

Overview of Trends in

Canadian mineral exploration



CANADIAN INTERGOVERNMENTAL WORKING GROUP ON THE MINERAL INDUSTRY

2001

Preface

This report is prepared annually, on behalf of the Intergovernmental Working Group on the Mineral Industry (IGWG), for presentation to federal, provincial and territorial mines ministers. It contains information, current as of October 2001, on recent exploration and deposit appraisal spending levels in Canada, a review of exploration and deposit appraisal activities in the provinces and territories, and analyses of domestic and international trends affecting the Canadian mineral exploration sector.

The analyses, articles and reviews found in this report were prepared by officials from respective provincial/territorial departments responsible for mineral exploration and from Natural Resources Canada (NRCan). The Minerals and Metals Sector of NRCan was responsible for compiling, editing, producing and distributing this report, which covers exploration and deposit appraisal activities for metallic minerals, nonmetallic minerals, coal and uranium. It does not refer to petroleum-related work.

The report is available on the Internet at <http://www.nrcan.gc.ca/mms/efab/invest/exploration>.

NOTE TO READERS

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Government Contacts

For further information on specific issues related to this report (i.e., exploration activities, incentives and programs, rules and regulations, geoscientific data, etc.), the reader is invited to contact the appropriate federal, provincial or territorial authorities at the telephone numbers listed below or to consult their respective web sites. The contact information for officials who prepared the provincial/territorial sections are also provided at the beginning of each of these sections while the NRCan officials who participated in the preparation of this report are listed below. Prince Edward Island is not included because of a current lack of mineral exploration activity.

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Executive Summary

Statistics from the federal-provincial/territorial Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures show that all-inclusive exploration and deposit appraisal spending has declined significantly since 1997, when the Canadian total amounted to \$921 million. Most of that decline occurred in 1998 when expenditures dropped by \$265 million (29%) to \$656 million. The downward trend continued in 1999 and 2000 when respective spending totals amounted to \$504 million and \$473 million (preliminary). Company spending intentions (compiled in January 2001) predict another decrease with forecast total expenditures of \$458 million for 2001.

While the rate of decline in exploration and deposit appraisal spending has slowed, the level of expenditures predicted for 2001 represents an historical low. Canadian governments, at the federal and provincial/territorial levels, have responded to this situation by introducing new exploration incentives and improving existing ones. These positive measures are playing an important role in sustaining exploration and deposit appraisal activity and will act as a catalyst when metal prices, the main reason for the industry's downturn, show signs of a lasting recovery.

Canada's grass-roots exploration sector, which had been particularly affected by the downturn that began after 1997, appears to have somewhat stabilized. Expenditures incurred for the exploration work phase declined by almost 50% between 1997 and 1999. However, in 2001, they were forecast to remain at about the same level as in the previous two years. Off-mine-site spending was also predicted to stay at about the same level as in 2000. While the number of junior mining companies actively conducting exploration projects was expected to decrease again in 2001, the remaining juniors were planning to spend more, on average, than in previous years. In 2000, they accounted for \$149 million (31%) of total exploration and deposit appraisal spending, compared to the \$325 million spent by senior companies. In 2001, junior company spending was forecast to be \$167 million (36% of the predicted total of \$458 million).

Precious metals and base metals continue to be the most sought-after commodity groups in Canada despite a continuation of the downward trend in these spending categories. Expenditures on the search for diamonds, on the other hand, remain around the \$100 million mark even though considerable amounts are being invested into more advanced work aimed at bringing deposits to the production stage.

As detailed in the Regional Outlook section of this report, a number of interesting exploration and deposit appraisal projects are currently under way. Provincial/territorial governments continue to support and promote exploration and deposit appraisal activities in their respective jurisdictions through various initiatives, including innovative fiscal incentives, the resolution of land access issues, and the provision of state-of-the-art geoscientific data.

Globally, Canada's position as one of the world's top mineral exploration targets improved in 2000, in relative terms, when the country garnered almost 14% of the exploration budgets of the world's larger exploration and mining companies, compared to about 11% in each of the previous three years. In 2000, Canadian companies planned to conduct mineral exploration programs around the world valued at roughly \$900 million, an amount equivalent to more than 30% of all the activity planned worldwide by larger companies. Canadian companies not only dominate the Canadian exploration market, but also the markets of South America, the Caribbean and eastern Europe.

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ABBREVIATIONS

The reader should note that a number of abbreviations for common units of measurement appear in the text:

| | |
|-----------------|-------------------------|
| cm | centimetres |
| ct | carats |
| ct/ht | carats per 100 tonnes |
| ct/t | carats per tonne |
| ct/y | carats per year |
| ft | feet |
| ft ² | square feet |
| g | grams |
| g/t | grams per tonne |
| ha | hectares |
| kg | kilograms |
| km | kilometres |
| km ² | square kilometres |
| lb | pounds |
| m | metres |
| m ² | square metres |
| mm | millimetres |
| Mct | million carats |
| Mha | million hectares |
| Mt | million tonnes |
| Mt/y | million tonnes per year |
| oz | troy ounces |
| ppm | parts per million |
| t | tonnes (metric) |
| t/d | tonnes per day |
| t/y | tonnes per year |
| tU | tonnes of uranium |

Note: Unless specified otherwise, all dollar figures are in Canadian dollars.

1. Indicators of Mineral Exploration and Deposit Appraisal Activity in Canada

1.1 INTRODUCTION

The first chapter of this report presents data and analysis on indicators of mineral exploration and deposit appraisal activity in Canada. The most important of these indicators is spending and, accordingly, most of the analysis focuses on expenditure trends and patterns. Chapter 1 also provides analysis on two other indicators of exploration and deposit appraisal activity: drilling and claim staking.

The Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures was redesigned in 1997 to provide a more comprehensive breakdown of the mineral development cycle in Canada. The introduction of new cost categories such as feasibility studies, environment and land access, and a clearer separation between the different work phases, offer expanded analytical options over the pre-1997 survey format. While the former survey data will continue to be used to show some historical trends, the analysis in this report will, unless otherwise mentioned, be based on the new set of definitions.¹ For a better understanding of the redesigned survey and its definitions, the reader is invited to read the following paragraphs and Appendix 2.

1.2 SUMMARY OF SURVEY DEFINITIONS

In the redesigned Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures, often referred to as the federal-provincial/territorial survey of mining and exploration companies, exploration is defined as the work carried out on- or off-mine-site to search for, discover and carry out the first delineation of a previously unknown mineral deposit to establish its potential economic value (tonnage and grade) and to justify further work. Deposit appraisal, on the other hand, includes the work carried out on- or off-mine-site to bring a delineated deposit to the stage of detailed knowledge required for a production feasibility study.

The more detailed cost breakdown of the new survey provides exploration and deposit appraisal expenditures that are generally higher than the ones obtained for the traditional “field work and overhead costs” in the old survey simply because cost categories like engineering, economic and feasibility studies, environment and land access were not previously accounted for. The survey also collects data on capital and repair costs for construction, machinery and equipment for each of the work phases (exploration, deposit appraisal and mine complex development), but these costs will seldom be referred to in this review. The comprehensive coverage offered by all these categories of expenditures provides a more complete picture of the total investment required to bring projects to the production decision stage.

¹ A different set of definitions is used in Chapter 3 for international exploration, which is based on data from the Metals Economics Group.

1.3 EXPLORATION AND DEPOSIT APPRAISAL EXPENDITURES

Over the years, levels of exploration and deposit appraisal expenditures have been relied upon to determine the health of Canada's mineral exploration sector and to provide an insight into the future of the country's minerals and metals production capacity. This section focuses on analyzing expenditure data for 2000 (preliminary estimates) and 2001 (company spending intentions), both compiled in January 2001. It also provides some coverage of the five-year period 1997-2001, which represents the first five years of data for the redesigned survey.

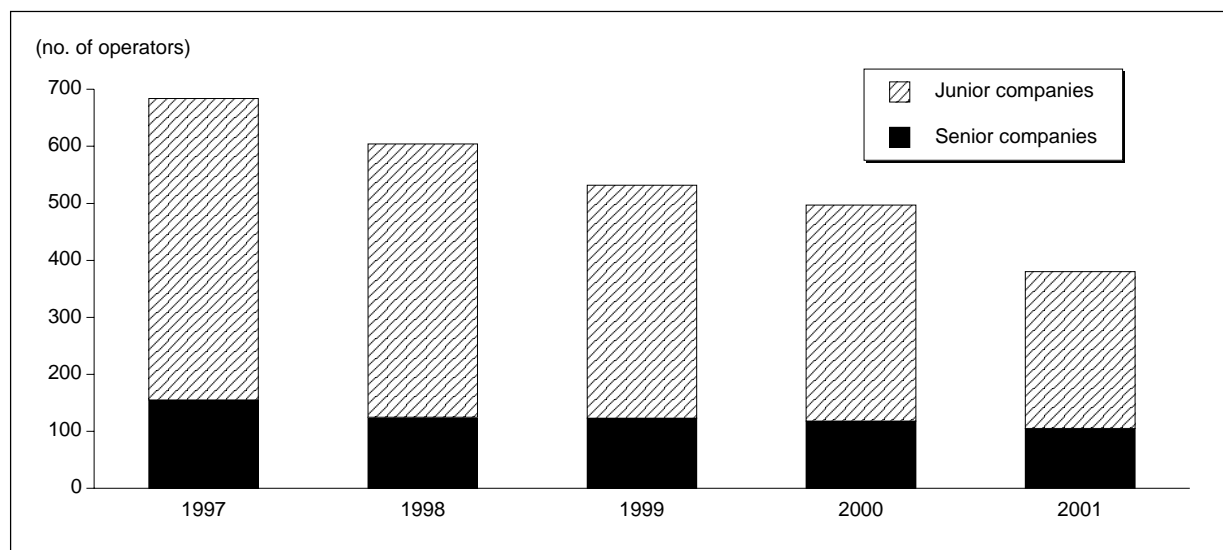
1.3.1 2000 Exploration and Deposit Appraisal Expenditures

1.3.1.1 Statistical Summary

In 2000, 497 companies (project operators) and some prospectors spent \$473 million on mineral exploration and deposit appraisal in Canada (**Figure 1**). That number of companies represented a decrease of 7% from the 1999 total of 532 companies (expenditures of \$504 million) and a continuation of the downward trend observed in recent years. In 1997, there were 684 project operators, 27% (187 companies) more than in 2000. A total of 82 companies (compared to 72 in 1999) spent more than \$1 million each in 2000 (**Table 1**); these companies' expenditures accounted for 83% of the total expenditures for that year, the same proportion as that of the 72 companies in 1999.

Compared to 1999, spending decreases totaling \$63 million were recorded in eight provinces and territories (**Figure 2 and Table 2**). Major declines occurred in the Northwest Territories (33% of the \$63 million total decrease) and Québec (21% of the \$63 million). Spending increases totaling \$32 million were recorded in Nunavut, Manitoba, Ontario and New Brunswick. Nunavut experienced the largest increase with a \$25 million gain over the previous year.

Figure 1
Project Operators Active in Exploration and Deposit Appraisal in Canada, 1997-2001



Source: Natural Resources Canada, based on the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.
Notes: Data exclude prospectors. Data for 2000 are preliminary; 2001 data are based on company spending intentions as compiled in January 2001.

TABLE 1. EXPLORATION AND DEPOSIT APPRAISAL EXPENDITURES, BY RANGE OF EXPENDITURES¹ AND BY TYPE OF COMPANY, 2000 AND 2001

| Range of Expenditures | Junior | | | Senior | | | Total | | |
|--------------------------|-----------|--------------|----------------------------|-----------|--------------|----------------------------|-----------|--------------|---------------------|
| | Companies | Expenditures | Percentage of Total Junior | Companies | Expenditures | Percentage of Total Senior | Companies | Expenditures | Percentage of Total |
| (\$) | (number) | (\$000) | (%) | (number) | (\$000) | (%) | (number) | (\$000) | (%) |
| 2000 | | | | | | | | | |
| >10 million | 1 | 17 596 | 11.8 | 7 | 149 352 | 46.0 | 8 | 166 948 | 35.3 |
| 5 million-10 million | – | – | – | 13 | 92 943 | 28.6 | 13 | 92 943 | 19.6 |
| 1 million-5 million | 32 | 65 528 | 44.1 | 29 | 68 399 | 21.1 | 61 | 133 926 | 28.3 |
| 500 000-1 million | 39 | 25 767 | 17.3 | 9 | 6 128 | 1.9 | 48 | 31 895 | 6.7 |
| 200 000-500 000 | 73 | 23 470 | 15.8 | 17 | 4 938 | 1.5 | 90 | 28 408 | 6.0 |
| 100 000-200 000 | 55 | 7 348 | 4.9 | 14 | 1 889 | 0.6 | 69 | 9 237 | 2.0 |
| 50 000-100 000 | 48 | 3 188 | 2.1 | 13 | 879 | 0.3 | 61 | 4 068 | 0.9 |
| 0-50 000 | 131 | 2 162 | 1.5 | 16 | 232 | 0.1 | 147 | 2 394 | 0.5 |
| Subtotal | 379 | 145 058 | 97.6 | 118 | 324 760 | 100.0 | 497 | 469 819 | 99.3 |
| Prospectors ² | 32 | 3 549 | 2.4 | – | – | – | 32 | 3 549 | 0.7 |
| Total 2000 | 411 | 148 608 | 100.0 | 118 | 324 760 | 100.0 | 529 | 473 368 | 100.0 |
| 2001 | | | | | | | | | |
| >10 million | – | – | – | 8 | 144 853 | 49.7 | 8 | 114 853 | 31.6 |
| 5 million-10 million | 3 | 26 696 | 16.0 | 12 | 84 751 | 29.1 | 15 | 111 447 | 24.3 |
| 1 million-5 million | 39 | 82 822 | 49.7 | 23 | 46 926 | 16.1 | 62 | 129 748 | 28.3 |
| 500 000-1 million | 35 | 22 716 | 13.6 | 12 | 7 620 | 2.6 | 47 | 30 336 | 6.6 |
| 200 000-500 000 | 76 | 23 634 | 14.2 | 16 | 4 843 | 1.7 | 92 | 28 476 | 6.2 |
| 100 000-200 000 | 39 | 5 216 | 3.1 | 10 | 1 444 | 0.5 | 49 | 6 660 | 1.5 |
| 50 000-100 000 | 23 | 1 544 | 0.9 | 7 | 468 | 0.2 | 30 | 2 012 | 0.4 |
| 0-50 000 | 60 | 896 | 0.5 | 17 | 276 | 0.1 | 77 | 1 172 | 0.3 |
| Subtotal | 275 | 163 523 | 98.2 | 105 | 291 180 | 100.0 | 380 | 454 703 | 99.3 |
| Prospectors ² | 18 | 3 031 | 1.8 | – | – | – | 18 | 3 031 | 0.7 |
| Total 2001 | 293 | 166 554 | 100.0 | 105 | 291 180 | 100.0 | 398 | 457 734 | 100.0 |

Source: Natural Resources Canada, based on the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Expenditures.

– Nil.

¹ On-mine-site plus off-mine-site; includes field work and overhead costs plus engineering, economic and feasibility studies, environment and land access costs. ² Data for prospectors are incomplete.

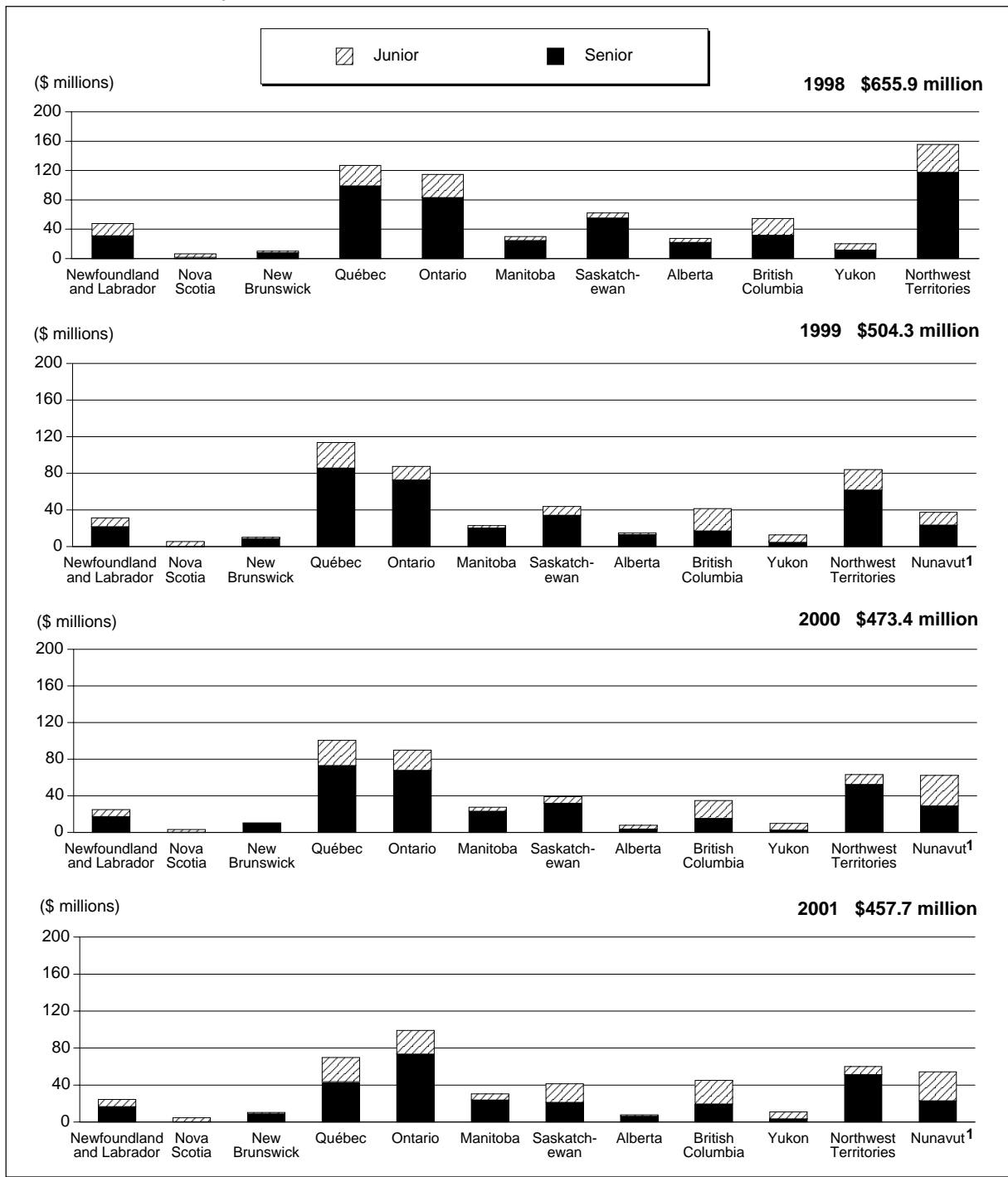
Notes: Data for 2000 are preliminary estimates; 2001 data are based on company spending intentions as compiled in January 2001. Numbers may not add to totals due to rounding.

The largest year-to-year decreases in expenditures (in terms of percentages) were experienced by Alberta (-47%) and Nova Scotia (-40%). In terms of year-to-year increases, Nunavut (+67%) and Manitoba (+20%) recorded the largest percentage gains. In decreasing order of amounts spent on exploration and deposit appraisal, Québec, Ontario, the Northwest Territories and Nunavut accounted for 67% of all such expenditures in Canada in 2000.

Expenditures for off-mine-site exploration and deposit appraisal activity decreased by 6% from the 1999 level of \$418 million (**Figure 3**). From 1997 to 2000, this type of spending decreased by 48%. Overall, \$391 million, or 83% of all exploration and deposit appraisal expenditures in 2000, was for off-mine-site activity. Québec ranked first in off-mine-site spending with 17% of the total for that category, followed closely by the Northwest Territories (16%), Nunavut (16%) and Ontario (15%) (**Figure 4**).

On-mine-site exploration and deposit appraisal expenditures also decreased by about 6% to \$82 million in 2000 from the 1999 level of \$87 million. They accounted for 35% of the exploration and deposit appraisal spending recorded in Québec and for 33% in Ontario. A total of \$65 million was spent for on-mine-site exploration and deposit appraisal activities in those two provinces alone.

Figure 2
Exploration and Deposit Appraisal Expenditures in Canada by Junior and Senior Companies, by Province and Territory, 1998-2001



Sources: Natural Resources Canada and Statistics Canada, based on the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.

¹The territory of Nunavut was created in April 1999 by dividing the former Northwest Territories into two distinct territories: Nunavut and the Northwest Territories.

Notes: Exploration and deposit appraisal activities include only the search for and appraisal of new deposits; they do not include work for extensions of deposits already being mined or committed to production. Exploration and deposit appraisal expenditures include off-mine-site and on-mine-site costs incurred for field work and overhead plus engineering, economic and feasibility studies, environment and land access costs. Data for 2000 are preliminary; 2001 data are company spending intentions as compiled in January 2001.

TABLE 2. EXPLORATION AND DEPOSIT APPRAISAL EXPENDITURES IN CANADA, BY PROVINCE AND TERRITORY, 1998-2001

| Province/Territory | 1998 | | 1999 | | 2000 ^p | | 2001 ^f | |
|---------------------------|------------------|------------------------------|------------------|------------------------------|-------------------|------------------------------|-------------------|------------------------------|
| | Expenditures | Percentage of Canadian Total | Expenditures | Percentage of Canadian Total | Expenditures | Percentage of Canadian Total | Expenditures | Percentage of Canadian Total |
| | (\$000) | (%) | (\$000) | (%) | (\$000) | (%) | (\$000) | (%) |
| Newfoundland and Labrador | 47 855.2 | 7.3 | 31 304.8 | 6.2 | 24 932.4 | 5.3 | 24 489.0 | 5.4 |
| Nova Scotia | 6 471.2 | 1.0 | 5 258.1 | 1.0 | 3 137.6 | 0.7 | 4 581.7 | 1.0 |
| New Brunswick | 10 111.4 | 1.5 | 10 112.7 | 2.0 | 10 431.4 | 2.2 | 10 292.0 | 2.2 |
| Québec | 127 072.2 | 19.4 | 113 547.0 | 22.5 | 100 567.0 | 21.2 | 69 603.0 | 15.2 |
| Ontario | 114 820.4 | 17.5 | 87 393.3 | 17.3 | 89 709.1 | 19.0 | 99 044.5 | 21.6 |
| Manitoba | 29 852.2 | 4.6 | 22 847.0 | 4.5 | 27 445.1 | 5.8 | 30 457.0 | 6.7 |
| Saskatchewan | 62 071.0 | 9.5 | 43 573.0 | 8.6 | 39 151.9 | 8.3 | 41 237.5 | 9.0 |
| Alberta | 27 465.5 | 4.2 | 14 738.8 | 2.9 | 7 799.5 | 1.6 | 7 849.5 | 1.7 |
| British Columbia | 54 515.1 | 8.3 | 41 310.2 | 8.2 | 34 829.4 | 7.4 | 45 126.0 | 9.9 |
| Yukon | 20 075.1 | 3.1 | 12 743.6 | 2.5 | 9 820.7 | 2.1 | 10 744.0 | 2.3 |
| Northwest Territories | 155 621.6 | 23.7 | 84 122.5 | 16.7 | 63 142.9 | 13.3 | 60 116.4 | 13.1 |
| Nunavut ¹ | n.a. | n.a. | 37 396.7 | 7.4 | 62 401.1 | 13.2 | 54 193.9 | 11.8 |
| Total | 655 931.0 | 100.0 | 504 347.7 | 100.0 | 473 368.1 | 100.0 | 457 734.5 | 100.0 |

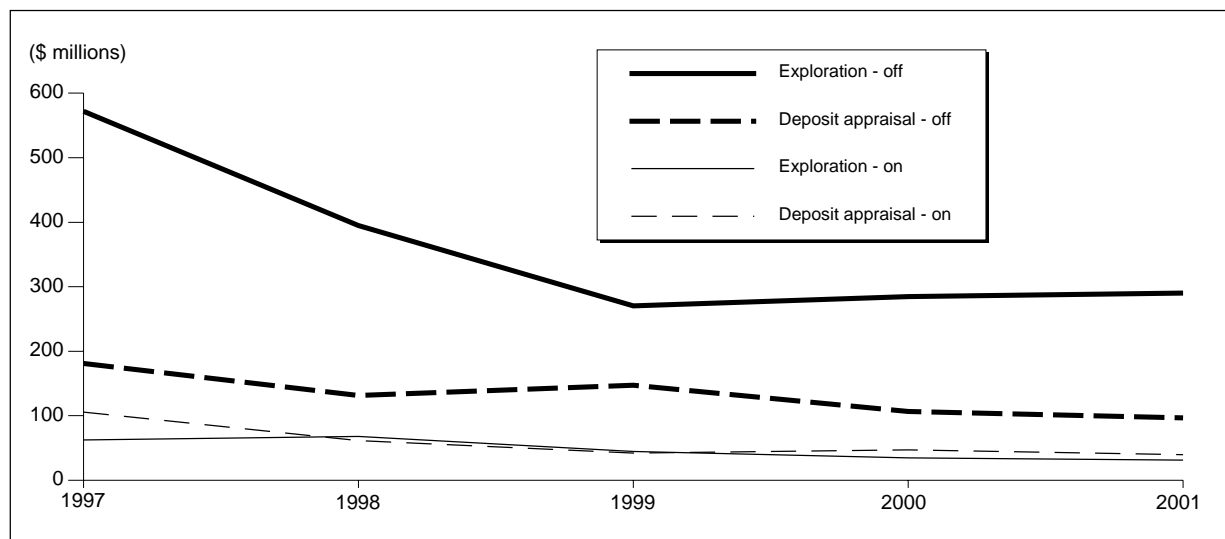
Source: Natural Resources Canada, based on the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.

^f Forecast; n.a. Not applicable; ^p Preliminary.

¹ The territory of Nunavut was created in April 1999 by dividing the former Northwest Territories into two distinct territories: Nunavut and the Northwest Territories.

Notes: Data for 2000 are preliminary estimates; 2001 data are spending intentions as compiled in January 2001. Exploration and deposit appraisal expenditures include off-mine-site and on-mine-site costs incurred for field work and overhead plus engineering, economic and feasibility studies, environment and land access costs. Numbers may not add to totals due to rounding.

Figure 3
On-Mine-Site and Off-Mine-Site Exploration and Deposit Appraisal Expenditures¹ in Canada, 1997-2001

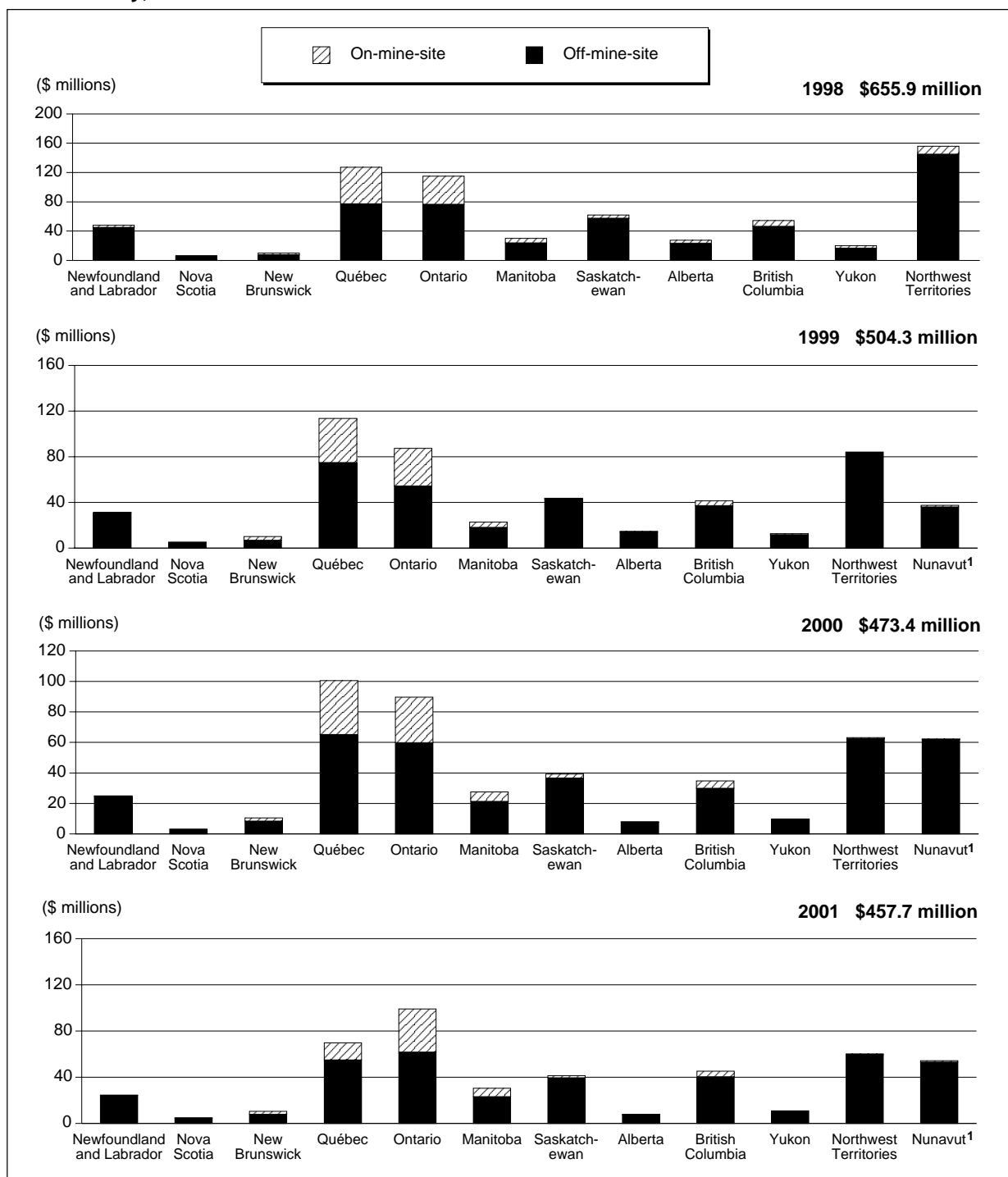


Source: Natural Resources Canada, from the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.

¹ On-mine site and off-mine-site exploration and deposit appraisal expenditures include field work and overhead costs plus engineering, economic and feasibility studies, environment and land access costs.

Note: Data for 2000 are preliminary; 2001 data are company spending intentions as compiled in January 2001.

Figure 4
On-Mine-Site and Off-Mine-Site Exploration and Deposit Appraisal Expenditures, by Province and Territory, 1998-2001



Source: Natural Resources Canada, based on the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.

¹ The territory of Nunavut was created in April 1999 by dividing the former Northwest Territories into two distinct territories: Nunavut and the Northwest Territories.

Notes: Exploration and deposit appraisal activities include only the search for and appraisal of new deposits; they do not include work for extensions of deposits already being mined or committed to production. Exploration and deposit appraisal expenditures include off-mine-site and on-mine-site costs incurred for field work and overhead plus engineering, economic and feasibility studies, environment and land access costs. Data for 2000 are preliminary; 2001 data are company spending intentions as compiled in January 2001.

1.3.1.1.1 SPENDING BY WORK PHASE

Because of the redesigned survey, it is now possible to follow separately and compare the trends between the exploration phase and the deposit appraisal phase (Figure 5).

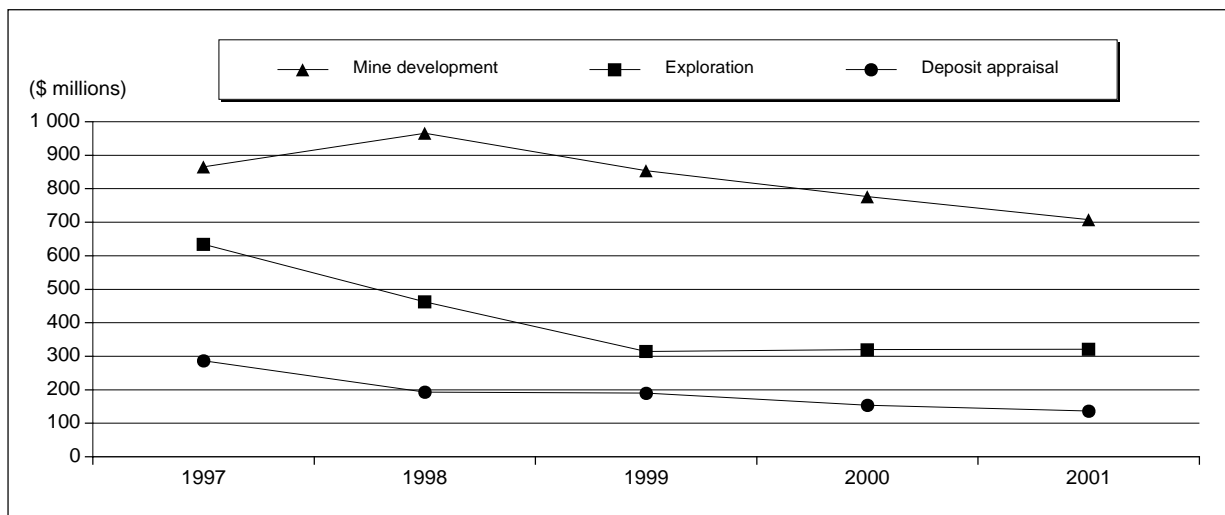
In 2000, exploration expenditures amounted to \$320 million (68% of total exploration and deposit appraisal spending) and deposit appraisal stood at \$154 million (32% of total spending). In 1999, spending on the exploration phase had amounted to \$315 million while a total of \$190 million was spent on deposit appraisal, representing an increase of 2% and a decrease of 19%, respectively.

Off-mine-site spending of \$285 million represented 89% of spending in the exploration phase in 2000, slightly more than the 86% recorded in 1999 when \$270 million was spent for off-mine-site exploration. Combined off-mine-site and on-mine-site exploration activities for 1999 had amounted to \$315 million (Figure 3). In terms of deposit appraisal expenditures, approximately 69% of the \$154 million recorded for off- and on-mine-site deposit appraisal activities in 2000 was reported as off-mine-site spending.

A provincial/territorial breakdown of exploration and deposit appraisal expenditures reveals that 100% of total 2000 spending was reported as exploration work in Alberta (Figure 6). The Yukon (96%), Nova Scotia (91%), Manitoba (85%), New Brunswick (81%) and British Columbia (81%) also recorded high proportions of exploration-related work. That number fell to between 71% and 59% in Newfoundland and Labrador, Nunavut, Québec, Ontario and Saskatchewan (in decreasing order).

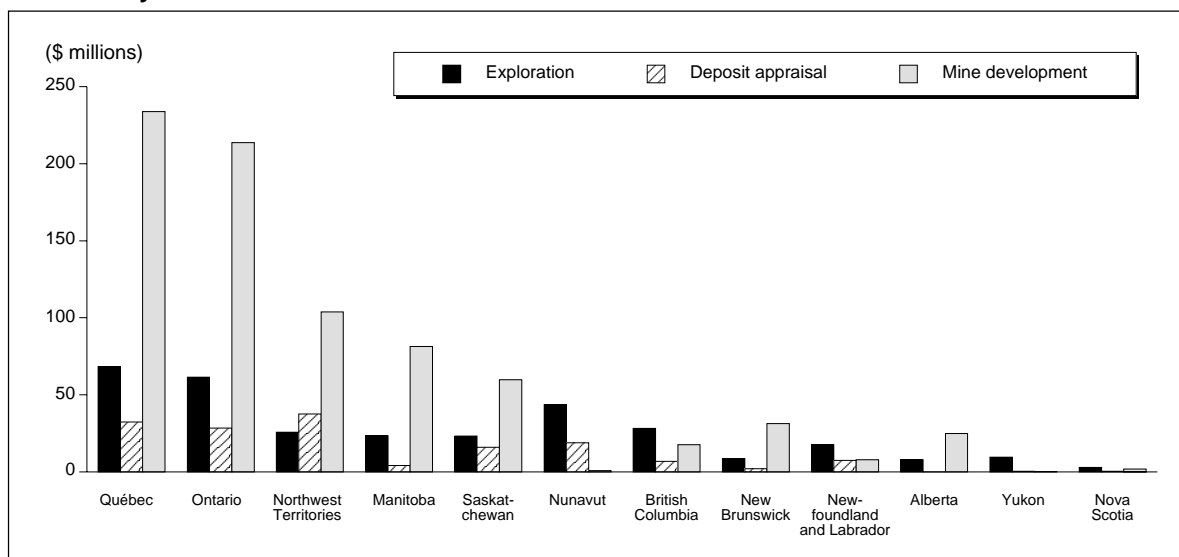
The advanced stage of some diamond projects in the Northwest Territories continues to be reflected by the high proportion of deposit appraisal spending in that territory. In 2000, 59% (\$38 million) of all exploration and deposit appraisal expenditures in the Northwest Territories was incurred for deposit appraisal activities.

Figure 5
Mineral Exploration, Deposit Appraisal and Mine Development Expenditures in Canada, 1997-2001



Source: Natural Resources Canada, based on the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.
 Notes: Exploration and deposit appraisal activities include only the search for and appraisal of new deposits; they do not include work for extensions of deposits already being mined or committed to production. Exploration and deposit appraisal expenditures include off-mine-site and on-mine-site costs incurred for field work and overhead plus engineering, economic and feasibility studies, environment and land access costs. Mine development expenditures include costs incurred to gain access to ore or to increase ore reserves at properties in production or already committed to production. They do not include investments for structures, machinery and equipment. Data for 2000 are preliminary; 2001 data are company spending intentions as compiled in January 2001.

Figure 6
Exploration, Deposit Appraisal and Mine Development Expenditures, by Province and Territory, Preliminary 2000



Source: Natural Resources Canada, based on the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.

Notes: Exploration and deposit appraisal activities include only the search for and appraisal of new deposits; they do not include work for extensions of deposits already being mined or committed to production. Exploration and deposit appraisal expenditures include off-mine-site and on-mine-site costs incurred for field work and overhead plus engineering, economic and feasibility studies, environment and land access costs. Mine development expenditures include costs incurred to gain access to ore or to increase ore reserves at properties in production or already committed to production. They do not include investments for structures, machinery and equipment. Data for 2000 are preliminary.

In terms of ranking by total exploration expenditures, Québec placed first followed by Ontario and Nunavut. For deposit appraisal spending, the Northwest Territories ranked first followed by Québec and Ontario.

1.3.1.1.2 SPENDING CATEGORIES BY TYPE OF ACTIVITY

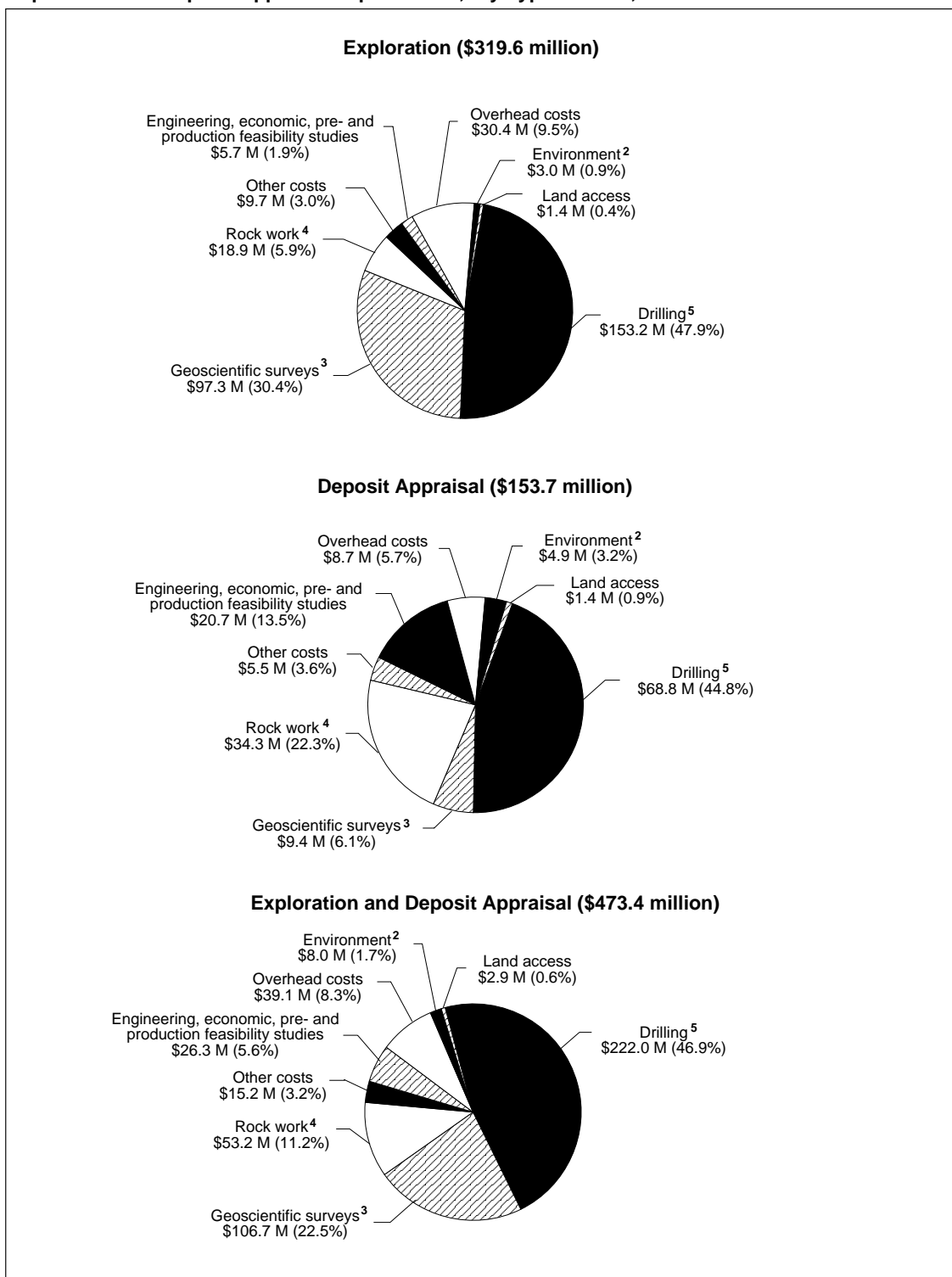
A detailed cost breakdown for each of the exploration and deposit appraisal phases shows clearly that drilling is the most important cost component in the discovery and delineation of a mineral deposit (**Figure 7**). In 2000, drilling (diamond drilling and other types of drilling) accounted for 48% (\$153 million) of the \$320 million spent in the exploration phase. Geoscientific surveys (geology, geochemistry and geophysics) represented the second most important type of expenditures for that work phase with 30% (\$97 million) of total exploration spending.

In the deposit appraisal phase, drilling accounted for 45% (\$69 million) of the total \$154 million spent while rock work (which includes costs incurred for shaft work, drifts, cross-cuts, raises, declines, rock sampling and dewatering) and the preparation of engineering, economic and feasibility studies were second and third, respectively, with 22% (\$34 million) and 14% (\$21 million) of total deposit appraisal spending.

Overall, drilling accounted for 47% (\$222 million) of all exploration and deposit appraisal spending in 2000 while geoscientific surveys with 23% (\$107 million) and rock work with 11% (\$53 million) ranked second and third.

As indicated earlier, the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development allows the tracking of exploration and deposit appraisal expenditures that are dedicated to categories of spending other than the traditional field work and overhead ones. As such, it is also possible to follow the spending evolution of other costs such as those related to the environment and land access.

Figure 7
Exploration and Deposit Appraisal Expenditures,¹ by Type of Work, 2000



Source: Natural Resources Canada, based on the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.
¹ Includes on-mine-site and off-mine-site activities. ² Environment includes characterization, permitting, protection, monitoring and restoration. ³ Geoscientific surveys include geology, geochemistry, ground geophysics and airborne 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. Data for 2000 are preliminary estimates.

TABLE 3a. EXPLORATION, DEPOSIT APPRAISAL AND MINE COMPLEX DEVELOPMENT EXPENDITURES,¹ 1998 AND 1999

| Expenditure Category | Exploration | | Deposit Appraisal | | Exploration Plus Deposit Appraisal | | Mine Complex Development | | Grand Total | |
|---------------------------------------------------------------------|-------------|---------|-------------------|---------|---------------------------------------|---------|--------------------------|-----------|-------------|-----------|
| | 1998 | 1999 | 1998 | 1999 | 1998 | 1999 | 1998 | 1999 | 1998 | 1999 |
| | (\$000) | | | | | | | | | |
| Field work and overhead ² | 445 055 | 303 963 | 130 865 | 133 889 | 575 920 | 437 852 | 932 290 | 796 957 | 1 508 209 | 1 234 809 |
| Engineering, economic and pre- or production feasibility studies | 4 851 | 6 249 | 39 773 | 34 568 | 44 624 | 40 817 | 19 031 | 24 477 | 63 655 | 65 294 |
| Environment | 11 294 | 2 744 | 20 373 | 15 782 | 31 667 | 18 526 | 9 958 | 31 297 | 41 625 | 49 823 |
| Land access | 1 605 | 1 703 | 2 115 | 5 449 | 3 720 | 7 152 | 4 783 | 1 428 | 8 503 | 8 580 |
| Subtotal | 462 805 | 314 660 | 193 126 | 189 688 | 655 931 | 504 348 | 966 061 | 854 160 | 1 621 992 | 1 358 508 |
| Off-mine-site ³ | 394 929 | 269 997 | 131 591 | 147 386 | 526 520 | 417 384 | n.a. | n.a. | 526 520 | 417 384 |
| On-mine-site ³ | 67 875 | 44 662 | 61 535 | 42 302 | 129 411 | 86 964 | 966 061 | 854 160 | 1 095 472 | 941 124 |
| Capital ⁴ | 9 697 | 4 929 | 25 103 | 29 107 | 34 800 | 34 035 | 1 226 347 | 840 541 | 1 261 147 | 874 576 |
| \$ for environmental protection and restoration ⁵ | 157 | – | 144 | 889 | 301 | 889 | 23 783 | 25 570 | 24 084 | 26 459 |
| Total | 472 501 | 319 589 | 218 230 | 218 795 | 690 731 | 538 383 | 2 192 409 | 1 694 701 | 2 883 139 | 2 233 084 |
| Repair and maintenance ⁴ | 4 838 | 4 835 | 17 995 | 16 564 | 22 832 | 21 399 | 1 671 588 | 1 269 740 | 1 694 420 | 1 291 139 |
| \$ for environmental protection and restoration ⁵ | 390 | 5 | 1 120 | 5 | 1 510 | 10 | 103 765 | 35 048 | 105 276 | 35 058 |
| Grand total | 477 339 | 324 423 | 236 224 | 235 359 | 713 563 | 559 782 | 3 863 997 | 2 964 441 | 4 577 560 | 3 524 223 |
| Total environment | 11 841 | 2 749 | 21 638 | 16 676 | 33 479 | 19 425 | 137 506 | 91 915 | 170 985 | 111 340 |
| Environment as a percentage of grand total | 2.5 | 0.85 | 9.2 | 7.09 | 4.7 | 3.47 | 3.6 | 3.10 | 3.7 | 3.16 |

Sources: Natural Resources Canada and Statistics Canada, based on the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.
– Nil; n.a. Not applicable.

¹ Includes 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 property taxes, and project-related head office expenditures. ³ Amount of exploration and deposit appraisal expenditures dedicated to off-mine-site and on-mine-site activities. ⁴ Includes construction, and machinery and equipment expenditures. ⁵ As part of capital expenditures or repair and maintenance expenditures. Note: Numbers may not add to totals due to rounding.

TABLE 3b. EXPLORATION, DEPOSIT APPRAISAL AND MINE COMPLEX DEVELOPMENT EXPENDITURES,¹ 2000 AND 2001

| Expenditure Category | Exploration | | Deposit Appraisal | | Exploration Plus Deposit Appraisal | | Mine Complex Development | | Grand Total | |
|---------------------------------------------------------------------|-------------|---------|-------------------|---------|---------------------------------------|---------|--------------------------|-----------|-------------|-----------|
| | 2000 | 2001 | 2000 | 2001 | 2000 | 2001 | 2000 | 2001 | 2000 | 2001 |
| | (\$000) | | | | | | | | | |
| Field work and overhead ² | 309 465 | 312 136 | 126 744 | 107 758 | 436 209 | 419 894 | 711 721 | 659 430 | 1 147 930 | 1 079 325 |
| Engineering, economic and pre- or production feasibility studies | 5 656 | 4 753 | 20 680 | 20 941 | 26 336 | 25 693 | 41 120 | 31 487 | 67 456 | 57 181 |
| Environment | 3 055 | 2 821 | 4 910 | 5 862 | 7 965 | 8 682 | 13 589 | 16 196 | 21 554 | 24 878 |
| Land access | 1 414 | 1 628 | 1 444 | 1 837 | 2 858 | 3 465 | 9 964 | 847 | 12 823 | 4 311 |
| Subtotal | 319 590 | 321 338 | 153 778 | 136 397 | 473 368 | 457 734 | 776 394 | 707 960 | 1 249 762 | 1 165 695 |
| Off-mine-site ³ | 284 891 | 289 965 | 106 534 | 96 814 | 391 425 | 386 778 | n.a. | n.a. | 391 425 | 386 778 |
| On-mine-site ³ | 34 699 | 31 373 | 47 244 | 39 583 | 81 943 | 70 956 | 776 394 | 707 960 | 858 337 | 778 916 |
| Capital ⁴ | 1 418 | 2 093 | 20 688 | 33 810 | 22 106 | 35 903 | 1 124 740 | 1 439 510 | 1 146 846 | 1 475 414 |
| \$ for environmental protection and restoration ⁵ | 383 | 293 | 812 | 1 020 | 1 195 | 1 313 | 50 455 | 49 649 | 51 650 | 50 962 |
| Repair and maintenance ⁴ | 3 377 | 381 | 7 719 | 5 877 | 11 096 | 6 258 | 1 192 727 | 1 145 760 | 1 203 823 | 1 152 018 |
| \$ for environmental protection and restoration ⁵ | 29 | 51 | 2 068 | 3 830 | 2 097 | 3 881 | 62 079 | 65 486 | 64 177 | 69 367 |
| Subtotal | 4 795 | 2 474 | 28 407 | 39 687 | 33 202 | 42 162 | 2 317 467 | 2 585 270 | 2 350 669 | 2 627 432 |
| Grand total | 324 385 | 323 812 | 182 185 | 176 084 | 506 570 | 499 896 | 3 093 861 | 3 293 230 | 3 600 432 | 3 793 126 |
| Total environment | 3 467 | 3 164 | 7 790 | 10 711 | 11 257 | 13 876 | 126 123 | 131 331 | 137 380 | 145 207 |
| Environment as a percentage of grand total | 1.07 | 0.98 | 4.28 | 6.08 | 2.22 | 2.78 | 4.08 | 3.99 | 3.82 | 3.83 |

Sources: Natural Resources Canada and Statistics Canada, from the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Expenditures.
n.a. Not applicable.

