Forum

Mineral development statistics, a mine of information

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ABSTRACT

This paper describes the new information available on Canadian mineral development statistics that cover the range of mineral development activity from grassroots exploration to mine production and provides a brief analysis of the data.

Non-fuel mineral exploration statistics have been collected in Canada since 1946, when survey activity was initiated by Statistics Canada. In 1967, a major revision and expansion of survey content took place. In 1985, under the aegis of the Federal-Provincial Committee on Mineral Statistics, chaired by Natural Resources Canada (NRCan), a new level of cooperation was reached when NRCan, Statistics Canada, the provinces and the territories agreed to produce a more comprehensive and consistent set of exploration and mine-site development statistics.

In 1997, a second major revision to the mineral exploration survey took place in consultation with industry. This revision identifies the three work phases of the full mineral development cycle (exploration, deposit appraisal, and mine complex development) and reflects the evolving complexity of mineral development and mining activity. New information is now collected on engineering, economic, pre-feasibility and production feasibility studies, land access and environment costs, in addition to the data already being collected on field work and overhead expenditures related to drilling, geoscientific surveys and rock work. Capital and repair expenditures that had only been collected for the mine complex development phase are now being collected for the exploration and deposit appraisal work phases. As a result, a mine of "high grade" statistics is now available.

The newly collected categories of expenditures contributed 6.4% ($361 million) of the total expenditures on mineral development in 1997, 3.7% ($171 million) in 1998, an estimated 5.3% ($177 million) in 1999, and 6.7% ($223 million) in spending intentions in 2000. In 1999, total exploration, deposit appraisal and mine complex development expenditures, including field and overhead, all newly defined expenditures, as well as capital and repair costs, amounted to $3.4 billion. This increased coverage of expenditures permits NRCan and its partners to provide a more complete insight into the full range of activities taking place in the Canadian mineral development industry.

Introduction

NRCan, in cooperation with Statistics Canada and the provincial and territorial governments, conducts surveys of mineral development activity. The *Annual Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures* is conducted twice a year and has a final response rate above 90%. A preliminary survey of current year expenditures and of spending intentions for the next year is carried out in the fall. Final survey expenditures for a given year are collected early in the following year.

The revised survey questionnaires are the result of a major survey review and rationalization process, implemented in 1997, that introduced new definitions of work phases, new categories of expenditures, and integrated reporting questionnaires. As a result, more complete and accurate coverage of mineral development expenditures across Canada, from exploration to mine production, is now available.

This paper first explains how the historical data series has evolved since 1946. The new definitions are then described and a comparison is made between the past and present series. The present status of the industry is then analyzed using trends from the new series of statistics that run from 1997 to 2000 (Tables 1 and 2). Finally, some future survey objectives are discussed.

The survey figures in this article are based on final survey results for 1997 and 1998, preliminary estimates for 1999 and industry spending intentions for 2000.

A Brief History

Statistics Canada began collecting mineral exploration statistics in 1946 to include this segment of the mineral industry in the System of National Accounts.

From 1946 to 1963, Statistics Canada reported exploration expenditures for metal mining companies in Canada as "prospecting" expenditures. These statistics measured expenditures on the search for new deposits on the surface and preliminary exploration by mining companies, exploration (non-mining) companies and prospectors. The accuracy of expenditures recorded in this period is uncertain because "prospecting" was not defined.

NRCan prepared a series of estimates, using actual survey responses, to cover the period from 1964 to 1966 because the original data were not completely compiled.

For the years 1967 to 1986, Statistics Canada compiled and published, using broader definitions, both mine-site and general (off-mine-site) exploration expenditures, as well as mine-site development expenditures and other capital and repair expenditures associated with mine development. In 1985, companies were sent a supplement to capture detailed expenditures on field work activity. Since 1988, NRCan has coordinated the survey of firms conducting general (off-mine-site) exploration, and the coordination of the survey of producers was a shared responsibility between Statistics Canada and NRCan.

A review of survey definitions was carried out in the mid-1990s with the aim of improving the quality of the survey. This revision was undertaken by the Federal-Provincial Committee on Mineral Statistics, in consultation with industry, and completed in 1997. The redesigned survey questionnaires were used to collect data from mining and exploration companies beginning with the 1997 preliminary and final surveys. At that time, NRCan became the national survey coordinator for mineral development expenditures.

