for about 55 percent of the total U.S. budget in 2015 and 49 percent in 2014. Junior companies accounted for about 32 percent in 2015 and 40 percent in 2014. Intermediate companies and government-based entities accounted for 13 percent in 2015 and 11 percent in 2014. Exploration associated with a producing property increased from 34 percent in 2014 to 40 percent in 2015. Early stage exploration decreased from 27 percent in 2014 to 24.5 percent in 2015. Late-stage exploration decreased from 38.5 percent in 2014 to 35 percent in 2015. SNL data suggest that exploration drilling in the United States increased by about 21 percent in 2015 from the level in 2014, based on the number of holes drilled.

In November 2015, data on 134 U.S. active exploration projects were collected and reviewed by the USGS; 65 sites were located in Nevada, 16 sites were located in Alaska, eight sites were located in California, seven sites were located in Arizona, six sites were located in Idaho, four sites each were located in Colorado, South Dakota and Utah, and the remaining 20 sites were located in 12 other states. Most of these sites had prior exploration activity, suggesting that economic conditions were such that exploration companies were continuing prior exploration activity or reevaluating sites because of technological advancements or their proximity or geologic similarity to other recent discoveries.

Exploration for precious metals represented about 65 percent of projected mineral exploration activity, based on 2015 site data compiled by the USGS. The principal exploration objectives in Nevada continued to be gold and silver, although some exploration for copper, diatomite, fluorspar, lithium, molybdenum, potash, tungsten and zinc occurred in Nevada. Based on data reported by the Nevada Division of Minerals, there were about 195,000 claims filed in Nevada in 2014, down from about 218,000 claims in 2013.

Exploration for lithium deposits in Nevada was stimulated by the plan of Tesla Motors Inc. to construct a 35-GWh capacity lithium battery factory in the state. Although the supply chain for battery components is primarily sourced in Asia, Tesla established a number of potential supply agreements with U.S. and Mexican suppliers of lithium for use in its batteries. Other companies were fast-tracking exploration of properties in Nevada as potential sources of supply to the new facility, which is expected to be completed in 2017.

Based on a 2015 report released by the Alaska Department of Natural Resources, Alaskan exploration expenditures (excluding development projects) decreased about 45 percent to about $96.2 million in 2014 from $175.5 million spent in 2013. About 37 percent of the total estimated exploration expenditure for 2014 was spent in the eastern interior of Alaska, 29 percent in southeastern region, 13.5 percent in the southwestern region, 12 percent in the northern region, 4 percent in the western region, 3.5 percent in the south-central region, and about 1 percent on the Alaskan peninsula. About 54 percent of this expenditure was for precious metals, 31 percent for polymetallic deposits containing base and precious metals, 9 percent for base metals and the remaining 6 percent for coal, industrial minerals, peat and other minerals. In 2014, approximately 6,000 federal and 41,000 state mining claims were active. Actual data for 2015 were unavailable although the exploration expenditures in Alaska were thought to be lower than the $96 million

expended in 2014.

The greatest proportion of the decrease in mineral exploration was experienced in southwestern Alaska, where continuing questions concerning the regulatory and political viability of mining on land adjacent to the Bristol Bay watershed and the withdrawal of the principal partners from the Pebble project reduced expenditures in the region from $74 million in 2013 to $13 million in 2014. The remainder of the decline in Alaska exploration was consistent with a 25-percent worldwide decrease in exploration expenditures. In February 2014, the U.S. Environmental Protection Agency (EPA) announced plans to initiate a process to protect the Bristol Bay fisheries from future mining of the Pebble copper-gold project. Although the EPA subsequently halted implementation of the process until resolution is reached, the mining industry reacted to this announcement by curtailing a significant amount of its planned exploration and development expenditure in Alaska in 2014 and 2015 until the regulatory environment could be clarified.

Exploration expenditures by major companies such as Coeur Mining Inc., Hecla Mining Co., Kinross Gold Corp., Sumitomo Metal Mining Co. and Teck Resources Ltd. accounted for more than half of the exploration expenditure in Alaska during 2014, and a similar trend was noted for 2015.

In the United States, the U.S. Senate passed HR 2262, the Space Act of 2015, which recognized the right of U.S. citizens to own asteroid resources they obtain and encouraged private sector investment in exploration and recovery of resources from asteroids.

Pacific Region. Based on SNL data, the 2015 exploration budget allocation for the Pacific region and Southeast Asia (excluding Australia) was about $429 million, down 28 percent from the 2014 level of $600 million. Indonesia, Papua New Guinea and the Philippines together accounted for about 73 percent of the total mineral exploration budget for the region. Much of the sustained interest in this region can be attributed to the continued interest by Chinese and Korean companies to expand sources of supply for gold, base metals and REE and by Japanese companies to develop regional copper and nickel deposits to supply Japan's smelting industry. Based on the data on active exploration sites compiled by the USGS, the three countries included in this region in descending order of the number of exploration sites were Papua New Guinea, the Philippines and Indonesia, together accounting for 56 percent of the active exploration sites in the region in 2015. Other countries with active exploration in 2015 include Burma (Myanmar), Cambodia, Fiji, Malaysia, New Zealand, the Solomon Islands, Thailand and Vietnam. Gold exploration accounted for approximately 52 percent of all exploration interest in the Pacific region, base metals accounted for about 31 percent, with minor exploration activity for iron ore and other minerals in 2015. About 52 percent of the sites in this region were conducting early-stage exploration, 27 percent were exploring for minerals adjacent to producing mines, 17 percent were undergoing feasibility studies and 4 percent were in development.