¹ Includes 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 property taxes, and project-related head office expenditures. ³ Amount of exploration and deposit appraisal expenditures dedicated to off-mine-site and on-mine-site activities. ⁴ Includes construction, and machinery and equipment expenditures. ⁵ As part of capital expenditures or repair and maintenance expenditures. Notes: Numbers may not add to totals due to rounding. Data for 2000 are preliminary estimates; 2001 data are company spending intentions as compiled in January 2001.

TABLE 4. SUMMARY OF EXPENDITURES NOT PREVIOUSLY RECORDED, 1997-2001

| Expenditure Category | 1997 | 1998 | 1999 | 2000 | 2001 |
|------------------------------------------------------------------|-------|-------|-------|-------|-------|
| (\$ millions) | | | | | |
| EXPLORATION PLUS DEPOSIT APPRAISAL | | | | | |
| Environment | 47.3 | 31.7 | 18.5 | 8.0 | 8.7 |
| Engineering, economic and pre- or production feasibility studies | 47.9 | 44.6 | 40.8 | 26.3 | 25.7 |
| Land access | 5.6 | 3.7 | 7.2 | 2.9 | 3.5 |
| Subtotal | 100.8 | 80.0 | 66.5 | 37.2 | 37.8 |
| Capital | 173.2 | 34.8 | 34.0 | 22.1 | 35.9 |
| Repair and maintenance | 55.9 | 22.8 | 21.4 | 11.1 | 6.3 |
| Total | 329.9 | 137.6 | 121.9 | 70.4 | 80.0 |
| MINE COMPLEX DEVELOPMENT | | | | | |
| Environment | 12.2 | 10.0 | 31.3 | 13.6 | 16.2 |
| Engineering, economic and pre- or production feasibility studies | 17.0 | 19.0 | 24.5 | 41.1 | 31.5 |
| Land access | 2.3 | 4.8 | 1.4 | 10.0 | 0.8 |
| Total | 31.5 | 33.8 | 57.2 | 64.7 | 48.5 |
| Grand total | 361.3 | 171.4 | 179.1 | 135.0 | 128.5 |
| % of total investment | 6.4 | 3.7 | 5.1 | 3.8 | 3.4 |

Source: Natural Resources Canada, based on the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.

Notes: Numbers may not add to totals due to rounding. Data for 2000 are preliminary estimates; data for 2001 are company spending intentions as compiled in January 2001.

In 1998, a total of \$32 million was recorded as environment-related expenditures (which include costs incurred for characterization, permitting, protection, monitoring and restoration), or 5% of all exploration and deposit appraisal expenditures for that year (**Tables 3a and 4**). This percentage declined to 4% in 1999 when \$19 million, out of total exploration and deposit appraisal expenditures of \$504 million, was spent on environment-related items. Thus, in dollar terms, environment-related spending dropped by \$13 million (41%) between 1998 and 1999. Most of that decrease is attributable to a drop in environment-related spending in on-mine-site exploration activities.

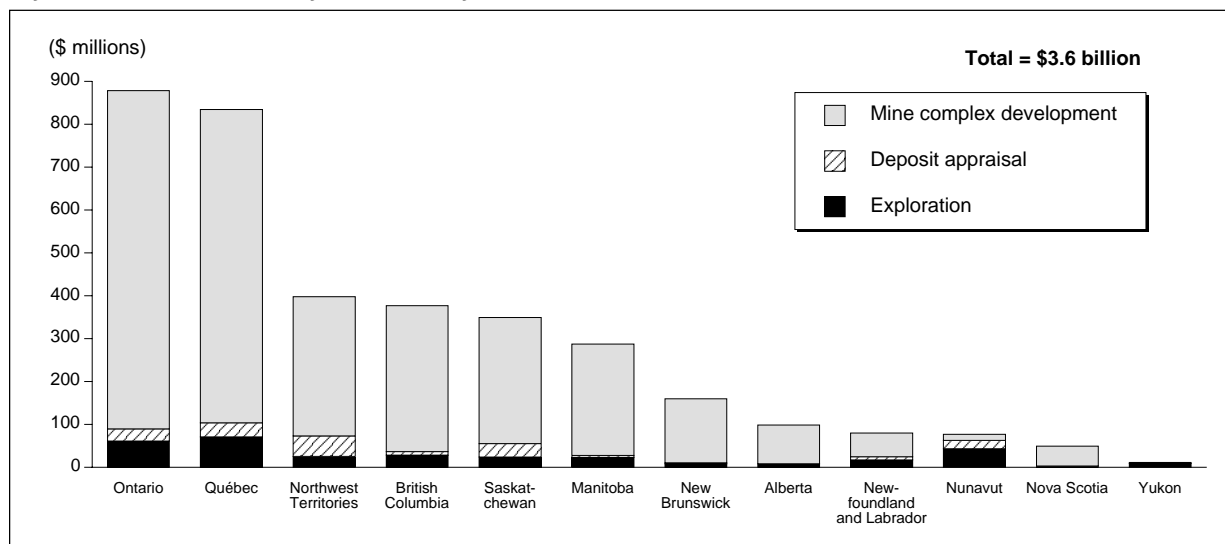
The decline in environment-related exploration and deposit appraisal expenditures continued in 2000 when only \$8 million was accounted for by that category of spending (**Table 3b**). This amount represented a drop of 58% from the 1999 level and a decline of 83% when compared to the 1997 total of \$47 million. Most of the decline recorded in 2000 can be attributed to reduced environmental spending at the deposit appraisal stage.

Usually, land access costs (which include costs incurred for impact benefit and socio-economic agreements, rights of way, damages and permits) only account for a small fraction of total exploration and deposit appraisal expenditures (0.6% in 1998, 1.4% in 1999 and 0.6% in 2000). However, expenditures for economic, engineering and feasibility studies are more significant. In aggregate, these costs represented 8% (\$41 million) of total exploration and deposit appraisal expenditures in 1999 compared to 7% (\$45 million) in 1998. For 2000, the costs associated with economic, engineering and feasibility studies amounted to 6% (\$26 million) of total exploration and deposit appraisal expenditures.

1.3.1.1.3 TOTAL MINERAL DEVELOPMENT INVESTMENT

The total mineral development cycle, as defined by the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures, consists of the exploration and

Figure 8
Total Investment for Exploration, Deposit Appraisal and Mine Complex Development Expenditures, by Province and Territory, Preliminary 2000



Source: Natural Resources Canada, based on the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.

Notes: Exploration, deposit appraisal and mine complex development expenditures include costs incurred off- and on-mine-site for field work; engineering, economic and feasibility studies; overhead; the environment; land access; structures, machinery and equipment; and repairs. Data for 2000 are preliminary.

deposit appraisal phases plus mine development and mine complex development activities. Mine development activities include work to outline, block out and gain access to ore or to increase ore reserves at properties in production or committed to production. These activities are a subset of mine complex development expenditures, which also include investments for structures, machinery and equipment, at a mine in production or committed to production.

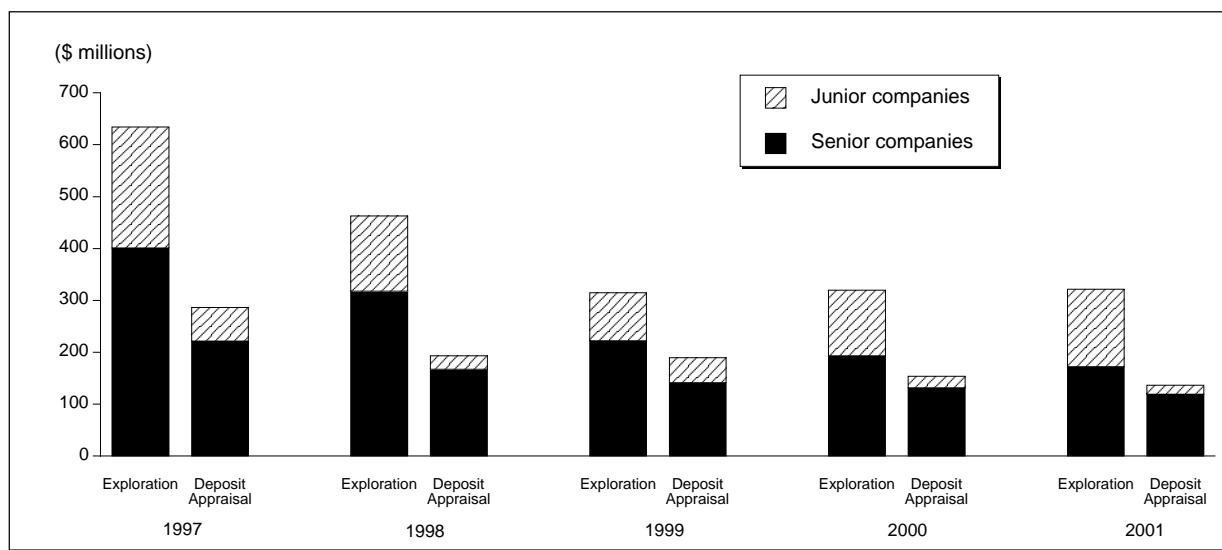
Mine development spending totaled \$776 million in 2000 and most of these expenditures (58%) occurred in Québec and Ontario (**Figure 6**). When adding all project work phases (exploration, deposit appraisal and mine development), and including all capital and repair costs associated with these three phases and with construction, machinery and equipment for mine complex development, mineral development investment totaled \$3.6 billion in 2000 (**Figure 8**), an amount slightly higher than the \$3.5 billion recorded in 1999. In decreasing order of expenditures, Ontario and Québec were responsible for 48% of all mineral development investment in Canada for 2000.

1.3.1.2 Spending by Type of Company

The analyses within this report often distinguish between senior and junior companies. In general terms, a senior company derives its income from mining or other business ventures and can direct part of that income towards its exploration and deposit appraisal projects. Junior companies, on the other hand, usually have no regular source of income and must finance their projects through the issuance of shares.

In 2000, 118 senior project operators accounted for 69% (\$325 million) of all exploration and deposit appraisal expenditures (**Figures 1 and 2**). About 59% of total senior spending was allocated to exploration activities with the remaining 41% going to deposit appraisal work (**Figure 9**). The number of senior project operators and their proportion of total spending were slightly higher in 1999 when 123 senior project operators reported 72% (\$363 million) of total spending. The lower spending in 2000 by almost the same number of senior project operators is primarily explained by the drop in the number of operators spending more than \$10 million. In

Figure 9
Exploration and Deposit Appraisal Expenditures, by Type of Company, 1997-2001



Source: Natural Resources Canada, based on the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.
 Notes: Exploration and deposit appraisal expenditures include off- and on-mine site field and overhead expenditures plus engineering, economic and feasibility studies, environment and land access costs. Data for 2000 are preliminary; 2001 data are company spending intentions as compiled in January 2001.

1999, 10 senior companies spent \$10 million or more for a total of \$191 million. In 2000, only 7 senior operators spent more than \$10 million and their total spending amounted to \$149 million (**Table 1**).

About 60% (\$193 million) of the expenditures reported by senior firms in 2000 were incurred in Québec, Ontario and the Northwest Territories (in decreasing order). Senior company expenditures exceeded 70% of total expenditures in each of New Brunswick, Manitoba, the Northwest Territories, Saskatchewan, Ontario and Québec (in decreasing order). They only amounted to 5% of total exploration and deposit appraisal spending in Nova Scotia and to 26% in the Yukon.

The number of junior project operators dropped to 379 in 2000, down by 7% from the 409 recorded in 1999 (**Figure 1** and **Table 1**). Prospectors are not counted in this total because only aggregated prospectors' expenditures are provided by provincial/territorial survey partners and because some provinces/territories do not survey prospectors. It is estimated that prospectors account for, at most, about 2% of total Canadian exploration and deposit appraisal expenditures.

Altogether, this lower number of junior companies and prospectors spent \$149 million on exploration and deposit appraisal in 2000, an increase in junior spending of 5% over 1999. This 5% increase is in contrast to the 11% decrease recorded by senior companies. Increases in junior spending occurred in Nunavut (+\$20 million), Ontario (+\$7 million), Alberta (+\$2 million) and Manitoba (+\$2 million) (**Figure 2**). The Northwest Territories and British Columbia experienced the largest decreases in junior spending with respective declines of \$12 million and \$5 million between 1999 and 2000. In decreasing order of expenditures, Nunavut, Québec and Ontario accounted for 56% of all junior expenditures in 2000.

With the exception of the large number of junior companies spending less than \$50 000, junior company spending in 2000 most frequently fell in the \$200 000-\$500 000 interval (**Table 1**). As for senior companies, the most commonly reported range of exploration and deposit appraisal expenditures was \$1 million-\$5 million.

1.3.1.3 Spending by Type of Commodity Sought

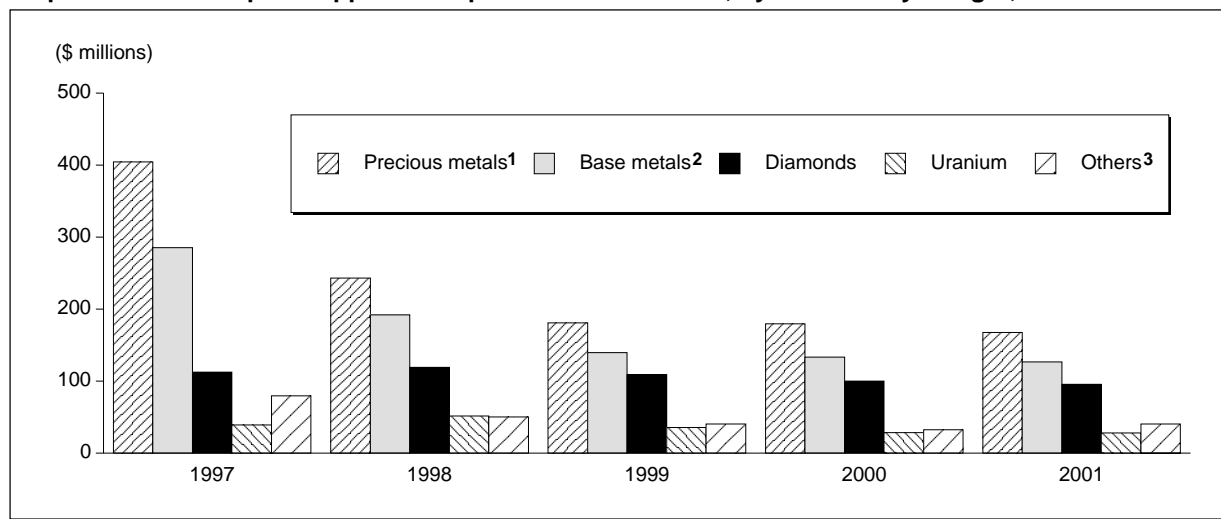
The redesigned survey provides a breakdown of exploration and deposit appraisal spending statistics by type of commodity sought. **Figure 10** shows such a breakdown for the groups of commodities or individual commodities most explored for in Canada: precious metals, base metals, diamonds, uranium and “others.”

Exploration and deposit appraisal spending for the two main commodity groups – precious metals (mostly gold) and base metals – declined significantly between 1997 and 2000. Precious-metal spending dropped from \$405 million in 1997 to \$179 million in 2000 while base-metal spending decreased from \$286 million to \$133 million over the same period. Low metal prices are mainly responsible for this downturn in precious- and base-metal exploration and deposit appraisal activity.

Diamonds are now firmly established as one of Canada’s most sought-after mineral commodities. After the initial flurry of exploration and deposit appraisal activities that resulted from earlier diamond discoveries, spending on the search for diamonds has accounted for roughly 20% of all expenditures since 1998. Diamond exploration and deposit appraisal activities took place across Canada again in 2000 with 315 properties being held for diamond exploration purposes, according to a July 2000 compilation (**Figure 11**). The Northwest Territories, Alberta, Saskatchewan, Ontario and Québec (in decreasing order) are the most common sites for diamond exploration and deposit appraisal activities in Canada.

In terms of expenditures, considerable sums (close to a total of \$1 billion since 1994) have been invested in diamond exploration and deposit appraisal activities in Canada. The total amount spent in 2000 was \$100 million, an 8% decrease from the 1999 total (**Figure 12**). During that

Figure 10
Exploration and Deposit Appraisal Expenditures in Canada, by Commodity Sought, 1997-2001

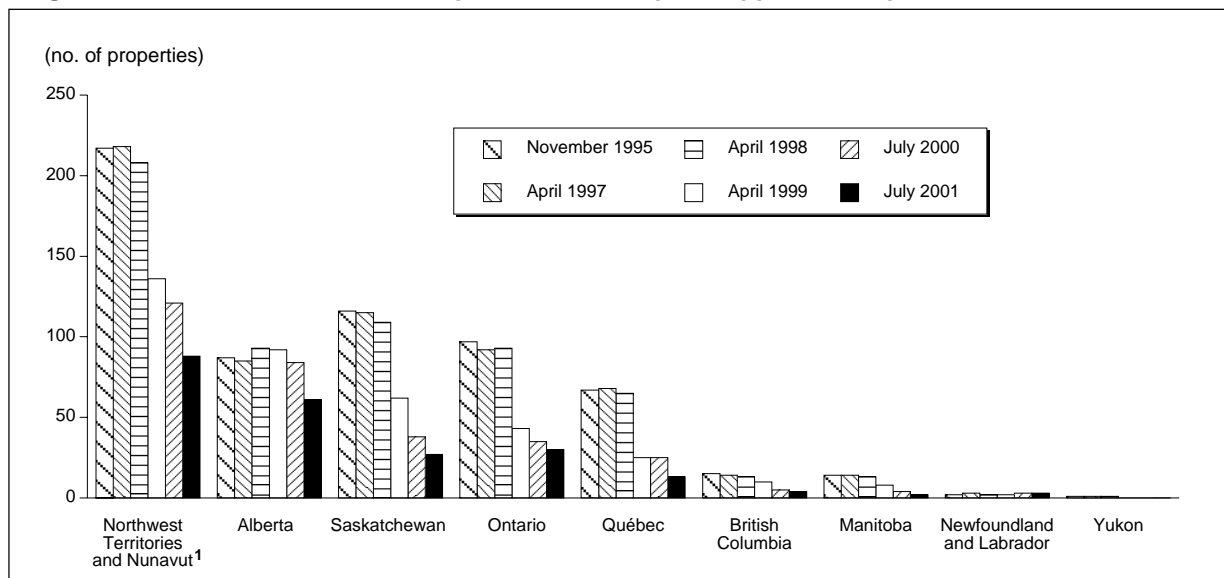


Source: Natural Resources Canada, based on the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.

¹ Includes gold, silver and platinum group metals. ² Includes copper, nickel, lead and zinc. ³ Includes ferrous metals, other metals, nonmetals (including coal), and "not specified."

Notes: Exploration and deposit appraisal expenditures include off- and on-mine-site field and overhead expenditures plus engineering, economic and feasibility studies, environment and land access costs. Data for 2000 are preliminary; 2001 data are company spending intentions as compiled in January 2001.

Figure 11
Regional Distribution of Diamond Exploration and Deposit Appraisal Properties, 1995-2001



Source: Natural Resources Canada, based on *MIN-MET CANADA* database for 1995-98 and InfoMine db for 1999-2001, Robertson Info-Data Inc., Vancouver, British Columbia, and used under licence.

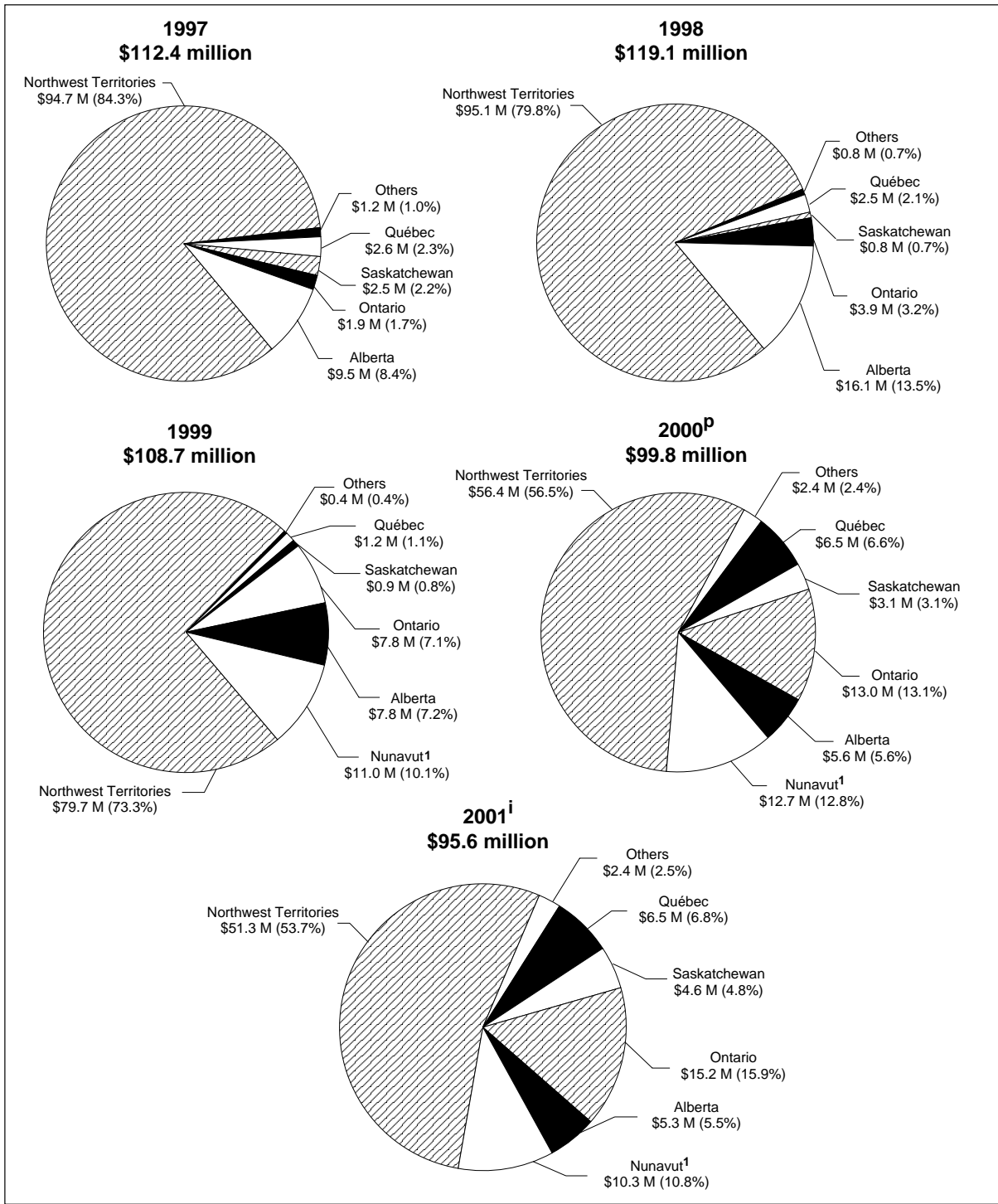
¹ In July 2001 (2000), there were 78 (112) diamond exploration properties in the Northwest Territories and 10 (9) in Nunavut, for a total of 88 (121) properties in the two territories.

year, the Northwest Territories was once again the recipient of most of the expenditures for the search for diamonds as \$56 million was spent in that territory, a decrease of 29% from the \$80 million spent in 1999. This decrease in spending is more indicative of a shift to more advanced development work than of a decrease in interest. Ontario (\$13 million), Nunavut (\$13 million) and Québec (\$7 million) were the other most popular Canadian jurisdictions for diamond exploration and deposit appraisal.

Table 5 combines information on both the types of companies conducting exploration and deposit appraisal activities and the types of commodities sought by these companies. In 2000, senior companies, as a whole, spent almost equal amounts on the search for precious metals and base metals with these two commodity groups accounting for almost 60% of their total spending. Diamonds (\$77 million) and uranium (\$25 million) also represented major exploration and deposit appraisal targets for senior companies.

As for junior companies, they showed a marked preference for precious-metals exploration with 46% (\$69 million) of their total 2000 exploration and deposit appraisal expenditures dedicated to the search for gold and platinum group metals (PGMs). Base-metals exploration was a distant second with \$35 million. Junior companies also spent \$24 million on the search for diamonds.

Figure 12
Diamond Exploration and Deposit Appraisal Expenditures in Canada, by Province and Territory,
1997-2001



Source: Natural Resources Canada, based on the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.

ⁱ Company spending intentions as compiled in January 2001; ^P Preliminary estimate.

¹ The territory of Nunavut was created in April 1999 by dividing the former Northwest Territories into two distinct territories: Nunavut and the Northwest Territories.

Notes: Exploration and deposit appraisal expenditures include off- and on-mine-site field and overhead expenditures plus engineering, economic and feasibility studies, environment and land access costs. "Others" includes Newfoundland and Labrador, British Columbia and Manitoba. Numbers may not add to totals due to rounding.

TABLE 5. EXPLORATION AND DEPOSIT APPRAISAL EXPENDITURES,¹ BY TYPE OF COMPANY AND MINERAL COMMODITY, 2000 AND 2001

| Type of Company | Metals | | | | | Nonmetals | Diamonds | Coal | Unspecified | Total |
|------------------|----------------|----------------|--------------|---------------|---------------|---------------|----------------|--------------|---------------|----------------|
| | Base | Precious | Iron | Uranium | Other | | | | | |
| (\$ 000) | | | | | | | | | | |
| 2000 | | | | | | | | | | |
| Junior companies | 34 505 | 68 510 | 77 | 3 117 | 8 838 | 6 454 | 23 542 | 180 | 3 384 | 148 607 |
| Senior companies | 95 322 | 97 732 | 578 | 25 175 | 9 507 | 5 482 | 76 707 | 1 446 | 12 811 | 324 760 |
| Total | 129 827 | 166 242 | 655 | 28 292 | 18 345 | 11 936 | 100 249 | 1 626 | 16 195 | 473 367 |
| 2001 | | | | | | | | | | |
| Junior companies | 44 259 | 63 930 | 38 | 9 082 | 8 164 | 7 685 | 29 340 | 2 056 | 2 000 | 166 554 |
| Senior companies | 80 118 | 86 771 | 2 333 | 18 579 | 9 651 | 4 987 | 69 996 | 7 679 | 11 066 | 291 180 |
| Total | 124 377 | 150 701 | 2 371 | 27 660 | 17 816 | 12 672 | 99 337 | 9 735 | 13 066 | 457 734 |

Source: Natural Resources Canada, based on the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.

¹ Exploration and deposit appraisal expenditures include off-mine-site and on-mine-site costs incurred for field work and overhead plus engineering, economic and feasibility studies, environment and land access costs.

Notes: Numbers may not add to totals due to rounding. Data for 2000 are preliminary; 2001 data are company spending intentions as compiled in January 2001.

1.3.2 2001 Exploration and Deposit Appraisal Expenditures

1.3.2.1 Statistical Summary

Company spending intentions, compiled in January 2001, reveal that 380 companies (project operators) and some prospectors intended to spend some \$458 million in 2001 on exploration and deposit appraisal in Canada (**Figures 1 and 2**). That number of companies represents a sizeable 24% decrease from the 2000 total of 497 companies (expenditures of \$473 million). A total of 85 companies (82 in 2000) each intended to spend more than \$1 million (**Table 1**). These 85 companies expected to spend a total of \$356 million, or 78% of total intended expenditures for 2001.

An analysis of the distribution of companies, according to how much they intended to spend in 2001, shows that the downward trend in the number of junior companies is expected to continue. A number of these companies became inactive on the exploration front due mainly to the ongoing weakness in metal prices and difficulties in raising exploration funds.

The difference between the 497 companies that reported their intention to spend in 2000 and the 380 companies that did so in 2001 is explained mostly by the drop of 121 companies (most of them juniors) in the last three spending intervals (70 companies in the \$0-\$50 000 range, 31 in the \$50 000-\$100 000 range and 20 in the \$100 000-\$200 000 range). While the combined loss, in dollar terms, of this lower number of smaller spenders was more than compensated for by the addition of two junior companies planning to spend more than \$5 million, for a total of 15 companies versus 13 in the \$5 million-\$10 million spending interval, these statistics continue to cause concern about Canada's grass-roots exploration capacity.

Based solely on spending levels, the fact that the 2001 forecast of \$458 million is still lower than the \$473 million total recorded in 2000 seems to indicate that the downward trend in exploration and deposit appraisal expenditures that had started in 1997 is continuing. However, as mentioned above, the 2001 forecast is based on company spending intentions compiled in January 2001 and companies may well have altered their spending plans since then. Nevertheless, at the time of writing this report, most metal prices remained weak and the world was faced with a new and rapidly evolving set of economic conditions brought about by the September 11, 2001, terrorist attacks in the United States. It remains to be seen whether exploration and deposit appraisal spending will continue on its downward trend, remain flat or increase in the near future.

Even before these events, many governments in Canada, including the federal government with its 15% Investment Tax Credit for Exploration, had recognized the difficult situation of the mineral exploration industry and introduced important tax incentives and programs. The availability of these various measures (some of these incentives and programs are described in Section 2) could help prevent further contraction of the industry and certainly provide an added impetus for a recovery should price levels start improving.

The former survey measure of field plus overhead costs provides further indication that traditional exploration and deposit appraisal activities remain fragile. As shown in **Table 21** (in Appendix 1), exploration and deposit appraisal spending (when considering only field and overhead costs) declined by a further 4% (\$16 million) from 2000 to 2001 after declining by 47% from 1997 to 2000. Hence, core spending in exploration and deposit appraisal is also on a downward trend.

Over 60% of the total all-inclusive intended exploration and deposit appraisal expenditures for 2001 were reported, in decreasing order, by Ontario, Québec, the Northwest Territories and Nunavut (**Figure 2** and **Table 2**). Increases in expenditures are expected in most provinces/territories but these increases will only amount to \$27 million. British Columbia (+\$10 million) and Ontario (+\$9 million) are expected to experience the largest increases compared to 2000. Together these two jurisdictions will account for 72% of the total \$27 million increase. As for those provinces/territories that will experience spending decreases (totaling \$43 million for a net loss of \$16 million) in 2001, Québec will lead the way with a \$31 million decline followed by the Northwest Territories with an expected decrease of \$8 million.

Company spending intentions indicate that off-mine-site exploration and deposit appraisal expenditures are expected to stay at about the same level as in the previous year with spending of \$387 million compared to \$391 million in 2000 (**Figure 3**). Québec and Nunavut will experience the most significant decreases (\$10 million and \$9 million, respectively) (**Figure 4**). An increase of approximately \$10 million is expected in British Columbia. Overall, off-mine-site spending should account for 84% of total exploration and deposit appraisal expenditures in 2001, a proportion similar to that of 2000. Ontario is expected to rank first in off-mine-site exploration and deposit appraisal activity with 16% (\$62 million) of the total spending intentions for that category, followed closely by the Northwest Territories (15%), Québec (14%) and Nunavut (14%).

On-mine-site exploration and deposit appraisal spending is expected to continue its downward trend with a further drop of 13% to reach \$71 million in 2001. These expenditures have dropped by 45% since 1998 and the decline is mostly explained by mining companies curtailing their exploration and deposit appraisal budgets in times of lower metal prices. This downward trend raises concerns about diminishing prospects for outlining and discovering additional reserves at existing mines.

The highest proportions of on-mine-site spending out of total exploration and deposit appraisal expenditures are expected to be recorded in Ontario (53%), Québec (21%) and Manitoba (10%). Québec is expected to account for almost all of the total on-mine-site spending decreases with a decline of \$21 million for that type of expenditure.

1.3.2.1.1 SPENDING BY WORK PHASE

For 2001, company spending intentions indicate that expenditures dedicated to exploration activities will remain at approximately the same level for the third year in a row. At \$321 million, 2001 exploration spending is only about \$2 million more than the 2000 total and about \$7 million more than in 1999. It is almost 50% lower than the 1997 total of \$634 million (**Figure 5**). The \$321 million to be spent on exploration in 2001 represents 70% of total intended exploration and deposit appraisal expenditures for that year. Of this \$321 million total, \$290 million (90%) will be incurred off mine sites (**Figure 3**). That single component

explains most of the drop in total exploration and deposit appraisal expenditures since 1997 when off-mine-site exploration expenditures amounted to \$572 million.

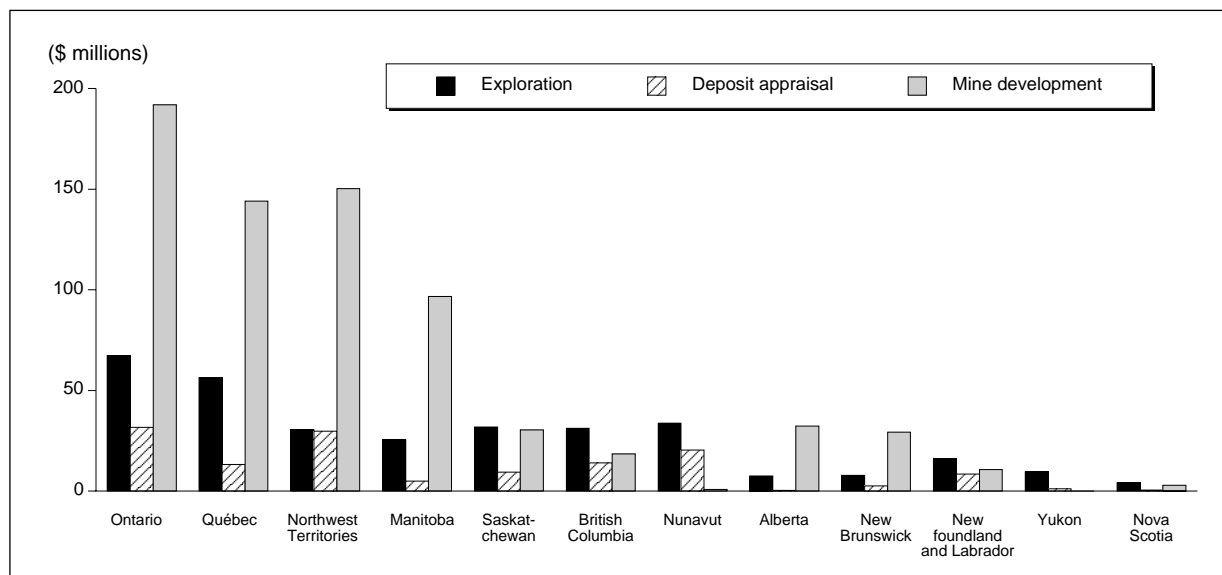
Deposit appraisal spending is expected to amount to \$136 million in 2001. This amount represents an 11% decrease from the 2000 level and reinforces the downward trend experienced in recent years for that category of expenditures. At 71% of total deposit appraisal spending, the proportion of off-mine-site deposit appraisal spending indicates that a higher percentage of appraisal work takes place on mine sites than is the case for the exploration phase.

On a provincial/territorial basis, exploration expenditures are expected to constitute 95% of the combined 2001 exploration and deposit appraisal expenditures in Alberta (**Figure 13**). The proportion of exploration work, out of total exploration and deposit appraisal spending, in other provinces/territories is expected to range between 90% and 80% in Nova Scotia, the Yukon, Manitoba and Québec and between 80% and 70% in Saskatchewan and New Brunswick. As in recent years, a high proportion of the spending (49%) in the Northwest Territories in 2001 will likely go to deposit appraisal activities at advanced diamond projects.

In terms of ranking by total exploration expenditures, Ontario is expected to rank first followed by Québec. Together, these two provinces should contribute about 38% of total Canadian exploration expenditures.

Ontario will take over from the Northwest Territories in terms of deposit appraisal spending in 2001 with forecast expenditures of \$32 million. The Northwest Territories (\$30 million) and Nunavut (\$20 million) will rank second and third.

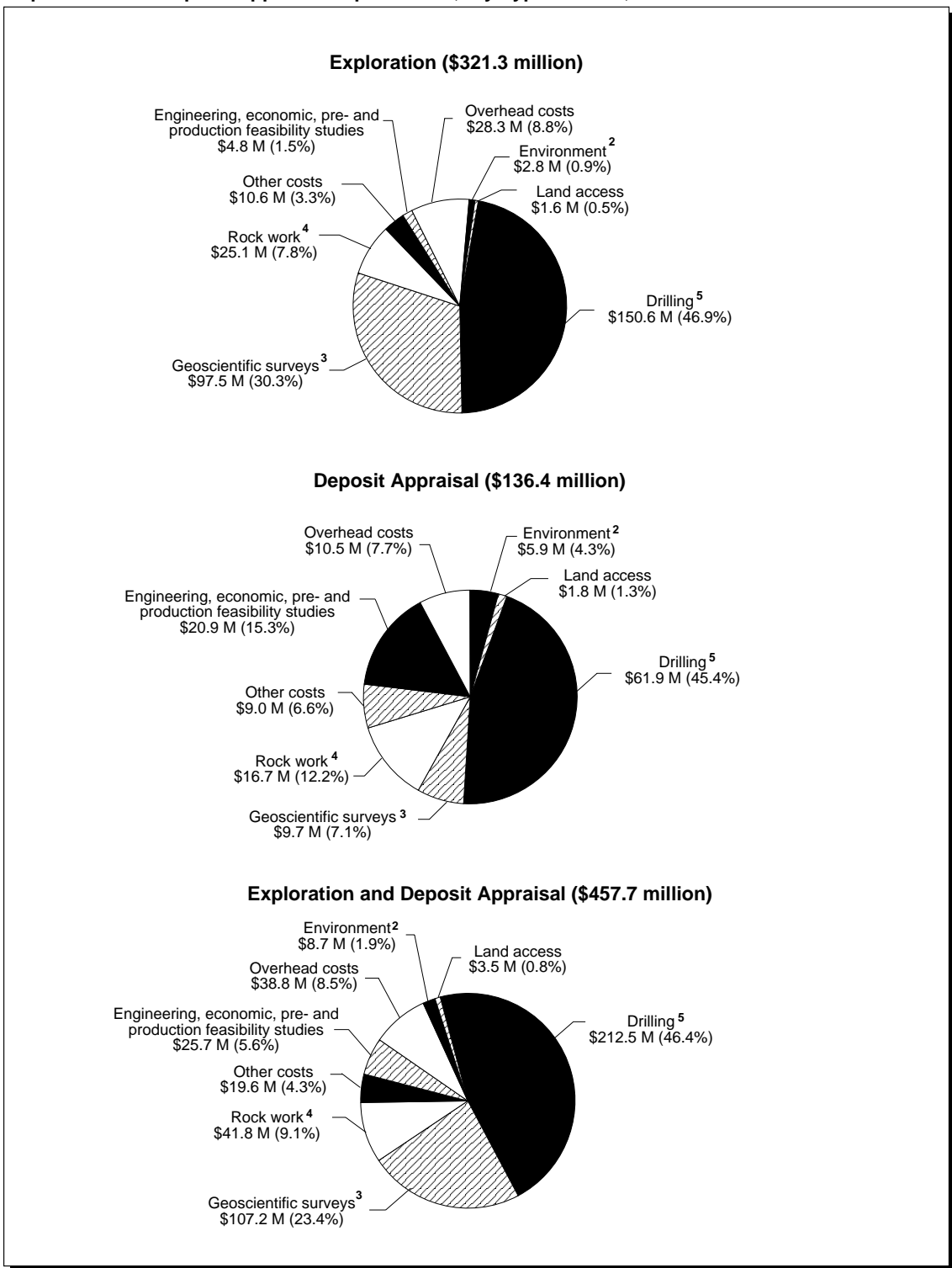
Figure 13
Exploration, Deposit Appraisal and Mine Development Expenditures, by Province and Territory, Forecast 2001



Source: Natural Resources Canada, based on the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.

Notes: Exploration and deposit appraisal activities include only the search for and appraisal of new deposits; they do not include work for extensions of deposits already being mined or committed to production. Exploration and deposit appraisal expenditures include off-mine-site and on-mine-site costs incurred for field work and overhead plus engineering, economic and feasibility studies, environment and land access costs. Mine development expenditures include costs incurred to gain access to ore or to increase ore reserves at properties in production or already committed to production. They do not include investments for structures, machinery and equipment. Data for 2001 are company spending intentions as compiled in January 2001.

Figure 14
Exploration and Deposit Appraisal Expenditures,¹ by Type of Work, 2001



Source: Natural Resources Canada, based on the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.
¹ Includes on-mine-site and off-mine-site activities. ² Environment includes characterization, permitting, protection, monitoring and restoration. ³ Geoscientific surveys include geology, geochemistry, ground geophysics and airborne 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.
 Notes: Numbers may not add to totals due to rounding. Data for 2001 are based on company spending intentions as compiled in January 2001.

1.3.2.1.2 SPENDING CATEGORIES BY TYPE OF ACTIVITY

A detailed cost breakdown for each of the exploration and deposit appraisal phases for 2001 demonstrates once again the importance of drilling in the total cost of discovering and delineating a mineral deposit (**Figure 14**). In 2001, drilling is expected to account for 47% (\$151 million) of the \$321 million to be spent on the exploration phase, a proportion similar to that of 2000. Spending on geoscientific surveys is also expected to equal that of 2000 and account for 30% (\$98 million) of total exploration expenditures in 2001.

In the deposit appraisal phase, drilling is expected to account for 45% (\$62 million) of the \$136 million spending forecast. In dollar terms, spending on drilling for that work phase is predicted to decrease from \$69 million in 2000 to \$62 million in 2001. Rock work is also expected to experience an important decrease in spending, going from \$34 million in 2000 to \$17 million in 2001. In terms of the most important spending categories in the two work phases combined, drilling is expected to account for 46% (\$213 million) of all exploration and deposit appraisal expenditures while geoscientific surveys should rank second with 23% (\$107 million).

According to company spending intentions for 2001, exploration and deposit appraisal expenditures related to the environment and land access will be almost similar to the levels recorded in 2000 (**Tables 3b** and **4**). The \$8.7 million anticipated to be spent on environment-related items in 2001 will once again be much lower than the levels recorded in 1999, 1998 and 1997. At \$3.5 million, land access expenditures, on the other hand, continue to be quite stable over the 1997-2001 period.

As mentioned earlier, costs incurred for engineering, economic and feasibility studies represent a larger portion of total exploration and deposit appraisal expenditures than do expenditures related to the environment and land access. For the second year in a row, these costs are expected to reach approximately \$25 million, a marked decline from the levels recorded from 1997 to 1999 when such spending exceeded \$40 million per year. These lower levels of spending on engineering, economic and feasibility studies indicate a reduction in the number of advanced projects. Deposit appraisal activities will account for most (82%) of the \$26 million total for 2001.

1.3.2.1.3 TOTAL MINERAL DEVELOPMENT INVESTMENT

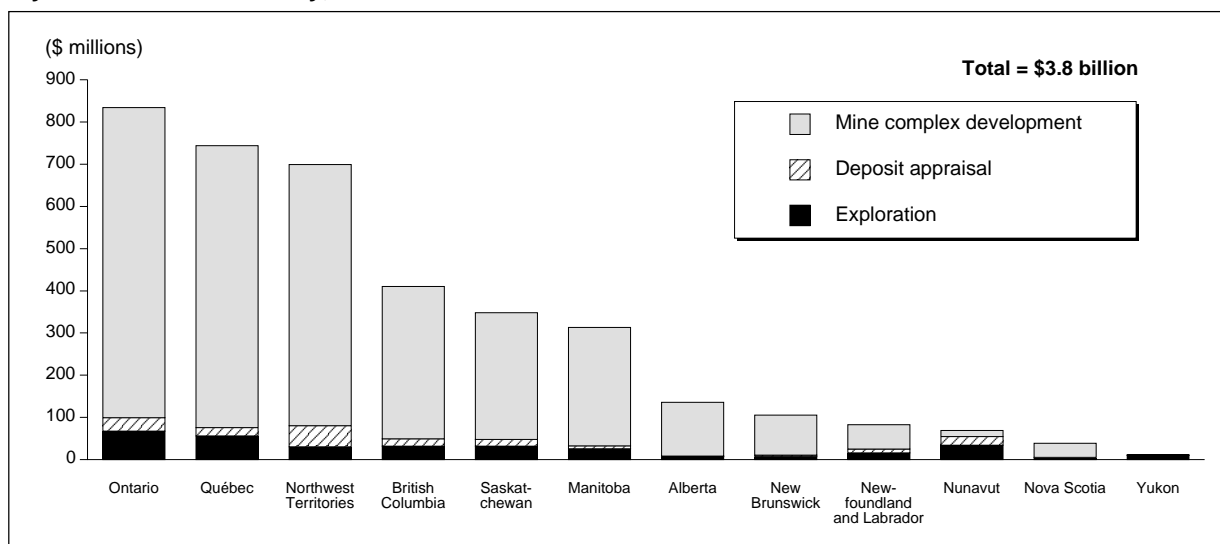
With a 2001 forecast of \$708 million (**Figure 13**), mine development spending is expected to be 9% lower than in 2000 when this type of spending reached \$776 million. Ontario, the Northwest Territories and Québec are expected to account for 69% of mine development spending in 2001. The Northwest Territories will benefit from the largest increase with an additional \$46 million to be spent on mine development while Québec, Saskatchewan and Ontario will experience decreases of \$90 million, \$29 million and \$22 million, respectively.

When adding all project work phases (exploration, deposit appraisal and mine development), and including all capital and repair costs associated with these three phases and with construction, machinery and equipment for mine complex development, the total mineral development investment is forecast at \$3.8 billion in 2001 (**Figure 15**), compared to \$3.6 billion in 2000. In decreasing order of expenditures, Ontario, Québec and the Northwest Territories should account for 60% of all mineral development investment in Canada in 2001.

1.3.2.2 Spending by Type of Company

Based on company spending intentions compiled in January 2001, a total of 105 senior project operators expected to spend \$291 million in 2001, accounting for 64% of all exploration and deposit appraisal expenditures for that year (**Figures 1** and **2**). About 59% of total spending by seniors was expected to be allocated to exploration activities and the balance to deposit appraisal activities (**Figure 9**).

Figure 15
Total Investment for Exploration, Deposit Appraisal and Mine Complex Development Expenditures, by Province and Territory, Forecast 2001



Source: Natural Resources Canada, based on the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.
 Notes: Exploration, deposit appraisal and mine complex development expenditures include costs incurred off- and on-mine-site for field work; engineering, economic and feasibility studies; overhead; the environment; land access; structures, machinery and equipment; and repairs. Data for 2001 are based on company spending intentions as compiled in January 2001.

In 2000, 118 senior project operators had reported 69% (\$325 million) of total exploration and deposit appraisal expenditures in Canada. The 11% decline in the number of active senior companies in 2001 was accompanied by a 10% decline in expenditures for that category of companies. The decline in terms of total expenditures by senior companies is more noticeable in the \$1 million-\$5 million range of company spending where approximately \$21 million less is expected to be spent in 2001 (**Table 1**). Companies planning to spend more than \$5 million are predicted to spend a total of \$230 million in 2001, \$13 million less than in 2000.

Almost 60% of the expenditures reported by senior firms in 2001 will be incurred in Ontario, the Northwest Territories and Québec (in decreasing order). Senior firms are expected to decrease their expenditures in 2001 in seven provinces/territories. The most severe decrease is forecast to occur in Québec where senior spending is predicted to fall from \$73 million in 2000 to \$44 million in 2001. Spending increases are anticipated in Ontario, British Columbia, Alberta, Manitoba and the Yukon (in decreasing order). Senior companies should be the main contributors to exploration and deposit appraisal spending in all Canadian jurisdictions in 2001 with the exception of Nova Scotia, British Columbia, the Yukon and Nunavut.

The number of junior project operators (excluding prospectors) is expected to drop again in 2001 to 275, a 27% decrease from the 379 recorded in 2000 (**Figure 1**). However, junior spending is expected to increase by 12% to \$167 million, its highest level since 1998 when junior spending reached \$171 million (**Figure 2**). This increase in junior spending will not, however, fully compensate for the anticipated senior spending decrease and overall expenditures will once again decline in 2001.

The paradox of having fewer junior firms spending more can be explained primarily by the increased number of juniors planning to spend in excess of \$1 million in 2001 (**Table 1**). Altogether, a total of 42 junior companies are expected to spend more than that sum, compared to 33 in 2000. As well, most of the companies that did not plan to explore in 2001 were situated in lower spending intervals in 2000; the overall effect of their withdrawal from active exploration projects will not, therefore, have a significant effect on the 2001 spending level.

Increases in expenditures by juniors are expected in eight provinces/territories for a combined increase of \$26 million. Saskatchewan, British Columbia and Ontario will account for 84% of that amount. Small decreases in junior spending are expected in Québec, Alberta, the Northwest Territories and Nunavut. In decreasing order of expenditures, Nunavut, Québec, Ontario and British Columbia, as a group, are expected to account for 65% of all junior expenditures in 2001.

1.3.2.3 Spending by Type of Commodity Sought

Company spending intentions reveal that exploration and deposit appraisal expenditures for precious metals and base metals will decline once again in 2001 (**Figure 10**). Exploration and deposit appraisal expenditures for precious metals are expected to reach \$168 million in 2001, compared to \$179 million in 2000, as the low price of gold continues to be a concern for exploration and mining companies. At \$127 million, base-metal spending is expected to be slightly lower than in 2000 when spending for base metals amounted to \$133 million.

Although there has been a weakening in the Canadian exploration and deposit appraisal sector in recent years, the search for diamonds continues to be a bright spot. In 2001, expenditures dedicated to their discovery are predicted to reach \$96 million, about \$4 million less than in the previous year (**Figure 12**). This spending will take place on a much smaller number of diamond properties (228 versus 315 in 2000) across Canada (**Figure 11**). The steadily declining number of diamond exploration properties reflects an increased focus by companies on the most promising properties. As a result, in areas of earlier discoveries, spending is more concentrated on deposit appraisal and mine development activities while, in areas of new discoveries, efforts usually involve more primary exploration work.

Overall, the Northwest Territories should record the highest diamond exploration and deposit appraisal expenditures in 2001 with \$51 million in company spending intentions (**Figure 12**). Ontario (\$15 million), Nunavut (\$10 million), Québec (\$7 million), and Alberta and Saskatchewan (\$5 million each) are also expected to host significant diamond exploration and deposit appraisal activities in 2001.

A breakdown of the commodities sought by type of company shows that senior companies are expected to spend almost the same proportion of total senior exploration and deposit appraisal spending on the search for precious metals and base metals in 2001 as they did in 2000 (**Table 5**). These two commodity groups are expected to account for 57% of senior expenditures while diamonds, with expected spending of \$70 million, will represent 24% of total senior spending in 2001.