TABLE 1. Exploration, deposit appraisal and mine complex development expenditures,[1] 1997 and 1998

Expenditure category	Exploration		Deposit appraisal		Exploration plus deposit appraisal		Mine complex development		Total	
	1997	1998	1997	1998	1997	1998	1997	1998	1997	1998
					($000)					
Field work and overhead[2]	599 336	445 055	220 839	130 865	820 175[a]	575 920[a]	834 040	932 290	1 654 215	1 508 209
Engineering studies	3 617	2 847	25 872	34 059	29 489	36 906	15 997	11 152	45 486	48 058
Economic studies	1 069	306	1 450	661	2 519	967	42	452	2 561	1 419
Pre- or production feasibility studies	4 290	1 698	11 614	5 053	15 904	6 751	981	7 427	16 885	14 178
Environment	21 560	11 294	25 726	20 373	47 286	31 667	12 193	9 958	59 479	41 625
Land access	4 538	1 605	1 058	2 115	5 596	3 720	2 288	4 783	7 885	8 503
Subtotal	634 410	462 805	286 560	193 126	920 970	655 931	865 542	966 061	1 786 511	1 621 992
Off-mine-site	572 027	394 929	180 951	131 591	752 979	526 520	n.a.	n.a.	752 979	526 520
On-mine-site	62 383	67 875	105 608	61 535	167 991	129 411	865 542	966 061	1 033 532	1 095 472
Capital[3]	25 716	9 697	147 435	25 103	173 151	34 800	2 089 640	1 226 347	2 262 792	1 261 147
$ for environmental protection and restoration[4]	81	157	126	144	207	301	27 034	23 783	27 241	24 084
Total	660 126	472 501	433 995	218 230	1 094 121	690 731	2 955 182	2 192 409	4 049 303	2 883 139
Repair and maintenance[3]	5 071	4 838	50 831	17 995	55 902	22 832	1 578 291	1 671 588	1 634 193	1 694 420
$ for environmental protection and restoration[4]	5	390	98	1 120	102	1 510	28 392	103 765	28 494	105 276
Grand total	665 197	477 339	484 826	236 224	1 150 023	713 563	4 533 473	3 863 997	5 683 496	4 577 560
Total environment	21 646	11 841	25 949	21 638	47 595	33 479	67 619	137 506	115 214	170 985
Environment as a percentage of grand total	3.3	2.5	5.4	9.2	4.1	4.7	1.5	3.6	2.0	3.7

TABLE 2. Exploration, deposit appraisal and mine complex development expenditures,[1] 1999 and 2000

Expenditure category	Exploration		Deposit appraisal		Exploration plus deposit appraisal		Mine complex development		Grand Total	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
					($000)					
Field work and overhead[2]	327 446	298 996	98 475	95 892	425 921[a]	394 888[a]	724 819	700 527	1 150 740	1 095 415
Engineering, economic and pre- or production feasibility studies	5 010	6 665	46 146	76 559	51 156	83 224	20 891	17 210	72 046	100 434
Environment	7 479	7 683	10 984	11 187	18 463	18 870	9 267	9 989	27 729	28 859
Land access	1 292	1 555	4 262	3 571	5 554	5 126	8 274	7 727	13 828	12 853
Subtotal	341 226	314 899	159 867	187 209	501 094	502 108	763 250	735 453	1 264 344	1 237 562
Off-mine-site	287 502	269 692	120 436	158 361	407 937	428 053	n.a.	n.a.	407 937	428 053
On-mine-site	53 725	45 207	39 431	28 848	93 156	74 055	763 250	735 453	856 407	809 508
Capital[3]	3 227	607	26 978	41 376	30 205	41 983	813 649	886 188	843 854	928 171
$ for environmental protection and restoration[4]	—	13	102	178	102	191	25 742	43 351	25 844	43 542
Repair and maintenance[3]	4 105	1 337	28 971	37 247	33 076	38 584	1 217 103	1 134 538	1 250 179	1 173 122
$ for environmental protection and restoration[4]	—	—	493	150	493	150	59 757	60 265	60 250	60 415
Subtotal	7 332	1 944	55 949	78 623	63 281	80 567	2 030 753	2 020 726	2 094 034	2 101 292
Grand total	348 558	316 843	215 816	265 832	564 375	582 675	2 794 003	2 756 179	3 358 377	3 338 854
Total environment	7 479	7 696	11 579	11 515	19 058	19 211	94 765	113 605	113 823	132 816
Environment as a percentage of grand total	2.1	2.4	5.4	4.3	3.4	3.3	3.4	4.1	3.4	4.0