Indonesia banned exports of unprocessed nickel and bauxite ore in 2014 to force mining companies to construct value-added smelters in the country. As a result, 11 new nickel smelters are planned for development over the next two years. Several were expected to be completed by the end of 2016. While nickel ore and bauxite exports from Indonesia have been curtailed, nickel exports from the Philippines and Vietnam have increased to meet continued demand from China. Consequently, interest in exploration for nickel and bauxite was lower in Indonesia but higher in neighboring countries in 2015. As of September, reports indicate that the government had no plans to rescind the export ban.

Rest of the World. Exploration budget allocations for the rest of the world decreased by about 19 percent in the 2015 SNL survey (as of November) to about $1.7 billion from the $2.1 billion budget reported in its 2014 survey. However, the global budget share remained at about 19 percent in 2015. Exploration in Russia and China accounted for about 57 percent of the exploration budget for countries in Asia, the CIS, Europe and the Middle East in 2015. China accounted for about 6 percent of the global exploration budget in 2015 and Russia accounted for about 5 percent. Based on the amount budgeted for exploration, the countries with the greatest exploration activity from this diverse group of countries in 2014 in descending order were China, Russia, Turkey, Kazakhstan, Finland, Sweden, India, Saudi Arabia, Mongolia and Serbia. Together, these countries account for about 83 percent of the group's exploration budget.

In terms of the number of exploration sites in descending order, the most active countries were Russia, Turkey, China, Finland, Spain, Sweden, Mongolia, Kazakhstan and Portugal. On the basis of exploration site data collected by the USGS, Russia accounted for about 18 percent of active

exploration sites in this composite region, Turkey accounted for about 8 percent, China accounted for about 6 percent, Finland, Spain and Sweden each accounted for 6 percent, Mongolia accounted for about 5 percent, Kazakhstan accounted for 4 percent and Portugal accounted for about 3 percent. The remaining 38 percent occurred in 32 other countries in Asia, the 13 countries that comprise the Commonwealth of Independent States (other than Russia), Europe and the Middle East.

Based on the number of exploration sites compiled by the USGS, exploration activity in Asia in 2015 primarily focused on precious metals (41 percent of all Asian sites), base metals (22 percent) iron ore (9 percent) and other minerals (28 percent). Exploration activity in the Commonwealth of Independent States focused on precious metals (69 percent), base metals (18 percent), iron ore (1 percent) and other minerals (12 percent). European mineral exploration primarily focused on base metals (26 percent), precious metals (38 percent), tungsten (9 percent), iron ore (3 percent) and other minerals (24 percent). Middle Eastern exploration (including Turkey) primarily focused on copper (31 percent), gold (61 percent), zinc (4 percent) and other commodities (4 percent).

The Chinese government continued to encourage domestic companies to invest globally. Free trade agreements were signed between China and Australia and also China and Brazil in 2015.

In response to a World Trade Organization (WTO) decision in 2014, China eliminated mineral export quotas as of Jan. 1, 2015 and revised its resource tax structure to replace volume-based export taxes with value-based royalties as of May 2, 2015. The new royalty rates for light REE ranged from 7.5 percent to 11.5 percent, depending on the area of production. The royalty on heavy REE is 27 percent. The government also set the resource tax at 6.5 percent for tungsten and 11 percent for molybdenum. Other changes include the introduction of a new export tax rebate of 9 percent for some copper products, the removal of an export tax rebate on boron-added steel products and the introduction of a selenium, boron and tellurium export tax rebate of 13 percent as of Jan. 1, 2015. As of April, 2015, China was considering reforming its iron ore resource tax and moving to a value-based tax. These changes may indirectly effect exploration for these commodities in China as they affect global supply and the cost of doing business in China.

China was conducting ongoing deep-sea mineral exploration in the Bohai Sea between China and North Korea and in the Indian Ocean. Discovery of gold and polymetallic sulfide deposits have been reported.

The Indian government was working to set up a policy that would allow foreign companies to conduct mineral exploration in India. But the country did not plan to offer any financial incentive or relaxed ownership rights in case of successful exploration.

In Mongolia, the development of phase 2 and further exploration of the large Oyu Tolgoi copper project was again progressing, as Rio Tinto resolved differences with the Mongolian government for the construction of a power generation plant to supply the project.

Russia began to implement plans to become a major REE producer with the commencement of exploration and development of the Tomtor mineral field in Yakutia. It contains REE resources in addition to iron, manganese, phosphorous, titanium and vanadium. The government has expressed its intention to develop a single chain of REE production from ore extraction through concentrate production to oxide and metal production. Reports suggest that a substantial drilling program has commenced. Russia signed an agreement with the ISBA, which provides rights to explore for cobalt-rich deposits in the Pacific Ocean near the Magellan Mountains.

The Turkish Parliament passed law number 6592 that modified the mining law passed in 1985. Modifications include increases in license fees, establishment of a gold royalty ranging from 2 to 16 percent of the sale price, subject to a 50-percent reduction if a process plant is on-site, and the establishment of an auction system for abandoned licenses. ■

For more information

The USGS collects and analyzes data on more than 100 mineral commodities in the United States and worldwide. More detailed information on the material covered in this article may be obtained from David Wilburn, U.S. Geological Survey, National Minerals Information Center, P.O. Box 25046, MS 750, Denver Federal Center, Denver, CO 80225-0046; telephone 303-236-5213; fax 303-236-4208 or wilburn@usgs.gov. For additional USGS information on mineral commodities and international mining activities, inquiries may be directed to Steven Fortier, U.S. Geological Survey, National Minerals Information Center, 988 National Center, MS 988, Reston, VA 20192; telephone 703-648-4920 or sfortier@usgs.gov.