In 2001, junior spending will not be as focused on precious metals as it was in 2000. In dollar terms, base metals (+\$10 million), uranium (+\$6 million) and diamonds (+\$6 million) are expected to experience the most important increases in junior spending. Precious-metals expenditures are forecast to decline by 7% (-\$5 million) to \$64 million, or 38% of all junior exploration and deposit appraisal spending in 2001.

1.3.2.4 Statistical Estimation of Exploration and Deposit Appraisal Spending (Based on Field and Overhead Costs Only)

1.3.2.4.1 METHODOLOGY

In this section, an attempt is made to predict the level of exploration and deposit appraisal spending for 2001 using standard statistical estimation techniques. Expenditures are estimated by linking historical exploration and deposit appraisal spending (field and overhead expenditures only) to factors for which historical data are available.

An analysis of historical data indicates that the level of expenditures on mineral exploration and deposit appraisal in a given year can be linked to the previous year's metal prices. This may be because companies view exploration and deposit appraisal as an investment, with expected returns on that investment dependent upon expected revenues from the subsequent mining of discovered deposits. Expected future revenues would obviously depend on future mineral and metal prices, and expectations of future prices would likely be influenced by current prices. As well, metal prices influence the level of a mining company's revenues and profits and are an important determinant of the amount of internal funds available for spending on exploration and deposit appraisal.

Changes in spending are likely to lag changes in metal prices because exploration and deposit appraisal activity in a particular year is the result of a budgeting process that takes place in the preceding year. Budget allocations in a given year are therefore likely to reflect the metal prices and company profits of the preceding year.

To capture this relationship between exploration, deposit appraisal and metal prices, the NRCan yearly metals price index, lagged one year, was included in the estimating equation. This index is a Fisher Ideal Index, based on the prices of six metals: gold, silver, copper, zinc, lead and nickel.

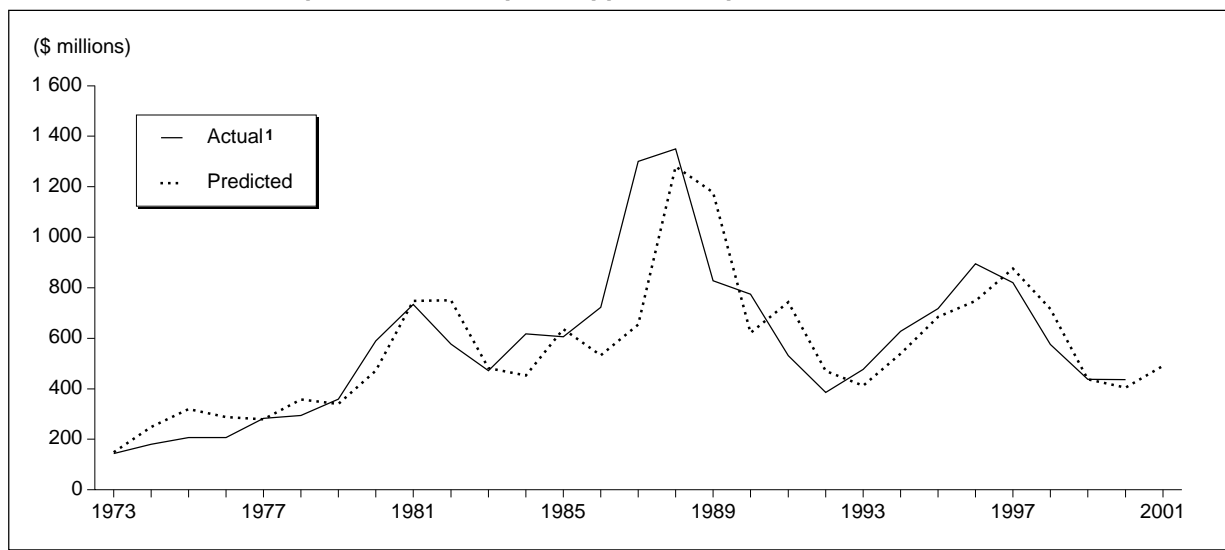
Mineral exploration and deposit appraisal is a multi-stage process (see Appendix 2) that usually proceeds over a relatively long period of time as information is gathered from geological mapping, geophysical and geochemical surveying, diamond drilling and so on. At various stages, this information is used by companies to decide on where to concentrate further activity and, indeed, whether to proceed at all. If early stages of exploration are successful in discovering promising mineralization, the company has a strong incentive to proceed with more detailed, and more costly, drilling and analysis, and to launch a feasibility study, thereby increasing the amount it spends on exploration and deposit appraisal. It can therefore be argued that exploration and deposit appraisal in a given period is related to spending in previous periods. To capture this relationship, a lagged dependent variable was also included in the equation.

1.3.2.4.2 RESULTS

It is important to remember that the following results are based on an analysis of expenditures that include only field and overhead costs. The new categories of expenditures, such as environment, land access, economic, engineering and feasibility studies, were excluded for the years for which they are available (1997, 1998, 1999 and 2000) in order to establish a valid comparison. It is also important to remember that diamonds are not included in NRCan's metals price index and that they have accounted for much exploration and deposit appraisal spending in recent years.

Therefore, notwithstanding these caveats and using data for the years 1973-2000, the statistical equation predicts that senior companies will spend about \$352 million on mineral exploration and deposit appraisal in 2001. For junior companies, the equation predicts expenditures of about \$148 million. For all companies, expenditures of about \$490 million are predicted (**Figure 16**). This estimation is higher than the \$420 million in field and overhead costs that were reported as company spending intentions for 2001 in the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.

Figure 16
Actual and Predicted Exploration and Deposit Appraisal Expenditures in Canada, 1973-2001



Source: Natural Resources Canada.

¹ For 2000, preliminary expenditures are shown because actual expenditures were not available.

Note: For comparison with pre-1997 years, the data include only off- and on-mine-site field and overhead expenditures.

1.4 DRILLING

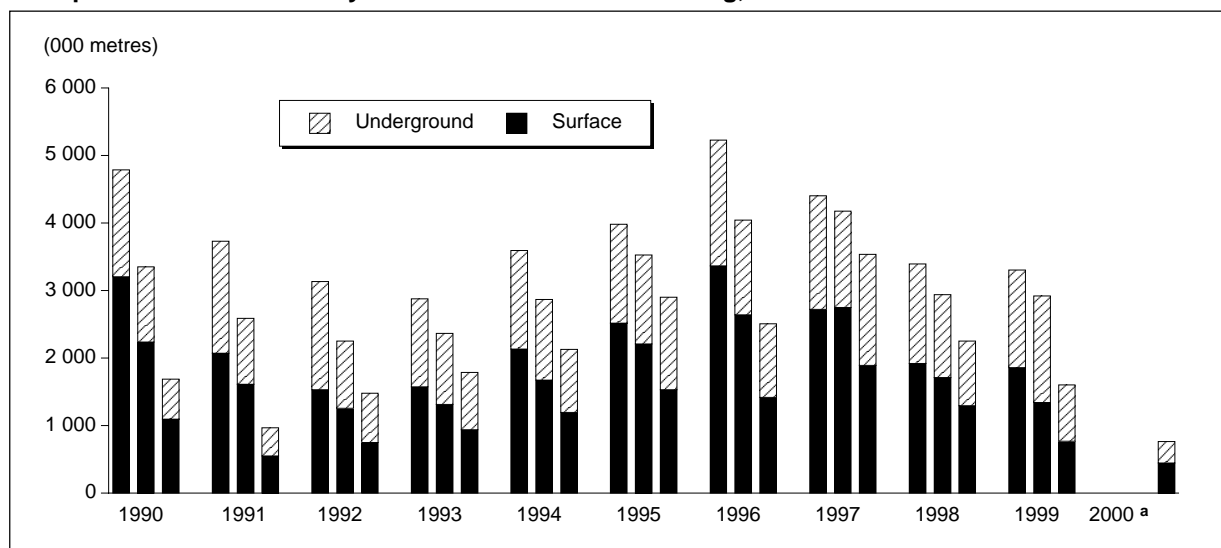
Drilling activities are an essential component of the mineral development cycle from the anomaly investigation stage to the deposit delineation and deposit definition stages. As such, drilling statistics constitute a valuable indicator of recent levels of Canadian mineral exploration and deposit appraisal activity.

1.4.1 Statistical Sources

Diamond drilling is the most widely used drilling method for determining the existence, location, extent, grade and tonnage of a mineral deposit. Canada harbours an important diamond drilling industry and many of its companies are represented by the Canadian Drilling Association (CDA). The CDA gathers diamond drilling statistics from its members, which cover about 50-60% of total Canadian contract diamond drilling activity. Although incomplete, these data provide a reasonable and the most up-to-date indication of recent national mineral exploration and deposit appraisal trends.

The yearly drilling statistics compiled by the CDA are depicted in **Figure 17**, along with two other sets of diamond drilling statistics: total Canadian contract diamond drilling, as reported annually to Natural Resources Canada by drilling contractors and published in Statistics Canada's catalogue no. 26-201; and diamond drilling data from the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures, which include all metres (m) drilled and expenditures reported by companies for their "own account" (drilling they did themselves) and for contracted drilling work. In this last set of data, exploration drilling and deposit appraisal drilling have been aggregated with mine development drilling to allow a valid comparison with the other two sets of statistics. Mine-site development drilling (mainly underground) consists of drilling aimed at extending ore reserves at producing mines.

Figure 17
Comparison of Three Surveys of Canadian Diamond Drilling, 1990-2000



Sources: Natural Resources Canada, based on the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures (left bar in each cluster); contract diamond drilling survey (middle bar in each cluster); Canadian Drilling Association (CDA) (right bar in each cluster).

^a Only CDA data were available for 2000.

Note: All data include exploration, deposit appraisal and mine development drilling.

1.4.1.1 Comparison of Drilling Statistics

Although the three sources of statistics mentioned above provide different annual results, the same overall trends are observable in the three surveys over the period 1990-99.

On an annual basis, the CDA diamond drilling statistics confirm the trends observed in exploration and deposit appraisal expenditures in recent years. **Figure 17** shows that, after peaking in 1997, the drilling reported to the CDA declined by 36% in 1998 and by 29% between 1998 and 1999. CDA statistics for 2000 show a dramatic decline of 52% to a level that represents less than a quarter of the drilling done by CDA members in 1997. The other two sets of statistics portrayed on that figure also show the same trend except for the fact that, in the statistics provided by the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures, drilling peaked in 1996 instead of 1997.

1.4.1.2 Drilling by Work Phase

According to the last-mentioned survey, a total of 2 466 000 m of surface and underground drilling (including diamond drilling and other drilling methods) was carried out for exploration and deposit appraisal purposes in Canada in 1999, compared to 2 598 000 m in 1998 (**Tables 6 and 7**). Of this, 2 277 000 m were accounted for by diamond drilling, down by 7% from the 2 458 000 m drilled in 1998. Diamond drilling aimed at mine development reached 1 027 000 m in 1999 (**Table 8**), up from the 933 000-m level of 1998. When adding diamond drilling metres for the three work phases, total diamond drilling amounted to 3 303 000 m in 1999, down from the 3 390 000 m reported in 1998.

The more specific contract diamond drilling survey reveals that 2 919 000 m were drilled by contractors in 1999, which represents 88% of the total amount of diamond drilling when this total is applied against the total reported above for the three work phases by the Survey of Mineral Exploration, Deposit Appraisal, and Mine Complex Development Expenditures. The remaining 12% of diamond drilling was done by companies on their own account (drilling they did by themselves).

TABLE 6. SURFACE AND UNDERGROUND EXPLORATION AND DEPOSIT APPRAISAL DRILLING,¹ BY PROVINCE AND TERRITORY, 1999

| Province/Territory | Surface Drilling | | | Underground Drilling | | | Total Drilling | | |
|---------------------------|------------------|-------------------|---------------|----------------------|-------------------|--------------|----------------|-------------------|---------------|
| | Exploration | Deposit Appraisal | Total | Exploration | Deposit Appraisal | Total | Exploration | Deposit Appraisal | Total |
| (000 m) | | | | | | | | | |
| Newfoundland and Labrador | 83.5 | 39.0 | 122.4 | — | — | — | 83.5 | 39.0 | 122.4 |
| Nova Scotia | 15.9 | 1.0 | 16.9 | — | — | — | 15.9 | 1.0 | 16.9 |
| New Brunswick | 50.1 | 18.0 | 68.1 | 1.9 | 15.0 | 16.9 | 52.0 | 33.0 | 85.0 |
| Québec | 652.7 | 50.9 | 703.6 | 73.5 | 130.1 | 203.7 | 726.3 | 181.0 | 907.3 |
| Ontario | 241.2 | 3.6 | 244.8 | 228.2 | 175.8 | 404.0 | 469.4 | 179.4 | 648.9 |
| Manitoba | 74.3 | 5.1 | 79.4 | 6.9 | 24.5 | 31.5 | 81.2 | 29.6 | 110.8 |
| Saskatchewan | 82.4 | 29.9 | 112.2 | — | 1.3 | 1.3 | 82.4 | 31.1 | 113.5 |
| Alberta | 28.3 | 115.3 | 143.7 | — | — | — | 28.3 | 115.3 | 143.7 |
| British Columbia | 73.6 | 7.4 | 81.0 | 20.1 | 11.2 | 31.3 | 93.7 | 18.6 | 112.3 |
| Yukon | 14.1 | 1.2 | 15.3 | — | — | — | 14.1 | 1.2 | 15.3 |
| Northwest Territories | 58.3 | 51.3 | 109.5 | — | — | — | 58.3 | 51.3 | 109.5 |
| Nunavut | 49.5 | 27.8 | 77.3 | 0.6 | 2.3 | 2.9 | 50.1 | 30.1 | 80.1 |
| Total | 1423.8 | 350.4 | 1774.2 | 331.3 | 360.2 | 691.6 | 1755.1 | 710.6 | 2465.7 |

Source: Natural Resources Canada, based on the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.
— Nil.

¹ Includes diamond drilling and other drilling methods such as rotary and percussion.

TABLE 7. SURFACE AND UNDERGROUND EXPLORATION AND DEPOSIT APPRAISAL DRILLING IN CANADA, 1985-99

| Year | Diamond Drilling | | | Other Drilling ¹ | | |
|-------------------|------------------|-------------------|-------|-----------------------------|-------------------|-------|
| | Metres Drilled | | | Metres Drilled | | |
| | Exploration | Deposit Appraisal | Total | Exploration | Deposit Appraisal | Total |
| (000 m) | | | | | | |
| 1985 | .. | .. | 2 531 | .. | .. | 270 |
| 1986 | .. | .. | 3 616 | .. | .. | 55 |
| 1987 | .. | .. | 6 221 | .. | .. | 262 |
| 1988 | .. | .. | 6 206 | .. | .. | 211 |
| 1989 | .. | .. | 3 940 | .. | .. | 297 |
| 1990 | .. | .. | 3 702 | .. | .. | 241 |
| 1991 | .. | .. | 2 341 | .. | .. | 234 |
| 1992 | .. | .. | 1 889 | .. | .. | 139 |
| 1993 | .. | .. | 1 932 | .. | .. | 282 |
| 1994 | .. | .. | 2 626 | .. | .. | 213 |
| 1995 | .. | .. | 2 993 | .. | .. | 280 |
| 1996 | .. | .. | 3 898 | .. | .. | 169 |
| 1997 ^a | 2 670 | 734 | 3 404 | 157 | 239 | 396 |
| 1998 | 2 024 | 433 | 2 458 | 58 | 82 | 140 |
| 1999 | 1 693 | 583 | 2 277 | 62 | 127 | 189 |

Source: Natural Resources Canada, based on the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.

.. Not available.

^a The exploration and deposit appraisal phases were adopted as part of the survey redesign in 1997.

¹ Other drilling methods include rotary and percussion.

TABLE 8. SURFACE AND UNDERGROUND EXPLORATION, DEPOSIT APPRAISAL AND MINE DEVELOPMENT DRILLING IN CANADA, 1999

| Work Phase | Diamond Drilling | Other Drilling ¹ | Total by Work Phase |
|-------------------|------------------|-----------------------------|---------------------|
| | (000 m) | | |
| Exploration | 1 693 | 62 | 1 755 |
| Deposit appraisal | 583 | 127 | 710 |
| Mine development | 1 027 | 839 | 1 866 |
| Total | 3 303 | 1 028 | 4 331 |

Source: Natural Resources Canada, based on the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.

¹Other drilling methods include rotary and percussion.

Some 51% (1 693 000 m) of the total diamond drilling activity in 1999 was dedicated to the exploration phase while approximately 18% (583 000 m) was dedicated to deposit appraisal work (**Table 8**). As mentioned above, the remaining 31% (1 027 000 m) was reported under the mine development category.

1.4.2 Drilling by Type of Company

Senior companies accounted for 89% (3 874 000 m) of all surface and underground drilling (including diamond drilling and other drilling methods) aimed at the three work phases of exploration, deposit appraisal and mine development in 1999 (**Table 9**). They accounted for all of the 1 866 000 m drilled for mine development in Canada for that year. In terms of exploration and deposit appraisal, drilling by senior companies represented 81% (2 008 000 m) of the total drilling for these two work phases. Junior companies accounted for 20% (352 000 m) of total exploration drilling and for 15% (105 000 m) of total deposit appraisal drilling.

In terms of surface and underground drilling, senior companies, by virtue of their mine-site development drilling activities, accounted for almost 99% of all underground drilling for the three work phases. When restricting this measure to only exploration and deposit appraisal work, senior companies still recorded 97% of total underground drilling activity. Surface drilling activity was somewhat less concentrated as seniors accounted for 82% (2 041 000 m) of total surface drilling compared to 18% (434 000 m) for junior companies.

Exploration drilling by senior companies was mostly conducted from the surface while 58% of their deposit appraisal drilling was conducted underground. Their mine development drilling also favoured underground activities as 62% of their metres drilled were underground. As can be expected, junior companies were more focused on surface exploration and deposit appraisal with 96% (340 000 m) of their exploration drilling conducted from surface and 89% (94 000 m) of their deposit appraisal drilling also originating above ground.

1.4.3 Drilling by Type of Commodity Sought

In terms of total surface and underground drilling (including diamond drilling and other drilling methods) by group of commodity sought, **Figure 18** shows that exploration and deposit appraisal drilling activities in Canada in 1999 were primarily aimed at the discovery of precious metals. A total of 1 317 000 m was drilled in the search for precious metals, representing 53% of total exploration and deposit appraisal drilling. Of this total, 817 000 m (62%) were

TABLE 9. SURFACE AND UNDERGROUND EXPLORATION, DEPOSIT APPRAISAL AND MINE DEVELOPMENT DRILLING¹ IN CANADA, BY TYPE OF COMPANY, 1999

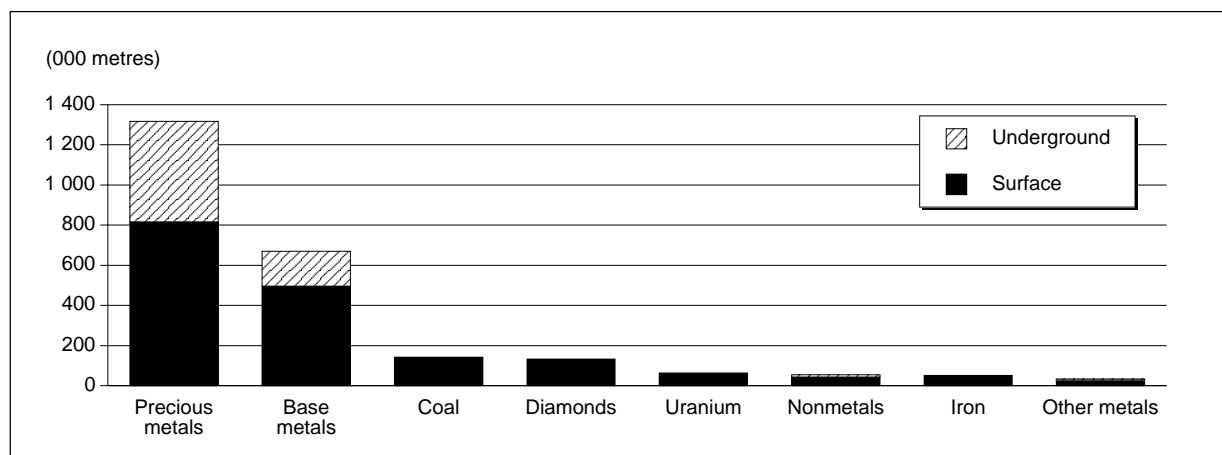
| Type of Company | Exploration Drilling | Deposit Appraisal Drilling | Mine Development Drilling | Total by Type of Company |
|------------------|----------------------|----------------------------|---------------------------|--------------------------|
| (000 m) | | | | |
| Junior companies | | | | |
| Surface | 339.7 | 94.0 | – | 433.7 |
| Underground | 12.7 | 11.4 | – | 24.1 |
| Subtotal | 352.4 | 105.4 | – | 457.8 |
| Senior companies | | | | |
| Surface | 1 084.1 | 256.3 | 700.6 | 2 041.1 |
| Underground | 318.6 | 348.8 | 1 165.0 | 1 832.5 |
| Subtotal | 1 402.7 | 605.2 | 1 865.7 | 3 873.6 |
| Total | 1 755.1 | 710.6 | 1 865.7 | 4 331.4 |

Source: Natural Resources Canada, based on the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.

– Nil.

¹Includes diamond drilling and other drilling methods such as rotary and percussion.

Figure 18
Surface and Underground Exploration and Deposit Appraisal Drilling¹ in Canada, by Commodity, 1999



Source: Natural Resources Canada, based on the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.

¹Includes diamond drilling and other drilling methods such as rotary and percussion.

drilled from the surface. Drilling for base metals accounted for 27% (669 000 m) of total exploration and deposit appraisal drilling and, once again, surface drilling was more prevalent with 74% (496 000 m) of the drilling aimed at this commodity group.

Surface drilling also accounted for most of the exploration and deposit appraisal drilling activity aimed at discovering commodities other than precious and base metals. In fact, it represented all of the drilling conducted, within these two phases of activity, in the search for coal, diamonds and iron, and it accounted for almost all (99%) drilling aimed at discovering uranium.

1.5 CLAIM STAKING

Claim staking is another useful indicator of exploration activity. It is particularly efficient at rapidly highlighting emerging trends, such as the mid- and late-1990s exploration rush for diamonds, and at pinpointing areas of interest. Because claim staking usually happens at a relatively early stage of the exploration and deposit appraisal process, it also provides a good measure of current grass-roots-type activities and a good insight into where future advanced (deposit appraisal) work could be focused.

1.5.1 Statistical Summary

The area of new mineral claims staked in Canada in 2000 (**Table 10**) totaled some 10.4 million hectares (Mha), which represents an improvement over the 5.4 Mha staked in 1999 but is still well below the 44.2 Mha staked in 1997. The area staked in 1997 was the largest area of new mineral claims ever recorded in Canada and was largely the result of a staking rush that followed the discovery of diamonds in the Buffalo Head Hills of Alberta. The largest yearly totals of new mineral claims areas recorded before 1997 had been 33 Mha in 1992 and 27 Mha in 1993. The 5.4 Mha recorded in 1999 is somewhat similar to the levels recorded prior to 1992, that is, prior to the major exploration and deposit appraisal efforts that were triggered by the discovery of diamonds in the Northwest Territories and, later, base metals in Labrador.

TABLE 10. AREA OF NEW MINERAL CLAIMS¹ STAKED IN CANADA, 1999 AND 2000

| Province/Territory | 1999 | | 2000 | |
|---------------------------|------------------|--------------|-------------------|--------------|
| | (hectares) | (%) | (hectares) | (%) |
| Newfoundland and Labrador | 241 075 | 4.4 | 324 225 | 3.1 |
| Nova Scotia | 157 394 | 2.9 | 96 819 | 0.9 |
| New Brunswick | 28 336 | 0.5 | 49 344 | 0.5 |
| Québec | 754 102 | 13.9 | 2 187 551 | 21.1 |
| Ontario | 604 096 | 11.1 | 874 896 | 8.4 |
| Manitoba | 566 571 | 10.4 | 1 832 577 | 17.7 |
| Saskatchewan | 161 083 | 3.0 | 523 440 | 5.0 |
| Alberta | 1 026 000 | 18.8 | 2 349 600 | 22.6 |
| British Columbia | 478 740 | 8.8 | 699 050 | 6.7 |
| Yukon | 152 731 | 2.8 | 52 675 | 0.5 |
| Northwest Territories | 563 378 | 10.3 | 891 419 | 8.6 |
| Nunavut | 710 092 | 13.0 | 498 230 | 4.8 |
| Total | 5 443 599 | 100.0 | 10 379 826 | 100.0 |

Source: Provincial and territorial mining recorders.

¹ Excludes coal.

1.5.2 New Claims Staked and Claims in Good Standing

As mentioned above, the total area of new mineral claims staked increased by almost 5 Mha in 2000, a jump of 91% compared to 1999. Increases occurred in all provinces/territories except Nunavut (-0.21 Mha), the Yukon (-0.10 Mha) and Nova Scotia (-0.06 Mha). The largest increases in total area of new claims staked were recorded in Québec (+1.43 Mha), Alberta (+1.32 Mha) and Manitoba (+1.27 Mha). These three provinces alone accounted for 76% of the total for those provinces/territories that did record increases in new mineral claims staked.

The 190% increase in new claims staked recorded in Québec in 2000 was due mainly to the delivery of a number of exploration permits for nickel-copper exploration in northern Québec. In Alberta, the 129% increase was reported as being mostly the result of the re-staking of lands in northern Alberta that had been surrendered back to the Crown due to the failure by previous holders to conduct sufficient assessment work to meet regulatory requirements. Some of these returned lands attracted other interested companies. The 223% increase in Manitoba was attributable to the search for diamonds in the Fox River Sill area.

Elsewhere in Canada, provincial and territorial mining recorders have reported that the increase in new mineral claims staked in 2000 can be attributed to: renewed interest in diamonds, platinum-palladium and uranium, as well as to the release of government-sponsored airborne geophysics results, in Ontario; to a gold staking rush in British Columbia; and, in Newfoundland and Labrador, to staking for iron ore in the western part of Labrador.

Saskatchewan recorded the largest year-over-year improvement in its area of new claims staked with a 225% increase. The province's mining recorder explains this increase by the fact that there was some re-staking of surrendered areas and an increased interest in diamond exploration in the Fort-à-la-Corne area.

The total area occupied by claims in good standing amounted to approximately 3.7% of Canada's total landmass in 2000, compared to 6.3% in 1999 (**Table 11**). This decrease is mostly attributable to the surrendering of permits (claims) in Alberta. The same explanation is applicable to Saskatchewan, although the decline there was not of the same magnitude as that in Alberta. It nevertheless amounted to a reduction of 20% in the area of claims in good standing in that province. Newfoundland and Labrador also experienced a decline in the order of 20% as some of the claims that were staked during the Voisey's Bay staking rush are being gradually surrendered every year.

Manitoba (+102%) and Québec (+44%) registered strong increases in their respective areas covered by claims in good standing from 1999 to 2000. Ontario, New Brunswick and the Northwest Territories reported smaller increases.

1.5.3 Exploration and Deposit Appraisal Intensity

There is considerable variation in levels of mineral exploration and deposit appraisal expenditures across Canada's provinces and territories. For example, 2000 spending amounted to \$101 million (preliminary) in Québec, but was only \$3 million in Nova Scotia. There is also great variation in the land areas of individual provinces and territories where mineral exploration and deposit appraisal activities are taking place. Nova Scotia is the smallest province where exploration activity is reported. It has an area of 55 490 km² compared to the 1 999 400 km² of Canada's largest jurisdiction, the territory of Nunavut. Because of these varying areas, it can be misleading to compare provinces and territories on the basis of exploration and deposit appraisal spending alone.

Although not all exploration and deposit appraisal expenditures in a particular jurisdiction are spent on existing mineral claims (some expenditures are incurred on unclaimed land,

TABLE 11. AREA OCCUPIED BY CLAIMS IN GOOD STANDING IN CANADA, 1999 AND 2000

| Province/Territory | Total Area | Area of Claims in Good Standing | Area of Claims/ Total Area |
|---------------------------|-------------|---------------------------------|----------------------------|
| | (hectares) | | (%) |
| 1999 | | | |
| Newfoundland and Labrador | 40 572 000 | 1 374 926 | 3.4 |
| Nova Scotia | 5 549 000 | 210 182 | 3.8 |
| New Brunswick | 7 344 000 | 238 144 | 3.2 |
| Québec | 154 068 000 | 3 073 123 | 2.0 |
| Ontario | 106 858 000 | 2 500 800 | 2.3 |
| Manitoba | 64 995 000 | 1 943 403 | 3.0 |
| Saskatchewan | 65 233 000 | 2 732 364 | 4.2 |
| Alberta | 66 119 000 | 39 348 013 | 59.5 |
| British Columbia | 94 931 000 | 3 425 000 | 3.6 |
| Yukon | 48 345 000 | 1 511 021 | 3.1 |
| Northwest Territories | 143 232 000 | 3 651 262 | 2.5 |
| Nunavut | 199 400 000 | 2 491 451 | 1.2 |
| Total Canada | 996 646 000 | 62 499 689 | 6.3 |
| 2000 | | | |
| Newfoundland and Labrador | 40 572 000 | 1 115 120 | 2.7 |
| Nova Scotia | 5 549 000 | 148 733 | 2.7 |
| New Brunswick | 7 344 000 | 240 480 | 3.3 |
| Québec | 154 068 000 | 4 440 661 | 2.9 |
| Ontario | 106 858 000 | 2 597 264 | 2.4 |
| Manitoba | 64 995 000 | 3 926 723 | 6.0 |
| Saskatchewan | 65 233 000 | 2 191 778 | 3.4 |
| Alberta | 66 119 000 | 10 957 925 | 16.6 |
| British Columbia | 94 931 000 | 3 307 875 | 3.5 |
| Yukon | 48 345 000 | 1 364 468 | 2.8 |
| Northwest Territories | 143 232 000 | 3 668 162 | 2.6 |
| Nunavut | 199 400 000 | 2 443 357 | 1.2 |
| Total Canada | 996 646 000 | 36 402 546 | 3.7 |

Sources: Natural Resources Canada; provincial/territorial mining recorder offices.
Note: Data for Prince Edward Island are excluded.

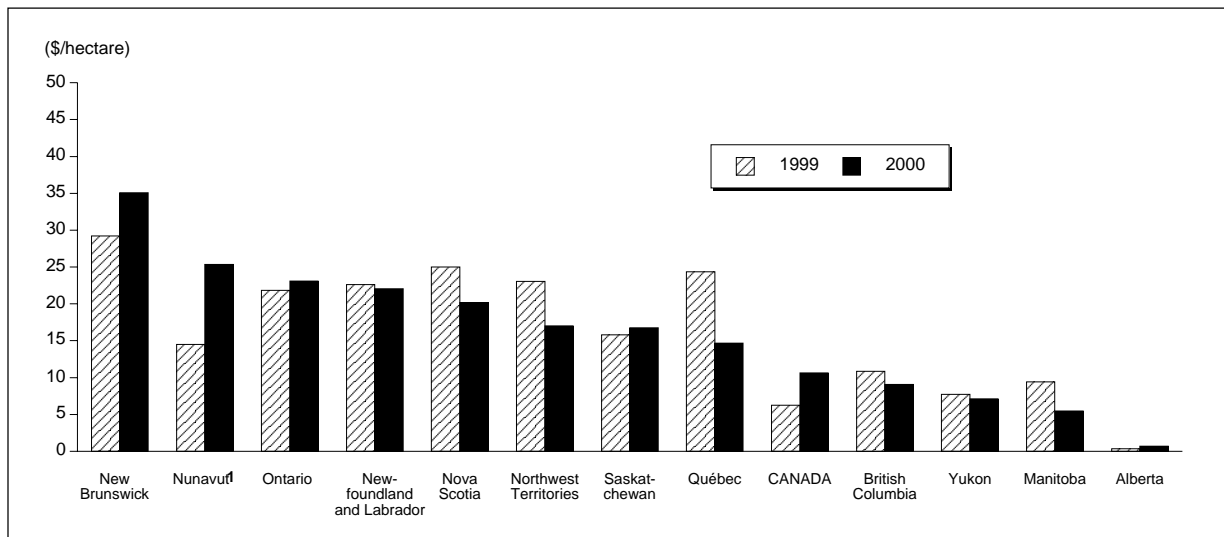
exploration permits or mining leases), off-mine-site expenditures per unit of area of mineral claims in good standing can serve as a measure of exploration and deposit appraisal intensity.

As shown in **Figure 19**, New Brunswick, Nova Scotia and Québec enjoyed the highest levels of off-mine-site exploration and deposit appraisal expenditures per hectare of claims in good standing in 1999. For 2000, New Brunswick took first place followed by Nunavut and Ontario.

The decrease in Nova Scotia's ranking can be explained by the 43% decline in off-mine-site spending in that province between 1999 and 2000. The same situation explains the drop in off-mine-site spending intensity in the Northwest Territories as off-mine-site spending declined by 26% while the area of claims in good standing remained virtually the same. In Québec, the decline was a result of both lower off-mine-site spending and an increased area of claims in good standing while, in Manitoba, a large increase in the area of claims in good standing could not be compensated for by increased off-mine-site expenditures. Alberta continued to be at the lower end of the spectrum, a situation that can be explained by the large area that remains covered by claims in good standing in that province and by decreasing off-mine-site exploration and deposit appraisal expenditures.

Increases in the cost per hectare in New Brunswick, Nunavut and Ontario can all be attributed to sharp increases in off-mine-site spending while the relatively smaller increase in Saskatchewan is a result of the 20% reduction in the area covered by claims in good standing in that province in 2000.

Figure 19
Off-Mine-Site Exploration and Deposit Appraisal Expenditures Per Hectare of Claims in Good Standing, by Province and Territory, 1999 and 2000



Sources: Natural Resources Canada, based on the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures; provincial/territorial mining recorder offices.

¹ The territory of Nunavut was created in April 1999 by dividing the former Northwest Territories into two distinct territories: Nunavut and the Northwest Territories.

Notes: Off-mine-site exploration and deposit appraisal expenditures include costs incurred off-mine-site for field work and overhead plus engineering, economic and feasibility studies, environment and land access costs. "Claims in good standing" excludes mining leases. Data for 2000 are preliminary.

For Canada as a whole, exploration and deposit appraisal off-mine-site spending per hectare of claims in good standing increased from \$6.68/ha in 1999 to \$10.75/ha in 2000. This change can be explained by a 42% drop in the area of claims in good standing while off-mine-site spending remained almost the same. This increase in spending intensity, for Canada as a whole, is not as meaningful since the decrease in claims in good standing in Alberta had an overwhelmingly negative effect on that ratio's denominator. When removing Alberta from the Canadian total, the spending intensity actually decreased from \$17.43/ha in 1999 to \$15.08/ha in 2000. This decrease is attributable to an increase in the area of claims in good standing rather than to a decline in off-mine-site spending.

1.6 SHORT-TERM OUTLOOK FOR EXPLORATION AND DEPOSIT APPRAISAL SPENDING IN CANADA

The three indicators (spending, drilling and claim staking) of exploration and deposit appraisal activity analyzed in this chapter confirm that the downward trend that began in 1997 continued into 2000. For 2001, company spending intentions point to a further decline in exploration and deposit appraisal spending with a forecast of \$458 million in 2001 versus expenditures of \$473 million in 2000. However, at the time of printing this report, early indications from the next survey exercise (preliminary 2001, forecast 2002) are that both the 2000 preliminary and 2001 forecast totals will turn out to be higher than previously estimated, at about \$500 million.

The difference between the 2001 forecast, based on company spending intentions compiled in January 2001, and the 2001 preliminary totals, based on company-reported spending data compiled in January 2002, illustrates quite clearly the under-estimation, or over-estimation, that can result from such a forecast. The fact that, in the current environment, many companies are noncommittal about their near-term spending plans further complicates any attempt at predicting short-term exploration trends. Factors that would exert a positive influence include

stronger metal prices and successful exploration stories, while flat or lower price levels would continue to act as the main impediment to increased exploration and deposit appraisal spending.

Although this chapter's analysis has centred mostly around the declining trends shown by the exploration and deposit appraisal indicators under review, some positive findings deserve to be mentioned. For example, spending on the exploration work phase alone (not including deposit appraisal expenditures) has remained relatively constant in the past three years due, in large part, to junior mining companies. These companies, despite accounting for a much lower number of project operators in the past few years, have, as a whole, continued to generate a significant proportion of the total exploration-phase activity. Junior exploration spending was even forecast to go against the general trend in 2001 and rise by 18% to almost \$150 million.

Having stable expenditures in the exploration work phase in times of decreasing overall exploration and deposit appraisal spending means that declining deposit appraisal activities are pulling the total spending curve downward. However, part of this effect can be explained by the use of funds for more advanced mineral development and mine complex development work at diamond-mining projects. Diamonds continue to bring good news to the Canadian mineral exploration scene and they have been strong contributors to all three work phases (exploration, deposit appraisal and mine complex development) in recent years.

Nevertheless, the Canadian mineral exploration and deposit appraisal sector has suffered in recent years and remains quite fragile. In recognition of this situation, Canadian governments, at both the provincial/territorial and federal levels, have improved their incentives and programs to encourage exploration and deposit appraisal activity. Preliminary statistics and anecdotal evidence show that companies are using these incentives to finance their activities and to bolster their exploration programs. These measures could also certainly act as a catalyst in the event that some metal prices improve and offer Canada a competitive advantage in terms of attracting mineral exploration investment. As mentioned earlier in this chapter, many of these recently introduced incentives are described in the provincial/territorial reviews found in the next section of this report.

2. Regional Outlook

2.1 INTRODUCTION

This section presents comments from provincial and territorial officials on recent exploration and deposit appraisal activities in their respective jurisdictions and indicates their expectations for 2001 and, in some cases, for 2002.

The reader should note that some provinces/territories, in their respective review of activities, use the term “exploration” in its broad sense; that is, it includes both exploration (grass-roots) and deposit appraisal (advanced) components. The expenditure data mentioned by the different provincial and territorial authorities may also differ from those reported in Chapter 1 (official federal-provincial/territorial figures released by NRCan) because some of these jurisdictions use different criteria or definitions in their own analyses.

2.2 NEWFOUNDLAND AND LABRADOR¹

Overview

Expenditures on mineral exploration in Newfoundland and Labrador in 2000 amounted to \$23.3 million, a decrease of 28% from the 1999 level and a result of the steady decline in exploration activity for nickel in Labrador, which peaked in 1996 following the Voisey’s Bay discovery. This trend may have come to an end, however, with preliminary 2000 and forecast 2001 totals from the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures both estimated at around \$26 million (**Table 12**). Base metals were the primary exploration target followed by gold and industrial minerals. Exploration for base metals accounted for over 70% of the total expenditures and was concentrated in Labrador, whereas much of the exploration activity for gold, other precious metals and industrial minerals took place in insular Newfoundland.

Although overall exploration levels are down, a small increase in exploration expenditures for insular Newfoundland is attributed to a resurgence in base-metal exploration, the discovery of several gold showings in central Newfoundland, and the development of dimension stone deposits in eastern Newfoundland.

Claims in good standing declined by a further 20% in 2000 to 46 124. However, this downward trend is slowing and claim staking increased to 12 969, a 35% increase from 1999. Diamond drilling activity declined by 35% in 2000 to 74 546 m.

¹ The Newfoundland and Labrador review of activities was prepared by Ges Nunn and Jim Hinchey. For more information, the reader is invited to contact Mr. Nunn by telephone at (709) 729-6418 or by e-mail at gesnunn@mail.gov.nf.ca.

TABLE 12. NEWFOUNDLAND AND LABRADOR EXPLORATION STATISTICS, 1994-2001

| | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000P | 2001f |
|--------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | (dollars) | | | | | | | |
| Exploration expenditures | 12 396 462 | 71 100 000 | 92 546 708 | 71 752 000 | 50 868 000 | 32 353 000 | 26 806 992 | 26 000 000 |
| | (number) | | | | | | | |
| Claim staking | | | | | | | | |
| Claims staked | 22 256 | 248 707 | 15 299 | 13 363 | 14 476 | 9 643 | 12 969 | 15 000 |
| In good standing | 37 084 | 280 750 | 168 815 | 126 766 | 86 955 | 57 431 | 46 124 | 48 000 |
| | (dollars) | | | | | | | |
| Exploration field expenditures | | | | | | | | |
| Base metals | 5 216 623 | 64 226 300 | 83 737 940 | 61 420 000 | 35 289 730 | 25 000 000 | 19 246 046 | 17 850 000 |
| Precious metals (gold) | 3 613 526 | 5 371 500 | 6 395 873 | 5 228 072 | 3 213 618 | 4 767 000 | 6 381 634 | 5 850 000 |
| Other | 884 000 | 1 241 000 | 2 412 895 | 2 336 828 | 12 366 652 | 2 586 000 | 1 179 312 | 2 300 000 |
| | (metres) | | | | | | | |
| Diamond drilling ¹ | | | | | | | | |
| Production/development | 7 260 | 8 107 | 9 424 | 13 318 | 4 967 | 4 168 | 6 920 | .. |
| Exploration | 42 225 | 120 803 | 226 208 | 141 320 | 90 428 | 112 095 | 67 626 | .. |
| Total diamond drilling | 49 485 | 128 910 | 235 632 | 154 638 | 95 395 | 116 263 | 74 546 | 80 000 |

Source: Newfoundland and Labrador Department of Mines and Energy.

.. Not available; f Forecast; P Preliminary.

¹ Based on a special diamond drilling survey.

Mining

Two mining leases were issued in 2000, both for industrial minerals.

In October 2000, Shabogamo Mining & Exploration Limited was granted a 5.87-ha mining lease for quartzite near Labrador City. The quartzite is shipped to Bécancour in Québec where SKW Canada Limited refines the high-purity product into silicon metal.

In August 2000, Lafarge Gypsum Canada Inc. was granted a 0.6-ha mining lease for gypsum at Fischells Brook in western Newfoundland.

Richmont Mines Inc. purchased the Hammerdown/Rumbullion gold deposit in March 2000 from Abiting Inc. of Québec. Richmont Mines Inc. completed the processing of a 17 505-t bulk surface sample in November 2000, and then constructed a ramp to access the deposit from underground for additional bulk sampling. The ore will help extend the life of the mill at Nugget Pond on the Baie Verte Peninsula until at least 2007. Richmont Mines Inc. has reported a resource (all categories) of 777 000 tons (704 894 t) at 0.41 oz/ton (14.1 g/t) for an approximate total of 320 000 oz (9953 kg) of gold.

Development-Stage Projects

A feasibility study on the Duck Pond base-metal project, southwest of Buchans in central Newfoundland, was completed in May 2001 by MRDI Canada Inc. for Thundermin Resources Inc. and Queenston Mining Inc. MRDI Canada issued an estimate of probable and proven reserves of 5.2 Mt grading 3.3% copper, 5.8% zinc, 0.9% lead, 59 g/t silver and 0.8 g/t gold for the Duck and Sleeper lenses plus the Boundary North and Boundary South zones. Announced inferred resources of 260 300 t grading 2.4% copper, 6.3% zinc, 0.9% lead, 57 g/t silver and 0.8 g/t gold for the Lower Duck and Sleeper lenses gave a total of 5.5 Mt at the reserve's grades. At an estimated mining rate of 1500 tonnes/day (t/d), the project would have a mine life of 10.2 years.

Exploration - Labrador

Voisey's Bay Nickel Company Limited completed various ground geotechnical surveys, diamond drilling and diamond drill core re-examination on its Voisey's Bay deposit claims in 2001. Resources (all categories) stand at 141 million tonnes (Mt) grading 1.24% nickel and 0.61% copper. On September 13, 2001, Inco Limited announced that its wholly owned subsidiary, Voisey's Bay Nickel Company Limited, was closing its exploration camp in Labrador, effective September 30, 2001. Since 1994, over 350 000 m of diamond drilling in 555 holes has been carried out and, since 1996, Voisey's Bay Nickel Company Limited and Diamond Fields Ltd. have spent in excess of \$160 million exploring the property.

Iron Ore Company of Canada has completed geological and airborne geophysical surveys. Ground geophysical, geological and diamond drilling programs are in progress.

In March 2001, SVB Nickel Company Ltd. was formed to take over the land holdings of Donner Minerals Ltd., Cypress Development Corp., NDT Ventures Ltd., Rcom Ventures Ltd. and Curion Ventures Corp. at South Voisey's in order to combine operations in the area with Donner Minerals Ltd. as operator. Subsequently, in September 2001, Donner Minerals Ltd., SVB Nickel Company Ltd., Northern Abitibi Mining Corp., Major General Resources Ltd. and Palalum Minerals Ltd. entered into an option earn-in agreement with Falconbridge Limited whereby Falconbridge can earn a 50% interest in the South Voisey's nickel-copper-cobalt project by spending \$23 million on exploration over five years. Agreements with the Innu Nation are in place and archeological and geophysical surveys, geological mapping and relogging of drill core are in progress.

From May to July 2001, Falconbridge staked 3440 claims in the St. Lewis River area of southwestern Labrador over the Kyfanan Lake gabbro-anorthosite-ultramafic intrusion.

On August 24, 2001, Vulcan Minerals Inc. announced that it had entered into a letter of agreement with Falconbridge Limited on the TL property located northwest of Voisey's Bay. Diamond drilling by previous operators had returned 23.7 m of 0.47% nickel, 0.16% copper and 0.02% cobalt, which included 5.2 m assaying 1.15% nickel, 0.42% copper, 0.04% cobalt, 0.25 g/t palladium and 0.11 g/t platinum. Ground geophysical surveys and soil and till geochemistry were planned for the fall.

In February 2001, Buchans River Ltd. reported anomalous values of palladium (up to 0.83 g/t), platinum (up to 0.36 g/t) and gold (up to 0.23 g/t) from grab samples from its Ossok Mountain property in western Labrador. The holdings were increased to 180 claims and a geological mapping and prospecting follow-up program was completed in June 2001. Also in February 2001, Altius Resources Inc. staked 156 claims around its 30-claim Lake Michael platinum-palladium property in eastern Labrador.

On July 3, 2001, Hudson Bay Exploration and Development Company Ltd. staked 292 claims in four separate areas covering nickel potential in the general areas of Hebron Fiord and Tasieluk Lake. On August 9 and October 1, 2001, Hudson Bay Exploration and Development Company Ltd. also staked a total of 159 claims near Kingurutik River. Reconnaissance geological programs were completed. Both areas are in northern Labrador.

Exploration - Newfoundland

On February 20, 2001, Cornerstone Resources Inc. announced that it had entered into a joint venture with Noranda Inc. on its Red Cliff copper property in the Bonavista Bay area. An additional 2651 claims were staked at about the same time. Noranda Inc. has made a firm commitment of \$1.2 million to be spent on exploration over the next two years. Exploration completed to date by the joint venture includes a 6-hole, 823-m diamond drilling program. On August 2, 2001, results from this diamond drilling program were released with up to 1% copper and

12.1 g/t silver over 14.25 m of core length reported. On June 4, 2001, Cornerstone staked an additional 1037 claims in the Bonavista Peninsula area, based on a Department of Mines and Energy till geochemistry data release. Cornerstone also completed a diamond drilling program on its West Princess copper property near Clarenville.

On April 2, 2001, Altius Minerals Corporation announced that it had signed an earn-in joint-venture agreement with Sudbury Contact Mines Limited on Altius's bonanza-type, epithermal gold Moosehead property near Bishop Falls. Values up to 400 g/t gold from boulders and 259 g/t gold over 0.1 m from diamond drilling have been reported by Altius from previous exploration on the property. On October 4, 2001, Altius announced the results of a 13-hole, 1113-m diamond drilling program, including 11.05 g/t gold over a core length of 17.11 m, which contained a quartz vein grading 96.72 g/t gold (uncut) over 1.5 m of core length. Currently, all data from the diamond drilling program and a detailed structural study are being integrated into a three-dimensional geological model.

In September 2001, Sulliden Exploration Ltd. withdrew from its option with Altius Resources Inc. on the Mustang and Rolling Pond properties. In October 2001, Altius staked 855 claims related to its sediment-hosted, low-sulfidation, epithermal gold Botwood Basin project. The claims occur along the northeast-trending, 40-km-long Mustang trend, extending from the Mustang property southwest to the Beaver Brook antimony mine and beyond to the Swiss Lake property, along with 85 claims at Rolling Pond and 15 claims at Chiouk Brook on the northwest-trending Miguel trend. Another 111 claims were also staked at the Paradise Lake property on the northeast-southwest Moosehead trend.

Hudson Bay Exploration and Development Company Ltd. completed a program of prospecting, geology, mapping, geochemistry, ground and airborne geophysics, and diamond drilling on its 600-claim Green Bay base-metal property near Springdale. Hudson Bay Exploration and Development Company Ltd. has an option to earn a 60% stake in the property from Major General Resources Ltd.

Gallery Resources Limited has completed prospecting, geological mapping, geochemical and geophysical programs, and a limited diamond drilling program on its Katie base-metal property, south of Bishops Falls, where high-grade volcanogenic massive sulphide (VMS) boulders had previously been located. Diamond drilling results include stringer zinc, lead and silver mineralization. Grades from 1.2-2.7% zinc have been reported from individual stringers. Additional diamond drilling is in progress.

In February 2001, Altius Minerals Corporation announced that it had acquired two new properties. The 62-claim Fortune Bay property in eastern Newfoundland covers an area of stratiform copper mineralization within a sequence of gray-green clastic sedimentary rocks. The 60-claim Rocky Brook property in western Newfoundland covers an area of unsourced boulders that contain anomalous values of uranium, silver and gold within Carboniferous sedimentary rocks. Altius has completed a trenching program on the Rocky Brook property and an additional 90 claims were staked in August 2001.

On November 2, 2001, Altius Minerals Corporation announced that it had signed an agreement to acquire the north portion of the past producing Rambler mines, on the Baie Verte Peninsula, from Ming Minerals Inc. Altius also has the right of first refusal on the Rambler South property.

Government Incentives

The Government of Newfoundland and Labrador's annual contributions to the Junior Company Exploration Assistance Program (\$1.75 million), the Prospectors Assistance Program (\$250 000) and the Dimension Stone Incentive Program (\$250 000), each matched by funds from the industry, remain unchanged.

Further changes to the Junior Exploration Company Assistance Program in 2000 included the acceptance of proposals to complete diamond drilling on selected geophysical and/or geochemical targets. As a result, most diamond drilling programs in the province now receive some assistance from this program.