Source: Natural Resources Canada, from a federal-provincial survey of mining and exploration companies.
n.a. Not applicable.
a This total can be compared to some extent with exploration expenditures prior to 1997.
[1] Incudes on-mine-site plus off-mine-site activities; exploration and deposit appraisal activities include only the search for and appraisal of deposits and do not include work for extensions of known reserves.
[2] Overhead expenditures include mineral leases, claims and rental costs, and project-related head office expenditures.
[3] Includes construction, and machinery and equipment expenditures.
[4] As part of capital expenditures or repair and maintenance expenditures.
Notes: Refer to Table 3 for the summary of expenditures not previously recorded. Data for 1999 are preliminary estimates; data for 2000 are company spending intentions.

New Definitions

Objectives of Survey Modifications

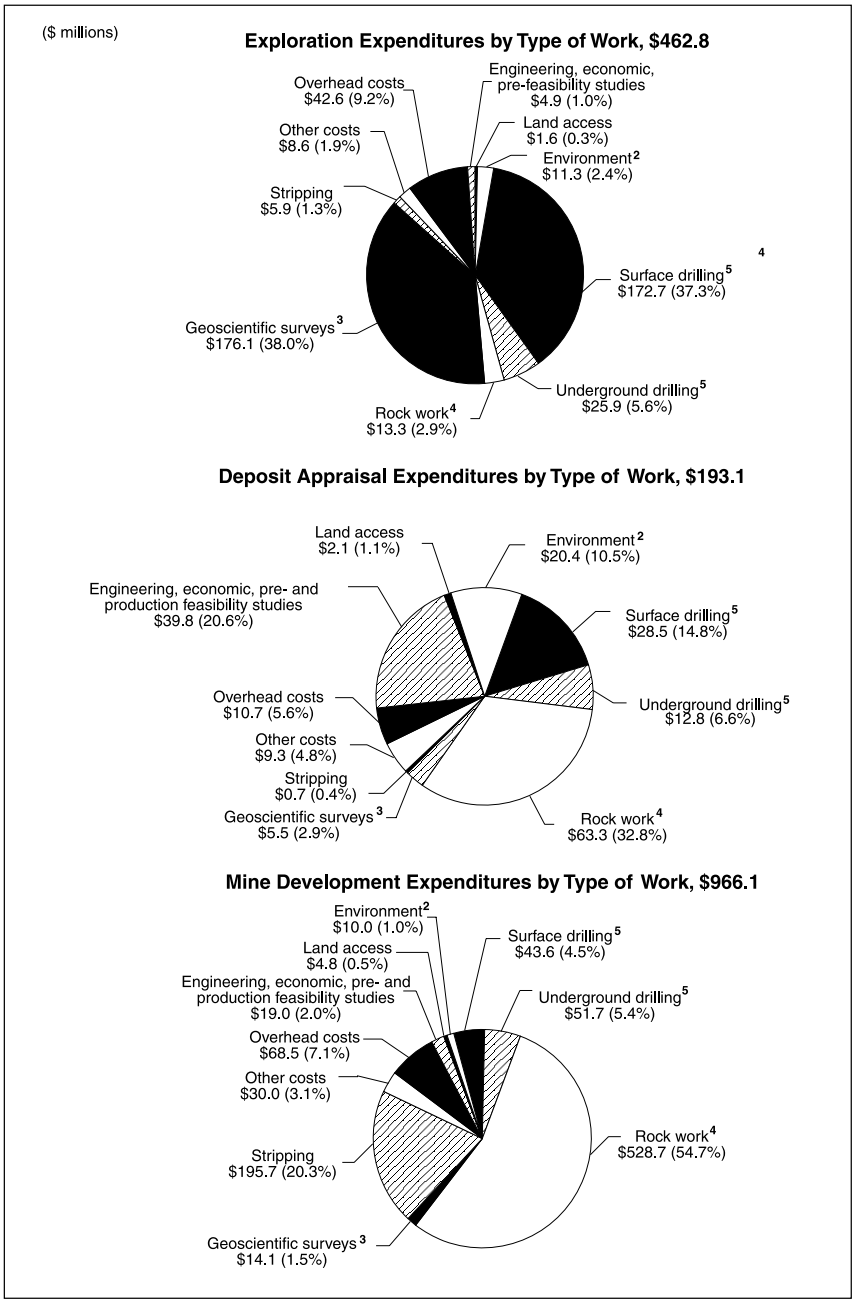
Several major changes were introduced into the 1997 surveys to improve the survey and support the planned changes to the System of National Accounts at Statistics Canada. The objectives of these changes and how they were met are described below.