In 2000, 106 prospectors received assistance from the Prospectors Assistance Program. Advanced prospectors' assistance of up to \$10 000 is now available under this program.

Legislative Changes

In December 2000, the Main River, a candidate for National Heritage River designation, was declared Exempt Mineral Lands (EML) and removed from staking.

In May 2001, the Mealy Mountains region in southwestern Labrador was also declared EML and a joint federal-provincial study was initiated on a proposed national park for the area.

2.3 NOVA SCOTIA²

Exploration Highlights

Exploration expenditures in Nova Scotia for 2000, including deposit appraisals, totaled an estimated \$3.7 million, an amount comparable to the 1999 total of \$3.6 million and representative of a halt to the decreasing trend since 1996 when \$6.9 million was spent on exploration (**Table 13**). If engineering, economic/feasibility studies, and environmental and land access costs are included, the total preliminary estimate for 2000 increases to \$4.3 million. The current forecast for 2001 expenditures is \$3.5 million.

TABLE 13. NOVA SCOTIA MINERAL EXPLORATION STATISTICS, 1994-2001

| | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 ^p | 2001 ^f |
|-------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-------------------|-------------------|
| Exploration expenditures (field + overhead) (\$) | 1 714 000 | 2 843 000 | 6 892 000 | 6 726 000 | 4 835 112 | 3 600 000 | 3 700 000 | 3 500 000 |
| Claim staking (new and reissued) (general + special licences) (no. of claims) | 14 614 | 16 407 | 34 265 | 26 403 | 9 440 | 14 249 | 9 624 | 8 030 |
| Exploration diamond drilling (metres) | 7 725 | 8 000 | 15 600 | 26 487 | 20 297 | 16 860 | 8 200 | .. |

Source: Nova Scotia Department of Natural Resources.
 .. Not available; ^f Forecast; ^p Preliminary.

Approximately two thirds (\$2.5 million) of the 2000 total was directed at industrial mineral commodities. Much of the work focused on the potential for secondary kaolin in Cretaceous sedimentary rocks in central Nova Scotia and primary kaolin, quartz and mica in Devonian granites in southwestern Nova Scotia. Kaolin from these projects is currently being evaluated for use as a filler and coater in the paper industry and for other applications. Other projects evaluated the potential for industrial minerals such as barite and titanium-bearing heavy mineral sands. Preliminary data indicate that the remaining one third of exploration expenditures was split between gold (\$1 million) and base-metal (\$250 000) projects, mostly in northern Nova Scotia and Cape Breton Island.

² The Nova Scotia review of activities was prepared by Michael MacDonald. For more information, the reader is invited to contact Mr. MacDonald by telephone at (902) 424-2523 or by e-mail at mamacdon@gov.ns.ca.

At the end of 2000, the total area under exploration licence, including new and re-issued claims and special licences, was approximately 157 000 ha (9624 claims), down roughly 30% from 230 000 ha (14 249 claims) in 1999. This is the lowest area under licence in the past 10 years, down substantially from the recent high of more than 500 000 ha (34 265 claims) in 1996.

Drilling in 2000 totaled approximately 8200 m, down from the 1999 total of 16 860 m. Approximately 50% of the exploration drilling was conducted by True Metallic Inc. on its Castle Frederick properties in Hants County to evaluate the potential for paleoplacer gold deposits. Evaluation of industrial mineral targets, including kaolin, silica and titanium-bearing sands, was responsible for some 40% of the drilling and the remaining 10% was focused on base-metal projects.

New Mines

In late 2000, Georgia Pacific Corp. began site preparation at its Melford surface gypsum mine in south-central Cape Breton Island upon receipt of all necessary permits. The deposit has a combined proven and probable mineable reserve of 35 Mt of gypsum. Georgia Pacific will bring the new quarry into operation while phasing out its nearby gypsum mine at Sugar Camp.

In May 2001, Newfoundland Goldbar Resources Inc. reported that EnviroGold Technologies Inc., the operators of Goldbar's 100%-owned Dufferin mine at Port Dufferin, had successfully driven the decline to the second saddle reef. Where intersected, the second quartz saddle reef has a true width of 4 m. Diamond drilling in 1999 traced this and two other saddle reefs for a strike length of 700 m. Newfoundland Goldbar previously reported a geological inventory for the Dufferin mine of 152 104 t of ore grading 13.25 g/t gold. In the 30-day period from May 15 to June 15, 2001, EnviroGold recovered 1448 oz (45 kg) of gold for delivery to the refinery. This was produced from an on-site gravity mill operating at a rate of 200 t/d. EnviroGold plans to slowly increase the milling rate to 300 t/d. The company has focused its mining efforts on the first and second saddle reef veins and has successfully mined by drifting along strike on both the first and second saddles.

C₂C Zeolite Corporation is proceeding with plans to develop a zeolite mine at its Tower View property, formerly referred to as Stronach Mountain, on the North Mountain basalt flows in southern Nova Scotia. The company has received all of the necessary permits for its project and has recently been issued a mining lease following the completion of geological mapping, diamond drilling, bulk sampling, test processing and other analytical work at the site. C₂C has also conducted research and product development work, and plans to build a processing facility in the Annapolis Valley, subsequent to the commencement of mining.

Development-Stage Projects

In May 2001, LaFarge Canada Inc. announced that it had leased the Rhodena Rock quarry at Porcupine Mountain on the Strait of Canso. The company reported plans to produce 100 000 t of aggregate from the quarry in the summer of 2001 to test the rock's marketability. If the results of initial testing are positive, the company plans to expand the 4-ha site and develop a large aggregate operation for the export market.

Black Bull Resources Inc. continues to work on its Yarmouth quartz-kaolin project located near Shelburne in southern Nova Scotia. Work completed to date includes trenching, geophysical surveys (induced polarization), diamond drilling, bulk sampling of a quartz zone, and sample testing. The company reports that the quartz-kaolin zone ranges from 100 to 200 m in width, exceeds 100 m in depth and extends for 1.6 km. Black Bull continues to conduct market research for the kaolin, quartz and muscovite from the deposit and has initiated the design and engineering studies necessary to bring the project to the development stage. Black Bull plans to commence quartz production in 2002, pending receipt of the necessary permits. The company has also reported that a kaolin product research program has been initiated with

assistance from Industry Canada's Industrial Research Assistance Program. This program will investigate the development of value-added kaolin products for use by manufacturers of paper, ceramics, sanitary ware and other products.

Pioneer Coal Limited continues to evaluate the application of highwall mining technology to extend mine life and increase production at its open-pit coal operations in northern Nova Scotia and Cape Breton Island. The company has constructed and successfully tested its own high-wall miner – the NovaMiner 2000 – at the Coalburn surface coal mine.

Dunlop Mining Corporation Limited has been issued a mining lease and plans to re-process barite tailings at Walton, Hants County, once the necessary approvals are obtained.

Exploration Projects

In July 2001, Titanium Corporation of Canada and NAR Resources Ltd. announced completion of an amalgamation to form Titanium Corporation Inc. The new company is exploring for titanium-bearing heavy mineral sands along the Shubenacadie River in central Nova Scotia. An independent valuation report by Florida-based Brian Stratford and Associates indicated a probable reserve of 331 Mt of sand with an average heavy mineral grade of 1.936%. The report also noted that the reserves may be increased by as much as 35-45% as the deposit remains open to the west and south. The company was conducting additional drilling at the time this report was prepared.

In May 2001, Atlantic Industrial Minerals Ltd. announced plans to acquire the assets of Lynx Minerals Inc. These assets include the Lake Ainslie barite project in Cape Breton Island where the Upper Johnson vein reportedly hosts a drill-indicated resource of 900 000 t and a probable resource of 300 000 t grading 45% barite. The vein is open at depth and to the west. During 2000, Lynx Minerals supplied mud-grade barite for use in offshore petroleum drilling in eastern Canada from its Scotsville operation. The company also completed a 12-hole drilling program to further evaluate the Scotsville deposit.

3779751 Canada Inc. conducted a diamond drilling project at the Strawberry Hill zone near the former Tangier Gold mine. The 12-hole drilling program was designed to test the distribution of auriferous veins at the deposit, evaluate the potential for saddle reef veins, and correlate stratigraphy with the former gold mine.

True Metallic Inc. has completed a 14-hole drilling program at its Castle Frederick project in central Nova Scotia. A total of approximately 5500 m were drilled in 2000 and early 2001. The company is evaluating the potential for gold in paleo-stream channels within Carboniferous sedimentary rocks adjacent to auriferous Meguma Group rocks.

Kaoclay Resources Ltd. continues to evaluate the quality and extent of kaolin and silica sand deposits in central Nova Scotia. The company has completed bulk sampling, regional and detailed grid drilling, and shallow seismic surveying, and continues to evaluate various industrial applications for the kaolin.

Earth Science Search Inc. conducted exploration on 10 gold and copper prospects on 1600 claims throughout mainland Nova Scotia and Cape Breton Island. The company employed a combination of its "Probe 1 Hyperspectral" remote sensing technology and on-line government databases, using desktop GIS technology, to focus its follow-up exploration activities.

Champlain Resources Inc. continues to evaluate the rare-metal potential of pegmatite and granitic rocks near the former East Kemtville tin mine.

Goliath Copperfields Ltd. and a joint-venture partner completed drilling at their Lochaber project to evaluate the potential for gabbro-hosted copper near the College Grant occurrence.

Work has recently been conducted on the Pine Brook barite deposit in central Cape Breton Island by Mercator Geological Services Ltd. The project, on the claims of George MacKay and Robert MacDonald, consisted of a 15-hole grid drilling program to the west of and along strike from the previous open pit. The drilling confirmed results from earlier, widely spaced drilling and successfully brought more tonnage into the measured category.

C₂C Zeolite Corporation has acquired 225 claims in nine locations throughout the central portion of the South Mountain Batholith in eastern Nova Scotia to explore for tantalum and other rare metals in the granitic rock units. The company conducted a preliminary program of till and rock sampling and geochemical analysis, basic prospecting and geophysical orientation work in 2001.

Several companies are currently evaluating the viability of salt dome structures for potential underground gas storage in light of the recent Sable Offshore Energy Project and the resurgence in offshore gas exploration in Nova Scotia. These interests have focused on structures near the Maritimes and Northeast Ltd. pipeline that extends from Goldboro on the Atlantic coast through central and northern Nova Scotia to New Brunswick and New England. Statia Terminals Canada Incorporated completed a two-dimensional seismic survey and was considering additional geological and geophysical programs to obtain information about the salt deposit in Port Richmond. Other companies evaluating geostorage in salt deposits include Intragaz and Company Limited Partnership, which is exploring in the McIntyre Lake and Kingsville areas, and Geostorage Associates, which is exploring near Stewiacke.

Mineral Production

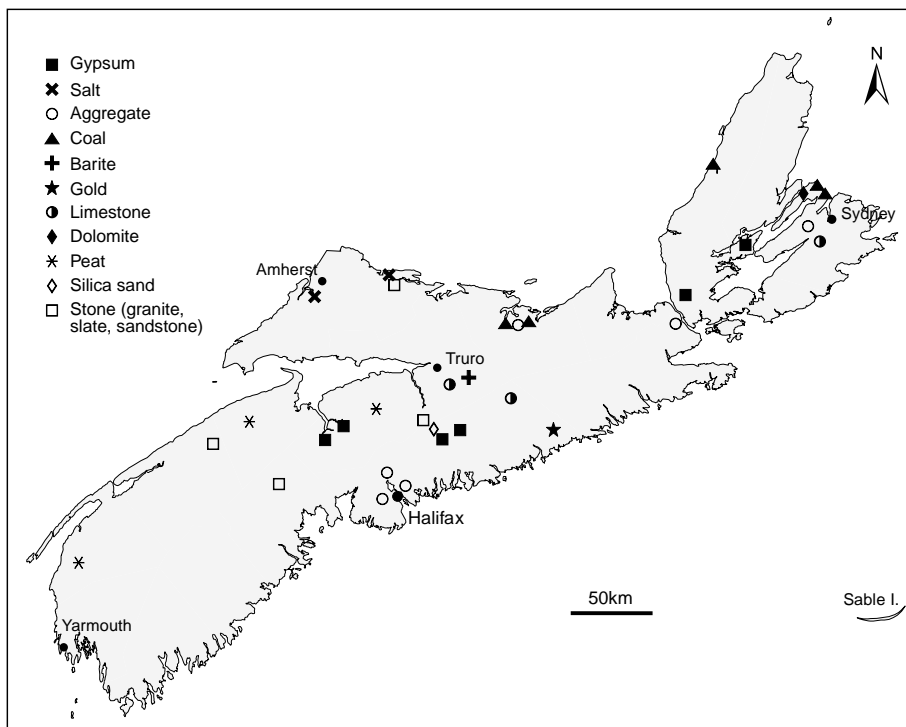
The estimated value of Nova Scotia mineral production for 2000 is \$310 million, a decrease of 9% from 1999. The closure of Cape Breton Development Corporation's Phelan colliery in September 1999 accounted for much of this reduction. The corporation's last remaining underground coal mine, the Prince colliery, ceased production on November 23, 2001.

Other sectors of Nova Scotia's mining industry, however, maintained strong production levels. Five operating open-pit mines produced 7.2 Mt of gypsum in 2000, accounting for approximately 80% of the total Canadian production (**Figure 20**). Most of the gypsum was shipped to wallboard plants along the eastern seaboard of the United States. Production of salt from the underground mine at Pugwash and the brining operation at Nappan was slightly more than 900 000 t in 2000, representing a 7% increase over 1999. Production of construction aggregates, including both crushed stone and sand and gravel, was 10.6 Mt in 2000. An independent survey ranked three Nova Scotia crushed stone operations in the top 20 quarries in Canada. These include the Martin Marietta Porcupine Mountain quarry, Municipal Contracting's Rocky Lake quarry, and Conrad Brothers' Dartmouth quarry. The 5.5 Mt of material produced by these three quarries accounted for 11.4% of total Canadian production in 2000. Cement shipments from the LaFarge plant near Brookfield were slightly higher in 2000 than in 1999. Production of gold from the underground mine at Port Dufferin represents the first significant metallic mineral production in Nova Scotia since 1991.

Prospector Assistance Program

Funding for prospector training and grass-roots exploration, through the four-year Prospector Assistance Program (PAP), ended in March 2001. However, some residual PAP funds are being used in the 2001/02 fiscal year to assist prospectors' efforts to market their properties to junior and senior mining companies at local, national and international trade shows. Funding will be available for prospectors to travel to the annual meeting of the Prospectors and Developers Association of Canada in Toronto in March 2002.

Figure 20
Active Mines in Nova Scotia, 2000



Source: Nova Scotia Department of Natural Resources.

2.4 NEW BRUNSWICK³

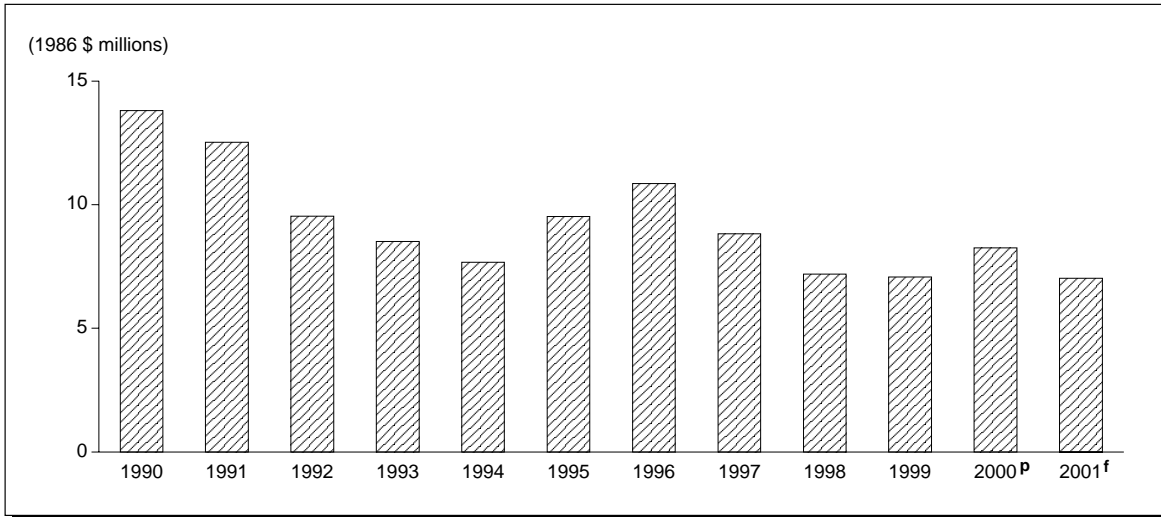
Exploration Highlights

The New Brunswick exploration industry experienced slightly higher activity levels in 2000 than in the previous two years. Actual exploration expenditure surveys conducted for New Brunswick in 2000 indicate that approximately \$12.1 million (\$10.0 million in 1999) was spent in the province on exploration projects. Exploration trends as expressed by monies spent (constant 1986 dollars) on exploration projects in New Brunswick over the past 10 years are shown in **Figure 21**.

Another upward trend in 2000 was in the number of new claims recorded in the province. In 2000, 3084 claims were recorded, compared to 1771 claims in 1999, a 74% increase. Although the number of new claims recorded was up substantially in the year, the number of total claim equivalents in effect for 2000 was down slightly at 20 747, a 3% decrease from the 1999 level of 21 362.

³ The New Brunswick review of activities was prepared by Don J.J. Carroll. For more information, the reader is invited to contact Mr. Carroll by telephone at (506) 453-2206 or by e-mail at Don.Carroll@gnb.ca.

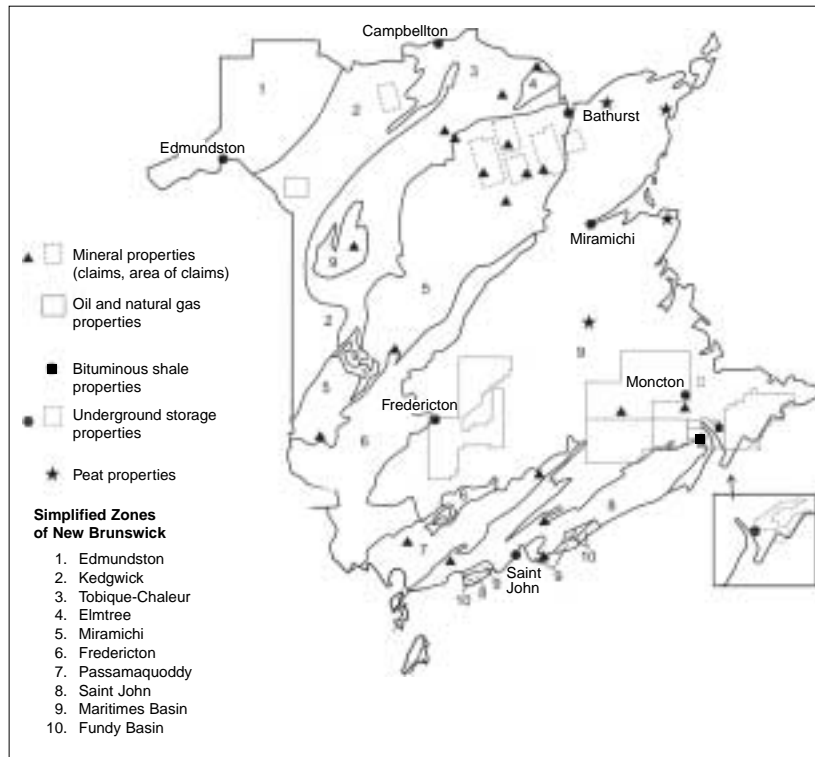
Figure 21
Mineral Exploration Expenditures in New Brunswick, 1990-2001



Source: New Brunswick Department of Natural Resources and Energy.

^f Forecast of intentions; ^P Preliminary.

Figure 22
Exploration Activity in New Brunswick, 2000



Source: New Brunswick Department of Natural Resources.

Metallic Minerals

Exploration activity in northern New Brunswick (**Figure 22**) remains focused on base metals in the Bathurst mining camp. In 2000, it is estimated that about \$8.6 million was spent by both major and junior mining companies, the bulk of the funds being concentrated on projects within the Bathurst mining camp.

The active major companies in northern New Brunswick included Hudson Bay Exploration and Development Co. Limited and Noranda Inc. Other majors such as CanZinco Ltd., Falconbridge Limited, Phelps Dodge Corporation of Canada Limited, and Teck Exploration Ltd. continue to hold land positions in the region. However, they did not do any work on their properties in 2000.

Noranda Inc. accounted for approximately \$7 million of the total exploration expenditures in northern New Brunswick. The company spent all of it within the Bathurst mining camp. Approximately \$2 million of this total was spent on a three-dimensional seismic survey in the Brunswick belt. Most of Noranda's work was focused on the Brunswick-Portage River and Upsalquitch-Halfmile lakes belts. Fifteen holes totaling approximately 14 000 m were drilled on the No. 12 Crown grant to test the Brunswick horizon along strike from the mine and to depths of about 1 km. However, no significant sulphide zones have been found to date.

In the latter part of 1999, Noranda made a new discovery by prospecting near Mount Fronsac in the Upsalquitch-Halfmile lakes belt. To date, 41 holes totaling approximately 17 000 m have been drilled to test a large sulphide-bearing system that is hosted by rocks of the Flat Landing Brook formation. Drilling continues but, to date, it has not been possible to demonstrate continuity between the higher-grade sections.

No further drilling was undertaken at the Halfmile Lake Deep zone that was discovered in 1999 as a result of following up a three-dimensional seismic target. Thick intervals of massive sulphides were encountered in several drill holes but the grades were not sufficient to warrant further drilling at that depth. However, three holes totaling 2300 m were drilled at Halfmile Lake North.

Hudson Bay Exploration and Development Co. Limited is a new player in the Bathurst mining camp and began early in the year by flying its in-house airborne geophysical system over parts of it. Because processing of these data took longer than expected, the company did not acquire ground until late summer. The company has staked about 200 claims in the western part of the camp and optioned additional claims, including some from Northeast Exploration Services Limited. One hole was drilled in the fall of 2000 to test an airborne target south of the Portage lakes. The company expects to do more work in 2001.

Junior mining companies also continue to be quite active in northern New Brunswick. East-main Resources Inc. has the second largest land position in the Bathurst mining camp after Noranda, the result of entering into an option agreement with Stratabound Minerals Corp. During the summer of 2000, the company focused its exploration effort on one property referred to as "Railroad."

Other juniors active within the region included PGE Resources Corporation, Major General Resources Limited, Slam Exploration Ltd., Forest Gate Resources Inc., Fancamp Resources Ltd. and Heron Mines Limited.

Exploration for precious metals and base-metal sulphides continued in southern New Brunswick during 2000 (**Figure 22**). Exploration expenditures for the year in this area of the province are estimated to be \$1 million. The most vigorous activities were related to the expansion of resources on known gold properties and the search for new gold occurrences in the southwestern part of the province. Recent work in this area has demonstrated that there is excellent potential for substantial gold deposits associated with tin-tungsten-bearing granites.

In southwestern New Brunswick, Freewest Resources Canada Inc. continued a trenching and stripping program on its Clarence Stream property. Mineralized veins and alteration zones on this property commonly yield spectacular gold grades and, in general, may indicate the presence of a high-grade, medium-tonnage deposit like the Pogo deposit in the Tintina belt.

A group of New Brunswick prospectors and geologists has been very active in conducting geochemical surveys and prospecting on numerous properties in search of gold associated with granites in the same area. The group includes Pro-Max Resources Inc. (Emilio Doiron), Southfield Resources Ltd. (William Gardiner), Peter Fenety, Raymond Thorn and David Stevens. Many of their properties have known granite-related gold potential.

Several other junior mining companies and geoscientists have become active near the Clarence Stream property of Freewest Resources Canada Inc. as well. These include Union Gold Inc., Murgor Resources Inc., PGE Resource Corporation, Rubicon Minerals Corporation, Fancamp Resources Ltd., Golden Hope Mines Limited and Avard Hudgins. Most have conducted geochemical surveys and have prospected on many of their claim groups.

Exploration for base-metal sulphides in the region is focused on two main areas in south-central New Brunswick, one north and one south of Fredericton. In 2000, several prospectors and explorationists initiated a variety of surveys and conducted follow-up sampling programs to investigate massive sulphide prospects in the region.

Nonmetallic Minerals

During 2000, exploration for industrial minerals focused mainly on expanding the resource potential for high-calcium limestone and titanium deposits. The main target for high-calcium products is Carboniferous limestone of the Windsor Group. Graymont (NB) Inc. (formerly Havelock Lime [a division of Goldcorp Inc.]) conducted a 71-hole diamond drilling program on its Hicksville property north of Havelock. The program, which was completed late in 1999, was successful in outlining a significant new resource and provided valuable geological information for further exploration. In the same area, Lafarge Canada Inc. re-evaluated deposits on its Springhill property. A detailed geological mapping, compilation and resource calculation program led to a significant increase in reserves.

Noranda Inc. has re-activated its diamond drilling program as a means of further investigating the titanium potential at Lower Coverdale, south of Moncton. In this area, extensive titanium and phosphorus mineralization is associated with a Lower Devonian, mafic-ultramafic complex buried beneath the Carboniferous cover sequence. Two of the original diamond drill holes will be deepened and additional holes are planned.

Five new applications for peat exploration licences on Crown lands were received in 2000. Since May 1999, however, all new peat applications received have been placed on hold pending the finalization of a government review of provincial policies concerning the peat industry.

Outlook

The outlook for 2001 is for stable mineral exploration activity in northern New Brunswick with perhaps increased activity in the southern part of the province, particularly in the southwestern sector in and around the community of Rollingdam. It is in this area that Freewest Resources Canada Inc. continues to receive encouraging gold results from its drilling program on the Clarence Stream property. These results have precipitated more claim staking by other junior companies and local prospectors.

Company spending intentions for 2001, as compiled by the federal-provincial/territorial Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures, point to possible exploration and deposit appraisal expenditures of \$10.3 million in New Brunswick in 2001.

Mining Highlights

The value of mineral production (including coal) in New Brunswick in 2000 is estimated to be about \$791 million (**Figure 23**), representing a drop of 7% from the final value of \$849 million in 1999. The year 2000 marked the first full year without production from Noranda's Heath Steele base-metal mine, which closed at the end of October 1999. An increase in the zinc price was not sufficient to offset this loss of production in the metals sector.

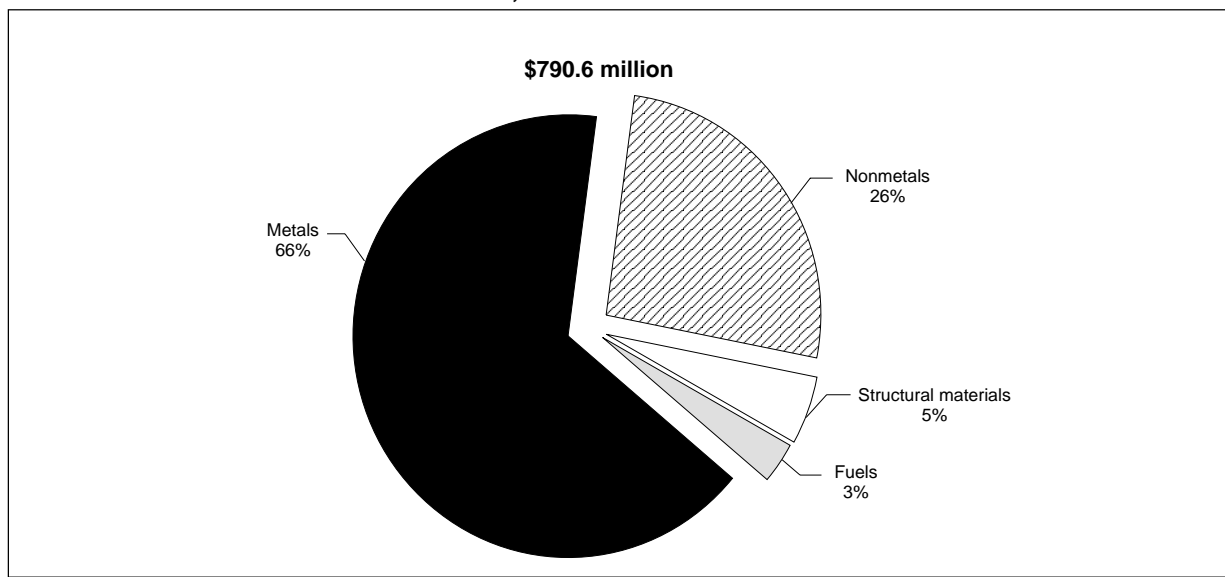
Current non-renewable mineral resource production (including coal and peat) is derived from 37 deposits: 1 base-metal, 1 potash, 1 coal, 2 silica, 4 dimension-stone, 6 limestone, 10 aggregate and 17 peat (**Figure 24**).

In 2000, the New Brunswick mineral industry employed an average of 2633 people. **Table 14** shows employment (permanent and seasonal) by sector in the mineral industry for 2000.

The value of metals production during the year was \$523 million, which represents 66% of the province's value of mineral production. Overall, the sector was down by 12% because of the closure of the Heath Steele mine. Noranda's Brunswick mine experienced slightly higher throughput. CanZinco's Caribou mine remained closed for the second full year after low metal prices and metallurgical difficulties forced the suspension of operations in August 1998.

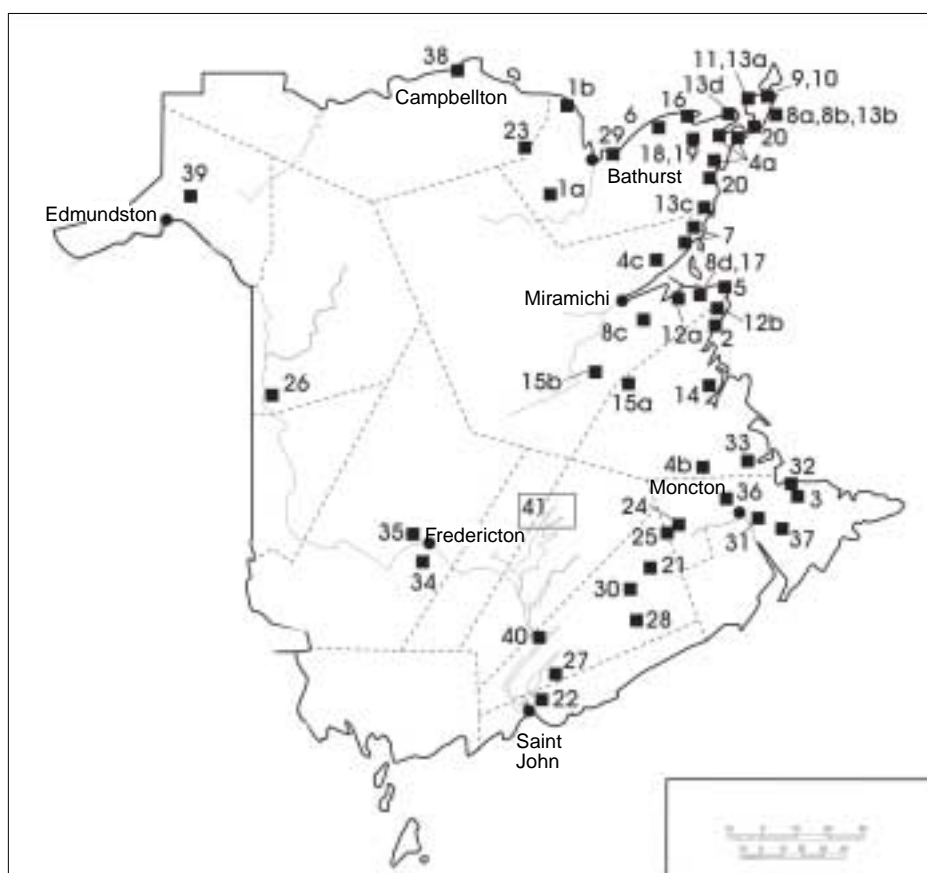
Zinc continued to dominate the metals sector with a value of \$398 million, which represents 76% of the total value of metal production. The value of zinc production decreased by approximately 12% from 1999. Lead contributed \$45 million to the value of metal production, down 17% from 1999. Lead production fell by 8% while the price fell by almost 10%. The value of copper production increased by 2% to \$26 million on the strength of a 15% increase in the price (82.2¢/lb in 2000 vs. 71.4¢/lb in 1999), even though production fell by 11%. Antimony, bismuth and cadmium continued to be produced as by-products at the Brunswick operation. The total value of the three by-product metals was practically unchanged. Gold production increased by 6.6% after a substantial decline in 1999 and its value increased by a similar proportion as the

Figure 23
New Brunswick Mineral Production Value, 2000



Source: New Brunswick Department of Natural Resources and Energy.

Figure 24
Mines, Quarries and Peat Harvesting Operations in
New Brunswick, 2000



- | | |
|--------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| 1. Noranda Inc.: (a) Brunswick mine (Pb, Zn); (b) Belledune lead smelter | 22. Brookville Manufacturing Company (limestone, dolomite) |
| 2. ASB Greenworld Ltd. (peat) | 23. Elmtree Resources Ltd. (limestone) |
| 3. Beausejour Peat Moss Inc. (peat) | 24. Graymont (NB) Inc. (limestone) |
| 4. Compagnie de Tourbe Fafard Itée (peat): (a) Shippagan; (b) Kent; (c) Burnt Church | 25. Lafarge Canada Inc. (limestone) |
| 5. Good Earth Canada Ltd. (peat) | 26. Upper Kent Lime Works Ltd. (marl) |
| 6. Grande Anse Peat Moss Co. Ltd. (peat) | 27. Kingsway Materials Ltd. (limestone) |
| 7. Heveco Ltd. (peat) | 28. Atlantic Silica Inc. (silica) |
| 8. La Mousse Acadienne (1979) Itée (peat): (a)Acadienne; (b) Chiasson; (c) Miramichi; (d) Eel River | 29. Chaleur Silica (a Division of The Shaw Group) (silica) |
| 9. La Tourbe de Pigeon Hill Itée (peat) | 30. Nelson Monuments Ltd. (dimension stone) |
| 10. La Tourbière de Petit-Shippagan (peat) | 31. Maritime Stone Works Inc. (dimension stone) |
| 11. La Tourbière du Centre de l'Île Itée (peat) | 32. Smith Cut Stone and Quarries Limited (dimension stone) |
| 12. Le Groupe Berger Itée (peat): (a) St-Camille area; and (b) Bay du Vin area | 33. Bastarache Stone Quarrie (dimension stone) |
| 13. Le Groupe Qualité Lamèque Itée (peat): (a) Lamèque; (b) St. Raphaël; (c) Canadian Supreme; (d) Pokesudie | 34. Diamond Construction Limited (crushed stone) |
| 14. Malpec Peat Moss Ltd. (peat) | 35. Gray Stone Quarries, a division of Tri Gil Paving and Construction Ltd.; Warren Maritimes Ltd. (crushed stone) |
| 15. Premier Horticulture (Premier Tech Itée) (peat): (a) south and (b) west of Rogersville | 36. Moncton Crushed Stone, a Division of Modern Construction Ltd.; H.E. Carson Limited (crushed stone) |
| 16. Sun Gro Horticulture Canada Ltd. (peat) | 37. Acadia Crushed Stone Division of Modern Construction Ltd.; MacDonald Paving and Construction Limited (crushed stone) |
| 17. Theriault & Hachey Peat Moss Ltd. (peat) | 38. C.M. Stewart Company Limited (crushed stone) |
| 18. Tourbière 2000 inc. (peat) | 39. Clarence Daigle et Fils Itée (crushed stone) |
| 19. Tourbière L.M. Itée (peat) | 40. Lafarge Construction Materials (sand and gravel) |
| 20. Tourbière Tracadie Itée (peat) | 41. N.B. Coal Limited (coal) |
| 21. Potash Corporation of Saskatchewan Inc. (New Brunswick Division) (potash, salt) | |

Source: New Brunswick Department of Natural Resources and Energy.

price remained unchanged. After a drop in 1999, the value of silver production fell by a further 14% as a 9.6% decrease in production was compounded by a 4.9% drop in the average price.

The nonmetals sector of the industry contributed \$203 million (26%) to the value of mineral production, a 10% increase over the 1999 value. The largest contributor to the value of nonmetals production was potash. Both the value and quantity of potash production increased from 1999 levels. Peat, the second largest contributor (\$60 million), represented 29% of the value of nonmetals. For the second consecutive year, both the amount and value of peat produced were higher than in the year before. Salt and sulphur in smelter gas ranked next in value of production with quartz and marl being minor contributors.

The value of coal produced by N.B. Coal Limited in the Minto-Chipman area increased by 16% to \$24 million despite a 4% decrease in production tonnage.

The value of production for structural materials (lime, stone, sand and gravel) decreased 14% to \$41 million. Sand and gravel production was down 17% while stone production decreased by almost 22%. These commodities provide the raw materials for the construction industry in New Brunswick.

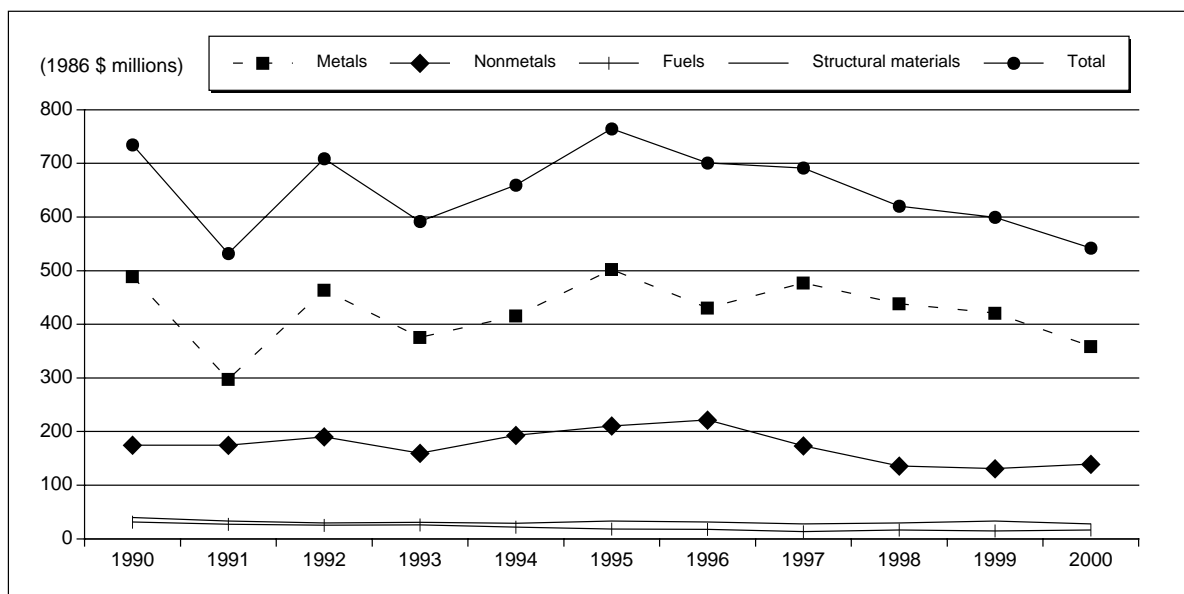
As reflected in the mineral production value trend graph for the past 10 years (**Figure 25**), New Brunswick is experiencing a slow, progressive decline in its value of mineral production for various reasons.

TABLE 14. EMPLOYMENT IN NEW BRUNSWICK'S MINERAL INDUSTRY, BY SECTOR, 2000

| Sector | Number of Employees |
|----------------------|---------------------|
| Metals | 1 617 |
| Potash | 419 |
| Coal | 95 |
| Peat | 400 ¹ |
| Structural materials | 100 |
| Total | 2 633 |

Source: New Brunswick Department of Natural Resources and Energy.
¹ The figure has been adjusted to reflect full-time employment.

**Figure 25
New Brunswick Mineral Production Values, 1990-2000**



Source: New Brunswick Department of Natural Resources and Energy.

Incentive Programs and Special Projects

Mineral Exploration Stimulation Program (MESP)

In 2000, the Province of New Brunswick continued its support for this popular prospector assistance program. The MESP budget for the year was \$90 000 (\$60 000 for prospecting grants and \$30 000 for prospecting courses). During the year, 38 applications for assistance were approved.

New Brunswick Exploration Assistance Program (NBEAP)

This program continues to be extensively utilized by the junior mining sector to assist in their exploration activities in the province. Funding levels for 2000 matched those of previous years and provided assistance to 13 recipients totaling \$350 000.

Value-Added/Mineral Processing Program (VAMP)

The VAMP, launched in 1996 in accordance with New Brunswick's Mineral Policy, is designed to provide funding on a shared basis for projects that could enhance the value of New Brunswick's minerals either by processing them to a higher level or by improving the recovery of present products. In 2000, the program funded one study, a geochemical technology project.

For More Information

To obtain a more in-depth review of the New Brunswick mineral industry, please visit the Minerals and Energy Division's web site at <http://www.gnb.ca/0078/minerals/index.htm> or, specifically, the report entitled *Preliminary Review of New Brunswick's Mineral Industry 2000*, which can be downloaded at <http://www.gnb.ca/0078/minerals/ftpleadin.htm> using the file name Mineral Resource Report 2001-1.pdf.

2.5 QUÉBEC⁴

Québec, A Winning Choice for the Mining Industry

Québec is known for its high mineral potential and many of its regions depend on the mining sector for their livelihood. World-class deposits of gold and base metals are mined in the province, which is the world's second largest producer of niobium and Canada's second largest producer of iron ore. The Québec government is constantly breaking new ground in developing and introducing some of the country's most generous tax measures. These measures are directed specifically toward mineral development and toward exploration in areas of Québec's Near North and Far North regions, which are under-explored. Prospectors and mining companies can take advantage of the many financial assistance programs that have been introduced over a period of almost 20 years.

A number of excellent tools have been developed to facilitate the delivery and administration of mining titles and searches of geomining databases that cover the vast territory of the province. For example, GESTIM is a tool that can be used to request mining titles on-line by map designation. This tool is accessible on the Internet at <http://tm.mrn.gouv.qc.ca>. Québec also has one of the world's most powerful geomining databases, which is easily accessible via the Internet and can be queried rapidly using the *SIGÉOM à la carte* interface (<http://www.geologie-Quebec.gouv.qc.ca/>). Québec – a great place to explore!

⁴ The Québec review of activities was prepared under the supervision of Raymond Beullac. For more information, the reader is invited to contact Mr. Beullac by telephone at (418) 627-6289, ext. 5605, or by e-mail at raymond.beullac@mrn.gouv.qc.ca.

Overview⁵

Total exploration and deposit appraisal expenditures for 2000 (final data) reached \$118.0 million, a drop of some 11% since 1999 (**Table 15**). This decline is attributed primarily to a decrease in on-mine-site spending and, to a lesser extent, in off-mine-site expenditures as well. The \$29.3 million in on-mine-site expenditures in 2000 represents a decline of 24% relative to the \$38.7 million reported in 1999. As for off-mine-site spending, it declined by 5% from \$93.6 million in 1999 to \$88.7 million in 2000.

A compilation of drilling data supplied by drilling companies reveals that a total of 593 605 m were drilled in 2000, a 17% decrease from the 717 724 m reported in 1999. This declining trend has been observed since 1996.

TABLE 15. EXPLORATION FINANCING IN QUÉBEC, 1996-2000

| | 1996 | 1997 | 1998 | 1999 | 2000P |
|------------------------------------------------|---------------|-------|-------|-------|-------|
| | (\$ millions) | | | | |
| Value of flow-through share issues | 27.4 | 22.9 | 12.3 | 7.2 | 12.3 |
| Exploration and deposit appraisal expenditures | 148.2 | 190.1 | 170.3 | 132.3 | 118.0 |
| Off-property | 124.5 | 124.9 | 100.5 | 93.6 | 88.7 |
| On-property | 23.6 | 65.2 | 69.8 | 38.7 | 29.3 |

Source: Service de l'imposition et des données minières, Ministère des Ressources naturelles du Québec.

P Preliminary data.

New Mining Act (Loi sur les mines)

Bill 182, amending the *Loi sur les mines (Mining Act)* and the new *Mineral Substances Other than Petroleum, Natural Gas and Brine Regulation*, took effect on November 22, 2000. The goal of these legal and regulatory changes was to modernize the Québec mining regime to increase the security of tenure of mining titles and to eliminate conflicts. A further result has been the simplification of the rules governing the acquisition of titles and their administration for both the Department and its clients.

The adoption of map designation as the sole mode of acquisition of exploration claims, based on a pre-defined and permanent division of the Québec landmass, means that claims are no longer vulnerable to third-party challenges. In addition, the adoption of the claim as the only exploration title gives the holder an exclusive right to search for all mineral substances in the public domain.

As of September 30, 2001, there were 91 883 active mining titles in Québec, compared to 95 981 at the end of 1999. Although the number of claims is lower, the total surface area they cover has increased from 4.6 Mha in November 2000 to 5.1 Mha in September 2001, representing an increase of 10%. This greater surface area is the result of the size of the new designated claim, which is, on average, three times larger than the former staked claim. Since November 22, 2000, 26 808 new designated claims have been registered.

In order to facilitate the administration of the new Act, the Québec Department of Natural Resources (MRN) has developed a computer tool for managing mining titles (GESTIM). This

⁵ Source: *L'industrie minière du Québec*, 2000 Edition, Québec Department of Natural Resources, 2001.

tool makes it possible to integrate geomatics, electronic commerce and the use of the Internet. GESTIM disseminates data from the public registry of mineral titles over the Internet. In addition, by enabling titles to be designated on maps, GESTIM makes it much simpler for prospectors and exploration companies to manage their mining properties.

Exploration and Deposit Appraisal

The main development projects include completion of the Penna shaft (2250 m in depth) at Agnico-Eagle Mines Limited's LaRonde mine. Agnico-Eagle has also completed its plant expansion, increasing the rate of daily production from 2000 t to 5000 t and adding a zinc circuit. The LaRonde mine is Canada's largest gold mine with resources of 7.8 million oz (243 000 kg), assuring it of a mine life of more than 15 years. Cambior Inc. and Aurizon Mines Ltd., co-owners of the Sleeping Giant mine located near Amos, have uncovered three new gold lenses that will extend the mine's life by at least two years.

The continued weakness in the price of many metals has prompted the government to take certain actions in support of the mining industry. It recently provided Richmond Mines Inc. with financial assistance of \$2.7 million over three years to cover, among other things, part of the cost of stabilizing the surface pillar adjacent to the Beaufor mine shaft. This will permit resumption of production, now planned for February 2002. Cambior Inc. received \$2.2 million in funding for advanced exploration work at the Mouska, Doyon and Sleeping Giant mines. In August 2001, McWatters Mining Inc. announced that it had obtained all the necessary approvals to reroute a section of highway 117 in Val-d'Or. This work is necessary to enable production to resume at the Sigma-Lamaque open pit and was initiated following the receipt of \$4.4 million in financial assistance, which was granted when the MRN and the province's Ministère des Transports, Ministère des Affaires municipales and Ministère de la Métropole joined forces. The federal government contributed \$2.2 million under the Canada-Québec Infrastructure Agreement.

Magnola Metallurgy has commenced production of magnesium at its Danville plant in the Asbestos region. Work continued on the development of deposits of apatite in the Sept-Îles region, of vanadium in the Chapais-Chibougamau region, of niobium in the Oka region, and of graphite in the Fermont region. The latter three projects received government assistance in 2001.

Exploration Highlights

One of the MRN's main objectives involves the diversification of Québec's mineral industry. To this end, through the intermediary of Géologie Québec, the MRN has begun mapping new areas of Québec's Near North and Far North regions. During the 2000-01 period, 33 new geological maps, covering over 137 000 km², were produced for areas across the province, leading to the discovery of new volcano-sedimentary belts that contain nickel, copper and gold showings. The Gayot Lake and Qullinaaraaluk Lake areas attracted the interest of companies searching for nickel.

In 2000-01, exploration companies focused on the search for diamonds, as well as base metals, specifically nickel and platinum group elements.

Diamond exploration focused on three centres: the Torngat Mountains, the Wemindji region, and the area north of the Otish Mountains. In 2000, some 15 diamond exploration companies spent approximately \$4 million exploring the region of the Torngat Mountains along the eastern shore of Ungava Bay. Several kimberlite dyke swarms were discovered, the largest of which is over 50 km in length. In April 2001, Twin Mining Corporation announced that 1548 macrodiamonds had been recovered from 342 t of kimberlite samples from the main dyke. The largest diamonds weigh between 0.199 carats (ct) and 0.685 ct. Tandem Resources Ltd. and Diamond Discoveries International Corporation also announced the discovery of diamonds

and rubies on their property in the Torngat Mountains area. Two samples, totaling 54.8 kg, taken from a kimberlite dyke 2 m thick and 5.6 km long, yielded ten diamonds, four of which were macrodiamonds.

Dianor Resources Inc. announced the discovery of the first diamond found in the western part of the James Bay region. The specimen is a macrodiamond and is pale yellow in colour. Near the village of Wemindji, on the shore of James Bay, Majescor Resources Inc. reported finding zones containing highly anomalous quantities of kimberlite indicator minerals. Kimberlite fragments were also discovered. Following these announcements, there were staking rushes in both areas.

In the region of the Otish Mountains, approximately 275 km north of the town of Chibougamau, Ditem Explorations Inc. sampled a kimberlite pipe in 1998. The pipe had originally been discovered by Uranerz in 1978 during a uranium exploration campaign. At that time, four gem-quality diamonds had been recovered from a 97-kg sample. In the past two years, Majescor Resources Inc./BHP Diamonds Inc. and SOQUEM INC./Ashton Mining of Canada Inc. have outlined an area rich in kimberlite-indicator minerals approximately 100 km north of the kimberlite pipe discovered by Ditem Explorations Inc. In October 2001, SOQUEM INC. and Ashton Mining of Canada Inc. announced that drilling had intersected ultramafic intrusions that bore a strong resemblance to kimberlites. Samples are being analyzed for diamonds. This region also experienced a staking rush.