The first objective was to obtain more complete coverage of all expenditures for this industry and improve our knowledge of grassroots and advanced exploration — this was achieved by defining two work phases within the former exploration work phase and adding new categories of expenditures and investment.

The second objective was to streamline the survey process — an integrated survey questionnaire was developed encompassing all work phases and rationalizing data collection between NRCan and its partners.

The third objective was to increase the utilization of the survey results to realize the potential benefits of this knowledge for both industry and government — the measures under way and planned are described later in this paper.

Fig. 1. Exploration, deposit appraisal and mine development expenditures[1] by type of work, 1998.



Source: Natural Resources Canada, from a federal-provincial survey of mining and exploration companies.
[1] On-mine-site plus off-mine-site activities. [2] Environment includes characterization, permitting, protection, monitoring and restoration. [3] Geoscientific surveys include geology, geochemistry, ground geophysics and airbourne geophysics. [4] Rock work activity includes shaft work, drifts, cross-cuts, raises, declines, rock sampling and dewatering costs. [5] Drilling includes diamond and other types of drilling.
Note: Numbers may not add to totals due to rounding.

Description of Changes

To better distinguish and monitor both grassroots exploration and advanced appraisal activity, the former exploration phase was replaced with the exploration and deposit appraisal work phases. The use of these two work phases had been developed by the Société québécoise d'exploration minière (SOQUEM) in its annual reports during the 1970s. In the early 1990s, large expenditures on advanced projects hid the decline in grassroots exploration in several jurisdictions. The exploration phase now extends up to and including the discovery and first delineation of a mineral resource of potential economic interest. The deposit appraisal phase brings a delineated deposit to the stage of detailed knowledge required for the feasibility study necessary to support a production decision and the accompanying investments. Expenditures for these two work phases are reported either as on-mine-site (at a mine site in production or committed to production) or as off-mine-site.

Capital asset investments for construction, machinery and equipment, as well as associated repair and maintenance expenditures, are now collected at the exploration and deposit appraisal phases. Repair and maintenance expenditures are required to maintain the productive capacity of existing capital assets. However, upgrades and refurbishing of current or purchased assets are included as capital expenditures.

The mine complex development phase occurs when a mine property is either in production or committed to production and includes mine development activities, and capital asset investment (construction, machinery and equipment), as well as associated repair and maintenance expenditures. Mine development consists of activities carried out to delineate the orebody in detail, to gain

access to the ore and to prepare it for production. It also includes activities to extend the known reserves. The mine complex development phase was renamed from mine-site development to reflect the dominance of spending on construction within this work phase. About 98% of the total expenditures on capital and repair and maintenance work occurred at the mine complex development phase in 1998.

New expenditure categories for engineering, economic and pre-feasibility and production feasibility studies, environment-related activities and land access have been added to all work phases. For example, environment-related expenditures are now collected as part of field expenditures and capital and repair expenditures (Tables 1 and 2). Since 1997, the ratio of environmental expenditures to total costs has varied yearly: 2% for 1997, 3.7% for 1998, 3.4% for 1999 and 4% for 2000.

Survey results reveal different spending patterns associated with the purpose of each work phase (Fig. 1). Spending on surface drilling and geoscientific surveys is more significant within the exploration work phase during the search for a new mineral deposit. Spending on rock work and technical studies is dominant within the deposit appraisal work phase when more underground work is being conducted and production is being considered. Expenditures at the mine development phase are highest for rock work because major underground development occurs at a mine or a deposit committed to production. In fact, three quarters of the spending in this latter phase is for rock work and stripping.

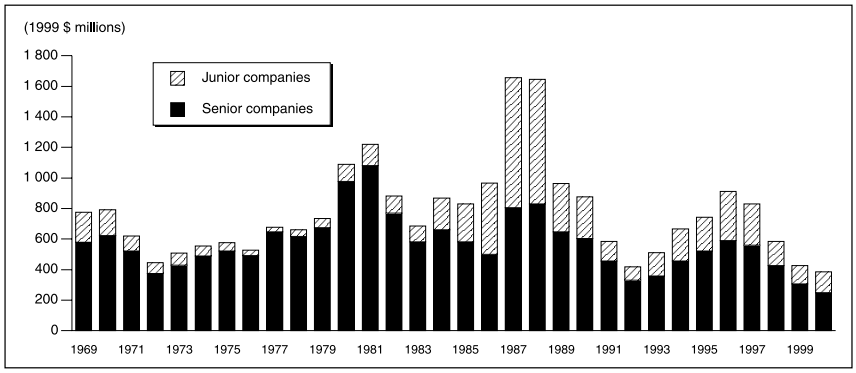
Table 3 shows the overall impact of the new definitions for the years 1997 to 2000. When tabulated across all categories and work phases, the ratio of expenditures added under the new definitions varied from 6.4% ($361 million) in 1997, to 3.7% ($171 million) in 1998, a preliminary estimate of 5.3% ($177 million) in 1999, and 6.7% ($223 million) in spending intentions in 2000. More than 80% of the expenditures in the new categories occurred within the exploration and deposit appraisal work phases.

TABLE 3. Summary of expenditures not previously recorded, 1997-2000

Expenditure category	1997	1998	1999	2000
			($ millions)	
Exploration plus deposit appraisal				
Environment	47.3	31.7	18.5	18.9
Engineering, economic and pre- or production feasibility studies	47.9	44.6	51.2	83.2
Land access	5.6	3.7	5.6	5.1
Subtotal	100.8	80.0	75.2	107.2
Capital	173.2	34.8	30.2	42.0
Repair and maintenance	55.9	22.8	33.1	38.6
Total	329.9	137.6	138.5	187.8
Mine complex development				
Environment	12.2	10.0	9.3	10.0
Engineering, economic and pre- or production feasibility studies	17.0	19.0	20.9	17.2
Land access	2.3	4.8	8.3	7.7
Total	31.5	33.8	38.4	34.9
Grand total	361.3	171.4	176.9	222.7
% of total investment[1]	6.4	3.7	5.3	6.7

Source: Natural Resources Canada, from a federal-provincial survey of mining and exploration companies.
[1] "Total investment" equals "Grand total" in Tables 1 and 2.
Notes: Numbers may not add to totals due to rounding. Data for 1999 are preliminary estimates; data for 2000 are company spending intentions.

Fig. 2. Exploration and deposit appraisal expenditures (fieldwork and overhead only) by junior and senior companies, 1969-2000.



Source: Natural Resources Canada, from a federal-provincial survey of mining and exploration companies.
[1] Includes on-mine-site plus off-mine-site activities.
Notes: Total expenditures for 1975-1981 are overstated by an average of about 17% relative to earlier and later years because of changes to the methodology used by Statistics Canada over the years. Expenditures for 1997 to 2000 include both exploration plus deposit appraisal as per new definitions; up to and including 1996, most of the expenditures now in the deposit appraisal work phase were reported under exploration (broadly speaking). Data for 1999 are preliminary estimates; data for 2000 are company spending intentions.

Survey Analysis

Total Expenditures

The *Annual Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures* surveys about 1800 establishments (reporting units).

Total exploration, deposit appraisal, and mine complex development field and overhead expenditures, as well as new categories of expenditures (excluding capital and repair costs), have gone from $1.8 billion in 1997 to $1.6 billion in 1998, $1.3 billion in 1999 and $1.2 billion in 2000.