Base-metal exploration focused primarily on the Abitibi area and on northern Québec. Near the Matagami airport, Noranda Inc. discovered three mineralized zones, Equinox, Perseverance and Perseverance West, located between 30 m and 250 m from surface. Indicated and inferred resources are estimated at 5 Mt grading 16.8% zinc, 1.3% copper, 34 g/t silver and 0.4 g/t gold. A feasibility study is under way to evaluate these deposits. On the Midrim property, located in the Belleterre area of the Témiscamingue region, drilling by Aurora Platinum Corporation intersected 21 m grading 2% nickel, 2.14% copper, 0.5 g/t platinum and 1.74 g/t palladium. In northern Québec, Osisko Exploration Ltd. and Virginia Gold Mines Inc. reported that drilling on the Payne Bay property intersected 321 m grading 0.48% nickel and 0.18% copper. At Qullinaaraaluk Lake, the MRN found a massive sulphide showing that can be followed over a distance of approximately 25 m and varies in width from one to four metres. Selected samples from this site graded between 1.7% and 2.6% nickel and 0.08% and 1.8% copper. Further to the south, Virginia Gold Mines Inc. and Billiton Metals Canada Inc. discovered several new occurrences of nickel, copper, cobalt and platinum group metals on the Gayot Lake property. Between Schefferville and Ungava Bay, the Australian company, WMC Ltd., obtained several exploration permits covering an area of 13 000 km². In April 2001, the company announced the discovery of mineral occurrences associated with electromagnetic conductors. Finally, north of Port-Cartier on the North Shore, Appalaches Resources Inc. continued drilling on its B-20 property, obtaining some interesting results, including 0.43% nickel over 12.7 m.

With regard to gold exploration, SOQUEM INC. and Eastmain Resources Inc. continued their work in the area of the Clearwater deposit in the James Bay region. Surface stripping to the west of known veins revealed six new, parallel, gold-bearing veins, one of which graded 21.3 g/t gold over a length of 67 m and an average width of 1 m. In addition, over 60 drill intersections have yielded values ranging from 5 to 200 g/t gold, confirming the extension of the gold structures at depth. Channel sampling on the PEM 1404 property of Dianor Resources Inc. yielded 1.3 g/t gold over 7 m (including 2.8 g/t gold over 2.26 m) and 1.7 g/t gold over 4.4 m (including 3.24 g/t gold over 1.47 m). Finally, SOQUEM INC. and Sirios Resources Inc. obtained highly anomalous gold values on their Aquilon property, 400 km east of Radisson in the James Bay area. Selected samples yielded assays of over 128 g/t gold.

Public Financing for the Québec Mining Industry⁶

In 2000, the mining sector raised funds of \$55.9 million on the Québec financial market, a 95% increase from the \$28.7 million raised in 1999. Nevertheless, the amounts raised in 2000 remain clearly insufficient and much lower than the average of recent years.

During the same year, flow-through share issues raised \$12.3 million for mineral exploration activities, a 71% increase from the \$7.2 million raised in 1999. Most (83%) of this \$12.3 million total was earmarked for exploration projects in Québec.

Other sources of public funding (common shares [non-flow-through] and debentures) raised \$43.6 million, with half of this amount going to projects in Québec. This represents an increase of over 100% from the \$21.5 million raised in 1999, 48% of which was allocated to projects in Québec.

Tax Measures in Support of Mineral Exploration

In 2001, a new refundable tax credit was introduced for mineral exploration in Québec. This tax credit is available to companies with eligible expenses in Québec after March 29, 2001. The tax credit rate amounts to 40% of eligible expenses in the case of a non-producing company and to 20% in the case of a producing company. These rates increase to 45% and 25%, respectively, for exploration taking place in Québec's Near North and Far North regions.

The flow-through share regime, which is primarily used by junior mining companies to fund their exploration, has been extended to December 31, 2003. Individuals investing in such shares before that date will continue to be able to obtain a tax deduction that can amount to 175% of the cost of their investment when the issuing corporation incurs surface exploration expenditures in Québec.

Sodémex and Sodémex II

The objective of the Sodémex (Société de développement des entreprises minières et d'exploration) limited partnership is to participate in the development of the Québec mining industry through equity investments in junior exploration companies and mining producers in Québec. It was established in late 1996 with funds contributed by limited partners SOQUEM INC. and Capital d'Amérique CDPQ Inc. (a subsidiary of Caisse de dépôt et placement du Québec). The capital subscribed by the limited partners totals \$17 million, with \$7 million invested at the time Sodémex was created and the rest to be paid over a five-year period until 2001 at the rate of \$2 million per year. Sodémex II was created in August 1997 by Capital d'Amérique CDPQ Inc. With \$15 million in subscribed capital, it can invest in the Québec mining sector and at the same time improve the international prospects of Québec junior mining companies.

In 2000, the two limited partnerships invested some \$2.67 million in the primary market (new share issues) for shares of mineral exploration and mining companies. Sodémex invested \$1.42 million with 72% going to exploration companies. Sodémex II committed \$1.25 million, 84% of which went to exploration companies. The two limited partnerships were also active on the secondary market (existing securities), where they invested \$5.8 million, with three quarters of that amount going to exploration companies.

As of December 31, 2000, the market value of the mining portfolios of Sodémex and Sodémex II amounted to \$15.5 million. Their portfolios included shares in 56 mineral exploration and mining companies. Over the course of the year, investments were made in the following junior

⁶ Source: *L'industrie minière du Québec*, 2000 Edition, Québec Department of Natural Resources, 2001.

exploration companies and mining producers: Afri-Can Marine Minerals Corp., Azimut Exploration Inc., Sulliden Exploration Inc., Les Ressources d'Arianne Inc., Matamec Explorations Inc., Minerais Bruneau Inc., Cancor Mines Inc., McWatters Mining Inc., Osisko Exploration Ltd., Allican Resources Inc., Appalaches Resources Inc., Canspar Resources Inc., Gold Hawk Resources Inc., Majescor Resources Inc., Orleans Resources Inc., Sirios Resources Inc., Strateco Resources Inc., and Southern Africa Minerals Corporation.

Mining Investment Portfolio of the Québec Federation of Labour (QFL) Solidarity Fund

In 1996, the Solidarity Fund of the Québec Federation of Labour (QFL) established a mining portfolio with initial capital of \$32.5 million. At the beginning of 1998, the value of the portfolio was increased to \$67.5 million, which represents approximately 1% of all Solidarity Fund investments.

The Fund still maintains its original goal of distributing its assets among mining companies and mineral exploration companies. Approximately 90% of its investments are allocated to bringing new deposits into production or for the growth of Québec mining producers. The remaining 10% is earmarked for mineral exploration companies, primarily to support working capital requirements.

The Fund was particularly active during the 1999/2000 fiscal year and has remained active since the beginning of the 2000/01 fiscal year. As of December 31, 2000, more than two thirds of the \$67.5 million reserved for the mining sector was already invested in or committed to companies active in Québec.

Among the most important of the new investments announced by the Fund was its contribution to a \$2 million commitment, along with several other investors, to McWatters Mining Inc. to finance the expansion of the Sigma-Lamaque mill. The Fund also invested over \$3.5 million in Granite Bussière Inc. to contribute to its acquisition of Granilac Inc. Glendyne Inc. received a \$300 000 investment from the Fund for its project to expand its slate roofing shingle plant in Saint-Marc-du-Lac-Long. The Fonds régional de solidarité du Bas-Saint-Laurent also contributed \$125 000 to this project.

Investments of over \$1.8 million were made in debentures and shares primarily to increase the working capital of the following junior companies: Boreal Exploration Inc., Maude Lake Exploration Ltd., Niocan Inc., Osisko Exploration Inc., Allican Resources Inc., Majescor Resources Inc., and Southern Africa Minerals Corporation.

The Fund also made a number of investments on the stock market, purchasing shares in mineral exploration companies and producers. During the 18-month period ending December 31, 2000, the Solidarity Fund QFL invested a total of almost \$9 million in the mining sector.

In addition to the investments described above, the Fonds régional de solidarité Nord-du-Québec and the Fonds régional de solidarité Abitibi-Témiscamingue committed funds to companies such as Azimut Exploration Inc. and Metco Resources Inc.

Société d'Investissement dans la Diversification de l'Exploration (SIDEX)

In the budget speech of March 29, 2001, Finance Minister Pauline Marois announced the implementation of several tax and budgetary measures, including the establishment of a mineral exploration diversification fund. This led to the establishment, by the Québec government and the Solidarity Fund QFL, of the SIDEX limited partnership.

SIDEX has a mission to invest in companies conducting mineral exploration in Québec with a view to diversifying the province's mineral inventory. Its investment strategy is to subscribe for

capital stock in companies that have exploration projects that will ultimately contribute to the diversification of Québec's mining industry in terms of the commodities extracted and in terms of mineral-producing regions and new territories explored. This fund will enable the Solidarity Fund QFL, the Québec government and other partners to assume meaningful financial positions in the most promising exploration projects. This initiative should motivate other private and institutional investors to become involved through the contribution of additional funds.

The initial capital for SIDEX was fixed at \$50 million over five years, a sum to be provided by the Québec government (70%) and the Solidarity Fund QFL (30%). The Québec government's contribution will be spread over five years with \$6 million invested at the outset, \$10 million in 2002/03, \$10 million in 2003/04 and \$9 million in 2004/05.

Programs of Financial Assistance for Exploration

To provide support for mineral exploration activities in the province, the MRN offers various financial assistance programs for prospectors, regional exploration funds, companies and Aboriginal communities in the Near North and Far North regions.

The Programme d'assistance à l'exploration minière du Québec (Québec Mineral Exploration Assistance Program) (PAEM) helps independent prospectors and companies involved in prospecting and mineral exploration in Québec. Independent prospectors can obtain up to \$5000 per year for a basic prospecting project and up to \$15 000 per year for an advanced prospecting project. Companies may receive assistance in the form of a refund of 50% of eligible exploration expenditures, up to \$50 000 (\$75 000 for the Near North and Far North regions). In addition, certain regions of Québec are covered by regional funds. Under an agreement, the MRN has transferred to the regional exploration funds part of the PAEM management for projects situated in their respective regions. Two Aboriginal mining funds (Innu and Inuit) are also in operation.

The Programme de soutien aux sociétés juniors d'exploration (program of assistance for junior exploration companies) is specifically targeted at companies headquartered in Québec and active mainly in that province. Such companies can receive up to \$500 000 in financial assistance, comprising a maximum contribution of \$150 000 to working capital and \$350 000 to exploration work. In the budget speech of March 2001, it was announced that this initiative was to be extended for the 2001/02 fiscal year.

During the 2000/01 fiscal year, the MRN allocated a total of \$10.84 million to support mineral exploration activities in Québec. This funding consisted of \$7.26 million for the PAEM (including \$3.26 million allocated to the Abitibi mining region) and \$3.58 million for the implementation of a support program for junior mining companies facing financial difficulties.

2.6 ONTARIO⁷

Mining in Ontario – The Future's Right Here

Ontario's mining industry is strong, confident and poised to build on its current standing as Canada's top jurisdiction for mining investment. The industry's confidence in the future and its firm belief in Ontario's potential is a testament to the mining industry itself, as well as to the many exciting initiatives the provincial government has implemented over the past year – initiatives that have made Ontario one of the leading mining jurisdictions in the world.

⁷ The Ontario review of activities was prepared by Peter Cashin. For more information, the reader is invited to contact Mr. Cashin by telephone at (705) 670-5620 or by e-mail at peter.cashin@ndm.gov.on.ca.

Ontario's policies and initiatives in support of mining have strengthened the mines and minerals sector and have clearly communicated to the global exploration and mining industry that Ontario is open for business.

Ontario Mining Sector Support Measures Introduced Since 1995

Since 1995, the Government of Ontario has introduced the following measures to support the Ontario mining sector:

- A 50% reduction in the mining tax rate from 20% to 10% by 2004;
- Reducing corporate income tax rates for resource companies from 13.5% to 8% by 2005;
- A 10-year mining tax exemption for new remote mines opened after January 2001, after which time their profits will be taxed at a rate of only 5%;
- A new flow-through share incentive offering individual shareholders a 5% provincial tax credit, on top of the 15% federal tax credit and the 100% deduction currently available in respect of eligible Canadian exploration expenses;
- A one-year extension of the original two-year Ontario Treasure Hunt geoscience survey program, increasing total funding from \$19 million to \$29 million;
- A four-year, \$27 million, Abandoned Mines Rehabilitation program to provide a systematic approach to cleaning up abandoned mine sites located on Crown land in the province;
- A new four-year, \$8 million, Ontario Mineral Exploration Technologies program, designed to stimulate the development of new technologies for mineral exploration;
- Contributions through the Northern Ontario Heritage Fund of \$4 million in support of the restructuring and establishment of a new prospectors association (Ontario Prospectors Association [OPA]);
- Reduction of red tape to increase efficiency and front-line client services;
- Reduced and stabilized mining costs through initiatives that held the line on hydro rates, workers' compensation rates, taxes for mining leases and patents, and payroll tax rates; and
- Introduction of the Professional Geoscientists Act to bring geoscientists under a system of licensure and enhance Ontario's position as a safe place to invest and raise capital.

General Overview

Preliminary figures for 2000 indicate that the total value of Ontario's mineral production in the four commodity groups that comprise the industry total (metals, nonmetals, structural materials and fuels) was \$5.87 billion. This represents an increase of 12.5% from the \$5.12 billion reported in 1999.

Ontario retained its position as the lead Canadian jurisdiction in the value of non-fuel mineral production as the 2000 rise in the value of nickel and platinum group metals helped to increase its share. In 2000, Ontario accounted for 30.8% of Canada's non-petroleum mineral production.

The contribution of each commodity group to the 2000 Ontario total was as follows: metallic minerals, \$3.72 billion (63.3% of the Ontario total); structural materials, \$1.61 billion (27.4%); nonmetallic minerals, \$380 million (6.5%); and fuels, \$165 million (2.8%). In 2000, Ontario produced 34% of Canada's metallic minerals and 27% of Canada's nonmetallic minerals (including structural materials but excluding mineral fuels).

The five highest-value metallic minerals produced in Ontario in 2000 were nickel (\$1.489 billion), gold (\$961 million), copper (\$551 million), platinum group metals (\$430 million), and zinc (\$143 million). Combined these represent 61% of the total value of Ontario's mineral production in 2000.

In 2000, Ontario yielded 63% of Canada's nickel production, 47% of Canada's gold production, 33% of Canada's copper production and 93% of Canada's platinum group metals production.

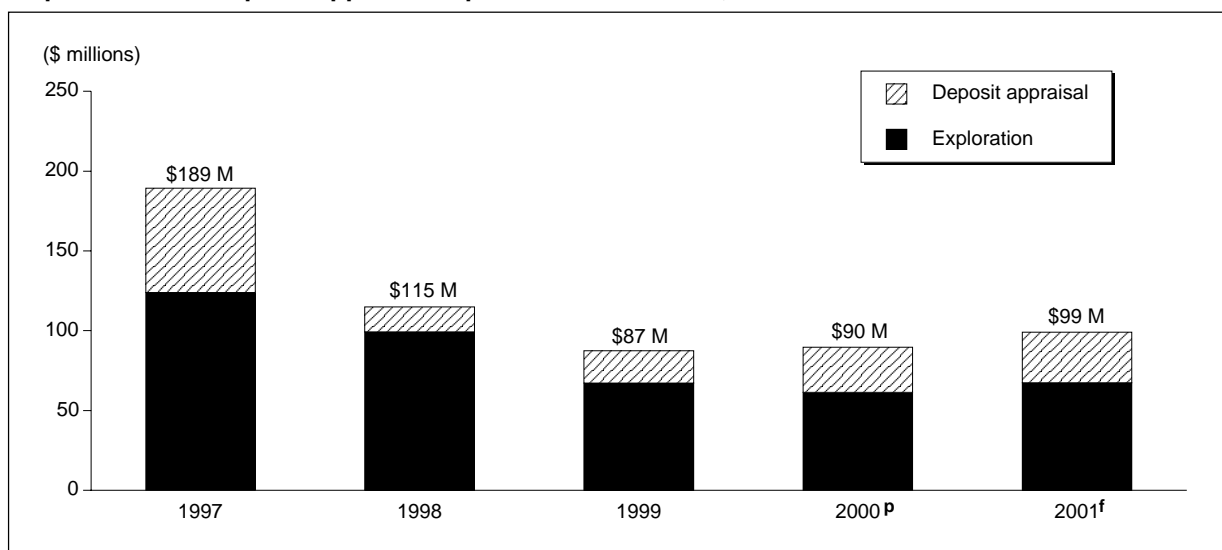
Final exploration and deposit appraisal expenditures for 1999 totaled \$87.4 million. Contrary to the national trend, preliminary estimates for 2000 show a 2.6% increase to \$89.7 million and a further forecasted increase of 10.4% to \$99.0 million for 2001.

Spending intentions for 2001 indicate that Ontario will lead the Canadian provinces and territories in exploration and deposit appraisal expenditures for the first time since 1997, representing 22% of Canada's total expenditures.

Preliminary figures for 2000 indicate that a total of \$303.3 million was spent on mineral exploration, deposit appraisal and mine development in Ontario (**Figure 26**). This total consists of \$60 million (19.7%) for off-mine-site exploration and deposit appraisal, \$29.7 million (9.8%) for on-mine-site exploration and deposit appraisal, and \$213.6 million (70.4%) for mine development. Forecasts for 2001 mineral exploration, deposit appraisal and mine development expenditures are estimated at \$291.1 million. The decline is attributed to a 10% decrease in mine development expenditures.

In 2000, spending by Ontario's senior mining companies decreased by 6.2% from 1999 while spending by Ontario's junior mining companies increased by 44.7%. Company spending intentions for 2001 indicate that spending by Ontario's junior companies will continue to increase, by 16.7% from 2000, and spending by Ontario's senior companies will increase by 8.3%. For these two years, Ontario's senior companies account for three quarters of all Ontario exploration expenditures.

Figure 26
Exploration and Deposit Appraisal Expenditures in Ontario, 1997-2001



Sources: Ontario Ministry of Northern Development and Mines; Natural Resources Canada.

^f Forecast; ^P Preliminary.

The number of mining claims in good standing in Ontario at the end of 2000 was 162 329, an increase of 3.8% from 1999. The increase can be attributed to the interest in exploration for diamonds and platinum group metals.

Spotlight on Ontario's Diamond Potential

History of Diamond Exploration in Ontario

Ontario has been the target of focused diamond exploration for nearly four decades. Interest dates back to the last century when diamonds were found in glacial deposits in southern Ontario, Michigan, Wisconsin and Illinois. The source of the diamonds was suspected to be Ontario, and most likely northern Ontario.

During the late 1940s, a government geologist identified a thin section of kimberlite in diamond drill core near Kirkland Lake. Kimberlite is a rock type favourable to hosting diamonds. Exploration for the bedrock source of the boulder in this area did not develop in earnest until the 1960s when minerals derived from kimberlite were found in esker sediments. The finding of these "indicator" minerals led to the discovery of a kimberlite dyke in the area and, later in the 1980s, the first kimberlite pipes were found in the province through the use of indicator minerals and geophysical investigations.

Diamond Exploration in Ontario

Much of the current diamond exploration in Ontario is focused in the following areas:

- James Bay-Hudson Bay lowlands;
- Wawa;
- Cobalt to Kirkland Lake; and
- in the vicinity of the northern portion of the Ontario-Manitoba border.

Evaluation of Diamond Potential by the Ontario Geological Survey

Work conducted by the Ontario Geological Survey (OGS) has highlighted diamond potential in several areas of Ontario, including Wawa, Kapuskasing, River Valley-Temagami, Marathon, Kirkland Lake and northwestern Ontario.

Recently, the OGS has focused on the Kapuskasing-Wawa, Marathon, River Valley, and Temagami-to-North Bay areas of Ontario. This work supplements previous diamond studies by the OGS in the Kirkland Lake area. OGS staff members are involved in a province-wide evaluation of kimberlite.

Under Operation Treasure Hunt, the OGS is overseeing kimberlite-indicator mineral studies in the zone stretching from Wawa to southwest of Moosonee, from Sault Ste. Marie to Espanola, and in portions of the James Bay lowlands. In collaboration with the Geological Survey of Canada and Industry Canada, the OGS conducted a geophysical airborne survey over an area inferred to have diamond potential between Chapleau and Kapuskasing.

Operation Treasure Hunt

Announced in March 1999, Operation Treasure Hunt (OTH) is a three-year, \$29 million Ontario government geoscience initiative to generate new exploration targets that will stimulate mineral exploration. The OTH investment is also intended to attract and retain national and international mineral investment in Ontario. The program includes state-of-the-art geophysical and geochemical procedures to pinpoint "buried treasure." The studies are intended to uncover specific target locations for prospectors and exploration companies to focus their activities in the

search for new mines. Because the data are useful for many years, the initiative will encourage long-term exploration as well.

Anticipated Outcomes

Mining is an important contributor to Ontario's wealth. New mines are only found as a result of exploration and prospecting. Exploration and prospecting are critically dependent upon basic geological information to help select target areas and key onto prospects.

OTH is creating new geoscience information about Ontario. That information, in the form of geological maps, reports, data and new exploration targets, is triggering mineral exploration and attracting new investment to Ontario.

OTH encourages exploration for the new mines that will provide the basis for future economic growth and jobs in Ontario.

Studies in Ontario, elsewhere in Canada and in Australia show that geoscience surveys can generate \$3 in total spending for each \$1 of public funds invested. If a mine is discovered, the new wealth produced from it can be worth as much as \$250 for each \$1 of government geoscience surveying.

In addition, it is anticipated that OTH will create or maintain as many as 300 exploration industry jobs over the next two years. Many more high-paying, long-term jobs will result if a new mine is discovered.

Work Program

The areas surveyed and the best techniques to use were determined by the Ministry of Northern Development and Mines' (MNDM) Ontario Geological Survey (OGS) in cooperation with the Ontario Geological Survey Advisory Board (OGSAB). The advisory board, made up of industry-related experts, helps ensure that the OGS's mapping priorities reflect changing industry and scientific requirements.

The mapping and surveying is being coordinated by the OGS and is delivered by private sector service contractors, including First Nation companies and the OGS. The OGS output of maps, reports, and databases describing the province's geology and mineral resources helps Ontario explorationists and developers find areas of the province to be explored – areas that may be developed into working mines.

The OTH geoscience program consists of:

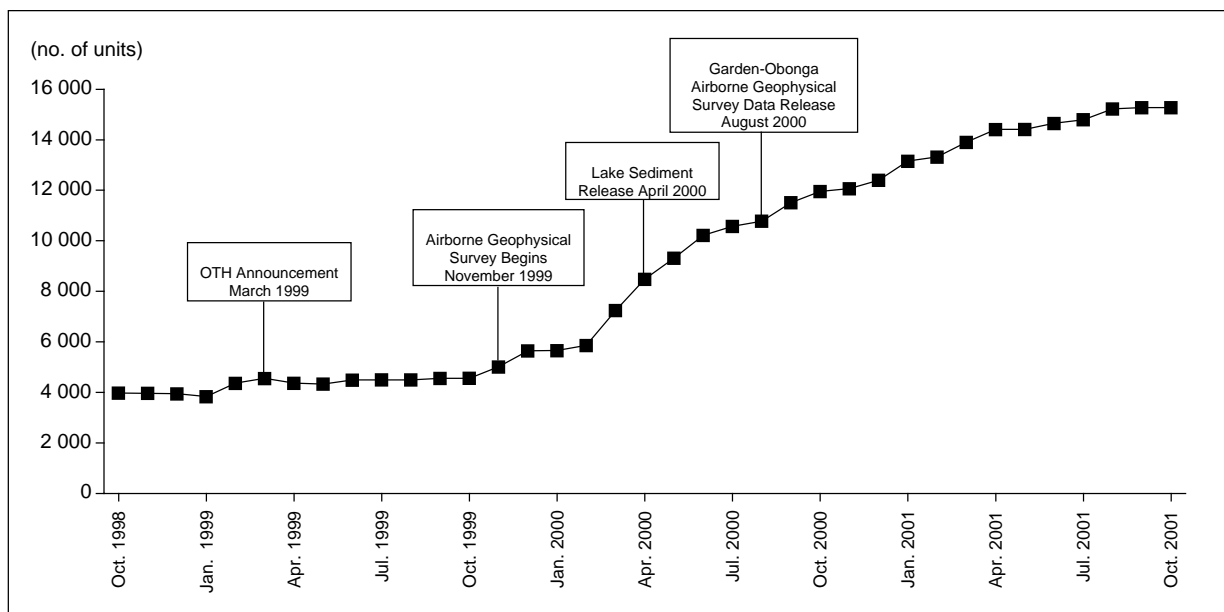
- Airborne geophysical surveys:
 - Flying of new airborne geophysical magnetic, electromagnetic and radiometric surveys,
 - Purchase of existing proprietary airborne geophysical datasets,
 - Continued development of an atlas and database to illustrate the location, ownership and technical specifications of some airborne geophysical surveys over Ontario, and
 - Physical rock properties project;
- Surficial geochemical surveys:
 - Lake sediment geochemistry,
 - Kimberlite indicator geochemistry,
 - Palladium-platinum indicators, and
 - Base-metal (copper, zinc) indicators;

- Bedrock map compilation;
- Purchase of surficial geochemical and lithochemical data;
- Methods development, including geochemical or geophysical modeling;
- Aggregate investigations;
- Industrial mineral studies;
- Compilation and understanding of platinum group element mineralization and mafic to ultramafic intrusions across Ontario;
- Compilation and understanding of fertile peraluminous granites and related rare-element pegmatite mineralization in Ontario; and
- Data management, claim maps digitization and product dissemination.

To date, OTH has secured technical success through the influx of new geoscience data. A total of approximately 300 new discrete products have been generated from program work. This includes airborne geophysical and surficial geochemical data covering some 150 000 km² of new survey area and 100 000 km² of area surveyed through the acquisition of proprietary company data.

As **Figure 27** shows, the release of OTH data and products to mineral industry clients has resulted in an increase in the acquisition of mining claims in the province. This has been particularly so in the areas of newly generated exploration targets.

Figure 27
Ontario Geological Survey - Operation Treasure Hunt (OTH), Total Active Claim Units in the OTH Garden-Obonga Airborne Geophysical Survey Area, October 1998 to October 2001



Source: Ontario Ministry of Northern Development and Mines.

Exploration Highlights - Northeastern Ontario

Falconbridge Limited continued work on the "D" mine at Kidd Creek in Timmins. This is the deep development from the 6800-foot (ft) to 10 200-ft level to access additional copper, zinc and silver ore below the existing mine workings. The deep development project is projected to cost \$640 million and will begin first production in 2004. When completed, the Kidd Creek mine will be the deepest base-metal mine in the world. The project includes two new internal shafts and a ramp, ore handling facilities, a paste plant for backfill, and a refrigeration plant to cool mine air at depth. The work will extend the mine life by over 15 years.

Placer Dome Mines Inc. is nearing completion of the second phase of open-pit gold mining at its Dome mine in Timmins. Once mining is completed to the 600-ft level, the third and final phase of the open-pit operations will extract ore down to the final pit depth of 1100 ft. The Dome mine, in continuous operation since 1910, is continuing an aggressive exploration effort in and around the mine property and on several optioned neighbouring properties to identify additional gold resources for the operation.

Ontario's most advanced diamond project is located 100 km west of Attawapiskat in the James Bay lowlands, approximately 500 km north of Timmins. De Beers Canada Exploration Inc. is testing the Victor kimberlite pipe for diamonds. A 250-t/d test mill has been constructed and, over the past two winters, a 10 000-t bulk sample of kimberlite from surface trenching and large-diameter drill holes has been processed. Results of the bulk sample are presently being evaluated and a desktop pre-feasibility study is under way on the project. Similarly, very active diamond exploration is under way in the area extending from Wawa to Kapuskasing where new diamond discoveries have been made and are being sampled.

The Montcalm nickel project, located 60 km northwest of Timmins, is being evaluated by Falconbridge Limited. Work by the previous owners, Outokumpu Mines Ltd., identified a resource of 7.1 Mt grading 1.54% nickel and 0.72% copper. Falconbridge Limited is completing a \$9 million advanced exploration program on the deposit. If the deposit proves viable, one of four mill circuits at the Kidd metallurgical site will be converted to process nickel ore. The Montcalm project could contribute 750 000 t of ore annually over seven years to Falconbridge's mining operations.

Globex Mining Enterprises Inc. acquired a 100% interest from McWatters Mining Inc. in the Ramp property (formerly the Argyll property) in Beatty Township, 12 km northeast of the town of Matheson. Previous work indicates proven, probable, possible and drill-indicated gold resources above the 220-m level totaling 510 116 tons (462 777 t) grading 0.25 oz/ton (8.57 g/t) gold. In addition, 283 358 tons (257 062 t) of deeper drill-indicated resources grading 0.24 oz/ton (8.23 g/t) gold brings the total resource on the property to 813 414 tons (737 929 t) grading 0.24 oz/ton (8.23 g/t) gold.

Hucamp Mines Limited signed an agreement with Sudbury Contact Mines Limited on its Temiskaming diamond properties in northeastern Ontario and Québec. The Ontario claims include four kimberlite occurrences discovered by Sudbury Contact in 1995 and 1996, as well as numerous untested geophysical and geochemical anomalies. Kimberlite 95-2, which has seen the most work, returned 33 macrodiamonds, including four stones greater than 1 mm in size, from 1104.44 kg of material processed. Two of the stones exceeded 2 mm in size, with the largest weighing 0.14 ct and described as a white, clear fragment by Lakefield Research.

KRL Resources Corp. received the final drill results from a 13-hole program completed in 2000 on its 100%-owned Copper Hill property. Hole GS-12 intersected two auriferous zones grading 2.57 g/t gold over 14.23 m and 0.99 g/t gold over 24.3 m. Hole GS-13 intersected 7.6 m grading 0.91 g/t gold.

Queenston Mining Inc. and Franco-Nevada Mining Corporation Limited completed a 5-hole, 1859-m diamond drill program east of Kirkland Lake in Lebel Township over their 180 Splay and South Break targets. Assay results on the holes intersecting the South Break were anomalous but sub-economic. Intersections on the 180 Splay included 7.27 g/t gold over 0.6 m and 2.09 g/t gold over 1.3 m in hole MU-12 and 3.88 g/t gold over 1.6 m and 2.03 g/t gold over 4.5 m in hole MU-16.

Strike Minerals Inc. completed an overburden stripping and diamond drilling program on its newly acquired LaCarte claims near Shining Tree. The program will evaluate gold showings at and around the recently discovered LaCarte Highway 560 showings where recent road construction revealed gold mineralization in a new road cut.

Temex Resources Corp. announced surface sampling results on the Cuniptau PGE project near Temagami. Mineralization was encountered at the footwall contact of a 10 to 15-m-wide mafic dyke and exposed over a strike length of 1.4 km. Platinum group metals are associated with disseminated to bleb-textured chalcopyrite, pyrite and pyrrhotite. Assays ranged upwards to 3 g/t gold, 1.9 g/t platinum, 6.0 g/t palladium, 1640 g/t cobalt, 10.85% copper and 1.59% nickel.

Exploration Highlights - Northwestern Ontario

The Musselwhite mine, owned by Placer Dome (CLA) Limited and TVX-Normandy Americas and located in the North Caribou greenstone belt, continued to produce gold throughout 2001. Production is forecast to exceed 230 000 oz (7154 kg) for the current year. A major construction project, which involves the installation of an underground conveyor to surface and mill upgrades, will be completed in 2002. During 2001, 33 852 m of exploration diamond drilling were completed and exploration targets advanced. Proven and probable ore reserves as of December 31, 2000, were 2.55 million oz (79 313 kg) of gold.

North American Palladium officially opened its Lac des Iles mine expansion project in August 2001. Over the life of the mine, Lac des Iles is estimated to produce, on average, 250 000 oz (7776 kg) of palladium per annum. Extensive exploration since 1998 has significantly increased the palladium resource on the mine property to 7.4 million oz (230 162 kg), with proven and probable reserves set at 4.8 million oz (149 294 kg) of palladium. Recent exploration efforts at Lac des Iles have increased the measured and indicated resource to 145 600 000 t at an average grade of 1.57 g/t palladium, 0.17 g/t platinum, 0.12 g/t gold, 0.06% copper and 0.05% nickel. Exploration in 2001 has identified a new source of mineralization grading 5.44 g/t palladium over 54 m, including 10.5 m grading 10.32 g/t palladium at the New High Grade zone.

Geomaque Explorations Ltd. completed extensive exploration of its Marathon palladium project, located 10 km north of Marathon. Preliminary assessment of the project indicates that, over a 15-year mine life, it will support the production of 949 000 oz (29 517 kg) of palladium, 267 million lb (121 109 t) of copper, 215 000 oz (6687 kg) of platinum, 146 000 oz (4541 kg) of gold and 1.7 million oz (52 875 kg) of silver. Geomaque intends to move forward as quickly as possible with a bankable feasibility study.

Aurora Platinum Corporation continues to evaluate a "reef" type layered gabbro complex, 30 km north of Lansdowne House in the Sachigo subprovince. Diamond drilling, which will include testing 15 significant airborne conductive zones, has previously intersected narrow zones of massive sulphides within 20-50 m zones of net-textured sulphides and will continue to test copper-nickel-PGE mineralization in the mafic complex. A total of 5000 m will initially be drilled.

PGM Ventures Corporation is active on two fronts in Thunder Bay North. The Springer-Lavoie lakes project is adjacent to Aurora Platinum Corporation's Lansdowne project. Exploration expenditures in the fall of 2001 will total \$400 000 on a property that hosts a reserve of 14.6 Mt

grading 0.58% copper, 0.37% nickel and unknown PGE values to date. The mineralization is hosted in a layered anorthositic gabbro intrusion. The Thierry mine project is located at Pickle Lake in the central Uchi subprovince. Exploration in 2001 was initiated with a geology and sampling program. Grab samples assayed up to 9.93 g/t platinum and palladium combined. PGE mineralization is associated with remobilized copper-nickel sulphides in an ultramafic assemblage. The Thierry mine historically produced 113.6 million lb (51 528 t) of copper, 27.7 million lb (12 565 t) of nickel, 17 500 oz (544 kg) of platinum and 47 000 oz (1462 kg) of palladium prior to its closing in 1982. Exploration in the 1970s and 1980s identified three additional satellite magmatic deposits (Kapkichi deposits) within the property. A reserve of 7 Mt grading 1.88% copper and 0.23% nickel exists.

East West Resource Corporation conducted an extensive re-sampling program of diamond drill core at the Norton Lake property, 60 km northeast of Fort Hope. The property consists of 203 claim units and is located in the East Uchi subprovince. PGE mineralization is associated with an 8-m-wide band of massive pyrrhotite-pyrite-chalcopyrite in a volcanic-gabbro synform. Results of reassaying of drill core include values of 3.1 g/t palladium over 7 m, platinum values of 4.38 g/t over 2.5 m, and cobalt values up to 1.09 kg/t. A resource of 944 500 t grading 0.72% nickel and 0.56% copper was outlined by the previous owner, Wasabi Resources Ltd., in 1981.

Landore Resources Inc. completed 2104 m of diamond drilling on the Juneau-Junior lakes PGE property northeast of Lake Nipigon in the Wabigoon subprovince. All drilling was focused on the B4-7 massive sulphides zone. Sample results ranging up to 1.9% nickel, 0.6% copper, 0.11% cobalt, 1.09 g/t palladium and 0.25 g/t platinum were returned. The B4-7 zone hosts resources of 2.2 Mt grading 0.87% nickel and 0.59% copper. An additional 5000 m of drilling is planned following geophysical and geochemical surveys.

Avalon Ventures Ltd. and Global Canada Company completed a fourth phase of drilling on the Lilypad Lakes tantalum project in the Uchi subprovince. Key results from a previously completed drill program include a 22-m section averaging 0.038% Ta₂O₅ and 2.123% Cs₂O from the Rubellite dyke, and a 10-m section averaging 0.40% Ta₂O₅ and 2.892% Cs₂O in the Pollucite dyke system. All nine drill holes intersected significant tantalum mineralization in the fourth phase of drilling.

Linear Resources Inc. released results from recent trenching and channel sampling at two zones on its Seymour Lake property located just north of Lake Nipigon and east of Armstrong. Results from the North Aubry zone returned values up to 2.49% Ta₂O₅ over 4 m. Preliminary trenching at the South Aubry zone indicated the pegmatite dykes are at least 50 m wide with similar mineralogy to the North Aubry zone and initial values of up to 0.29% Ta₂O₅ over 1-m intervals. Both the North and South Aubry zones remain open along strike to the north and south.

Exploration Highlights - Southern Ontario

Aldershot, Canada Brick's new fully automated, state-of-the-art brick manufacturing plant, produced its first load on June 25, 2001. Once fully operational, the plant will have the capacity to produce 150 million bricks per year. The 250 000-square-foot (ft²) (23 225 m²) Aldershot plant taps into a rich long-term body of Queenston Formation shale immediately behind the plant. Use of the robots will leave the 54 plant employees free to run computerized equipment and attend to maintenance duties.

Brampton Brick, with the inauguration of its new state-of-the-art plant, now operates the single largest clay brick-producing facility of its kind in North America. The new plant added 125 000 ft² (11 613 m²) to the existing facilities, thus bringing the total operational area to almost 400 000 ft² (37 160 m²). With the added facilities, production has gone up by almost 50%. Other new machinery includes a complete new production line comprising two brick-

making machines, robotically controlled setting, three dryers, a steel-encased tunnel kiln, and packaging equipment. The expansion, which cost \$35 million, brings the plant's capacity to 200 million bricks per year.

2.7 MANITOBA⁸

Overview

The preliminary estimate of exploration expenditures for 2000 in Manitoba is \$27.4 million, slightly above the previous estimate of \$25.0 million. Company spending intentions for 2001 were estimated at \$30.5 million; however, investment in mineral exploration and development in Canada in 2001 will have been challenged by low commodity prices, a slowing economy and the difficulty for juniors to raise equity financing.

In October 2001, Hudson Bay Mining & Smelting Company Ltd. (HBMS) announced that it will permanently close the Ruttan mine in Leaf Rapids by May 2002. The mine had been scheduled to close in 2003. The company cited generally depressed mineral markets and record low commodity prices as the main reasons for the accelerated closure. In southeastern Manitoba, South African-based Harmony Gold Mining Company Limited placed the Bissett underground gold mine on care and maintenance, citing an inability to turn a profit. The Bissett operation needs a gold price above US\$300/oz to be economic.

Despite the challenges experienced by the exploration industry worldwide, there are reasons to be optimistic about future exploration activity in Manitoba. Encouraging results from multi-media geochemical surveys conducted by the Manitoba Geological Survey continued to lure new companies to join in one of Canada's newest diamond plays.

The total area of mining claims, exploration permits and special exploration permits issued in 2000 was 1 832 577 ha, a significant increase from 801 550 ha in 1999 and 475 634 ha in 1998. The total area of mineral dispositions and leases in good standing at the end of 2000 was 2 757 482 ha, compared to 1 943 442 ha at the end of 1999. Surface exploration diamond drilling in 2000 is estimated at 90 000 m, compared to 83 000 m in 1999.

Further testimony to the Manitoba "Mining Advantage" is the level of new mining development being undertaken in the province. Topping the list is the \$400 million expenditure by HBMS on the 777 project. The 777 project includes access to a 14.5-Mt orebody of 2.5% copper and 4.68% zinc. An additional \$600 million will be invested in ongoing capital replacement until the year 2016. The company celebrated the official opening of the Chisel North mine in Snow Lake on June 1, 2001.

Manitoba is a national leader in minimizing the impact of protection on resource development while at the same time addressing the need for environmental protection. Manitoba's Protected Areas Initiative involves sectoral consultations to ensure that resource industries, as well as communities and First Nations, are fully consulted on proposals for establishment of protected areas. The mining sector consultation in Manitoba is unique in Canada and provides the industry with confidence that areas of high mineral potential will not be compromised in the process. Industry participation in the review of sites proposed for Manitoba's Network of Protected Areas provides increased certainty related to land use issues.

⁸ The Manitoba review of activities was prepared by D. Prouse, R. Syme, J. Payne, G. Ostry and M. Lavergne of Manitoba Industry, Trade and Mines. For more information, the reader is invited to contact Ric Syme by telephone at (204) 945-6556 or by e-mail at rsyme@gov.mb.ca.

Partnerships between the mineral industry and northern and Aboriginal communities have become increasingly important in terms of certainty of land access and tenure for mineral exploration and development. A new initiative to develop a process for relationship-building between the stakeholders was launched in 1998. By 2000, a set of guiding principles to facilitate relationship-building between those involved in or affected by mineral activity in the province was developed. This work has been captured in a document entitled *The Manitoba Minerals Guideline: Building Relationships and Creating Opportunities – Guiding Principles for Success between the First Nations, Metis Nation, Northern Community Councils, the Minerals Industry and the Province of Manitoba* and continues to provide a framework for discussion on future mineral development in Manitoba.

Base Metals

Flin Flon-Snow Lake Region

Development work continued at the HBMS 777 project in Flin Flon. The \$400 million development includes: two new underground mines, the 777 mine in Flin Flon and the Chisel North mine near Snow Lake; expansion of the Flin Flon concentrator and zinc plant; upgrades to the spill gas handling system; and upgrades to the Flin Flon infrastructure to support new projects. The Chisel North mine and spill gas system upgrading were completed in 2000. Expansion projects at the Flin Flon smelter complex and development of the new 1540-m shaft at the 777 mine are ongoing. Sinking of the new shaft had reached the 1262-m level at the end of September 2001. The fully commissioned shaft is scheduled to be completed by the end of 2002.

HBMS's exploration division, Hudson Bay Exploration and Development Company Limited (HBED), conducted a limited drilling campaign in the Hargrave Lake-Huzyk Creek and Ponton areas early in the year. In March 2001, all of HBED's Manitoba exploration operations were suspended for the remainder of the year.

Callinan Mines Limited conducted drilling on various projects in the Snow Lake area. Drilling was conducted at the Pot Lake, Daly Lake and East Morgan zones where only minor copper and zinc values were reported. Follow-up drilling on its Jackfish property returned an intersection of 2.77 m grading 1.16% nickel and 0.56% copper.

Fort Knox Gold Resources Inc. and Berland Resources Ltd. completed drilling on the East zone at their Watts River property northwest of Ponton. Notable results included 9.7 m of 2.2% copper and 9.5 m of 2.0% copper.

Thompson Nickel Belt and Extension

In Thompson, Inco Limited continued with the \$70 million deepening of the Birchtree mine shaft. When completed in 2002, Birchtree's daily production will nearly double to 3175 t. The deepening project will access proven reserves of 13.6 Mt of 1.79% nickel and extend Birchtree's production to 2016.

Inco Exploration and Technical Services continued a program of deep penetrating geophysical surveys and follow-up drilling of high-priority targets as part of an exploration strategy to discover new mineralization near current mines or known deposits in the Thompson nickel belt.

Nuinsco Resources Limited completed a geophysical survey and a six-hole drill program on the Mel claims northwest of Thompson. The property is under option from Inco, who is acting as project operator. Nuinsco also signed a letter of intent with Inco for development of the Pipe 1 and Pipe 2 deposits south of Thompson.

At the Bucko deposit near Wabowden, Nuinsco completed a 10-hole delineation drilling program and received encouraging results, including 8.5 m of 5.4% nickel and 7.9 m of 3.6% nickel.

The drilling expanded the resource, which previously stood at 2.0 Mt of 2.27% nickel. Despite encouraging results, Nuinsco suspended operations at Bucko until ore-processing issues are resolved.

Northeast of Thompson, Canmine Resources Corporation completed a five-hole drill program at its BINCO property.

In the William Lake area, south of Ponton, Falconbridge Limited and partner HBED completed a 17-hole drill program.

Northeastern Region

At the Fox River property, located 200 km east of Thompson, Falconbridge completed a 3600-m drill program within its permit area. Geophysical targets were drilled for both magmatic nickel-copper sulphide and platinum group metals (PGM) deposits. In addition, a number of magnetic anomalies consistent with kimberlite intrusive signatures have been identified. The property was optioned to Rockwell Ventures Inc., a wholly owned subsidiary of the Hunter-Dickinson Group Inc. At the end of July 2001, Rockwell announced that a major drill program had been initiated to test targets previously outlined by Falconbridge.

Activity on WMC International Limited's large permit area at the east end of the Fox River sill included compiling data and modelling magnetic and electromagnetic (EM) responses through the Paleozoic cover sequence.

Lynn Lake-Leaf Rapids Region

Aur Resources Inc. is planning to start diamond drilling targets on its properties in the Counsell Lake-Boiley Lake area early in 2002. Plans call for an initial 3000-m drill program. Aur completed detailed mapping and prospecting on a portion of the Boiley Lake grid in June 2001.

Agassiz Drilling will undertake diamond drilling and bulk sampling of the Y-Zone zinc-copper deposit at Lynn Lake for metallurgical testing and possible sale to HBMS.

Cominco Ltd. has renewed its interest in the region, recently acquiring three exploration permits (totaling 51 831 ha) in the Baldock Lake area north of Leaf Rapids. Cominco has planned a linecutting and geophysical program for the property.

Southern Region

Canmine Resources has measured resources of 2.66 Mt grading 1.27% nickel and 0.21% copper, plus cobalt and PGM values, at the Maskwa deposit in southeastern Manitoba. Canmine plans more work in the vicinity of mineralized zones to upgrade the value of the project.

Extensive sampling and a gravity survey were carried out by Dave Busch near Arborg in the province's Interlake. This work continued previous investigations to find Mississippi Valley-type lead-zinc deposits.

Platinum Group Metals

In January 2001, Fort Knox Gold Resources Inc. received encouraging drilling results at its McBratney Lake platinum-palladium property near Flin Flon. A hole drilled to confirm a previous HBMS intersection returned 16.8 m grading 8.9 g/t palladium and 1.8 g/t platinum. Fort Knox initiated a stripping and bulk sampling program in August and additional drilling was planned for the fall of 2001.

Gowest Amalgamated Resources Ltd. conducted geophysics and completed a nine-hole drill program at its Cuthbert Lake property southeast of Thompson to further evaluate PGM surface occurrences. Drilling returned low base-metal and PGM values.

Rubicon Minerals Corporation completed a lithochemical sampling program on its permit property in the Cuthbert Lake-Partridge Crop Lake area.

Wildcat Exploration Ltd. conducted a summer mapping and sampling program on its Reed Lake property in the Flin Flon belt. The property is underlain by a large, layered, mafic-ultramafic sequence.

In southeastern Manitoba, Exploratus Ltd. conducted a stripping and channel sampling program at its Maskwa-Mayville property.

Gold

International Curator Resources Inc. announced a new gold discovery at its Assean Lake property northeast of Thompson in April 2001. The newly discovered Hunt zone was intersected in six holes over a strike length of 500 m. The discovery hole intersected 4.6 m grading 8.98 g/t gold. A 35-hole summer drill program also returned encouraging results of 8.15 m of 9.37 g/t gold and 4.4 m of 12.51 g/t gold. The summer program confirmed that the steeply plunging gold-bearing shoot continues to depth.

In southeastern Manitoba, partners ManQuest Resources Corporation and Iriana Resources Corporation drilled known gold zones at their Beresford Lake property. Tudale Exploration Ltd. conducted drilling at its Moore Lake, Wanipigow River and Wallace Lake properties. Wildcat Exploration carried out summer mapping and sampling programs on its substantial holdings around Bissett. A fall drill program tested a number of small past-producing properties in the area.

Union Gold Inc. has completed a prospecting program on its Gemmell Lake property near Lynn Lake, and has also cut a grid in the Westdahl Lake-Hughes Lake area.

Diamonds

The rush for prospective ground for diamond exploration continued into early 2001. Both junior and senior diamond explorers acquired additional permits in the Knee-Oxford lakes and Gillam areas, partly in response to encouraging results obtained by the Manitoba Geological Survey from multimedia geochemical surveys carried out in the northern Superior Province since 1996. Senior companies acquiring permits in late 2000 included De Beers Canada Corporation (23 permits totaling 8170 km²), BHP Minerals, and Kennecott Canada Exploration Inc. In early 2001, junior companies such as New Claymore Resources Ltd., Marum Resources Inc., Iriana Resources and others either acquired permits or entered into joint ventures with other property holders.

A number of companies conducted aeromagnetic surveys on their properties in 2001 and reported identifying distinct magnetic targets. Follow-up ground geophysical surveys were carried out at some of the more advanced projects. Initial drill programs were conducted in late winter 2001 by partners Kennecott and Montello Resources Ltd. in the Oxford Lake area and by partners BHP Minerals and New Blue Ribbon Resources Ltd. on the Moose River project southeast of Gillam. None of the project partners reported kimberlite, although New Blue Ribbon intersected a large sub-economic massive sulphide zone. BHP and New Blue Ribbon drilled additional magnetic targets at the Moose River project in the summer.

BHP Minerals conducted a large-scale, helicopter-supported kimberlite-indicator mineral (KIM) survey over a large area between Baldock Lake and Tadoule Lake, east of Gillam.

Dasher Energy Corp. will undertake geophysical and geochemical programs on its diamond property 50 km northwest of Thompson.

Rare Earth Metals

Strider Resources Ltd./Vital Pacific Resources Ltd. cut a 60 line-km grid on their Eden Lake property east of Lynn Lake and will undertake magnetometer surveys, geological mapping and geochemical sampling on the property.

Industrial Minerals

In southeastern Manitoba, Avalon Ventures Ltd. conducted linecutting and geophysics on a tantalum prospect in the East Braintree area. Tantalum Mining Corporation carried out small pegmatite exploration programs near its Bernic Lake mine. Emerald Field Resources Corporation and G. Royer conducted mapping and sampling of pegmatites on their respective properties east of Bernic Lake.

Cabot Corporation obtained 82% of the world's known reserves of pollucite when it purchased the Tanco mine in 1993. A US\$50 million cesium formate processing plant was constructed in 1998 with an annual production capacity of over 5 million lb and a staff of 23 people. In January 2001, Cabot announced the first successful drill-in of oil in the North Sea using cesium formate fluid as drilling mud. In October 2001, it was announced that all Cabot cesium products would be manufactured at Bernic Lake.

Precambrian granite dimension stone quarries, formerly operated under Canital Granite Ltd., Canital Explorations Inc. and Manex Granite Ltd. in southeastern Manitoba, are being transferred to the latter. The stone, marketed under the trade names Northern Mahogany, Meditation and Prairie Gold, is obtained from three quarries approximately 80 km east of Winnipeg. Granifab Corporation will market the stone from a plant in Transcona on the east side of Winnipeg.

Berger Group Ltd. has taken out leases over a sphagnum peat bog, 20 km south of Hadashville in southeastern Manitoba. Investigations by the company have indicated that there are economic resources present and its intention is to develop a producing operation in the near future.

In southwestern Manitoba, Albchem Manitoba Ltd. has started construction of a sodium chlorate plant as part of a \$50 million investment. The plant is located at Hargrave, 10 km west of Virden. The plant will produce 40 000 t/y of sodium chlorate. It will employ 26 full-time people and contribute \$2.5 million to the local economy. Raw material for the plant will be salt dissolved from the Devonian Prairie evaporite at depth. The site was selected because of its proximity to the salt deposit and favourable electricity rates.