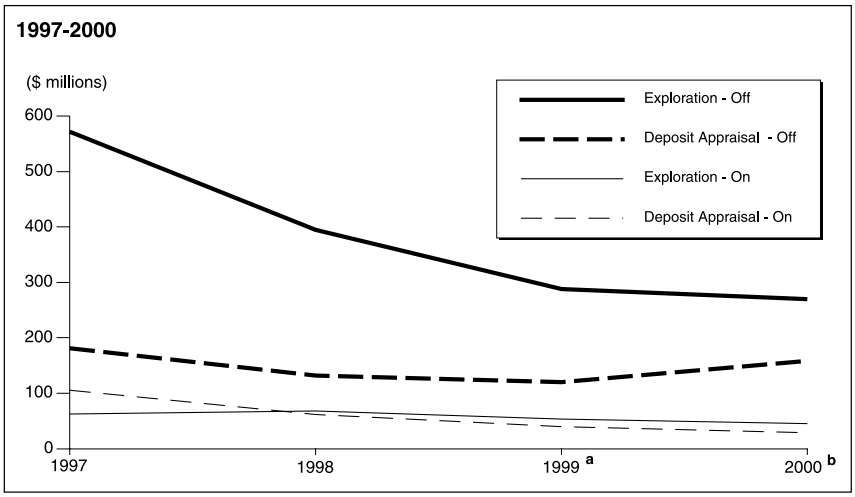
Capital expenditures in the three work phases varied from $2.3 billion in 1997 to $1.3 billion in 1998, $844 million in 1999 and $928 million in 2000. Repair and maintenance expenditures varied from $1.6 billion in 1997 to $1.7 billion in 1998, $1.3 billion in 1999 and $1.2 billion in 2000.

The total of all expenditures for the three work phases has decreased from $5.7 billion in 1997 to $4.6 billion in 1998, $3.4 billion in 1999 and $3.3 billion in 2000.

Exploration and Deposit Appraisal Expenditures

An historical comparison of exploration and deposit appraisal expenditures (Fig. 2) is made possible by using both the old survey definitions (only field work and overhead expenditures) and constant 1999 dollars. After peak levels of expenditures were reached in 1987 and 1988 (as a result of flow-through shares and the Mining Exploration Depletion Allowance), exploration and deposit appraisal expenditures in Canada fell to a low of $419 million in 1992. From 1993 to 1996, the level of activity rebounded by 118% to reach a

Fig. 3. On-mine-site and off-mine-site exploration and deposit appraisal expenditures[1], 1997-2000.



Source: Natural Resources Canada, from a federal-provincial survey of mining and exploration companies.
a – Preliminary estimates; b – Company spending intentions.
[1] Includes engineering, economic and feasibility studies, environment and land access costs.

peak of $912 million in 1996. The upward surge in expenditures was triggered by important discoveries of diamond deposits in the Northwest Territories that resulted in Canada's first diamond mine. In addition, the announcement of the nickel-copper-cobalt discovery at Voisey's Bay, Labrador, in late 1994 resulted in a flurry of exploration activity in the area and base-metal expenditures increased sharply in 1995, 1996 and 1997.

Survey data from 1997 to 2000 indicate a continuous decline in exploration and deposit appraisal field work and overhead expenditures of 58% to $387 million in 2000. If this figure proves to be accurate, it would bring expenditures close to the lowest levels, in constant dollars, recorded in the past 30 years. However, spending intentions may vary from the final reported value due to the difficulty that companies have in accurately forecasting expenditures at the time of the survey.

When new expenditures (excluding capital and repair) are added to field and overhead for data from 1997 to 2000, the new totals (current dollars) are $921 million in 1997, $656 million in 1998, a preliminary estimate of $501 million in 1999, and spending intentions of $502 million in 2000 (Tables 1 and 2). The increased spending for feasibility studies in the deposit appraisal phase appears to be offsetting the decline in exploration to stabilize expenditures in 1999 and 2000.

On-mine-site[1] and off-mine-site exploration and deposit appraisal expenditures for the period from 1997 to 2000 are shown in Figure 3 and Tables 1 and 2. Total off-mine-site exploration expenditures decreased dramatically from $572 million in 1997 to $395 million in 1998 and $288 million in 1999, and are expected to be $270 million in 2000. Off-mine-site deposit appraisal exploration dipped from its 1997 level of $181 million to $132 million and $120 million in 1998 and 1999, respectively. An expenditure level of $158 million is expected in 2000. On-mine-site exploration expenditures dropped about 20% in 1999 and 2000 from their 1997 and 1998 levels of $62 million and $68 million, respectively. On-mine-site deposit appraisal expenditures declined from $106 million in 1997 to $62 million in 1998 and $39 million in 1999; only $29 million is expected in 2000.