Graymont Western Canada Inc. continues to quarry the high-calcium limestone deposit located near Faulkner in Manitoba's Interlake region. The company name was changed from Continental Lime Ltd. in December 2000. The stone is situated within the Devonian Elm Point formation and is calcined into high-calcium lime in a plant adjacent to the quarry.

On June 13, 2001, Georgia-Pacific Corp. announced that it would close its wallboard plant in Winnipeg. The gypsum quarry on the west shore of Lake Manitoba, near Harcus, will continue to be leased by Georgia-Pacific Canada Inc. The quarry produced from the Jurassic Amaranth formation.

Bird River Mines Co. Ltd. has extracted a small stockpile of high-purity, non-swelling calcium bentonite near Deerwood, 8 km northwest of Miami. The bentonite is found as thin layers of altered volcanic ash that alternate with thin layers of black shale. These beds are situated within the Cretaceous Pembina member of the Pierre shale.

More information on exploration and development in Manitoba is available on the Internet at <http://www.gov.mb.ca/itm/mrd>.

Incentives

The Government of Manitoba has made more than \$9 million in funding available over a three-year period starting in April 1999 to further encourage exploration and mining investment in the province. The funding is obtainable through the following mineral incentive programs:

Mineral Exploration Assistance Program (MEAP)

The Mineral Exploration Assistance Program (MEAP) provides financial assistance to companies or individuals undertaking mineral exploration in Manitoba. The program, established in the fall of 1995, aims to increase exploration and stimulate activities that may lead to the development of new mines. Companies or individuals may qualify for up to 35% of eligible exploration expenditures to a maximum of \$400 000 per recipient per fiscal year, depending on the area of exploration.

MEAP announced its first offering of \$1 million in October 1995, followed by \$3 million per fiscal year, for three years, beginning January 2, 1996, and ending March 31, 1999. A continuation of the program was approved in June 1998 with \$8.25 million of assistance allocated over a three-year period beginning April 1, 1999. In response to difficult times brought on by the downturn of the minerals industry, MEAP was expanded to provide a higher percentage of assistance on eligible expenditures for projects in the Lynn Lake-Leaf Rapids area. In the fall of 2001, exploration in the Bissett region also became eligible for a higher percentage of assistance. MEAP conducts two offerings per fiscal year to coincide with the spring/summer and fall/winter exploration seasons.

PROGRAM HIGHLIGHTS FROM OCTOBER 1995 TO MARCH 31, 2001

- From October 1995 to March 31, 2001, a total of 83 companies have participated in MEAP, representing 233 exploration projects.
- Of these 83 companies, 50 are considered new to Manitoba, including 7 joint-venture partners. Of the 83 companies, 12 are major exploration companies and 71 are junior companies (a company is considered a major exploration company if its market capitalization is greater than \$100 million).
- A total of \$11 million in assistance has been issued to 233 completed projects.
- A total of \$45.3 million in exploration expenses has been reported.
- Reported exploration expenditures under the program indicate that every \$1 million in assistance paid generated \$4.1 million in exploration expenditures.

Specialty Minerals Incentive Program (SMIP)

The Specialty Minerals Incentive Program (SMIP) commenced on August 3, 1999, with \$250 000 available for each of two fiscal years ending March 31, 2001. The program was designed to assist specialty minerals companies evaluate the economic potential of existing mineral deposits and market those resources more effectively.

SMIP provided financial assistance towards eligible expenses as they pertained to the resource. These included consultant contract fees for the preparation of marketing studies, process flow sheets or business plans, definition drilling, geochemical analysis, bulk testing, metallurgical studies related to the testing of the commodity, and certain administrative costs. It was anti-

pated that this program would assist local specialty minerals producers as well as new producers to the province attempting to establish themselves in Manitoba. In 1999, six proposals were received and two were approved for funding.

Due to the lack of applications and the high lapse rate of funds for approved projects, SMIP was not continued past the March 31, 2001, program period; however, some of the exploration activities that were eligible under the program will now be eligible under MEAP.

Manitoba Prospectors Assistance Program (MPAP)

Since its inception in 1992, the Manitoba Prospectors Assistance Program (MPAP) has offered \$125 000 per year to encourage mineral exploration by experienced prospectors. Grants are available for 50% of eligible costs to a maximum of \$7500 upon completion of the field project and submission of an acceptable report. In 2001, the Prospectors Assistance Program Regulation was amended to increase the assistance available for projects undertaken in more remote areas of the province. For these projects, the amendment provides up to an additional \$1500 per year for the cost of chartered fixed-wing aircraft.

In fiscal year 2000/01, 26 applications were received, of which 25 projects were approved. Twenty-two projects were completed and \$106 351 in assistance was paid out. The initial spring 2001 offering of MPAP was oversubscribed with 27 applications received for proposed project expenditures of \$335 642. Twenty-one projects were approved.

The last offering of MPAP will take place in the fall of 2001. The Government of Manitoba is presently exploring the possibility of extending the program by evaluating its economic impact in the province and its effectiveness in assisting Manitoba prospectors conduct grass-roots mineral exploration.

Assay Credit Program

For the 2000/01 fiscal year, the province has allocated \$20 000 towards this program. A prospector can earn assay coupons for eligible expenditures on exploration work. Coupons can be redeemed for assays for certain metals as specified in Manitoba Regulation 64/92.

In fiscal year 2000/01, a total of 6849 credits were issued to 11 prospectors; 8 prospectors redeemed 5734 credits.

More information on Manitoba's mineral exploration and development incentives is available on the Internet at <http://www.gov.mb.ca/itm/mrd/busdev/incentives>.

Land Use

Priorities regarding land-use management in 2000 focused on the ongoing implementation of the Network of Protected Areas Action Plan. Technical support to the stakeholder assessment/consultation process was provided by documenting mineral tenure and withdrawing Crown mining rights. Manitoba has created a successful partnership with the Mining Association of Manitoba and World Wildlife Fund Canada, and has found a sustainable balance between environmental preservation and economic development. Special attention was given to Wildlife Management Areas and the northern areas of special interest.

Other significant land-use activities included progress towards meeting provincial obligations for Treaty Land Entitlement, Northern Flood Agreement, and the ongoing implementation of sustainable development as required by *The Mines and Minerals Act*.

More information on land access and sustainable development in Manitoba is available on the Internet at <http://www.gov.mb.ca/itm/mrd/mines/sustain>.

The Mines and Minerals Act

To ensure Manitoba's mining laws remain competitive and reflect today's trends in exploration, Manitoba has recently completed a review of *The Mines and Minerals Act* and accompanying regulations. The review was conducted in consultation with representatives of the mining and exploration industry in Manitoba. Proposed amendments relate primarily to technical and administrative issues with respect to mineral dispositions, submission of exploration data and confidentiality requirements. It is expected that the amendments to the Act will be introduced in the House in the fall of 2001. Amendments to regulations that do not need an amendment to the Act are in the drafting stage and will be registered by the end of 2001.

2.8 SASKATCHEWAN⁹

Overview

The annual survey of mineral exploration expenditures carried out by the resident geologists indicated that mineral exploration expenditures in 2000 were about \$28.2 million, an increase of \$4.5 million over 1998 (**Table 16**). Exploration expenditures rose for uranium and diamonds, decreased for base metals, and remained low for gold. In 2001, total exploration expenditures are forecast to rise slightly to about \$29.2 million. These estimates indicate that diamond exploration will more than double to \$8.6 million with activity in most other sectors decreasing, although there is new interest in rare earth elements (REE) and tantalum potential.

TABLE 16. SASKATCHEWAN EXPLORATION EXPENDITURES, 1991-2001

| | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 ^e |
|------------------|---------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------------------|
| | (\$ millions) | | | | | | | | | | |
| Uranium | 9.69 | 8.07 | 7.25 | 11.06 | 12.54 | 16.76 | 27.32 | 22.4 | 14 | 17.74 | 14.19 |
| Gold | 5.03 | 5.5 | 2.17 | 3.67 | 8.38 | 7.42 | 3.5 | 2.76 | 0.95 | 0.73 | 0.92 |
| Base metals | 5.65 | 3.8 | 4.15 | 4.18 | 3.96 | 5.2 | 10.11 | 3.68 | 5.64 | 4.47 | 2.43 |
| Diamonds | 2.67 | 4.19 | 3.99 | 10.14 | 3.76 | 5.72 | 2.3 | 1.01 | 1.43 | 4.11 | 8.56 |
| PGM ¹ | – | – | – | – | – | – | – | – | 0.91 | 1.02 | 1.23 |
| Other | 0 | 0.25 | 0.55 | 0.1 | – | 0.32 | 0.15 | 0.21 | 0.81 | 0.14 | 1.9 |
| Total | 23.04 | 21.81 | 18.11 | 29.15 | 28.64 | 35.42 | 43.38 | 30.06 | 23.74 | 28.21 | 29.23 |

Source: Resident Geologists' Survey, Saskatchewan Department of Energy and Mines.

– Nil; ^e Estimated.

¹ Exploration for platinum group metals (PGM) was not reported separately prior to 1999.

Note: "Other" includes mostly industrial mineral activity, including rare earth elements (REE) exploration.

As of October 1, 2001, the total number of metallic mineral dispositions in good standing was 3353 covering 2 470 356 ha. Their distribution reflects the recent resurgence in diamond exploration as they include 1621 dispositions totaling 491 782 ha for diamond exploration, compared to October 1, 2000, when there were 837 dispositions for diamonds covering 181 943 ha.

⁹ The Saskatchewan review of activities was prepared by Gary Delaney. For more information, the reader is invited to contact Mr. Delaney by telephone at (306) 787-1160 or by e-mail at gdelaney@sem.gov.sk.ca.

Uranium

In 2000, expenditures on uranium (U) exploration increased to \$17.7 million from \$14 million in 1999 (**Table 16**). Activity in 2001 is forecast to fall back to about \$14.2 million. This decrease reflects weak prices that have only recently begun a modest recovery. At the end of 2000, the uranium spot price (restricted) reached an all-time low of US\$7.10/lb of U_3O_8 . By September 30, 2001, the uranium spot price had recovered to US\$9.50/lb of U_3O_8 . This is still significantly below the high of US\$16.60/lb of U_3O_8 in 1996.

Over a dozen companies acting either independently or in joint-venture programs are exploring for uranium in the Athabasca Basin.

In 2000, Saskatchewan continued to be the world's leading miner of uranium, accounting for 31% of global mine production. Total Saskatchewan production was 10 683 tonnes of uranium (tU), up 30% from the 1999 total of 8214 tU. This increase was largely due to ore from the new McClean Lake and McArthur River mines.

McClean Lake (70% COGEMA Resources Inc., 22.5% Denison Mines Ltd., and 7.5% OURD (Canada) Co. Ltd.) achieved its annual licensed production capacity of 2308 tU (6 million lb U_3O_8) in the first 10 months of 2000. COGEMA projects similar results for 2001 by processing a blend of low to high-grade SUE C and low-grade JEB ores that average 2.6% U (3.06% U_3O_8). Recently, approval was received to increase the McClean Lake mill's annual production capacity to 3085 tU (8 million lb U_3O_8). If a decision is made to mine at the Cigar Lake and Midwest projects, and government approvals are received, a second phase of construction is planned to increase the mill's annual capacity to 4616 tU (12 million lb U_3O_8).

In 2000, Key Lake (69.805% Cameco Corporation and 30.195% COGEMA Resources Inc.), the largest high-grade uranium milling operation in the world, produced about 4154 tU (10.8 million lb U_3O_8), of which 3740 tU was from McArthur River ore. The mill has a production capacity of 6924 tU (18 million lb U_3O_8), which is the McArthur River mine's annual licensed production capacity. Ore from McArthur River is trucked to the Key Lake operation as a slurry, where it is diluted with the remaining Key Lake low-grade ore stockpiles, dry hauled low-grade ore (<1.7% uranium [$< 2\% U_3O_8$]) and special waste (> 0.03% U [$0.03\% U_3O_8$]) from McArthur River. The result is an average blend of about 3.4% U (4% U_3O_8). The Deilmann pit Tailings Management Facility holds the tailings.

McArthur River (69.805% Cameco Corporation and 30.195% COGEMA Resources Inc.) is the world's largest high-grade uranium deposit with proven and probable reserves of more than 151 742 tU (394.5 million lb U_3O_8) at an average grade of 17.96% U (21.18% U_3O_8).

With the depletion of stockpiles, the Rabbit Lake mill (100% Cameco Corporation) was placed in care and maintenance mode in June of 2001 after producing 1755 tU (4.6 million lb U_3O_8) in 2001 and 2790 tU (7.3 million lb U_3O_8) in 2000. Operations at Rabbit Lake's Eagle Point mine were suspended in early 1999 and this closure extended through 2000 and 2001. Past production had increased from 2885 tU (7.5 million lb U_3O_8) in 1994 to 4616 tU (12 million lb U_3O_8) in 1997. Production then declined to 4500 tU (11.7 million lb U_3O_8) in 1998 and 2693 tU (7 million lb U_3O_8) in 1999.

Cameco has re-evaluated the mining plan at Eagle Point to achieve further efficiencies through the introduction of changes to the mining method. Subject to market conditions and regulatory approval, the mill may restart in the second quarter of 2002. Mining at Eagle Point, which will provide the Rabbit Lake mill feed, is expected to resume about three months before the mill is restarted. Remaining Eagle Point reserves are 7308 tU (19 million lb U_3O_8). An application has been made to the regulators to mill all Cigar Lake ore at McClean Lake rather than to send 57% of the Phase 1 Cigar Lake ore to the Rabbit Lake mill, as originally proposed. If approved, the Rabbit Lake mill will receive 57% of the solutions containing yellowcake product and complete the milling process.

Originally scheduled to end in 2000, operations at Cluff Lake (100% COGEMA Resources Inc.) have been extended through 2001 due to higher ore grades, available capacity in the tailings management area, lower production costs, and improved productivity. The current plan is to continue mining until the end of May 2002 and to continue milling until the end of 2002. In 2000, production was 1462 tU (3.8 million lb U₃O₈) with the mill operating on a one-week-on, one-week-off basis. Production in 2001 is expected to be 1231 tU (3.2 million lb U₃O₈). The mill, which normally runs at 400 t/d on a one-week-on and one-week-off basis, was shut down from June 11 to July 16. The mill will also be shut down from November 26 to December 31, 2001.

COGEMA Resources Inc. has applied to the Canadian Nuclear Safety Commission (CNSC) for a 28-month operating licence for Cluff Lake from January 1, 2002, to April 30, 2004. Currently, ore is being mined underground from a west extension of the West Dominique-Janine (WDJ) ore zone, a system of high-grade, mostly continuous lenses. This zone was discovered in the summer of 2001.

The Cluff Lake comprehensive study was submitted to the regulators in early January 2001. This study describes the proposed decommissioning plan, options, mitigation and environmental effects of decommissioning. The document covers the entire site, including the Tailings Management Facility, the mining areas, mill complex and other structures such as the camp and airstrip. Summer 2001 work included removal of redundant buildings, site clean-up and reclamation. Other decommissioning studies are under way. The company's short-term schedule for mining and milling at Cluff Lake has been finalized. A long-term decision to restart the mill at a later time or to completely decommission the site will depend on a number of factors such as uranium prices and exploration success. A surface exploration program will commence in January 2002.

With total proven and probable reserves of 89 076 tU (231.6 million lb U₃O₈) at an average grade of 15.44% U (18.21% U₃O₈) and total inferred resources of 45 650 tU (118.6 million lb U₃O₈) at an average grade of 14.35% U (16.92% U₃O₈), Cigar Lake (50.025% Cameco Corp., 37.1% COGEMA Resources Inc., 7.875% Idemitsu, and 5% TEPCO) is the world's second largest, high-grade uranium deposit. Production is not expected before 2005, assuming a positive production decision is made, regulatory approval is obtained, construction is completed, and operating licences are received. After the initial test phase was completed in 1993, the project was operated on a care and maintenance basis until 1997 when a second phase of test mining commenced. This second phase of test mining was completed in late 2000 and the site is presently operated on a care and maintenance basis. The owners propose to develop the Cigar Lake project at a capital cost of \$350 million and have applied to the regulatory agencies to transfer the role of project operator to Cameco by the end of 2001. A base amount of 1923 tU (5 million lb U₃O₈) of Cigar Lake ore will be milled at McClean Lake each year. This arrangement will change if the regulators approve an application to mill all Cigar Lake ore at McClean Lake rather than partly at Rabbit Lake as originally proposed. Under the proposed arrangement, the McClean Lake mill would receive all of the transported ore slurry and the solution containing the yellowcake product would be shared between the two mills in the same proportions as was agreed to for the ore.

Gold

Although the potential for the discovery of new orebodies is high, the current depressed price for gold has had a severe effect on gold exploration and only eight companies are active. Most of this work, which was about \$0.7 million in 2000 and forecasted to be about \$0.9 million in 2001, was in the La Ronge, Glennie and Flin Flon domains. One of the principal exploration programs was that of Claude Resources Inc. in the vicinity of the Seabee mine. Another was that of Masuparia Resources on two optioned properties in the McClean Lake belt northeast of La Ronge.

In 2000, Claude Resources Inc.'s Seabee mine produced 58 300 oz (1813 kg) of gold. The mill processed 237 500 t at an average head grade of 8.58 g/t (0.25 oz/ton) gold. Subsequently, the mill processed 133 019 t averaging 6.30 g/t (0.18 oz/ton) gold to produce 22 800 oz (709 kg) of gold in the first six months of 2001. This reduction in production was attributed to lower-than-expected ore grades from the Currie Rose property massive sulphide D zone, the current area of mining at Seabee. The mining schedule, however, does provide for concurrent development of the B and C zones, which consistently grade higher than the D zone. With improving grades in the D zone and expected higher-grade swell and free pull from the B and C zones, production is anticipated to steadily improve over the balance of the year. As a result, 2001 production forecasts have been adjusted to 50 100 oz (1558 kg) of gold from an original budget of 55 000 oz (1711 kg) of gold with total cash costs under US\$200/oz and total production costs under US\$250/oz.

Since production began in December 1991 to the end of June 2001, 506 106 oz (15 741 kg) of gold had been produced at the Seabee mine at an average head grade of 8.66 g/t (0.25 oz/ton) gold. The annual A.C.A. International Ltd. report, prepared in March 2001, established total Seabee proven and probable reserves at 579 349 t grading 7.54 g/t (0.22 oz/ton) gold. In addition, the audit documented 19 250 t grading 8.30 g/t (0.24 oz/ton) gold and 1 680 000 t grading 8.0 g/t (0.23 oz/ton) gold in the indicated mineral reserve and inferred mineral resource categories, respectively. The reduced grade in the D section has led to a reduction in the mine's proven and probable reserves to 435 000 t at the end of the second quarter. The company added a second underground drill and expected to replace these tonnes over the next three or four quarters.

The focus at Greater Lenora Resources Corporation's Goldfields project, near Uranium City, is to develop an open-pit mine on part of the Box deposit. An Environmental Impact Statement (EIS) is mostly complete. The company has continued evaluating the property and believes that a higher grade of ore may be extracted using selective mining techniques and that the orebody may be amenable to gravity separation followed by vat leaching. Management believes the property could be brought into production relatively quickly following a sustained improvement in gold prices. Recent metallurgical testing by Gekko, of Australia, completed in February 2001, has indicated excellent recoveries by gravity separation alone. This recovery method could lower capital and operating costs substantially. Continuing metallurgical testing and economic evaluations of this approach are being undertaken.

Base Metals

Compared to 2000, base-metal exploration expenditures in 2001 are forecast to decline from \$4.2 million to \$2 million. Exploration programs for volcanogenic massive sulphide (VMS) deposits continued in both the exposed and sub-Phanerozoic parts of the Flin Flon and Glennie domains. Golconda Resources Ltd. carried out an extensive exploration program in the Wapawekka Lake area that resulted in a new discovery of copper-nickel and gold-bearing massive sulphide lenses. This opens new possibilities for base-metal exploration in the southern, sub-Phanerozoic part of the prospective Glennie domain. Leader Mining International Inc. and joint-venture partner Kores Canada Corp. continued work in the vicinity of the Knife Lake deposit in the Scimitar Lake area. Five new geophysical conductors were identified within favourable horizons at Knife, Gilbert, Scimitar, Pistol and Red Hill lakes. Five targets were tested by 12 drill holes totaling 1800 m that were completed in March 2001. The best intersection was a 25-m-wide massive sulphide lens containing traces of copper and nickel at Red Hill Lake.

Base-metal production in Saskatchewan in 2000 and 2001 came from the Konuto Lake mine and the Saskatchewan part of the Callinan deposit. Hudson Bay Mining and Smelting Company Ltd.'s Konuto Lake mine at Denare Beach is developed in a mafic-hosted, back arc rift-type copper-zinc deposit. The north-northeast-striking, near vertical dipping, and steeply south-plunging deposit has a strike length of approximately 180 m. The copper-zinc-gold-silver

mineralization occurs in four sulphide lenses, including three massive sulphide lenses (Lenses 1, 3 and 4) and one stringer "remobilized" lens (Lens 2). The ore zones extend to a depth of approximately 440 m below the 18 mining level.

As of January 1, 2001, mineable reserves and resources at Konuto Lake were listed at 1 296 802 t of ore grading 4.04% copper, 1.50% zinc, 2.154 g/t gold and 8.403 g/t silver. Since production commenced in 1998 until the end of 2000, the mine had produced 572 417 t of ore grading 4.48% copper, 1.16% zinc, 1.99 g/t gold and 9.25 g/t silver. From January 1 to September 1, 2001, the mine produced 93 707 t of ore grading 4.455% copper, 1.22% zinc, 1.85 g/t gold and 8.57 g/t silver. During this period, production was suspended from March 21 until August 2. Production for the remainder of 2001 is estimated at approximately 98 000 t of ore.

The Callinan mine (100% Hudson Bay Mining and Smelting Company Ltd., subject to a 6.67% net profits interest [NPI] agreement with Callinan Mines Ltd.) is a VMS deposit that consists of three east-plunging zones (south, east and north) in a sequence of rhyolitic rocks that are likely equivalent to the host "mine rhyolite" of the Flin Flon mine. Only the upper part of the Callinan North deposit extends into Saskatchewan.

Since start-up in April 1990 until the end of 2000, the Callinan mine produced 5 020 952 t of ore grading 1.41% copper, 3.75% zinc, 2.64 g/t gold and 24.00 g/t silver. Of this amount, 144 519 t grading 1.47% copper, 4.17% zinc, 1.64 g/t gold and 18.00 g/t silver came from the Saskatchewan part of the deposit. Saskatchewan production in the first eight months of 2001 was 37 544 t of ore grading 1.08% copper, 2.42% zinc, 1.82 g/t gold and 16.66 g/t silver. Production for the remainder of the year is estimated at approximately 27 574 t of ore grading 1.08% copper, 2.42% zinc, 1.82 g/t gold and 16.66 g/t silver. As of January 1, 2001, mineable resources in the Saskatchewan part of the North zone were 787 187 t grading 1.19% copper, 2.98% zinc, 1.53 g/t gold and 18.07 g/t silver.

Since April 1998, Foran Mining Corporation has had an option to purchase a 100% interest in the McIlvenna Bay deposit (67.1% Cameco Corporation and 32.9% BHP Billiton) in the Hanson Lake area of the Flin Flon Domain, west of Flin Flon. After three years, \$3 million has been paid. Foran's program comprised a two-phase diamond drill program totaling 15 000 m, the purpose of which was to define probable reserves and expand the known geological resource. On November 4, 1999, Foran released the results of an independently audited, revised resource estimate for the McIlvenna deposit. Total combined indicated and inferred resources for the Lens 2 massive sulphide and the newly discovered Upper West zone are now 11.4 Mt grading 6.08% zinc, 0.94% copper, 0.45% lead, 0.45 g/t gold and 24.40 g/t silver. For the copper stringer zone underlying the Lens 2 massive sulphide and the upper West zone, the total indicated and inferred resource is 11.7 Mt grading 1.79% copper, 0.48% zinc, 0.57 g/t gold and 11.96 g/t silver.

Copper-Nickel Sulphides and Platinum Group Metals

For 2001, exploration expenditures for these metals are expected to remain low at about \$1.2 million, an amount similar to actual expenditures of about \$1 million in 2000. Although seven companies hold ground in the Peter Lake domain, totaling 170 243 ha, little work has been reported since last fall. Nearby, in the Rottenstone domain, Uravan Minerals Inc. and BHP Billiton Diamonds Inc. have an option agreement whereby BHP Billiton can earn up to 70% in the Rottenstone platinum group metals (PGM)-nickel-copper property by incurring \$4.3 million in exploration expenditures.

Diamonds

On October 1, 2001, the amount of land under disposition for diamonds was approximately 490 000 ha, up significantly from the same date in 2000. This figure is still low compared to the 4 Mha under disposition in the early 1990s at the height of the diamond boom. More

importantly, however, 2001 diamond exploration expenditures are forecast to double that spent in 2000. Most of this year's estimated total of \$8.6 million for diamond exploration will be spent in the Fort-à-la-Corne area.

Although this revival of Saskatchewan diamond exploration activity is due primarily to two projects reporting favourable results, it also reflects a number of other factors including unfettered access to mineral dispositions, proximity to infrastructure, a re-evaluation of the diamond exploration paradigm as applied to the Fort-à-la-Corne (FALC) kimberlites, and resolution, in at least one case, of technical difficulties that resulted in incomplete diamond recovery.

The FALC project is a joint venture between De Beers Canada Exploration Inc. (42.25%), Kensington Resources Ltd. (42.25%), Cameco Corporation (5.5%), and UEM Inc. (carried 10%). Exploration is focused on 63 confirmed kimberlite bodies that form one of the largest kimberlite fields in the world. Geophysical modeling of the bodies has shown that they range from 2.7 ha to 184 ha in diameter with estimated masses of 3 Mt to 675 Mt. These kimberlites are relatively unique in that they are dominantly pyroclastic crater-facies. At the beginning of 2000, the De Beers' Mineral Resource Evaluation Department (MINRED) reviewed all available macrodiamond and microdiamond data and re-prioritized the kimberlites within the FALC field.

In early fall 2000, a \$2.2 million mini-bulk sampling drilling program was undertaken on kimberlites 122 and 141, two of the higher priority bodies. Body 122 covers an estimated area of 108 ha and embodies a mass, estimated by geophysical modeling, of 540 Mt of kimberlite within margins based on a greater-than-30-m-thick cut-off. Body 141 has an estimated area of 106.8 ha and a mass of 395 Mt based on the greater-than-30-m thickness cut-off that excludes the tapered edge of the kimberlite. A mini-bulk sample totaling 580 t of kimberlite was collected from three large-diameter (609 mm) reverse circulation drill holes on kimberlite 122 and two on kimberlite 141. A total of 212 macrodiamonds, having a combined weight of 17.305 ct, were recovered from 328.3 t of kimberlite from body 122. Some 251.8 t of kimberlite from body 141 yielded 278 macrodiamonds having a combined weight of 21.175 ct. De Beers has used macrodiamond recoveries from the 2000 drilling and available microdiamond data to refine kimberlite grade forecasts for kimberlites 122 and 141. The 2000 macrodiamond recoveries from body 122 have revised the grade forecast (1.0 mm lower cut-off) from an initial estimate of 9 carats/hundred tonnes (ct/ht) to a range between 8 and 13 ct/ht. Significantly, the modeled grade forecast (1.0 mm lower cut-off) for body 141 has increased from 14 to 19 ct/ht.

Encouraged by the results from the 2000 program, the joint-venture partners approved a \$4.79 million, two-phase 2001 exploration program to recover up to 80 additional carats from kimberlite 141 to improve the confidence limits on diamond value estimates. The first phase of drilling involved the completion of 16 NQ core holes on kimberlites 141, 140 and 150. Kimberlite 140 is now interpreted to be part of the 141 body. Core drilling was conducted to provide geological control for large-diameter drilling and to provide additional geological information away from the 2000 drill sites. This work, completed in July, entailed 4292 m of drilling that included 2432 m of kimberlite. One hole was terminated at 450 m, still in kimberlite.

Subsequently, in the summer and fall of 2001, nine large-diameter (609-mm) reverse circulation drill holes sampled kimberlite 141 and a single hole sampled kimberlite 150. A total of 413.1 t of kimberlite was extracted from kimberlite 141 and 58.0 t from kimberlite 150. Initial sample processing was completed in Grande Prairie and final diamond recovery is under way at the De Beers geological sample processing facility in Johannesburg. Some results should be available in December 2001.

Shore Gold Inc.'s Star kimberlite is at the southeast end of the FALC kimberlite field. This kimberlite consists of diatreme and pyroclastic crater-facies rocks covering an area of over 4 km² and ranging from 3.0 m to at least 539.4 m thick. Preliminary estimates of continuous diamond-bearing kimberlite exceed 500 Mt, with an average thickness of 88 m, based on a minimum cut-off thickness of 30 m.

Shore's 2000 Phase 1 diamond drill program included 15 NQ holes and one PQ (85-mm-diameter) hole. By February 14, 2001, a total of 2245.4 kg of core had been analyzed resulting in the recovery of 523 diamonds, including 120 macros (>0.5 mm) weighing 0.621 ct for an average grade of 27.8 ct/ht. Star 016, the PQ diameter hole, yielded 10 stones that had at least one dimension equal to or greater than (\geq) 1.0 mm. The largest stone in this hole, a fragment, is 2 mm wide and weighs just over 0.04 ct.

The company started a Phase 2 drill program at the end of 2000. The purpose of this was to test the continuity of the kimberlite body outside the existing defined boundaries of the deposit, as well as to provide additional geological information on certain areas in the kimberlite where geophysical modeling indicated a possible location for a diatreme root. The fourth hole, Star 020, cut 539.4 m of kimberlite and was stopped in kimberlite at a depth of 627 m. This kimberlite intersection is the thickest drilled in North America. Preliminary logging of the core defined diatreme facies lithologies and abundant large mantle derived xenoliths, and pyrope and eclogitic garnets indicated that Star 020 had been drilled into a feeder system for the Star kimberlite. Diamond recoveries from hole Star 20 were encouraging. A 626-kg sample of split kimberlite core, taken over a continuous interval of 311.6 m from a depth of 87.6 m below surface to a depth of 399.2 m, averaged 61 ct/ht and included higher-grade intersections of 25.6 m grading 435 ct/ht and 133 m grading 116 ct/ht.

A summer 2001 drill program completed seven new NQ-sized diamond drill holes. Three holes were drilled within 100 m of Star 20. They were drilled to provide the data necessary for delineating an area, with a minimum 200-m thickness of kimberlite, where a representative sample could be taken either by various large-diameter drill methods or by sinking a vertical shaft into the kimberlite. In October 2001, in preparation for the extraction of a major bulk sample from the Star kimberlite, Shore Gold recovered a sample of approximately 90 t of wet kimberlite chips using a large-diameter (609-mm) reverse circulation drill. This sample is currently being processed.

Since the start of the exploration program on the Star kimberlite in 1996, a total of 26 diamond drill holes with a total sample weight of 4623 kg have been analyzed, resulting in the recovery of 1.477 ct of diamonds. Stones larger than 0.5 mm made up 84% of the total weight of recovered diamonds from the Phase 2, 2000/01 program. Stones larger than 1 mm comprised approximately 60% of the weight of the same sample.

Rare Earths

Great Western Gold Corp. has made the last in a series of option payments to Daren Industries Ltd. for the Hoidas Lake rare earth project located approximately 56 km northeast of Uranium City. Great Western can finish earning a 70% interest in the property by incurring \$1.5 million in exploration expenditures by September 1, 2004.

The company has now identified 24 separate rare earth occurrences on the 6475-ha property. The showings are in a wide zone adjacent to and within more than 10 km of a northeast-trending fault system. Only one rare earth occurrence, the JAK zone, has received recent exploration work. In February 2001, 16 holes totaling 1100 m of core were completed along 475 m of the JAK zone to a depth of 65 m. These holes intersected multiple parallel and sub-parallel veins containing significant rare earth mineralization. Individual veins were traced continuously along strike with the highest average grade running 4.62% total rare earth oxides (TREO) over a width of 5.2 m and the maximum width of 6.9 m grading 4.41% TREO. Metallurgical tests carried out on a composite sample from the drill core (averaging approximately 4.4% TREO) have shown that a significant amount of the rare earth mineralization is derived from phosphate minerals (apatite and monazite) in addition to the silicate mineral allanite. Testing also shows that the rare earth elements contained in the minerals are amenable to upgrading by flotation and recovery by acid leaching.

Tantalum

MPP 1186 (70% Leader Mining International Inc. and 30% Buhlman and Associates, with Nikanj and Associates Consulting Inc. holding a 1% net smelter return royalty) covers a cluster of coincident tantalum-cesium-rubidium-tungsten lake sediment anomalies in the Bright Lake area of the Dodge domain north-northeast of Stony Rapids. A program of stream and lake sediment sampling and geological reconnaissance work was completed in early September 2001. Sample 8117, from a pegmatite south of Premier Lake, contained 276 parts per million (ppm) tantalum, 49 ppm tin, 110 ppm lithium, 438 ppm rubidium and 75 ppm cesium. Interesting results were also obtained from a swarm of large, very coarse-grained pegmatites near the eastern end of Marchant Lake.

Summary of Mining Lands Activity - Calendar Year 2000

The Mineral Disposition Regulations, 1986 (Metallic Minerals and Diamonds)

A relatively quiet exploration climate was reflected by the small number of new dispositions and area of land acquired in calendar year 2000. For the readers' reference, the status of land in the surveyed (southern) part of the province is typically a reflection of diamond exploration activity, which is concentrated in the Fort-à-la-Corne area northeast of Prince Albert. Activity in the unsurveyed (northern) part of the province is a reflection primarily of uranium exploration activity, but also of base- and precious-metal exploration activity.

During 2000, 740 dispositions (523 375 ha) were recorded. Of these, 213 (405 917 ha) were issued in the unsurveyed (groundstaking) part of the province while 527 dispositions (117 458 ha) were acquired by map staking in the surveyed part of the province.

In the same period, 1576 dispositions covering 1 042 556 ha of Crown mineral lands lapsed in fiscal year 2000 for a net loss of 519 181 ha.

At the end of calendar year 2000, 2789 metallic mineral dispositions totaling 2.3 Mha of Crown minerals lands remained in good standing. Of these, 1827 dispositions covering 2 119 676 ha were located in the unsurveyed part of the province, while 962 dispositions covering 215 020 ha were active in the surveyed area. Overall, the number of active dispositions and amount of land under disposition in 2000 were reduced from calendar year 1999 levels when a total of 3633 dispositions, covering 2.9 Mha, were active.

Assessment Work Expenditures – 2000

Approved assessment work expenditures for claims and leases totaled \$43.4 million for calendar year 2000. The majority (>80%) of the approved expenditures were carried out in the Athabasca Basin area and were related to uranium exploration. Expenditures related to test mine and underground development accounted for approximately 45% of the approved assessment expenditures. Forthcoming changes to the regulations will eliminate these types of expenditures as being available for acceptance as assessment work in future years. Of the remaining approved expenditures, diamond drilling and ground geophysics were the most prevalent types of submitted assessment work expenditures.

Industrial Minerals

There were 857 active industrial mineral dispositions (potash, coal, sodium sulphate, and quarriable substances) covering 355 200 ha in calendar year 2000. These numbers are relatively consistent with previous years.

In total, 3646 mineral dispositions totaling 2.7 Mha of Crown minerals lands remained under disposition in calendar year 2000.

Regulatory Initiatives

To maintain the competitiveness of Saskatchewan in the resource sector and to ensure relevant regulations are in place to address evolving exploration trends and technology, regulations are in the process of being developed or are under review. Consultation with industry continues to be an important part of these processes.

In 2000, the Saskatchewan budget included a number of regulatory initiatives to stimulate and support mineral exploration investment in Saskatchewan. The new Saskatchewan Mineral Exploration Tax Credit introduces a new, temporary 10% tax credit on eligible exploration expenses incurred by mineral exploration companies. The company must carry out exploration in Saskatchewan, and the credit can only be claimed by qualified investors paying Saskatchewan income tax. The program will parallel the new 15% federal mineral exploration tax credit and is retroactive to October 18, 2000. In addition, effective May 2000, a 50% reduction in recording fees for new mineral claims was introduced. A complementary reduction in permit-related fees, including a 50% reduction in acquisition fees, decreased year-one work requirements, and a reduction for permit cash deposits will be effective in 2001.

Comprehensive consultations with industry on substantive revisions to *The Mineral Disposition Regulations 1986* continued in 2000. These revisions include reductions in permit-related fees and changes to promote the timely and orderly exploration of Crown minerals. The latter includes changes to the allowable expenditure activities for assessment purposes, requiring assessment work expenditures and reports to be submitted within two years of work being completed, and a retroactive capping of assessment work credits on existing claims to 21 years.

2.9 ALBERTA¹⁰

Overview

During 2000, approximately 2.3 Mha were staked in Alberta and, to the end of September 2001, an additional 3.5 Mha (399 permits) had been applied for, bringing the area in good standing to about 9.6 Mha. The area in good standing has decreased by some 1.3 Mha from the previous year due to lands being returned. In 2000, some \$17.3 million were filed for assessment whereas, to the end of September 2001, there had been a significant decrease to only \$2.5 million (**Table 17**). Most of the exploration during 2000 and 2001 was directed at diamondiferous kimberlites with lesser amounts directed at exploration for precious/base-metal deposits in northern Alberta, uranium in the Athabasca Basin in northeastern Alberta, and iron or other mineral commodities elsewhere in the province.

Exploration for Diamonds

To early October 2001, a total of 45 kimberlites had been discovered in Alberta, including: 1 at Mountain Lake south of Peace River, 36 at Buffalo Head Hills in north-central Alberta, and 8 in the Legend area in the Birch Mountains in northeastern Alberta.

¹⁰ The Alberta review of activities was prepared by R.A. Olson, R. Eccles, T. Berezniuk, E. Kimball (Alberta Geological Survey) and B. Hudson (Alberta Department of Energy). For more information, the reader is invited to contact Mr. Olson by telephone at (780) 427-1741 or by e-mail at reg.olson@gov.ab.ca.

TABLE 17. ASSESSMENT REPORT SUBMISSIONS IN ALBERTA, 2000 and 2001^a

| | 2000 | 2001 ^a |
|----------------------------------|------------|-------------------|
| Summary | | |
| Number of permits worked on | 1 138 | 242 |
| Hectares worked | 11 130 903 | 2 030 682 |
| Work expenditures | 17 286 747 | 2 516 604 |
| Geophysical work | | |
| Airborne geophysics line km | 347 390 | 4 807 |
| Airborne geophysics expenditures | 3 451 815 | 120 103 |
| Ground geophysics line km | 579 | 477 |
| Ground geophysics expenditures | 504 820 | 306 206 |
| Drilling | | |
| Metres drilled | 8 397 | 1 127 |
| Number of drill holes | 134 | 11 |
| Drilling expenditures | 1 646 934 | 416 667 |

Source: R.A. Olson, R. Eccles, T. Berezniuk and E. Kimball (Minerals Section, Alberta Geological Survey) and B. Hudson (Alberta Department of Energy), November 2001.

^a Data for 2001 are incomplete. They only include statistics up to October 1, 2001.

Discovered in 1990, the Mountain Lake kimberlite, which is about 90 km south-southwest of the town of Peace River within the National Topographic System (NTS) map area 83N, was the first kimberlite discovered in Alberta. Little exploration has been performed in this area since its discovery. A recent supplemental petrographic study by the Alberta Geological Survey (AGS) (AGS Special Report 15 by Skupinski and Langenberg) indicates that the pipe may be of "mixed origin," i.e., although comprised mainly of hybrid alkaline ultramafic rocks of alnoitic affinity, the presence of garnet (G5, G9 and G11), chrome diopsides, chromite and picro-ilmenite supports a kimberlitic contribution. The Mountain Lake kimberlite and surrounding area were acquired in mid-2000 by New Claymore Resources Ltd. Recent press releases indicate that the company has completed ground magnetometer surveys and has a drill program planned for the near future.

The Buffalo Head Hills (BHH) kimberlite field in north-central Alberta (NTS 84B, G), which is predominantly centred about 50 km northwest of the village of Red Earth, or 400 km north-northwest of Edmonton, represents one of Canada's new diamondiferous kimberlite provinces. The area was initially identified as prospective for diamondiferous kimberlites almost simultaneously by the AGS (AGS GeoNote 1997-1, Fenton and Pawlowicz) and by the Alberta Energy Company, which acted to form the Ashton Mining of Canada Inc. (45%)/Alberta Energy Company Limited (45%)/Pure Gold Minerals Inc. (10%) joint venture, with Ashton as the operator. Since 1996, this joint venture has discovered at least 36 kimberlites, with over 50% of the BHH kimberlites being diamondiferous. This is anomalous because typically, worldwide, only about 10% of the kimberlites in a field are diamondiferous.

Kimberlite crops out at four places at BHH, but most are covered by overburden that, in places, reaches thicknesses of up to 127 m. Recent (2000 and 2001) discoveries in the BHH region by Ashton include kimberlites K8, K160, K252 and K281, bringing the total number of kimberlites in the area with estimated grades greater than (\geq) 3 ct/ht to be at least six (K6, K11, K14, K91, BH225 and BH252), with the K252 pipe having the highest reported grade. Ashton reports that the K252 kimberlite is the first kimberlite discovered in Alberta by the joint venture to date that has a weak magnetic signature, unlike the previous 34 kimberlites, which displayed sharp magnetic contrast against the surrounding mudstone bedrock. The company believes the association of weakly magnetic characteristics with higher diamond content in K252 has

significant exploration implications for the joint-venture properties in Alberta. Ground geophysical programs will consequently be conducted to define and select electromagnetic (EM) and seismic targets for drilling in the first quarter of 2002. In May 2001, Ashton reported that a 22.8-t mini-bulk sample from the K252 kimberlite returned a total 12.54 ct of diamonds larger than 0.8 mm, for an estimated diamond content of 55.0 ct/ht, and this included eight macrodiamonds ranging from 0.17 ct up to a 0.94-ct colourless composite crystal that came from the breccia. The number and size of macrodiamonds in this mini-bulk sample indicate the potential for K252 to host commercial-sized stones. Ashton announced a winter 2001/02 exploration program that will include delineation drilling and the collection of a 200 to 400-t bulk sample at K252.

Ashton has also conducted exploration elsewhere in north-central Alberta, including in the Caribou Mountains and Athabasca/Lesser Slave Lake areas, which are approximately 600 km and 275 km north of Edmonton, respectively. Their reported exploration activities included: heavy mineral sampling, regional fixed-wing magnetic surveys, a detailed helicopter-borne magnetic survey, 13 ground magnetic surveys, and drill testing. Ashton subsequently reported drilling in the Caribou mountains, but encountered an ironstone unit rather than kimberlite. For the Athabasca, Lesser Slave Lake and Whitemud Hills areas, Ashton has reported a total of 336 heavy mineral samples that show very broad patterns of kimberlite-indicator minerals, including counts of up to 21 olivines in the Lesser Slave Lake area.

In the Birch Mountains (NTS 84H) in northeastern Alberta, approximately 110 km northwest of the town of Fort McMurray, New Blue Ribbon Resources Ltd. acquired the Legend property where Kennecott Canada Exploration Inc., Montello Resources Ltd. and Redwood Resources Inc. discovered seven kimberlites by the end of 1999. In November 2000, New Blue Ribbon drilled one target and discovered the Kendu kimberlite under 91.4 m of overburden with kimberlite intersected to the end of the hole at 191 m. The Kendu kimberlite is about 20 km northwest of the Legend kimberlite. A 170-kg sample from Kendu did not return any diamonds. New Blue Ribbon reports that geophysical surveys have identified at least six additional targets that may indicate underlying kimberlite sources, but these have yet to be drill tested.

Elsewhere in Alberta, there has been a significant level of exploration for diamondiferous kimberlites at and near Calling Lake (NTS 83P), which is about 60 km north of the town of Athabasca in north-central Alberta. Several companies have acquired mineral properties in this area. The most active during 2000 was Buffalo Diamonds Ltd. on the adjoining Calling Lake and Varlaam properties. During early 2000, the company completed about 1300 line-km of helicopter-borne magnetic surveys, identifying 36 anomalies that might be caused by kimberlite pipes. In March 2000, the company announced that a winter drill program totaling 1100 m to test 11 targets was under way. It was subsequently reported that 10 holes had been drilled into the Calling Lake targets, but the core reportedly was not logged or sampled and has been sealed and in storage since the spring of 2000. Although Buffalo Diamonds has not been actively exploring since the spring of 2000, it remains interested in the area because, in June 2001, the company exercised its option to acquire a 50% interest in the Varlaam property from New Claymore Resources Ltd. As well, BHP World Explorations Inc. reportedly staked about 700 000 ha (1.73 million acres) in the Calling Lake area during the first part of 2001.

New Claymore Resources acquired three mineral permits in early 2000 at the Steen River structure (NTS 84N) in northwestern Alberta. The Steen River structure is about 120 km north-northwest of the town of High Level and is reported to be of meteorite impact origin. New Claymore postulated that kimberlitic diatremes might be spatially or genetically related to the Steen River structure and drilled a total of about 1019 m in three holes during the early part of 2000. New Claymore subsequently reported that the rock encountered in all three holes was not kimberlite but an impact breccia that probably resulted from a meteorite impact, as postulated by a number of geologists. Although not kimberlitic, the breccia forms widely spaced pipelike bodies. The company analyzed a 48-kg sample of the core for diamonds but none were reported. With the permission of New Claymore, the AGS studied the "exotic breccia" in the drill holes and, in a soon-to-be-released report (AGS ESR 2001-04, Molak et al.), also concluded that the Steen River structure breccia is primarily of meteorite impact origin.

In early 2000, Shear Minerals Ltd. conducted airborne and ground follow-up geophysical surveys on its Obed property, 20 km east of Hinton. That work identified two drilling targets, but to date these have not been drilled. Shear also conducted work in the Pelican Mountains (NTS 83P), identifying a number of magnetic shallow-sourced anomalies. Unfortunately, drilling encountered an aquifer and, as a result, the anomaly remains untested.

Exploration for Precious Metals, Base Metals and Uranium

With respect to precious metals exploration in Alberta, the area of greatest interest has, for a number of years, been north of Fort McMurray (NTS 74D, E). Since the early 1920s, many anomalous results for precious metals have been reported in samples or drill core from both Devonian carbonate strata and the immediately overlying Cretaceous clastic rocks, including in some places, oil sands. Exploration results reported from the area in the late 1990s were the subject of some controversy regarding assay methods. Very little exploration work was conducted in the area during 2001.

The AGS currently has a Targeted Geoscience Initiative (TGI) project to study the metallic mineral potential of the Devonian carbonates in northern Alberta. This project is predominantly focused on the potential for Mississippi Valley-type deposits similar to those that exist at Pine Point but, to some extent, the carbonates also are being assessed for their "Prairie Gold" potential. This TGI project is being done in cooperation with the Geological Survey of Canada (GSC) and the Geological Division of the federal Department of Indian Affairs and Northern Development, located in the Northwest Territories.

In the Chinchaga region (NTS 84D, E) of northwestern Alberta, Marum Resources Inc. drilled 746 m in 15 holes at two target areas located 8 km apart. However, in May 2000, Marum reported that no economic or anomalous gold or platinum group metal values were obtained from any of the samples.

In the Pelican Mountains north of Calling Lake, New Blue Ribbon reported in July 2000 the drilling of 491 m in 11 holes to test a titanium-iron inferred resource believed to be a paleo-placer deposit in Late Cretaceous strata. Assays are up to 35.18% Fe₂O₃, 9.94% TiO₂ and 0.61% ZrO₂. The publicly available information indicates that no further work has been done on this prospect since early 2000.

Finally, there appears to be renewed interest in uranium exploration in the Athabasca Basin region (NTS 74E, L) of northeastern Alberta, south of Lake Athabasca. During 2001, Cogema Resources Inc. re-examined Athabasca Group and underlying basement core from the Maybelle River area that is stored at the AGS's Mineral Core Research Facility in Edmonton.

Industrial Minerals

Alberta has a long history of industrial mineral production, with the production and dollar value being on a slight increasing trend over the past few years. At present, the main production is limestone for the production of cement and lime, with some production of clay, dimension stone and a few other mineral commodities. An important change in limestone production has been the conversion from natural gas-fired kilns to coal-fired kilns. For example, Graymont Western Canada Inc.'s Exshaw lime plant near Canmore is already converted to coal, and both Inland Cement Limited and Lafarge Canada Inc. are in an engineering phase to convert their cement operations to coal-fired as well.

With respect to other industrial mineral production for 2000 and 2001, marl and zeolite have recently come into production. Marl was previously produced in Alberta, but zeolite is a new commodity for the province and production is from the Crowsnest Pass area in southwestern Alberta. Thunderstone Quarry, a small building stone quarry near Canmore in the Banff transportation corridor, supplies "Rundle Rock" dimension stone and has seen some expansion

over the past year. Ammolite, which is formed by iridescent aragonite on the surface of fossilized ammonite shells, continues to be produced by Korite International in southern Alberta. In northwestern Alberta, United Industrial Services had been operating an adjacent open-pit mine and silica sand processing plant 10 km north of the town of Peace River since 1999. However, the plant and mine ceased operation during 2001.

Turning to exploration, there were two assessment reports on industrial minerals filed with the Alberta Department of Energy and archived by the AGS during 2000. One concerns the exploration of high-calcium limestone in west-central Alberta (NTS 82O/12, 13 and 83B/3, 4, 5), west of Rocky Mountain House, and the second concerns bentonite exploration in central Alberta near Camrose (NTS 83A).

Finally, in southwestern Alberta (NTS 82G), the Burmis deposit is again being looked at for its potential to provide magnetite for use in coal beneficiation. Micrex Development Corp. conducted exploration and metallurgical testing studies on this paleoplacer magnetite deposit to evaluate whether the deposit can be brought into economic production. In August 2001, Micrex reported that it was further evaluating the Burmis deposit for economically exploitable secondary minerals, particularly ilmenite.

2.10 BRITISH COLUMBIA¹¹

Summary and Outlook

Next to a world-class mine discovery, the single most important influence on exploration investment and growth in the mining sector over the coming years will be the change initiated by British Columbia's newly elected government. This new pro-business government is committed to revitalizing mining and mineral exploration by supporting a thriving private sector that generates high-paying jobs and prosperity for all British Columbians. It has made major cuts to taxes and is committed to reducing red tape by one third in the next three years for business. This is essential to developing a long-term exploration and mining strategy for the province.

Industry's renewed optimism is reflected in its forecast for total exploration spending in 2001, which shows a projected increase, as indicated in **Table 18**. The forecast of an increase is supported by estimates of 2001 field work, and marks a significant turn-around after the long decline that began in 1996. The forecast increase in British Columbia's spending in 2001 over 2000 (i.e., from \$34.8 million to \$45.1 million) is particularly significant when contrasted with the 3% decline forecast for Canada as a whole (from \$473 million in 2000 to \$458 million in 2001).

Figures 28a and **28b** compare British Columbia exploration spending with that for Canada as a whole. **Figure 28a** shows the "dollars spent" comparison. **Figure 28b** plots British Columbia expenditures as a percentage of the Canadian total. From 1986 to 1997, British Columbia exploration expenditures were substantially greater in both dollar and percent-share-of-Canada terms than in recent years. During this period, British Columbia expenditures continuously exceeded 10% of the Canadian total, peaking at almost 30% of the Canadian total in 1990. British Columbia's high mineral potential combined with the new government's planned regulatory streamlining are expected to result in the province's share of exploration spending reaching the 10% share of the Canadian total once again. This is indicated in **Figure 28b** by the up-tick forecast for 2001 (which equates to 9.8% of Canada's total).

¹¹ The British Columbia review of activities was prepared by Jim Lewis. For more information, the reader is invited to contact Mr. Lewis by telephone at (250) 952-0521 or by e-mail at jim.lewis@gems3.gov.bc.ca.

TABLE 18. EXPLORATION EXPENDITURES IN BRITISH COLUMBIA, 1997-2001

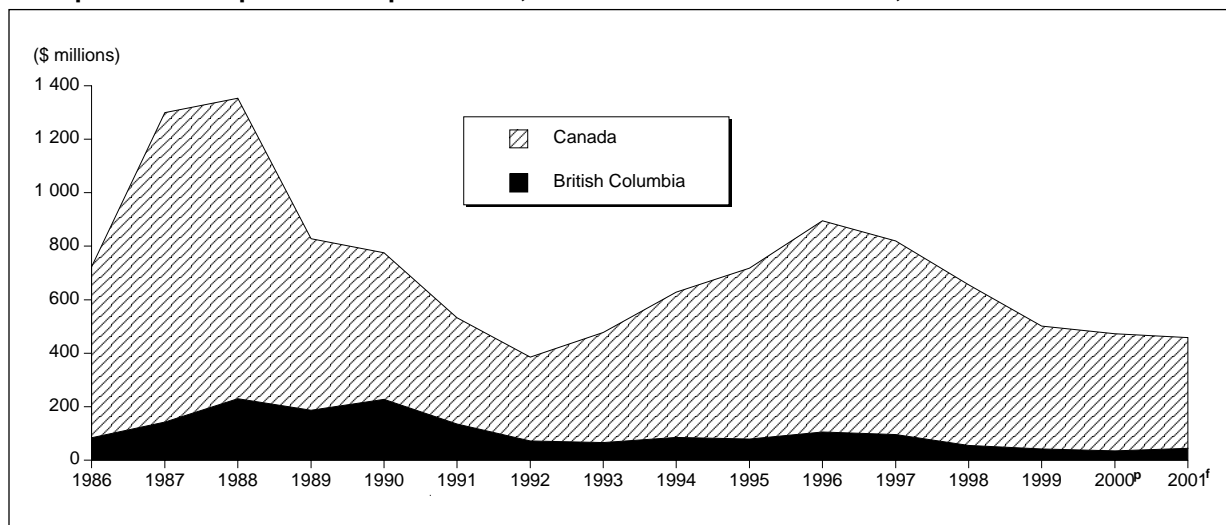
| | 1997 | 1998 | 1999 | 2000 ^P | 2001 ^f |
|----------------------------|---------------|------|------|-------------------|-------------------|
| | (\$ millions) | | | | |
| Official and comprehensive | 115.2 | 54.5 | 41.3 | 34.8 | 45.1 |
| Percent change | . . | -53% | -24% | -16% | +30% |
| Field work and overhead | 95.8 | 44.3 | 33.4 | 28.4 | 37.5 |
| Percent change | -9% | -54% | -25% | -15% | +32% |

Source: British Columbia Ministry of Energy and Mines.

. . Not available; ^f Forecast of intentions; ^P Preliminary.

Notes: All figures include exploration and deposit appraisal (and exclude mine complex development). In addition to field work and overhead expenditures, "official and comprehensive" statistics include engineering, economic and feasibility studies, environmental and land access spending and are used for analyses in this chapter. These statistics are the official federal/provincial numbers from the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures and are the source of Statistics Canada's National Accounts. "Field work and overhead" are used for comparison with pre-1997 published exploration spending statistics.

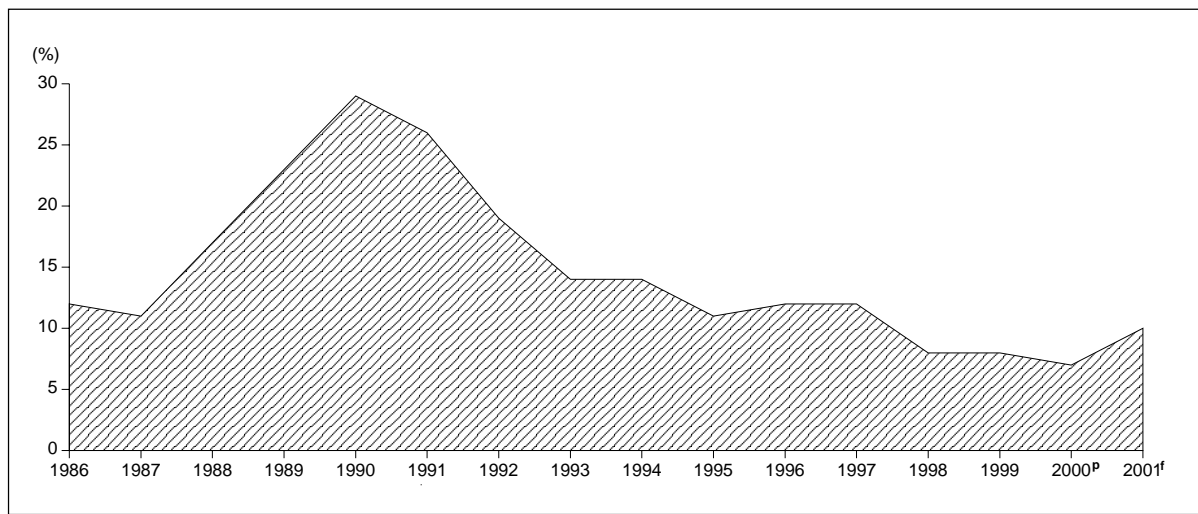
Figure 28a
Comparison of Exploration Expenditures, British Columbia and Canada, 1986-2001



Source: British Columbia Ministry of Energy and Mines

^f Forecast of intentions; ^P Preliminary.

Figure 28b
British Columbia's Exploration Expenditures as a Percentage of Canada's Total Expenditures, 1986-2001



Source: British Columbia Ministry of Energy and Mines.

^f Forecast of intentions; ^P Preliminary.

Government Initiatives

During the summer and fall of 2001, the new provincial government completed an in-depth analysis of the opportunities for:

- a. investment and growth in the mineral exploration and mining sectors, as well as other sectors of the British Columbia economy;
- b. reduction of the regulatory burden, with a target of eliminating one third of existing regulations; and
- c. focusing each government agency on its core programs and services.

As a result of these strategic planning processes, the British Columbia Ministry of Energy and Mines has been authorized to focus its efforts on fostering resource sector investment through such means as establishing a one-window authority for mining (including mineral exploration) and an external relations agency accountable for investment facilitation and new initiatives.

The following British Columbia government initiatives (some economy-wide and some mineral sector-specific) have been implemented to stimulate investment and growth:

- In June 2001, personal income taxes were cut by 25%.
- The corporate capital tax was cut in half and will be eliminated in less than a year.
- The Provincial Sales Tax (PST) on production machinery and equipment was removed for minerals and other processing and manufacturing industries.
- On January 1, 2002, corporate income tax will be reduced by 3% to 13.5%.

- A new 20% British Columbia flow-through share tax credit has been implemented. This tax credit is harmonized with the federal program.

Statistical Trends in British Columbia's Exploration Sector

This section provides an explanation of key trends in the province's exploration sector, as derived from federal-provincial/territorial survey statistics and additional data collected by the British Columbia Ministry of Energy and Mines.

Figure 29 shows over two decades of exploration spending and compares this spending with a mineral price index. The evident correlation indicates the dependency of spending levels on mineral demand, as reflected by international mineral commodity prices. The mineral price index includes copper, lead, zinc, silver, gold and coal prices, which account for over 90% of British Columbia's mineral sales. Part of the increased spending shown in 2001 is also attributable to price increases in the PGEs and carbonatite minerals (i.e., tantalum and niobium).

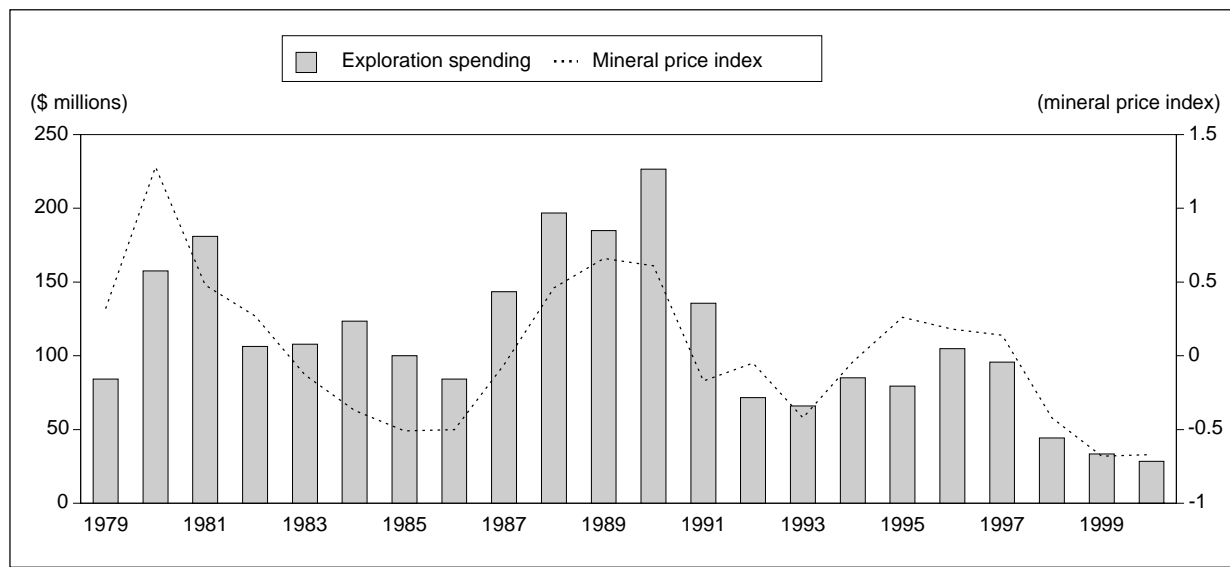
The following three charts (**Figures 30a, 30b** and **30c**) highlight the dependency of exploration expenditures on commodity price levels and the attractiveness of government policies.

As shown in **Figure 30a**, the prices of British Columbia's four key mined commodities have experienced more declines than increases over the past five years. Although copper, gold and zinc prices have declined in 2001, higher coal prices (and, to some extent, higher PGE, tantalum and niobium prices) may lead to the higher spending forecast for 2001.

Unlike the decline in exploration spending, mineral sales (**Figure 30b**) have maintained a steady total of \$3 billion during the past five years. However, there has been a steady decline in the number of major mines (**Figure 30c**).

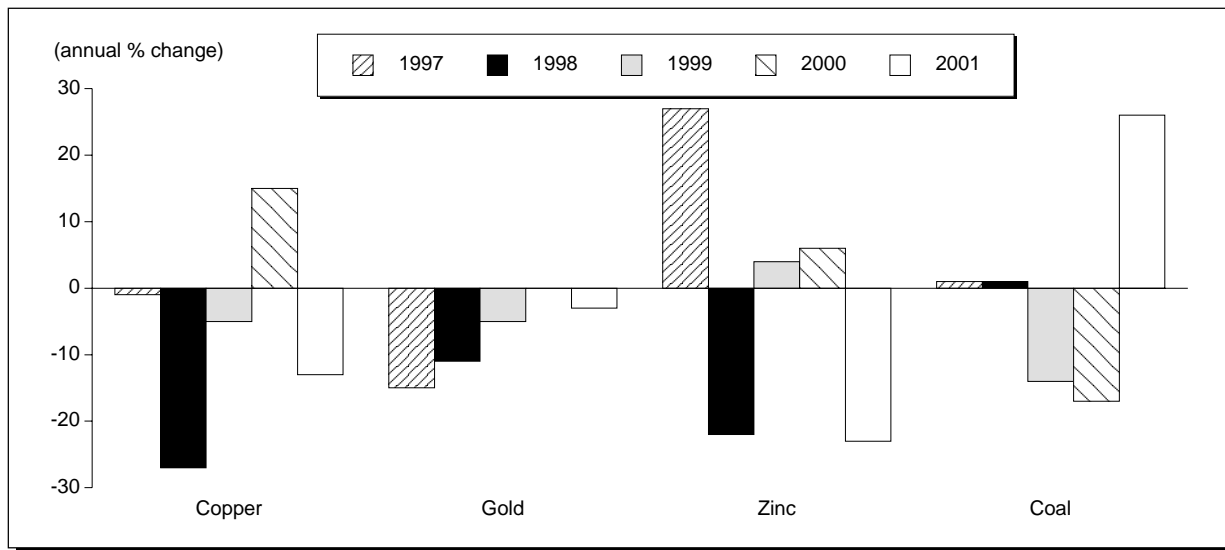
Figure 31 shows an increase in the number of claim units outstanding in 2000 and 2001, compared with the previous two years, as a result of new discoveries. The slight decline in claims

Figure 29
Annual Exploration Expenditures and British Columbia's Mineral Price Index, 1979-2001



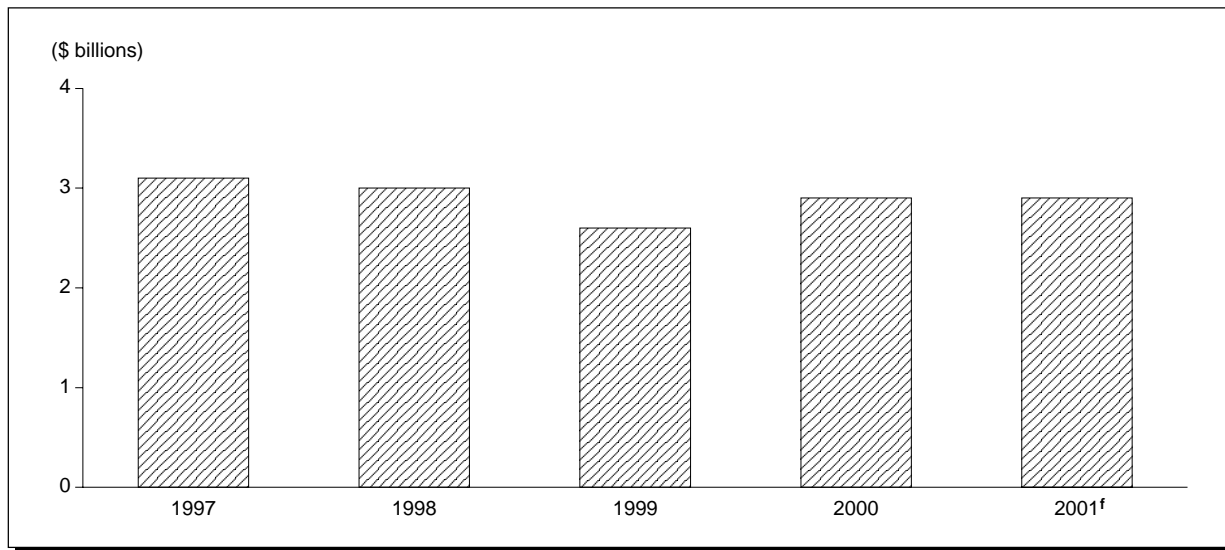
Source: British Columbia Ministry of Energy and Mines.
Note: Exploration expenditures for 2001 are based on a forecast of intentions; 2000 expenditures are preliminary.

Figure 30a
Mineral Commodity Price Changes, 1997-2001



Source: British Columbia Ministry of Energy and Mines.

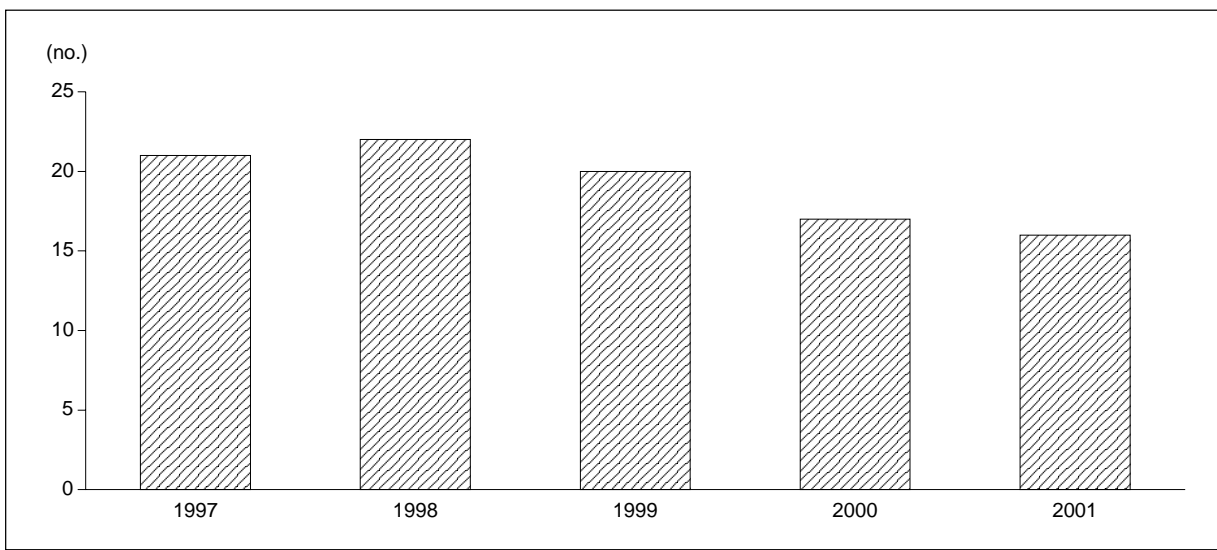
Figure 30b
Mineral Sales in British Columbia, 1997-2001



Source: British Columbia Ministry of Energy and Mines.

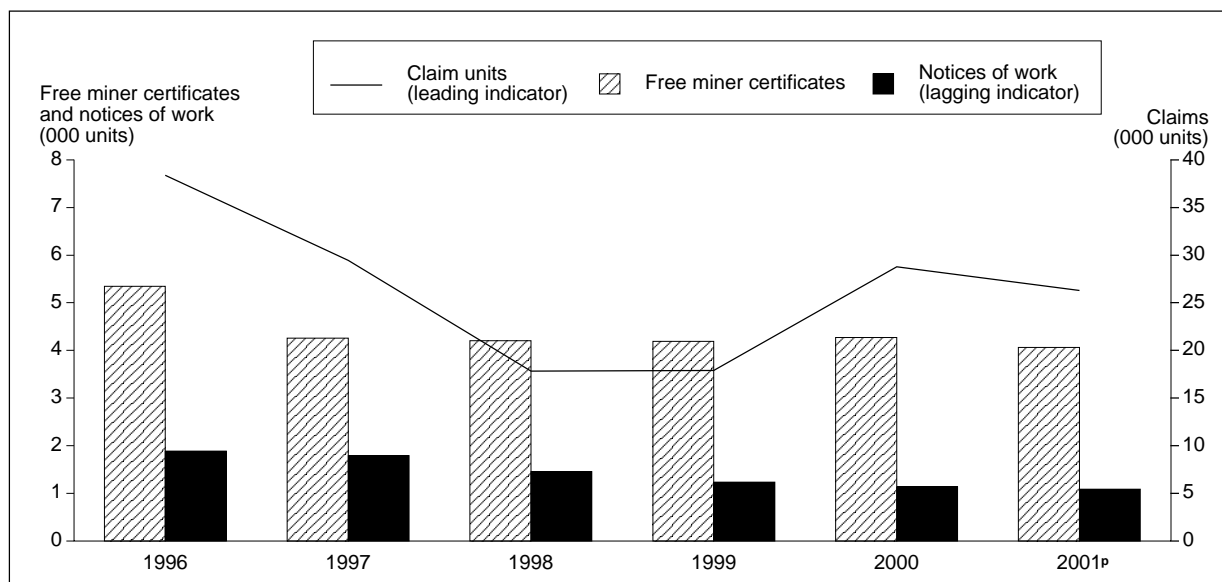
^f Forecast.

Figure 30c
Major Mines in British Columbia, 1997-2001



Source: British Columbia Ministry of Energy and Mines.

Figure 31
Exploration Activity in British Columbia as Indicated by Claim Units, Free Miner Certificates and Notices of Work, 1996-2001



Source: British Columbia Ministry of Energy and Mines.

^p Preliminary.

and free miner certificates issued from 2000 to 2001 may reflect a situation of tight financing for prospectors and junior companies in 2001. Claim unit changes are a leading indicator, whereas Notices of Work, which are required to undertake exploration, are a lagging indicator. Although Notices of Work are still declining, they are expected to increase next year as planned follow-up exploration programs are undertaken. This is subject, of course, to successful financings.

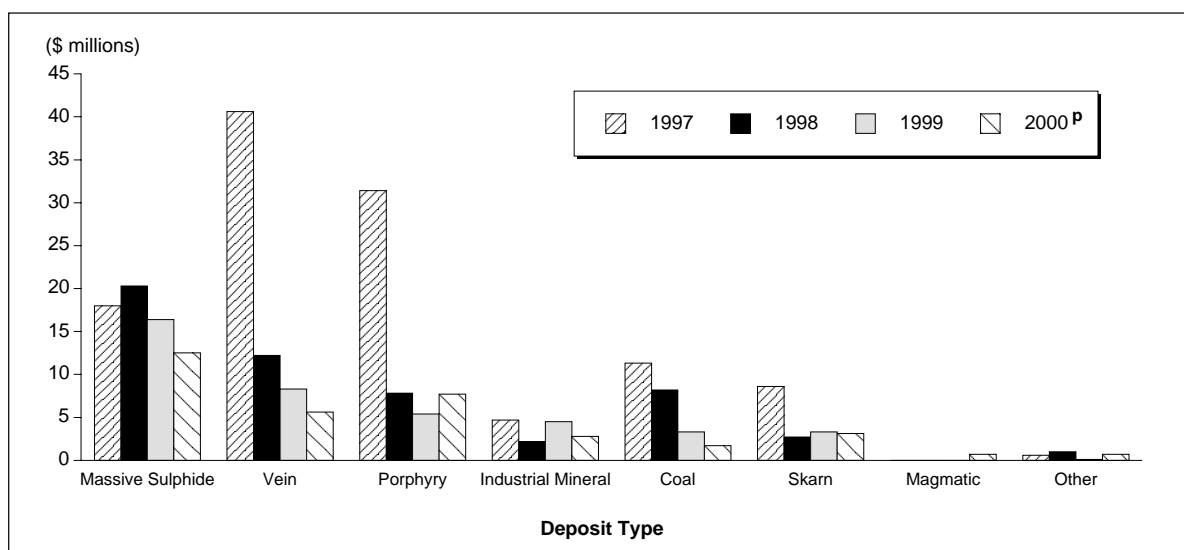
Figures 32, 33, 34, 35, 36a and 36b indicate that although exploration spending in British Columbia has been at low levels in recent years, expenditures have been allocated across the range of exploration opportunities. For example, funds have been spent across a diversity of mineral and deposit types and across the early to late-stage phases of exploration. This balanced spending helps ensure that the province maintains a healthy, well-rounded portfolio of potential exploration and mine investment projects.

Figure 32 shows spending across six generic deposit types and a new target of magmatic deposits.

Figures 33 and 34 indicate a balance of exploration spending, year after year, on early to advanced-stage projects. In Figure 33, "Exploration" represents early project stages, "Deposit Appraisal" represents more advanced stages (e.g., moving into feasibility studies), and "Mine Development" represents an expansion of reserves in ongoing mining operations.

Figure 34 shows the distribution of exploration companies by total annual spending in each of eight different groupings of spending (from less than \$10 000 to over \$5 million in a specific year). Spending, in each histogram group, occurs every year. About 80% of the companies spend less than \$500 000 and there is a major break between companies spending more than and less than \$100 000. Total expenditures, by companies and prospectors who fall within the groups spending less than \$100 000 per year, have decreased over the past three years. This reflects the challenge to the smaller players of raising risk financing in tight markets. In comparison, companies spending more than \$100 000 per year are more strongly capitalized and spending in these groupings has been relatively steady.

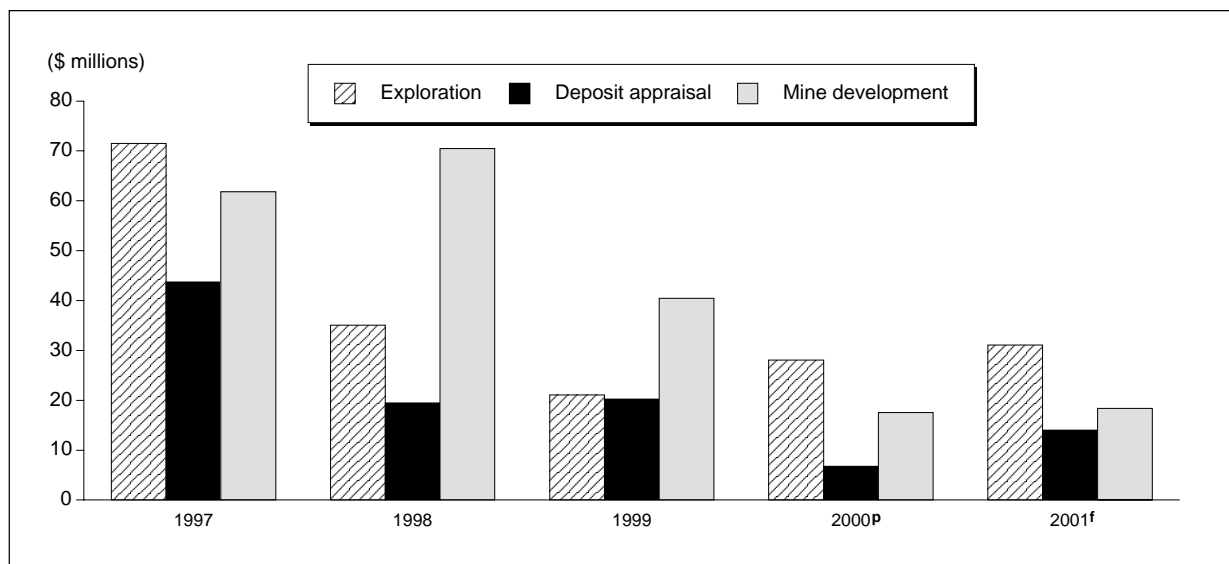
Figure 32
Exploration Spending in British Columbia, by Deposit Type, 1997-2000



Source: British Columbia Ministry of Energy and Mines.

^P Preliminary.

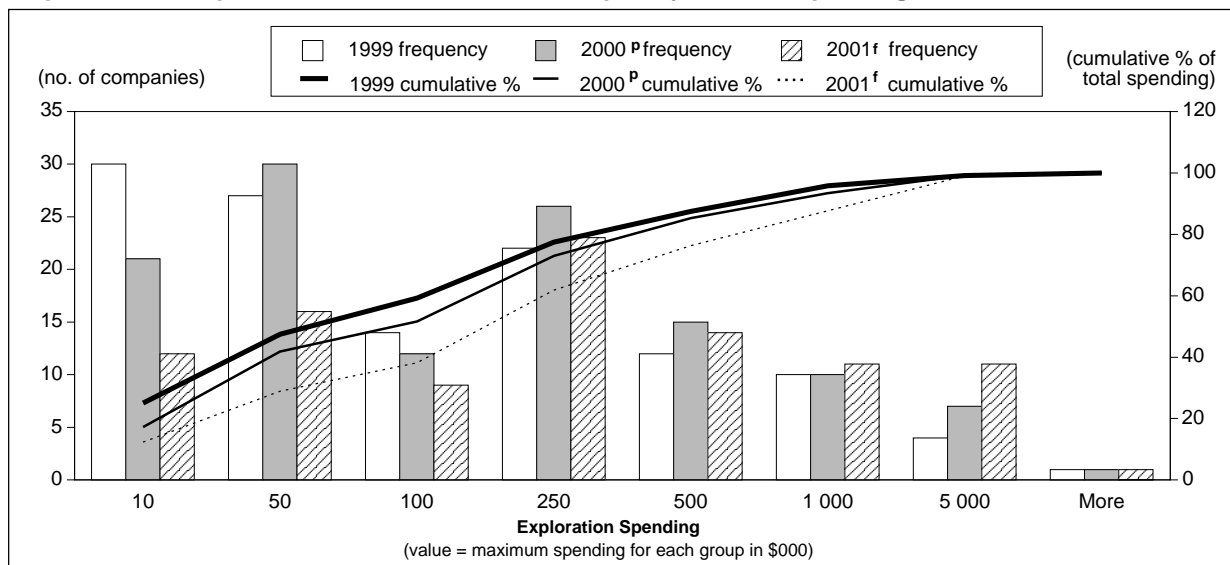
Figure 33
Exploration Spending in British Columbia, by Work Phase, 1997-2001



Source: British Columbia Ministry of Energy and Mines.

^f Forecast; ^P Preliminary.

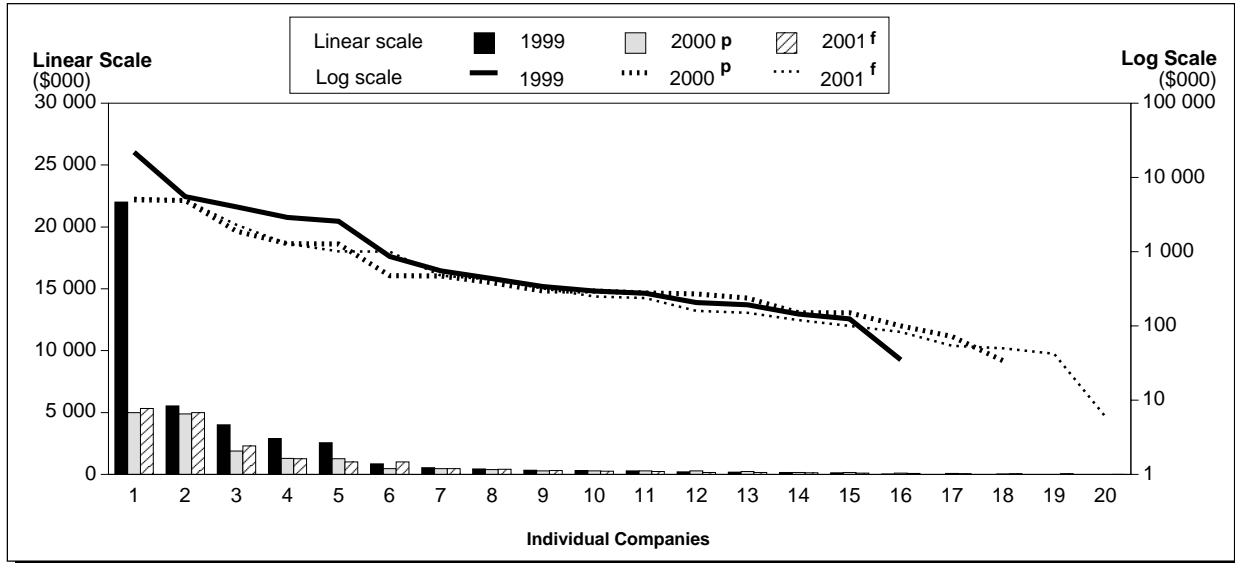
Figure 34
Exploration Companies in British Columbia Grouped by Level of Spending, 1999-2001



Source: British Columbia Ministry of Energy and Mines.

^f Forecast; ^P Preliminary.

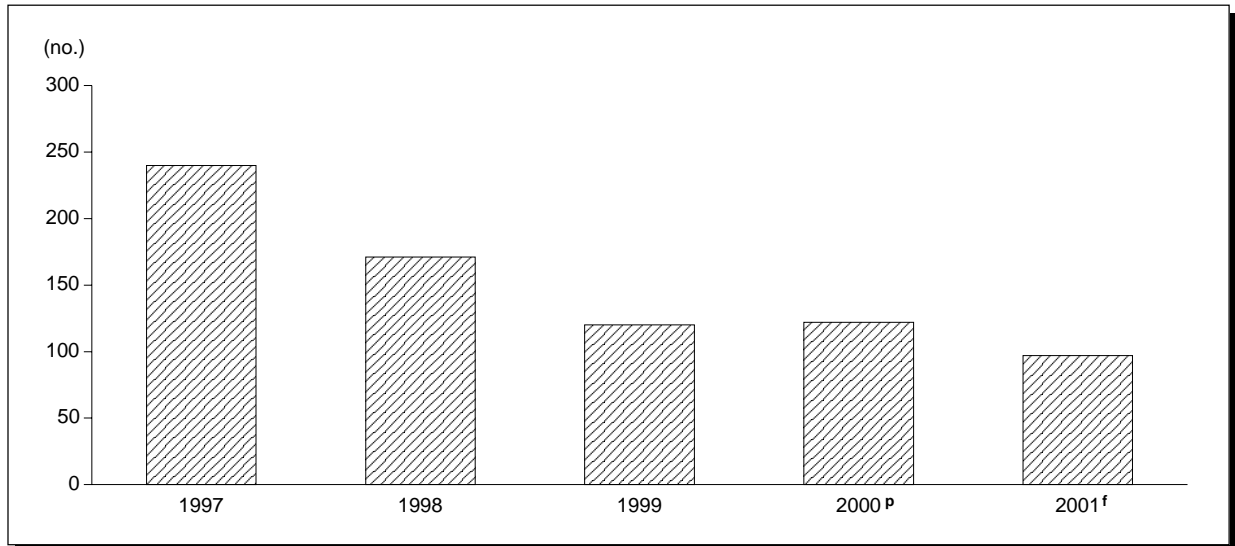
Figure 35
Distribution of Mine Development Spending in British Columbia, by Company, 1999-2001



Source: British Columbia Ministry of Energy and Mines.

f Forecast; P Preliminary.

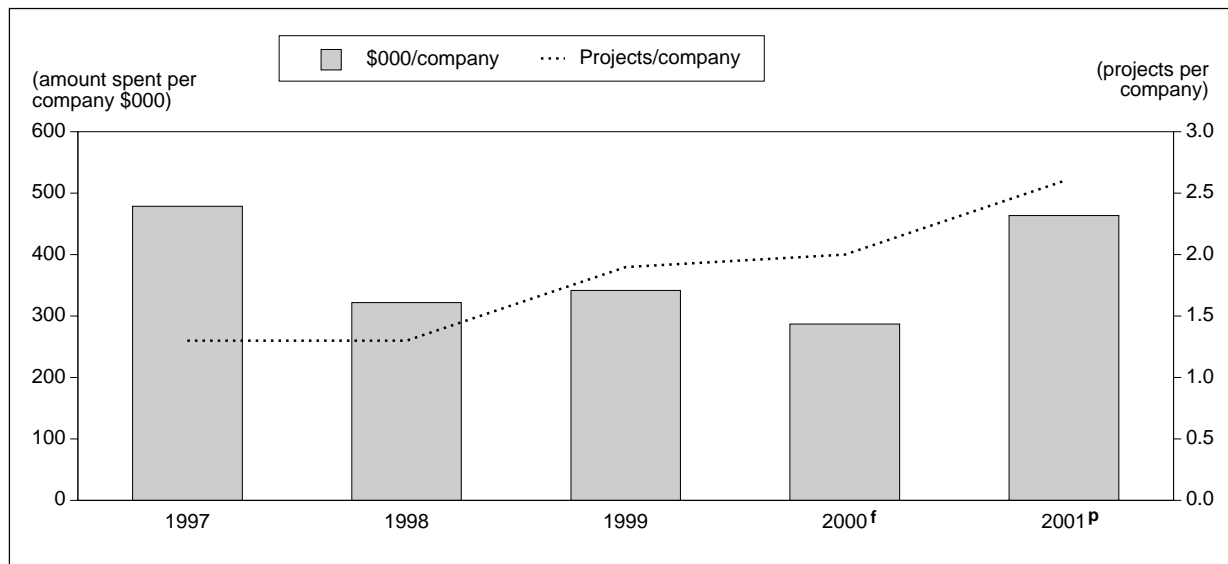
Figure 36a
Number of Companies Exploring in British Columbia, 1997-2001



Source: British Columbia Ministry of Energy and Mines.

f Forecast of intentions; P Preliminary.

Figure 36b
Average Amount Spent and Number of Exploration Projects, by Company, in British Columbia, 1997-2001



Source: British Columbia Ministry of Energy and Mines.

^f Forecast of intentions; ^P Preliminary.

Figure 35 shows the distribution of companies and their total spending on mine development work. The relatively even slopes on the log scale plots, over the three years shown, indicate consistent spending levels ranging from \$15 000 to about \$20 million.

Figure 36a shows a decline in the number of companies exploring in British Columbia.

While the average dollars spent per company varies between \$280 000 and \$480 000, there has been a steady increase in the average number of projects (or properties) per company, rising from an average of 1.25 to 2.5 over the past four-year period (**Figure 36b**). This could be symptomatic of industry consolidations such as the recent mergers of Barrick-Homestake, BHP-Billiton and Teck-Cominco.

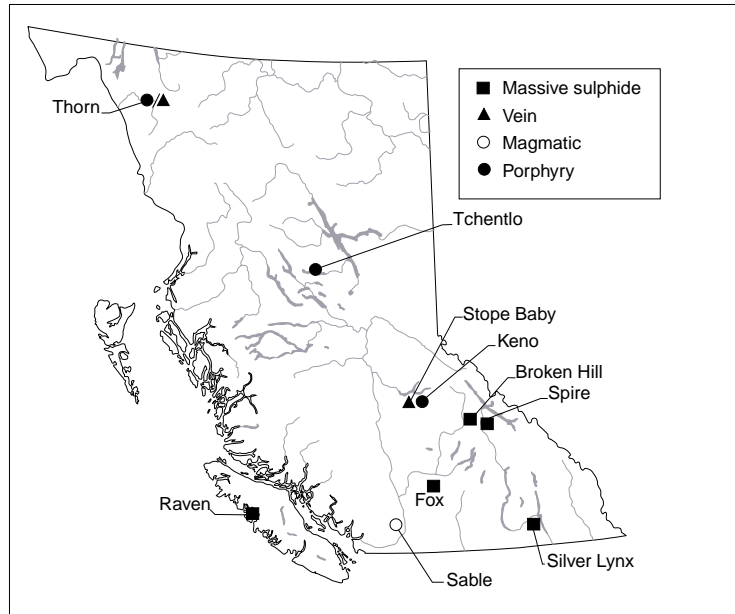
Exploration Highlights

The three maps that follow (**Figures 37, 38** and **39**) show the locations of all key exploration projects in 2000, including new discoveries, major exploration projects and advanced exploration and development projects.

In addition to the projects listed on these three maps, **Table 19** shows new discoveries and special interest exploration projects to the end of September 2001. This table lists key projects by sector and highlights key characteristics. Detailed descriptions of these projects can be found in *British Columbia Mineral Exploration Review 2000*, Ministry of Energy and Mines, IC 2000-1. This information is also available on the Internet at http://www.em.gov.bc.ca/DL/GSBPubs/Reviews/2000/Exploration_Review_2000.pdf. *British Columbia Mineral Exploration Review 2001*, IC 2001-1, will be published in February 2002.

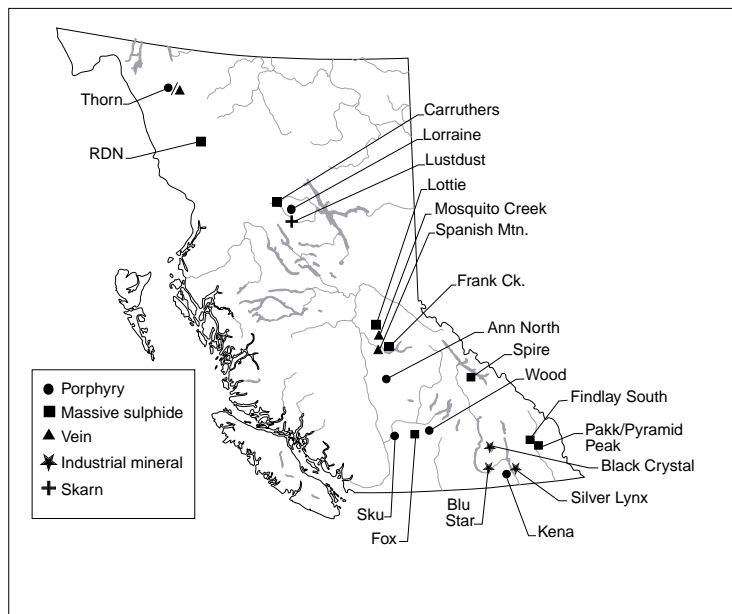
The range of exploration activities is incorporating an increasingly diverse spectrum of metal, coal and industrial mineral commodities, including nickel, PGEs, polymetallic massive sulphides, carbonatite minerals, rare earth elements, magnesite, opal and diamonds.

Figure 37
New Discoveries in British Columbia, 2000



Source: British Columbia Ministry of Energy and Mines

Figure 38
Selected Major Exploration Projects in British Columbia, 2000



Source: British Columbia Ministry of Energy and Mines

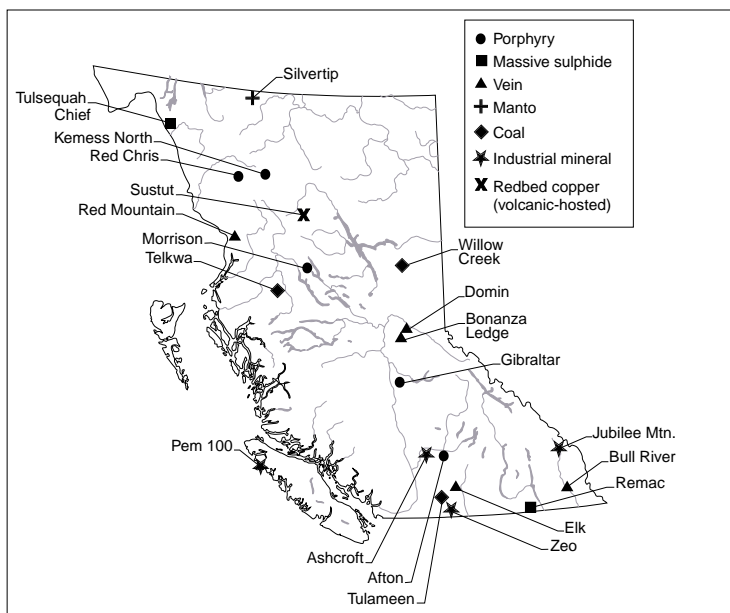
TABLE 19. NEW DISCOVERIES AND SPECIAL INTEREST EXPLORATION PROJECTS IN BRITISH COLUMBIA, AS AT OCTOBER 1, 2001

| Property/Project | Company/Operator | Commodity | Geologic Setting | Location |
|------------------------------------|----------------------------------------------------------|------------------------|--------------------------------------|-----------------------------------------------|
| Metal Projects | | | | |
| Bill | Rimfire Minerals | Au | Vein system | Smithers, 290 km N |
| Cogburn nickel deposit | Leader Mining International Incorporated | Mg-Ni-Cu-PGE | Ultramafic body | Harrison Lake, near Hope, Vancouver, 100 km E |
| Copper Star | Doublestar Resources | Cu-Mo | Porphyry | Houston, 60 km S |
| Dave (Aumax) | Gary Polischuk | Au-Ag | Vein-mesothermal | Lillooet, 8 km SSW |
| DS | R. Strong, Jim Dyke | Cu-Ni-Co-Pt-Pd | Volcanogenic massive sulphide-Cyprus | Jordan River |
| Endako | Thompson Creek Mining Company | Mo | Porphyry | Fraser Lake, 10 km SW |
| Eskay | Barrick-Homestake | Au-Ag-Zn-Pb-Cu | Volcanogenic massive sulphide | Stewart, 90 km N |
| Fir | Commerce Resources Corporation | Ta-Ni | Carbonatite | Blue River area |
| Fran | Navasota Resources Limited | Au-Cu | Porphyry | Fort St. James, 70 km NE |
| Goldstream | Orphan Boy Resources | Cu-Zn | Volcanogenic massive sulphide-Besshi | Revelstoke, N |
| Harrison Lake | Garex International | PGE's | Ultramafics | Harrison Lake area |
| Harrison Gold | Eagle Plains Resources Limited | Au | Vein/porphyry | Harrison Lake, 3 km SE |
| Hearne Hill | Eastmain Resources, Pacific Booker Minerals Incorporated | Cu-Au | Porphyry | Smithers, 65 km NE |
| Highland Valley | Highland Valley Copper Mines Limited | Cu-Mo | Porphyry | Kamloops, 20 km SW |
| Huckleberry | Huckleberry Mines Limited | Cu-Mo-Au-Ag | Porphyry | Huston, 123 km SW |
| Ingenika-Swannel | Cross Lake Minerals Limited | Au-Pb-Ag | Sedex | Smithers, 250 km NE |
| Jasper | Inspiration Mining Corporation | Cu-Zn | Volcanogenic massive sulphide | Cowichan Lake, 12 km SW |
| Kemess South | Northgate Exploration Limited | Cu-Au | Porphyry | MacKenzie, 290 km NW |
| Mactush, Dauntless | SYMC Resources | Cu-Au-Ag-Zn | Vein-mesothermal/porphyry | Port Alberni area |
| Mann Creek | | Au | Placer | Barriere area |
| Melba | Wallopier Gold Resources Limited | Au | Epi/mesothermal | Kamloops, 25 km SW |
| Mt. Polley | Imperial Metals Corporation | Au-Cu | Porphyry | Williams Lake, 56 km NE |
| Myra Falls | Boliden-Westmin (Canada) Limited | Cu-Zn-Au-Ag | Volcanogenic massive sulphide | Campbell River, SW |
| Nitnat | Crest Geological Consultants | Cu-Au | Skarn? | Vancouver Island |
| Praxis | CSS Exploration | Au-Ag-Zn-Pb-Cu | Volcanogenic massive sulphide | Stewart, 25 km S |
| Privateer | Proprietary Energy Industries | Au | Vein-mesothermal | Zeballos |
| Red Hill | Teck-Cominco | Au | Volcanogenic massive sulphide | Ashcroft area |
| Ruby Creek | Stirrup Creek Gold Limited | Au | Placer | Atlin area |
| SCR | Barker Minerals | Au | Volcanogenic massive sulphide | Cariboo Lake, SE end |
| Silver Lake | Christopher James Gold Corp. | Au-Cu-Ag | Volcanogenic massive sulphide | Little Fort, 17 km NW |
| Sulphurets & Kerr | Seabridge Resources, Noranda | Cu-Au | Volcanogenic massive sulphide | Eskay Creek mine, 20 km SE |
| Upper Kitsault | Teck-Cominco | Mo, polymetallic | Porphyry, polymetallic veins | Stewart, SE |
| Valentine Mountain | Beau Pre Explorations Limited | Au | Vein-mesothermal | Victoria, 11 km NW |
| Verity | Commerce Resources Corporation | Ta-Ni | Carbonatite | Blue River area |
| Coal Projects | | | | |
| Brazion, West Brazion | Western Canadian Coal Corporation | Coal | NE coal basin | Tumbler Ridge area |
| Burnt River | Western Canadian Coal Corporation | Coal | NE coal basin | Tumbler Ridge area |
| Dove Creek | Priority Ventures | Coal, coal bed methane | Coal basin | Courtenay, N |
| Fording River | Fording Coal | Coal | SE coal basin | Elkview |
| Line Creek | Luscar-Sheritt Gordon | Coal | SE coal basin | Sparwood |
| Quinsam, Quinsam East | Hillsborough Resources Limited | Coal | Sedimentary basin | Campbell River, 27 km W |
| T'sable River | Hillsborough Resources Limited | Coal, coal bed methane | Sedimentary basin | Courtenay, 15 km SE |
| Wolverine | Western Canadian Coal Corporation | Coal | NE coal basin | Tumbler Ridge area |
| Industrial Mineral Projects | | | | |
| Apple Bay | Tilbury Cement Limited | Industrial mineral | Industrial mineral deposit | Port Hardy |
| Firestorm | Okanagan Opal Incorporated | Opal | Semi-precious mineral deposit | Burns Lake, S |
| Hat Creek | (Enquiries only) | Carbon sequestration | Ultramafics-silicates, coal | Hat Creek |
| Ice Diamond | Skeena Resources Limited | Diamonds | Kimberlite | Elkford, 8 km SW |
| Lang Bay | Homegold | Industrial minerals | Industrial mineral deposit | Lang Bay |
| Matrix | Paul Watt | Dimension stone | Industrial mineral deposit | Vancouver Island |
| Polar Jade | Jade West | Jade | Industrial mineral deposit | Dease Lake, 50 km E |
| Salvation | John Cucherans | Talc, magnetite | Industrial mineral deposit | Southwest British Columbia |
| Xeno | Pacific Ridge Exploration | Rare earth elements | Industrial mineral deposit | Dease Lake, 140 km E |

Source: British Columbia Ministry of Energy and Mines.

Ag Silver; Au Gold; Bi Bismuth; Co Cobalt; Cu Copper; Mg Magnesium; Mo Molybdenum; Ni Nickel; Pb Lead; Pd Palladium; PGE Platinum Group Elements; Pt Platinum; Ta Tantalum; W Tungsten; Zn Zinc.

Figure 39
Advanced Projects in British Columbia, 2000



Source: British Columbia Ministry of Energy and Mines.

Even mines that have been placed on care and maintenance, such as Myra Falls and Mount Polley, have completed successful drilling programs in 2001 that defined new deposits and deposit extensions, and/or identified new ore zones. These successes bode well for greater mine production once metal prices cycle upwards again.

Conclusions and Future Outlook

With over 12 000 documented mineral occurrences in the province and a mining economy that has generated roughly \$3 billion in annual sales over the past six years, British Columbia is well positioned to sustain a healthy mineral sector.