The largest decrease in terms of expenditures occurred for off-mine-site exploration expenditures between 1997 and 1998 (a decrease of $177 million, or 67% of the loss in total exploration and deposit appraisal expenditures). About 40% of all off-mine-site exploration expenditures were incurred by junior companies between 1997 and 2000. From 1997 to 1998, off-mine-site expenditures by juniors decreased by 38%.

The Bre-X incident in the spring of 1997 had an adverse effect on exploration financing. This event both preceded and accentuated the strong negative impact on expenditures caused by the Asian financial crisis and the dramatic drop in the price of most metals that occurred at the end of 1997 and early in 1998. In the first half of 1999, the persistence of these conditions and the announcement of gold reserve sales by central banks depressed the price of gold to the US$250/oz level. In late 1999, following revisions of central banks' policies, the price rallied to US$321/oz but has trended downward since that time.

Capital expenditures at the exploration and deposit appraisal phases are due mainly to underground work and were previously not collected. In the exploration phase, they totalled $25.7 million in 1997, $9.7 million in 1998, $3.2 million in 1999, and $0.6 million in 2000. In the deposit appraisal phase, capital expenditures totalled $147.4 million in 1997, $25.1 million in 1998, $27.0 million in 1999, and $41.4 million in 2000.

Repair and maintenance expenditures for the exploration phase totalled $5.1 million in 1997, $4.8 million in 1998, $4.1 million in 1999, and $1.3 million in 2000. For the deposit appraisal phase, these expenditures amounted to $50.8 million in 1997, $18.0 million in 1998, $29.0 million in 1999, and $37.2 million in 2000. The figures for capital, and repair and maintenance need a longer time series to be adequately interpreted.

Mine Complex Development Expenditures

Mine development expenditures in operating mines and mines committed to production were $866 million in 1997, $966 million in 1998, $763 million in 1999, and $735 million in 2000. Capital expenditures for construction, machinery and equipment were $2.1 billion in 1997, $1.2 billion in 1998, $814 million in 1999, and $886 million in 2000. Repair and maintenance expenditures amounted to $1.6 billion in 1997 and $1.7 billion in 1998, but declined to $1.2 billion in 1999 and are expected to be $1.1 billion in 2000. The declining expenditures reflect reduced activity in the production sector, the main contributor to these expenditures.

Expenditures by Junior and Senior Companies

Total spending by junior companies (excluding capital and repair) declined from $298 million in 1997 to $171 million in 1998, $137 million in 1999, and are expected to rebound to $165 million in 2000. Senior company spending went from $623 million in 1997 to $485 million in 1998, $364 million in 1999, and could decline further to $337 million in 2000. Juniors were responsible for 26% of the total expenditures for exploration and deposit appraisal in 1998. This number is

[1] A mine site is the area that can be accessed and exploited from the current or committed installations.

expected to increase slightly to 27% in 1999 and climb to 33% in 2000. Thirty-four juniors spent more than $1 million each in 1998, contributing 49% of the combined exploration and deposit appraisal expenditures for juniors. This contribution is expected to be 53% in 1999 and 62% in 2000. In 1998, 57 of 125 senior companies (project operators) spent more than $1 million each, accounting for 96% of all expenditures reported by seniors in 1998. The proportions are similar for 1999 and 2000 although the number of active senior companies dropped to 107 project operators.

Future Survey Improvements

This section outlines the objectives for the future and briefly discusses our response to some industry concerns. Mineral development statistics require continuing improvement in methodology, survey definitions and concepts, expansion of the level of analysis, and dissemination of the information collected.

To improve the survey, NRCan and its partners intend to:

- monitor and analyze variations in survey results and apply advanced analytical techniques to earlier statistical series;
- clarify the definition of the pre-production stage;
- reconcile environment expenditures with Statistics Canada's Environmental Protection Expenditures in the Business Sector Survey;
- develop ways, such as the electronic exchange of information, to improve the efficiency of the survey process;
- encourage use of the new survey definitions to decrease problems of interpretation and reporting errors; and
- study the possibility of undertaking a revised forecast sample survey to improve the accuracy of spending intentions.

The utilization of survey results could be enhanced by linking results with other initiatives such as:

- other NRCan databases in order to perform more complete project-based analysis; and
- the newly developed electronic mapping tool that integrates multilayers of information from other sources such as the National Atlas of Canada.

Other Challenges

One of the key challenges in mineral development is the optimization of investment by measuring the discovery payback from grassroots exploration. Prior to 1997, the only tool available was the comparison of on-mine-site with off-mine-site exploration expenditures. As mentioned previously, high levels of expenditures on advanced projects hid, at times, a shortage of grassroots exploration; however, a comparative measure of discovery payback for on-mine-site relative to off-mine-site investment for exploration or deposit appraisal has not yet been systematically quantified.

Another key challenge is the extension of the lives of operating mines. This is becoming particularly important, given the low metal prices that have prevailed over the past two years. A study, based on published 1998 reserves and current production rates in one Canadian province, showed that only six of the twenty-three operating precious and base-metal mines will remain in production in five years. And only one of six new projects is based on reserves of more than five years.

Given the importance of industry and public investments already made in mining areas across Canada, extending the life of operating mines should be a priority. This can be achieved in two ways: by mine development activities and by on-mine-site exploration. Mine development consists of activities carried out to delineate the orebody in detail, to gain access to the ore and to prepare it for production. On-mine-site exploration is targeted at finding new deposits that can be extracted from existing installations. As described earlier, expenditures for on-mine-site exploration and deposit appraisal work declined from 1998 to 2000, indicating a decrease in investment of work that may extend reserves at existing mines.

The share of mine development expenditures targeted at extending known reserves is not available because of a poor response rate to this question on the survey questionnaire. The question asks respondents for the percentage of the total mine development budget that has been targeted to extend the known reserves. On the 1997 and 1998 final surveys, a large proportion of the potash and coal mines supplied this information but, surprisingly, few metal mines did.

Why did this difference occur? In coal and potash mines, little drilling accompanies production, so reporting on drilling activity to extend the current reserve is more obvious. In metal mines, drilling (and support activities) is carried out almost continuously, at varying rates, as a part of mine development investments to prepare for production. Apparently, the part of this budget that is used to extend the known reserves is rarely planned, budgeted and executed separately.

Some mining geologists suggest that operating mine budgets often work against the objective of extending a reserve. A common saying among mining geologists is that the first budget cut always targets drilling expenditures. Drilling to extend the mine reserves as well as on-mine-site exploration could be budgeted separately, as corporate investments, rather than as mine operating costs.

Conclusion

Mineral exploration expenditure statistics have improved substantially since their inception in 1946. The most dramatic and important reform to the survey is the recent initiative that broadens our understanding of the industry by ensuring the statistics reflect the full mineral development cycle. The pattern of spending revealed within each work phase provides both a greater knowledge of the importance of each category of expenditure and an improved description of the evolution of a mineral project. Furthermore, a complete investment picture will provide more accurate data on mining's contribution to the economy as reflected in the Gross Domestic Product.

Much remains to be accomplished and the support and cooperation of the industry is needed to continue to produce sound statistics and to face the challenges of the new millennium. Every respondent owns a share in this mine of information and can use it to improve decision making. NRCan and Statistics Canada, together with their provincial and territorial partners, working through the Federal-Provincial Committee on Mineral Statistics, are committed to keep improving the information collected.

NRCan Website

The *Canadian Minerals Yearbook* (CMY), prepared annually by NRCan, presents survey information in a more detailed manner than this article allows. CMY chapters are available in *.pdf format on the NRCan website at http://www.nrcan.gc.ca/mms/cmy/index/_e.html for the years 1994 to 1998 (survey years 1993 to 1997).

Notes

1. Information in this abbreviated review was current as of March 31, 2000.
2. Details and analysis of mineral development activities and other information are available on the Internet at http://www.nrcan.gc.ca/mms/efab/mmsd/exploration.
3. Definitions, survey tools (including the questionnaires), Survey Reporting Guide and the Survey Guidelines are also available on the Internet at the above site.
4. For more information or to comment, please contact Ginette Bouchard at Tel.: (613) 992-4665 or e-mail at gbouchar@nrcan.gc.ca.
5. A special thank you to Brock Greenwell and Greig Birchfield for their support in preparing this paper.