2.11 YUKON¹²

Overview – 2000 and 2001

Mineral exploration expenditures in Yukon continued at low levels through 2000 and 2001. The preliminary estimate of Yukon mineral exploration expenditures by Natural Resources Canada (NRCAN) is \$9.8 million for 2000, compared with \$12.7 million in 1999. The spending intentions forecast by NRCAN for Yukon in 2001 is estimated at \$10.7 million, although this amount will most likely decrease given a slower season in 2001 compared with 2000. Poor commodity prices, the continued lack of speculative investors in the junior mining sector, and mergers and cutbacks in the senior mining industry hampered any sectoral recovery. Exploration in Yukon continued to focus on a wide range of deposit models and commodities in 2000 and 2001, with approximately 60% of expenditures directed at base metals and the remainder at precious metals.

¹² The Yukon review of activities was prepared by Lori Walton. For more information, the reader is invited to contact Ms. Walton by telephone at (867) 667-5462 or by e-mail at lori.walton@gov.yk.ca.

A total of 2379 claims were staked in 2000. Claims in good standing in 2000 dropped to 56 240, a significant decrease from 1999. A total of 1608 claims were staked from January to October 2001 and claims in good standing as of October 31, 2001, dropped further to 50 930.

A total of 12 693 m of diamond drilling was carried out in 2000, compared to 10 579 m in 1999. A total of 12 884 m of diamond drilling was carried out in 2001.

Mines and Mine Development

The Brewery Creek gold mine was Yukon's only operating hard-rock mine in 2000 and 2001. It is a bulk tonnage, heap leach operation located 57 km east of Dawson City. In 2000, the mine produced 48 048 oz (1494 kg) of gold at a cash operating cost of US\$243/oz. In 2001, seasonal mining was discontinued due to the low price of gold; however, heap leaching continued at the mine with production of 10 811 oz (336 kg) of gold in the first half of 2001, at a cash operating cost of US\$199/oz. Measured and indicated resources at Brewery Creek as of December 31, 2000, were 920 000 t grading 1.43 g/t gold. Viceroy Resources continued to demonstrate its environmental stewardship at the mine with an ongoing reclamation program. A substantial amount of reclamation work was conducted on five of the pit and waste rock areas.

The Minto deposit, located 240 km northwest of Whitehorse, is being developed by Minto Explorations Ltd. as a conventional open-pit mining and milling operation. Work at the Minto site in 2000 and 2001 included geotechnical and environmental studies, finishing work in the camp facilities, and site work around the mill, camp and access road. The deposit has a mineable reserve of 6.51 Mt grading 2.13% copper, 0.62 g/t gold and 9.3 g/t silver at a 4.9:1 waste-to-ore stripping ratio. The company has a mining venture agreement with ASARCO Inc. (a subsidiary of Grupo Mexico) under which ASARCO can acquire a 70% interest in the project for providing up to US\$25 million for its development. Although the project is fully permitted and could be in production within one year, a production decision has not yet been made. A confirmation diamond drilling program in 2001 was approved by ASARCO Inc./Grupo Mexico for the Minto property. Results of the drilling indicate that the tonnage and grade of the current reserves will increase with the onset of mining.

A.M.T. Canada Inc. purchased the historic Elsa properties of United Keno Hill Silver Mines in central Yukon in October 2001. The acquisition of the property is a significant step in returning the historic mining camp to active production. The mines at Elsa have produced over 200 million oz of silver since the onset of production in 1914 at an historic camp grade of approximately 1370 g/t (40 oz/ton) silver. Proven and probable underground reserves at the mine currently stand at 415 000 t grading 1145 g/t silver, 7.5% lead and 5.6% zinc. A.M.T. Canada Inc. is working on obtaining a production licence for the property.

The CanTung mine of North American Tungsten Corp. Ltd., located in the Northwest Territories, is slated for re-opening in December 2001. The mine can be accessed by way of the Nahanni Range Road and supplies for the mine are obtained from Watson Lake, Yukon, 310 km to the southwest. The Yukon government signed a road maintenance agreement in 2001 to support the re-opening of the mine. North American Tungsten Corp. Ltd. has a strategic alliance and supply contract agreement with Sandvik AB of Stockholm, Sweden, and Osram Sylvania Products of Pennsylvania, United States, to supply tungsten over a three-year period. CanTung was the largest producer of tungsten in the Western World from 1962 until 1986 when the mine was placed on care and maintenance. Current mineable reserves at CanTung are 630 000 t grading 1.82% WO₃.

Placer Mining Industry

A total of 140 placer gold mines operated in 2000 with approximately 450 people directly employed in the industry. Placer gold production for 2000 totaled 76 507 crude ounces, lower than the 87 680 crude ounces produced in 1999. The total value of gold production in 2000 was

\$25.4 million, compared to \$29.6 million in 1999. The 2000 mining season was the first time operators were required to have mining land use licences on their claims, in addition to water licences. In addition to the continuing low price of gold and unexpectedly high fuel prices, this created challenging economic conditions for Yukon's placer mining industry.

The downward trend continued in 2001. A total of 124 placer mines operated during the year with approximately 400 people employed. Placer gold production for 2001 is estimated to be about 69 000 crude ounces with an estimated value of \$22 million.

Exploration

Exploration in 2000 was divided equally between the search for base and precious metals, while the focus of exploration shifted slightly towards base metals in 2001 on the search for zinc, lead, copper and tungsten.

Precious Metals

Gold exploration in 2000 was dominated by the search for intrusion-related gold deposits within the Tintina gold belt. Projects involving diamond drilling in 2000 included: high-grade veins and bulk tonnage targets at the Longline property on the Yukon-Alaska border in central Yukon, high-grade skarn at the Horn property near Dawson, a quartz-breccia zone at Clear Creek, skarn and replacement zones at McQuesten, near Keno Hill, and replacement and structural zones on the Sun/Sprogge property in southeastern Yukon. Significant results from drilling were obtained on several of the properties. Exploration for PGE in 2000 was conducted mainly in the Kluane ultramafic belt. Several other reconnaissance projects were also directed at other PGE-prospective areas in Yukon.

Exploration for precious metals decreased in 2001 compared with 2000. The reduced expenditures are directly reflected in the amount and size of advanced projects involving diamond drilling that were conducted in 2001. Results from all the programs were generally good but the continuing malaise in the markets denied junior companies the opportunity to expand their programs. Some of the precious-metal targets in 2001 included intrusion-related gold deposits in the Tintina gold belt, epithermal gold mineralization in the vicinity of the Grew Creek deposit in central Yukon, structurally controlled gold mineralization in the Wheaton River district near Whitehorse, and PGE in the Kluane mafic-ultramafic belt.

Base Metals

Base-metal exploration in 2000 and 2001 was dominated by the search for volcanogenic massive sulphide deposits. In 2000, the consolidation of the Kudzu Ze Kayah and Wolverine deposits in the Finlayson Lake district advanced the project to a pre-feasibility study; however, the project was terminated in 2001. Other base-metal targets in 2001 included sedimentary-exhalative and replacement zinc-lead deposits in the Selwyn Basin, porphyry copper-gold deposits in central Yukon and near Whitehorse, iron-oxide-associated copper-gold deposits in the Ogilvie Mountains, and tungsten occurrences in the Selwyn Basin.

Yukon Government

Yukon Mineral Exploration Tax Credit

The Yukon government offers a refundable mineral exploration tax credit of 25% on exploration expenditures for eligible individuals and companies. The tax credit is in effect until March 31, 2003.

Yukon Mining Incentives Program (YMIP)

The Yukon Mining Incentives Program is designed to support and encourage mineral prospecting, exploration and development activities in Yukon. The program's function is to provide a portion of the risk capital required to locate and explore mineral deposits. Grass-roots programs (Prospecting and Grubstake categories) are conducted on open ground. Target evaluation programs are conducted on newly discovered prospects and targets covered by mineral claims, placer prospecting leases and claims, and coal licences and leases. Technical assistance is offered to prospectors upon request. Offered technical program funding for YMIP in 2000 was \$761 800 with \$557 852 spent. A total of \$250 000 in contributions was approved in 2000 for the grass-roots program and a total of \$511 800 was approved for the target evaluation program.

Offered technical program funding for YMIP in 2001 amounted to \$917 400. A total of \$200 000 in contributions was approved in 2001 for the grass-roots program and a total of \$717 400 was approved for the target evaluation program.

Devolution Transfer Agreement and Land Claims Agreements

A long-awaited development that will affect Yukon's mining industry is the initialing of the Devolution Transfer Agreement in September 2001 by federal, territorial and First Nation negotiators. The negotiators have recommended to their Principals that the effective date of devolution be April 1, 2003. Devolution is the transfer of the federal government's current responsibilities for managing most of Yukon's natural resources to the Government of Yukon.

As of October, 2001, eight of fourteen Yukon First Nations had reached land claims and self-government agreements. Negotiations on the remaining six agreements are progressing well with a target completion date of April 1, 2002.

2.12 NORTHWEST TERRITORIES¹³

Introduction

The Northwest Territories constitutes 13.48% of Canada's total landmass and its geological record encompasses billions of years of the Earth's geological history. As such, the history of mining in the Northwest Territories is rich and varied. Base- and precious-metal mines have traditionally been the mainstay of the economic activity surrounding mining in the Northwest Territories. However, more recently, the focus has shifted to exploration for diamondiferous kimberlite pipes and dykes, and diamond mining. The shift is mainly an economic one as a result of low commodity prices for gold, silver and base metals.

On April 1, 1999, the territory of Nunavut came into existence, along with the new Northwest Territories. The move removed the Polaris and Nanisivik base-metal mines from the Northwest Territories. Ekati™, Canada's first diamond mine, reached full production during the same year.

¹³ The Northwest Territories review of activities was prepared by Christy Campbell. For more information, the reader is invited to contact Ms. Campbell by telephone at (867) 920-3345 or by e-mail at christy_campbell@gov.nt.ca.

Mineral Production Summary

The total value of metal shipments from the Northwest Territories dropped to \$42.2 million in 1999 from \$349 million in 1998. Decreased gold production, depressed commodity prices and territorial division were the major reasons for the decline. The Northwest Territories produced \$42.1 million and \$58.1 million worth of gold in 1999 and 2000, respectively, representing over 99% of the territory's total metal production by value. A small amount of silver made up the rest. Gold production from the Northwest Territories accounted for some 2% of total Canadian production during this period. There is currently no base-metal or steel industry metal production in the Northwest Territories, although the CanTung tungsten mine is slated to re-open in December 2001. Shipments of diamonds from the Northwest Territories totaled \$606.3 million in 1999 and \$638.2 million in 2000. Diamonds are, therefore, the most important mineral commodity produced in the Northwest Territories.

Producing Mines

GIANT AND CON GOLD MINES

In 2001, there were three operating mines in the Northwest Territories: Con, Giant and Ekati™. The CanTung tungsten mine is scheduled to re-open in December 2001, while the Diavik diamond mine, currently under construction, is slated to commence production in 2003.

In December 1999, the Con autoclave was successfully recommissioned to process refractory ore concentrates. By mid-February 2000, the autoclave was consistently processing 500 tons per day (454 t/d) of refractory ore from both the Con and Giant mines. Production at the Con mine for the first and second quarters of 2001 amounted to 65 937 oz (2051 kg) of gold. Third- and fourth-quarter production is estimated at 64 000 oz (1991 kg) of gold at a production cash cost of US\$272/oz.

Miramar has been able to reduce cash operating costs at Con through increases in production and cost reduction measures. Approximately 92 000 tons of ore (83 462 t) were mined during the second quarter of 2001, with production from Giant accounting for 20% of the total. Giant's contribution represents a substantial proportion of the total and the mine has therefore played an integral role in lowering operating costs at Con. The most recent reserve estimates for the Con and Giant mines are presented in **Table 20**. The reserve estimates are based on a gold price of US\$280/oz for Giant and US\$300/oz for Con.

TABLE 20. PROVEN AND PROBABLE MINERAL RESERVES FOR THE CON AND GIANT MINES, NORTHWEST TERRITORIES, AS OF DECEMBER 31, 2000

| | Tonnage | Grade | Quantity of Gold | |
|-------|-----------|-------|------------------|---------|
| | (t) | (g/t) | (kg) | (oz) |
| Con | 1 138 000 | 12.0 | 14 211 | 442 000 |
| Giant | 117 000 | 12.7 | 1 543 | 48 000 |
| Total | 1 255 000 | 12.1 | 15 754 | 490 000 |

Source: Northwest Territories Department of Resources, Wildlife and Economic Development, based on company information.

On June 22, 2001, Miramar gave notice that it would return the Giant mine property to the federal Department of Indian Affairs and Northern Development (DIAND) on December 14, 2001. Subsequently, the company reached an agreement with DIAND to extend operations at Giant until late 2002. DIAND has agreed to cover a portion of the environmental compliance and holding (e.g., power) costs that were previously the responsibility of Miramar. Mine-site exploration at Con and Giant has been halted.

EKATI™ DIAMOND MINE

By December 2000, over 5 million ct had been produced from the Ekati™ diamond mine, located 300 km northeast of Yellowknife near Lac de Gras. For the 16 months ended May 31, 2001, Ekati™ produced 3 601 000 ct of diamonds and sold 3 594 000 ct at an average price of US\$165/ct, among the highest price for any kimberlite mine in the world. The BHP Billiton Limited group holds an 80% interest in the Core zone joint venture, which governs the property on which the mine is located through its wholly owned subsidiary, BHP Diamonds Inc. In April 2001, BHP launched Ekati™-brand diamonds, becoming the first diamond mine to brand its own premium-quality diamonds and also guarantee their quality and country of origin through government certification. In July 2001, BHP acquired Dia Met in a \$687 million deal, thereby raising its stake in Ekati™ from 51% to 80%. The other participants in the Core zone joint venture are Charles Fipke (10%) and Stewart Blusson (10%). BHP Diamonds Inc. also holds a 58.8% interest in a property governed by the Buffer zone joint venture. The other participants in the Buffer zone joint venture are Archon Minerals Limited (31.2%) and Charles Fipke (10%).

To date, 138 kimberlite pipes have been identified on the Ekati™ claim block, 9 of which are in the mine plan. The overall value of ore ranges from US\$37/t at the Pigeon pipe to US\$187/t at the Panda pipe. Mining rates for each area are determined by ore grade, diamond quality and specific ore-processing characteristics. A total of approximately 76 Mt of ore, of which 85% is defined as proven or probable reserves, and approximately 508 Mt of waste rock, are scheduled to be mined over the life of the project. Seven of the nine pipes in the mine plan will initially be developed using open-pit mining. The Panda and Koala pipes will subsequently be exploited via underground methods because of the higher value of their ore. The Koala North pipe will be exploited using underground methods only. On average, at Ekati™, it will take 3 t of rock to recover 3 ct of diamonds. The ore is currently being processed at a rate of 9000 t/d, but it is planned to increase this to 21 000 t/d from year 8 onwards. The Ekati™ mine produces around 3 million ct (Mct) of gem- and rough industrial-quality diamonds a year, about 4% of current global production by weight and 6% by value. The mine life is currently pegged at 17 years.

CANTUNG TUNGSTEN MINE

North American Tungsten (NAT) owns both the CanTung mine and the MacTung deposit, located in the Deh Cho and Sahtu regions, respectively. Both are situated on the Northwest Territories/Yukon border and contain approximately 15% of the Western World's known tungsten resources. The CanTung mine operated from 1962 to 1986; it was subsequently closed due to low commodity prices. It has been on care-and-maintenance status since then. The MacTung deposit is undeveloped at this time but contains substantial resources of tungsten.

NAT has indicated its intention to re-open the CanTung mine on December 1, 2001, in light of recent increases in the tungsten price. The company has secured concentrate sales agreements with two tungsten producers. In addition, the Yukon government and NAT have signed a road maintenance agreement to support the re-opening of the mine.

2001 Exploration Summary

The deposit appraisal costs incurred at Ekati™, Diavik and Snap Lake are a major component of the total exploration and deposit appraisal spending in the Northwest Territories. These costs include engineering studies, environmental studies, additional drilling to firm up on grade and tonnage estimates of known mineral deposits, etc. Thus, exploration and deposit appraisal expenditures in the Northwest Territories are, in large part, attributable to these projects. The proportion of expenditures directed at the (grass-roots) exploration phase (i.e., work involved in the initial discovery of a new mineral deposit) out of total exploration and deposit appraisal spending is proportionally lower in the Northwest Territories than elsewhere in Canada. Diamonds remain the driving force behind exploration in the Northwest Territories despite progressively lower exploration and deposit appraisal expenditures in the territory from 1998 to 2001.

A total of 4670 claims covering 3 860 699 ha were in good standing as of September 5, 2001. Leases in good standing as of the same date totaled 714 covering 290 727 ha. Three prospecting permits covering 69 489 ha were also in good standing as of September 5, 2001.

Diamonds

EKATI™ CORE ZONE AND BUFFER ZONE EXPLORATION

Surface exploration activities are ongoing throughout the mine property area. An extensive airborne gravity survey was completed over the entire property. Exploration core drilling of geophysical and geochemical targets confirmed 13 additional kimberlite pipes, bringing the total number of known kimberlite occurrences on the property to 138. Three of the new discoveries, all within the Buffer zone, contain significant quantities of macrodiamonds. Sample processing was completed on four pipes that were bulk sampled in early 2000. The valuation of diamonds obtained from a bulk sample of the Lynx pipe returned an average value of US\$139/ct. The Lynx pipe is located about 3 km southwest of the Misery pit. Bulk sampling of the Fox pipe was completed in early 2001. Sample processing is in progress.

DIAVIK DIAMOND MINE

Permit and licence approvals were obtained from the federal government in late 1999 for the Diavik diamond mine (Diavik Diamond Mines Inc.). Construction of the mine, at a cost of \$1.3 billion, is currently under way. During the 2001 winter road season, 4089 truckloads of fuel, construction materials and equipment were hauled to the project site.

Diavik is scheduled to commence production in April 2003. Reserves are estimated at 25.6 Mt grading 4.15 ct/t, making this deposit one of the richest in the world. A 20-year mine life is envisaged with diamond production averaging 5.4 Mct/y. At recent diamond prices, the diamond production at Diavik is expected to have a value of US\$63.74/ct.

SNAP LAKE

De Beers Canada Corporation purchased Winspear Diamonds (majority owner of the Snap Lake deposit) in September 2000 and Aber Diamond Corporation's share of Snap Lake in February 2001, giving the company 100% ownership of the property. A \$45 million advanced exploration program was implemented at Snap Lake during 2000 to allow the completion of a feasibility study in 2001. Twelve 500-t bulk samples were taken from intervals within the dyke. The assay results confirmed a diamond value of approximately US\$100/ct. In February 2001, De Beers submitted a project description in support of the application for licences and permits required for operating a mine at the site. That process is currently under way, although De Beers recently announced it would delay the start of production at Snap Lake by more than a year to late 2005.

Gold

Exploration for gold in the Northwest Territories during 2001 remained at very low levels due to depressed gold prices. The gold price dropped from US\$388/oz in 1996 to an average of US\$279/oz in 1999 and 2000. The metal rallied in May 2001, jumping from US\$273/oz to US\$291/oz, before sinking back to the US\$275/oz level. To date, the slowing global economy has not greatly affected total gold demand, with prices stabilizing in the US\$270-\$275 range. The recent depreciation of the U.S. dollar against the Euro has had minimal impact on the gold price. Based on short-term gold price forecasts, gold exploration in the Northwest Territories is expected to remain sluggish.

Base Metals

Metals exploration highlights for 2000 and 2001 (as of October 1) are as follows:

- Exploration has resumed on Canadian Zinc Corporation's Prairie Creek lead-zinc project. The company has applied for a number of land-use permits in order to carry out further drilling and to process a bulk sample of the orebody. One infill drill hole, which intersected high-grade lead-zinc mineralization, has been completed to date. The company is attempting to complete a feasibility study.
- Fortune Minerals Limited, owner of the NICO cobalt-gold-bismuth project, carried out metallurgical test work to improve metal recoveries. Recoveries are now estimated at 83% for cobalt, 42% for bismuth, and 50-70% for gold.
- As mentioned earlier, NAT intends to re-open the CanTung mine on December 1, 2001.

2001 Government Programs (C.S. Lord Northern Geoscience Centre)

DIAND's Northwest Territories Geology Division and the Government of the Northwest Territories' Department of Resources, Wildlife and Economic Development began merging their geoscience programs in 1997. In 2001, staff from both governments involved in the collection of new geoscience data moved into shared facilities, the C.S. Lord Northern Geoscience Centre, located in Yellowknife. The Centre is supported by DIAND, the Government of the Northwest Territories, and the Geological Survey of Canada (GSC).

MVT Project

This project is focused on carbonate-hosted lead-zinc Mississippi Valley Type (MVT) occurrences in northern Alberta and the southern Northwest Territories. The MVT project originated from a geoscience sub-agreement in the 1999 Alberta-Northwest Territories Memorandum of Understanding for Co-operation and Development. This project is being undertaken as a partnership between the C.S. Lord Northern Geoscience Centre, the Alberta Geological Survey and the Calgary office of the GSC. Funding comes from the three agencies involved and from the federal Targeted Geoscience Initiative.

The project aims to delineate and describe the origin, distribution and potential for carbonate-hosted lead-zinc deposits in the northern Western Canadian Sedimentary Basin. The study area includes Cominco's Pine Point mine, which produced 83 Mt of ore between 1964 and 1987. The proposed project will examine the host lithology, associated structures, and geochemical signatures of the lead-zinc deposits to address the source and pathways of the mineralizing fluid and the timing of ore deposition for the purpose of advancing current exploration models.

Walmsley Lake Project

A three-year project to conduct integrated bedrock mapping and mineral showings compilation began in the Walmsley Lake area of the southeastern Slave Province in 2000. The project is a collaboration between the C.S. Lord Northern Geoscience Centre, the GSC and university researchers. Funding for the project comes from the partners and from the federal Targeted Geoscience Initiative. Bedrock and surficial geology mapping at a scale of 1:100 000 will be integrated with petrogenetic studies of mantle- and crustal-derived plutonic rocks (undertaken by the GSC). The petrogenetic studies include isotopic analyses to identify the eastern limit of the Meso-Archean basement at depth.

The Walmsley Lake region is an area of active diamond exploration with lesser-known potential for gold and base-metal deposits. Outputs from the project will improve the framework for mineral and diamond exploration in this region by generating new geological maps and geoscientific understanding of the area. Two Masters of Science thesis projects are being supported through the Walmsley Lake project. The project received \$190 000 in funding from the federal Targeted Geoscience Initiative during fiscal year 2000/01. Other funding has come from the C.S. Lord Northern Geoscience Centre and from the GSC in Ottawa. A similar funding profile is expected for fiscal year 2001/02.

Snare River Mapping Project

The Snare River mapping project is a bedrock mapping project in the southwestern Slave Province that is focused on upgrading the existing bedrock geology base and integrating geochemical, pressure-temperature (P-T), geochronological and isotope studies. The project is in its final year of fieldwork in 2001.

Mineral and Energy Resource Assessment

DIAND has provided funding for two term positions to conduct resource assessments under the Northwest Territories Protected Areas Strategy (PAS), one for minerals and one for petroleum. The positions run from April 2001 to March 2004. Both positions have been filled.

The PAS geologists will coordinate mineral and petroleum resource assessments of candidate protected areas under Step 5 of the Northwest Territories PAS. In addition, these two geologists will provide technical support and mineral/energy resource-related information to communities and organizations that wish to propose potential protected areas.

Mineral Occurrences Database

Work on populating the NORMIN.DB database of mineral showings and geological/exploration references slowed considerably in 2001 due to fiscal constraints. The population of NORMIN references with spatial metadata was in progress during the year. NORMIN will be the Northwest Territories/Nunavut node of the Canadian Geoscience Knowledge Network data catalogue, a web portal providing query capability for publications and datasets listed in databases distributed across Canada.

Databases to Support Diamondiferous Kimberlite Exploration

The second release of KIDD (Kimberlite Indicator and Diamond Database) was published in March 2001. It contains kimberlite-indicator mineral picking results from 110 000 samples of glacial till collected over diamond exploration properties in the Slave Province.

The KIMC (Kimberlite Indicator Mineral Chemistry) dataset was published at the same time; it contains electron microprobe results for various mineral grains selected from till samples. Like KIDD, it is a compilation of data submitted to DIAND by the mineral exploration industry.

SMAC (Slave Magnetics Compilation) will be published in November 2001. It is a compilation of georeferenced images of airborne total field magnetics data derived from industry submissions covering a large portion of the Slave Province. Where raw data are in the public domain, images were created by processing in-house; where only paper maps were available, these were scanned and georeferenced.

A database of drill holes that tested targets for potential kimberlites will be released in late 2001. It contains the locations of all holes drilled to test for kimberlite, including those that intersected kimberlite, header data and scanned drill logs for each hole, and the file number of the relevant assessment report.

2.13 NUNAVUT¹⁴

Land Tenure in Nunavut

In 1993, the largest Aboriginal land settlement in Canadian history was reached, resulting in the formation of the new territory of Nunavut on April 1, 1999. Nunavut, which covers 1 994 000 km², comprises the eastern and northern portions of land previously referred to as the Keewatin and Franklin districts of the Northwest Territories. Nunavut's population is approximately 27 000, of which 85% are of Inuit origin. A total of 27 communities are home to anywhere from 50 to 6000 people. Most communities offer a range of services including regular scheduled air service. Several offer specific mining and exploration-related services, and are home to experienced local personnel and independent prospectors.

The land claim settlement provided for the allocation of roughly 2% of Nunavut as "Inuit Owned Land" whereby surface rights are held by Regional Inuit Associations (RIAs) and subsurface rights are held by the Inuit people and administered by Nunavut Tunngavik Incorporated (NTI). An additional 16% is also considered as "Inuit Owned Land" whereby only surface rights are held by the Inuit and are administered by the RIAs. In this case, subsurface rights are retained by the Crown and administered by the federal Department of Indian Affairs and Northern Development (DIAND). In both cases, mining and exploration are allowed, subject to permitting through the respective Inuit associations. Significantly, this is a final settlement whereby all land claims allocations have been completed. The Government of Nunavut continues to work with DIAND, the newly established Canada-Nunavut Geoscience Office (C-NGO), and other pertinent government divisions and associations in an effort to improve the territory's geoscience database through regional mapping programs and geological compilation, and to address regulatory and permitting regimes on mining and environmental issues.

Mineral Production Summary, 2000 and 2001

According to preliminary figures from Natural Resources Canada (NRCan), the total value of metallic mineral production for 2000 in Nunavut stood at \$384 million, up from \$349 million in 1999. This represents 3.5% of Canada's total mineral production.

A large proportion of this total was derived from zinc shipments, totaling approximately 185 000 t valued at \$310 million. This equates to 81% of Nunavut's total metal production. Lead shipments accounted for \$21 million from sales of 32 000 t; silver sales totaled \$3.76 million from shipments of 16 000 kg. Gold production, curtailed in 1998, resumed in 2000, resulting in \$49 million from shipments of 3696 kg.

¹⁴ The Nunavut review of activities is continually updated by the Nunavut Department of Sustainable Development. For more information, the reader is invited to contact Bernie MacIsaac by telephone at (867) 975-5914 or by e-mail at bmacisaac@gov.nu.ca.

Nunavut ranked third in Canada in both zinc and lead production, accounting for 19.8% of Canada's zinc and 22.3% of its lead. The territory also contributed 1.4% of Canada's total silver sales and 2.4% of its gold sales.

Polaris Zinc-Lead Mine (Teck Cominco Ltd.)

In 2000, the Polaris mine produced 217 500 t of zinc concentrate (132 226 t of zinc metal) and 43 700 t of lead concentrate (30 756 t of lead metal), down somewhat from the 1999 concentrate production of 238 000 t (142 851 t of zinc metal) and 49 300 t (35 423 t of lead metal), respectively. Ore reserves at the end of 2000 stood at 1.4 Mt grading 12.1% zinc and 2.9% lead. Production to June 30, 2001, stood at 86 900 t of zinc concentrate and 17 400 t of lead concentrate. Based on current reserve estimates, the mine, which employed 225 people at the end of 2000, is scheduled to cease production during the summer of 2002.

Nanisivik Zinc-Silver Mine (Breakwater Resources Ltd., Canzinc Ltd.)

Production in 2000 totaled 59 399 t of zinc and 567 707 oz of silver from 811 283 t of ore milled. The ore grade averaged 7.6% zinc and 30 g/t silver. Production to June 30, 2001, was 23 439 t of zinc and 249 494 oz of silver. Projected production for 2001 is estimated to be 62 000 t of zinc and 591 000 oz of silver. By August 2001, Breakwater had implemented its "Dense Media Separation" plant, combining high-grade ore with lower-grade ore, thus increasing overall reserves. Current mineable reserves in the proven and probable categories total 2 868 000 t grading 6.9% zinc, 0.4% lead and 28 g/t silver. However, due to low zinc prices, the company has announced the closure of the Nanisivik mine, scheduled for September 2002.

Lupin Gold Mine (Echo Bay Mines Ltd.)

Mining operations at the Lupin mine resumed in April 2000 after a suspension of operations early in 1998. Production in 2000 totaled 117 729 oz (3662 kg) of gold, exceeding the company's target of 105 000 oz (3266 kg). Production to June 30, 2001, was 72 710 oz (2261 kg) of gold, a significant milestone towards achieving the 2001 target of 150 000 oz (4665 kg). Proven reserves currently stand at 434 000 oz (13 499 kg) of gold, with a further available resource of 268 000 oz (8336 kg), deemed sufficient for a predicted annual production of 150 000 oz (4665 kg) through 2004. Echo Bay's Ulu deposit, located 160 km north of Lupin, contains a resource of 375 000 oz (11 664 kg) of gold, representing potential additional ore feed for the Lupin milling facility.

Exploration Summary, 2000 and 2001

The preliminary estimate for 2000 total exploration and deposit appraisal spending within Nunavut is \$62.4 million, up 67% from 1999. The proportion of expenditures by junior mining companies rose sharply to \$33.5 million, or 54% of this total. Spending estimates for 2001 are projected at \$54.2 million, of which \$31.4 million, or 58%, is expected to be incurred by junior companies. Nunavut differs from the national trend of dominant exploration spending by senior companies, although the proportion of junior company spending has risen steadily in recent years across Canada.

Diamonds

JERICO PROJECT, CONTWOYTO LAKE
(TAHERA CORPORATION)

Tahera is proceeding through the regulatory process to bring the Jericho diamond-bearing pipe to production. Resource calculations released in September 2000 give a total indicated resource of 3.667 Mt averaging 1.14 recoverable ct/t at a value of US\$82.50/t. Additional inferred

resources stand at 3.401 Mt averaging 0.52 ct/t. Mineable reserves total 2.53 Mt grading 1.19 ct/t, recoverable by open-pit mining during a projected four-year operation, followed by four years of underground mining. Start-up is targeted for 2004. The company is in the process of negotiating joint-venture agreements with Kennecott Canada Exploration Inc. and BHP Billiton Diamonds Inc.

ROCKINGHORSE PROJECT, ROCKINGHORSE LAKE
(TAHERA CORPORATION, KENNECOTT CANADA EXPLORATIONS INC.)

Exploration in 2001 resulted in the discovery of the Anuri kimberlite pipe. A total of 937 diamonds, including 61 macrodiamonds, one of which weighed three quarters of a carat, was recovered from 656 kg of sample material. Two additional kimberlites, the Anuri East and Qamutiik, were also discovered.

KNIFE LAKE PROJECT, KIKERK LAKE
(RHONDA CORPORATION, DE BEERS CANADA EXPLORATION INC.)

In 2000, De Beers optioned the Knife Lake project of Rhonda Corporation. The project is located roughly 80 km southeast of Kugluktuk on the Coronation Gulf. A 75-kg composite core sample from diamond drilling of the Knife kimberlite pipe in 2000 returned 98 diamonds, including 6 macrodiamonds. A subsequent 397-kg composite sample yielded 217 diamonds, including 9 macrodiamonds. In 2001, a six-hole drill program established that the Knife pipe covers about 6 ha on surface, which is very large by Canadian standards.

Rhonda also conducted till sampling on the adjacent Inulik property during the summer of 2001.

ROCKINGHORSE PROJECT, ROCKINGHORSE LAKE
(DE BEERS CANADA EXPLORATION INC., INMET MINING CORPORATION)

Situated west of Tahera's Jericho project, operator De Beers continues to carry out till sampling and diamond drilling of four kimberlite pipes.

RIC PROJECT, SOUTH OF KIKERK LAKE
(ASHTON MINING OF CANADA INC., PURE GOLD MINERALS INC.)

Exploration continued on the diamondiferous Perseus kimberlite dyke in 2001. Drilling by Ashton indicates that the dyke has a consistent width of about 10 m along a 470-m strike length. Analytical results are pending.

KIKERK LAKE PROJECT, KIKERK LAKE
(ASHTON MINING OF CANADA INC., CALEDONIA MINING CORPORATION)

Situated just west of the Knife Lake pipe, Ashton discovered the Potentilla kimberlite pipe in 2001. This new find is located at the head of a dispersion fan within which a macrodiamond was found. To date, 230 microdiamonds and 22 macrodiamonds have been extracted from 208 kg of core from the 2001 summer drilling program.

KIM PROJECT, WEST OF KIKERK LAKE
(ASHTON MINING OF CANADA INC.)

Ashton also discovered the Artemisia kimberlite on the Kim property located 30 km to the north of the Ric project. Till sampling delineated an area of indicator minerals that also yielded one macrodiamond. Kimberlitic float material was later identified in an area measuring 140 m by 150 m. One vertical hole was drilled returning 342 microdiamonds and 38 macrodiamonds from 103 kg of core.

**JACKSON INLET PROJECT, BRODEUR PENINSULA, BAFFIN ISLAND
(TWIN MINING CORPORATION)**

In 2000, Twin Mining completed the formal acquisition of a 100% interest in the property from Helix Resources. Twin Mining recovered 681 diamonds from a 1669-kg composite sample, including 62 macrodiamonds, during the 2000 field season. A total of 29 diamonds from this composite sample measured greater than 1.0 mm in length. In 2001, Twin Mining staked an additional 49 claims to enclose the original claim block and conducted an airborne geophysical survey. This work outlined the Freightrain pipe plus eleven other anomalies with similar signatures. Of these, eight occur along a 30-km linear trend and the remaining three occur roughly 20 km to the south. Drilling of one of these three pipes resulted in the discovery of the diamondiferous Cargo 1 pipe.

In addition, two samples from the Freightrain pipe returned 86 macrodiamonds greater than 1.0 mm in diameter, including a 1.217-ct diamond. Diamonds appear to be largely clear and of gem quality with a notable absence of impurities and low-grade coloured specimens. In September 2001, the company shipped a 320-t sample taken from six mini-bulk samples at the Jackson Inlet site to Lakefield Research Ltd.

Gold**HOPE BAY JOINT VENTURE, HOPE BAY GREENSTONE BELT
(HOPE BAY GOLD CORPORATION, MIRAMAR MINING CORPORATION)****Madrid Deposit Area**

The joint venture completed 23 600 m of diamond drilling in three program phases, testing several targets along the 8-km-long Deformation zone (DFZ) west and southeast of the Madrid deposit. Phase 3, consisting of 4680 m of drilling, was conducted from July through September 2001. Two new significant gold deposits, called Naartok and Suluk, were defined. Resources for these deposits have not yet been announced.

The Naartok deposit comprises a steeply dipping and raking zone of quartz veins and silicified breccia in the hanging wall of the DFZ, a setting distinct from the shear-zone hosted quartz veins of the Boston and Doris deposits. The Naartok zone extends more than 200 m along strike and at least 250 m down dip. Two other parallel lenses occur in the hanging wall. The Suluk deposit consists of three or four steeply dipping parallel lenses. Both the Naartok and Suluk deposits are open at depth. The drilling also tested the South Patch and Suluk-180 zones, returning encouraging results.

Indicated resources at Madrid as at November 2000 stood at 78 000 oz (2426 kg) of gold with 222 000 oz (6905 kg) in the inferred category.

Boston and Doris Deposits

A total of 9700 m of core drilling was completed at the Boston deposit in 2001. Most of the meterage was used to improve definition of the southern extension of the Boston mineralization. Of the core drilling completed this year, 1400 m were conducted to improve the definition of the Doris Connector zone, which lies between the Doris North and Doris Central deposits.

As of November 2000, measured and indicated resources at the Boston and Doris deposits stood at 1.3 million oz (40 434 kg) of gold, with a further 579 000 oz (18 009 kg) in the inferred resource category.

ELU BELT PROJECT, ELU GREENSTONE BELT
(SHERWOOD PETROLEUM CORP.)

The Hope Bay joint venture completed the sale of 34 Crown mineral claims in the Elu greenstone belt to Sherwood Petroleum Corp. Located northeast of the Hope Bay belt, reconnaissance exploration carried out by the Hope Bay joint venture on behalf of Sherwood uncovered several vein-hosted targets having gold potential. Exploration results have not yet been reported. The area is also considered prospective for base metals and platinum group metals.

GEORGE LAKE-GOOSE LAKE PROJECT, GEORGE LAKE
(WHEATON RIVER MINERALS LTD, KINROSS GOLD CORPORATION)

In late September 2001, Wheaton River Minerals Ltd announced it had signed a Letter of Intent to sell its George Lake project to Kinross Gold Corporation. Kinross has been the project operator since 1999.

The George Lake project consists of six iron formation-hosted gold deposits with a combined indicated and inferred resource of 2.8 million oz (87 088 kg) of gold. This includes an inferred resource estimate for the largest of the deposits, the Goose Lake deposit, of 1.57 million oz (48 832 kg). The 2001 program focused on step-out drilling of a south extension of the main Goose Lake zone. Intersections of up to 11.8 g/t gold across 17.45 m (uncut) were returned. This showed that the extension is part of the Main zone. Kinross also conducted a 3000-m summer drilling program that, in part, tested the down-plunge potential of the Goose Lake deposit beneath the promising drill intercepts of 2000.

MELIADINE WEST PROJECT, RANKIN INLET
(WMC INTERNATIONAL LTD., CUMBERLAND RESOURCES LTD., COMAPLEX MINERALS CORPORATION)

In April 2001, Western Mining Corporation (WMC) announced its intention to sell all of the company's global gold assets, including its 56% interest in the Meliadine West project. The company is reportedly negotiating the sale of its Meliadine West interest with potential purchasers.

The project, located just north of Rankin Inlet, consists of four major deposits: the Tiriganiaq, Wolf, Pump and F zones. Late in 2000, WMC reported total indicated and inferred resources of 22.1 Mt grading 6.33 g/t gold (3.0 g/t cut-off) for 4.96 million contained oz (154 271 kg). Using a 5.0 g/t gold cut-off, the Tiriganiaq zone alone hosts an indicated resource of 6.9 Mt grading 9 g/t gold, for 2.01 million oz (62 517 kg).

Exploration in 2001 was limited to a regional airborne geophysical survey.

MELIADINE EAST PROJECT, RANKIN INLET
(CUMBERLAND RESOURCES LTD., COMAPLEX MINERALS CORPORATION)

Exploration at the Meliadine East project was suspended in 2001. The property includes the Discovery deposit, which contains resources of approximately 400 000 oz (12 441 kg) of gold. It also contains numerous other promising prospects.

MEADOWBANK PROJECT, BAKER LAKE AREA
(CUMBERLAND RESOURCES LTD.)

Pre-feasibility studies completed in April 2000 outlined a reserve of 962 000 oz (29 921 kg) of gold in the Third Portage and Goose Island deposits, part of the 2.1 million oz (65 316 kg) resource base then delineated within four closely spaced deposits on the property.

In early 2001, Cumberland completed a 19-hole, 4000-m diamond drilling program across the Vault zone. Drilling continued to return impressive results and has expanded the deposit at

depth, as well as outlined zones of higher-grade mineralization. In October 2001, the company announced revised inferred resource figures for the Vault zone of 7.47 Mt grading 3.90 g/t gold for 936 700 contained oz (29 134 kg) of gold. Total revised resource estimates, including the Vault zone, stand at 1.447 million oz (45 006 kg) in the measured and indicated category and 1.561 million oz (48 551 kg) in the inferred category.

KAZAN COPPER-GOLD PROJECT, BAKER LAKE AREA
(TRI ORIGIN EXPLORATIONS LTD., BHP BILLITON)

Exploration in 2001 included airborne gravity and magnetic surveys. Tri Origin has targeted this 680-km² property for Olympic Dam-style iron oxide-copper-gold mineralization. BHP Billiton can earn an initial 50% interest in the project by contributing \$1.6 million in exploration expenditures.

Base Metals

BATHURST INLET PORT AND ROAD INFRASTRUCTURE PROJECT

In August 2001, DIAND committed \$3 million towards a feasibility study and associated environmental assessment evaluation to lay the framework for construction of a 295-km all-weather road extending from the Izok Lake zinc-copper deposit to a proposed deep-water port at Bathurst Inlet. The Government of Nunavut and the private sector are also contributing to this feasibility study, which is currently under way. The project will be directed by a Technical Committee consisting of representatives from Kitikmeot Corporation, Inmet Mining Corp., Nuna Logistics (Inuit-owned), the Community of Kugluktuk, and the departments of Sustainable Development and Community Transportation of the Government of Nunavut.

This infrastructure would access Inmet's Izok Lake base-metal deposit, which contains an indicated resource of 16.5 Mt grading 11.4% zinc, 2.2% copper, 1.1% lead and 60 g/t silver, worth approximately \$2 billion. Other known deposits such as Teck Cominco's Hackett River deposit (19.5 Mt grading 5.0% zinc, 0.41% copper, 0.75% lead, 145 g/t silver and 0.45 g/t gold) might also benefit from the road and port. Upon development, the infrastructure is expected to focus future exploration on this region.

HIGH LAKE PROJECT, HIGH GREENSTONE BELT, CORONATION GULF
(WOLFDEN RESOURCES INC.)

In 2001, Wolfden conducted a drill program across the B zone, which is the main zone at this polymetallic project. The program returned some spectacular results, including 12.53% copper, 0.44% zinc, 0.78 g/t gold and 40.01 g/t silver across 14.35 m. The deposit is open at depth. Re-evaluation of previous drill hole data indicates other mineralization may be found beneath a synvolcanic sill, previously believed to truncate the ore zone at depth. An interpretation of magnetic data suggests the presence of several "feeder" pipes on the property. One pipe is associated with surface mineralization that has returned copper values of up to 6.38%. Combined historical resources for the deposit, outlined by 1993, stand at 5.3 Mt grading 4.05% copper, 2.36% zinc, 1.76 g/t gold and 31.73 g/t silver in three zones.

STORM AND WELLINGTON PROJECTS, SOMERSET AND DEVON ISLANDS
(NORANDA INC., TECK-COMINCO LTD.)

The Storm project year-2001 field program was extended from June 27 to August 4 with a crew based at the Aston Bay exploration camp. The purpose of the program was to drill-test two zones of zinc mineralization and to complete a limited amount of follow-up prospecting and sampling on "Airborne Electro Magnetic (AEM) – Hyperspectral" targets identified the previous year.

The principal target was prospective stratigraphy hosting the Seal zone zinc mineralization. Cominco Ltd. outlined this mineralization in a basal member of the Ship Point formation in 1995/96. An additional zinc target, the Typhoon zinc zone, was discovered in 2000 by follow-up prospecting of AEM and hyperspectral anomalies. This target was the first to be tested as the drill was situated on this site following the completion of drilling in 2000.

A total of seven holes (1193 m) were drilled in 2001, of which six holes (822 m) were completed on the Seal zone and a single hole (371 m) was completed at Typhoon. Reconnaissance prospecting of other targets failed to return any significant base metals.

On the Wellington project, Noranda completed approximately 2100 m of diamond drilling in 2001, targeting "Polaris-type" carbonate-hosted zinc mineralization. Noranda also conducted surface geological mapping plus geophysical and geochemical surveys. Additional exploration work is planned.

Nickel-Copper-Platinum Group Metals (PGMs)

MUSKOX PROJECT, MCGREGOR LAKE
(MUSKOX MINERALS CORPORATION)

Exploration continued on the Muskox intrusion located 70 km south of Kugluktuk. Analytical results from the 23 holes drilled on the Keel 1 target in 2000 were received early in the year, showing generally low values. A total of 12 drill holes for approximately 2800 m were completed on the Keel 2 target in 2001. Hole 35 gave the best assay results, including 15 m of 1.28% copper, 0.45% nickel, 1.2 g/t palladium and 0.18 g/t platinum. Drilling was guided by down-hole EM (electromagnetic) and AMT (audio magnetotelluric) geophysical surveying. Hole 36 tested the southern Keel sector and intersected 1.28% copper, 1.17% nickel, 0.17% cobalt and 0.17 g/t palladium over 4.33 m at a depth ranging between 317.09 and 321.42 m, part of a 28.6-m massive to semi-massive sulphide intersection. The company reports this to be a new mineralized zone. Surface mapping and grab sampling elsewhere on the property have returned impressive PGM values from the Lower and Upper Chromitie reefs, each with a near-surface extent of 1 km.

NORTH MUSKOX PROJECT, CANOE LAKE, COPPERMINE RIVER
(TRILOGY METALS INC.)

The company carried out extensive analysis of surface magnetic and gravity surveying from its 2000 program. The data indicate the occurrence of two interconnected ultramafic-mafic magma chambers and several satellite intrusive bodies, possibly related to the Muskox intrusion. Several possible kimberlite targets have also been delineated. Trilogy has entered into an option agreement with PGM Holdings, which can earn a 70% property interest through cash payments, share issuance and work expenditures.

FERGUSON LAKE PROJECT, FERGUSON LAKE, KIVALLIQ
(STARFIELD RESOURCES INC.)

Diamond drilling continued in the area of the three main deposits at Ferguson Lake: the West zone, East zone I and East zone II. The majority of drilling focused on delineation of the westward extension of the West zone, identified by a gently plunging UTEM electromagnetic conductor. The company also conducted surface mapping across the Main and East zones and the recently discovered "Anomaly 51" prospect.

Starfield has increased the inferred resource base at Ferguson Lake to 51.7 Mt grading 0.92% copper, 0.58% nickel and 1.44 g/t combined platinum and palladium, using a 1.0% combined nickel and copper cut-off. Using a 2% combined copper-nickel cut-off, resources are calculated at 9.3 Mt grading 1.37% copper, 0.87% nickel and 2.06 g/t combined platinum and palladium. The latter figure represents a series of regularly spaced high-grade pods that are potentially exploitable by open-pit mining.

In October 2001, Starfield announced a narrow, high-grade intersection of 103 g/t palladium and 26.7 g/t platinum over 0.35 m. The horizon is situated 15 m stratigraphically above the main West zone. Since then, the company also announced a separate intercept of low-sulphide mineralization grading 9.90 g/t palladium and 1.44 g/t platinum located roughly 100 m below the main West zone.

Grass-Roots Projects in Nunavut

Several reconnaissance and grass-roots exploration programs were conducted in various localities in Nunavut, mainly by senior mining companies. Falconbridge Ltd. conducted a reconnaissance program within the Piling Basin of central Baffin Island. BHP-Billiton carried out some base-metal exploration in the same area. Both of these programs utilized geology base map and assay data obtained from the Canada-Nunavut Geoscience Office (C-NGO) Central Baffin project, ongoing since 2000. In the Kivalliq Region, BHP-Billiton carried out a reconnaissance diamond exploration program and Hudson Bay Exploration and Development Company Limited conducted a sizable exploration program for base metals.

2001 Government Programs

Canada-Nunavut Geoscience Office

The Canada-Nunavut Geoscience Office (C-NGO), a partnership between the Government of Nunavut, the Geological Survey of Canada (GSC [NRCan]) and DIAND continued with the Committee Bay and Central Baffin mapping projects. In collaboration with Cominco Ltd. and Noranda Inc., the C-NGO also continued with its study focusing on potential base-metal-bearing horizons in the Polaris mine district of the Arctic Islands.

The C-NGO also performed new detailed underground mapping and sampling at Breakwater Resources' Nanisivik mine to investigate structural and stratigraphic controls of Mississippi Valley-type zinc-lead-silver mineralization comprising the deposit, and to establish criteria for exploration for similar deposits in the area. Staff of the C-NGO also visited the Hope Bay gold project to study volcanic stratigraphy and gold mineralization in the "Wolverine-Madrid" corridor and volcanic stratigraphy of the QSP area.

The Committee Bay project, collaboratively delivered with the GSC, focused on the Prince Albert group located southwest of Committee Bay. The area is part of an Archean greenstone belt considered to have high potential for gold and base-metal mineralization. Over the course of the 2000, 2001 and 2002 field seasons, bedrock and surficial materials mapping will have been performed over NTS map sheets 56J, 56K, 56O and 56P. In 2001, studies were completed on gold mineralization in the Three Bluffs iron formation near Walker Lake, and the relationship of the proximal Walker Lake shear zone to regional deformation in the Committee Bay belt. The project also included detailed 1:50 000-scale Quaternary mapping and reconnaissance till geochemistry and kimberlite-indicator mineral surveys across NTS sheet 56K and parts of sheets 56J and 56O. A study of glacial landforms and a chronology of ice-flow movements were also done on sheet 56O. Several reports of various technical aspects of this project will be published in the GSC's upcoming research volume (January 2002).

Undertaken in collaboration with the GSC, the Central Baffin project focused on bedrock and surficial mapping and interpretation of sedimentary stratigraphy of the Paleoproterozoic Foxe Fold belt in central Baffin Island. Over three field seasons (2000-02), the project will cover NTS map sheets 37A and 37D, as well as the western halves of sheets 27B and 27C. The area has elevated potential for base-metal and gold mineralization. Four new maps of the area were released on March 1, 2001, through the GSC publication system. Reports of various technical aspects of this project will be published in the GSC's upcoming research volume (January 2002). A paper describing the stratigraphic relationship within the Piling group and underlying Archean basement rock in the project area is being completed in 2001.

The C-NGO initiated fieldwork for a thematic study focusing on potential base-metal-bearing horizons in the Polaris mine district in the Arctic Islands, in collaboration with Cominco and Noranda. The companies are providing logistical support, technical and in-house geoscience data, and representative rock samples from past activities. In 2001, the project continued with a study of lead-zinc showings and mineralizing systems on western Cornwallis Island.

Privately funded exploration tends to be attracted to the vicinities of these government-sponsored projects, due to upcoming releases of improved geoscientific information following the field programs. Both BHP and Cominco Ltd. conducted reconnaissance visits to the Central Baffin area in 2000, and Teck-Cominco, BHP-Billiton and Falconbridge Ltd. conducted regional programs there in 2001.

Department of Indian Affairs and Northern Development (DIAND)

DIAND continued to regulate and monitor exploration and mining activities in 2001 with site visits to major projects such as the Ferguson Lake, Muskox and Jackson Inlet projects, as well as the Lupin, Polaris and Nanisivik mines. DIAND has begun a program of visits to abandoned sites, such as the closed Cullaton Lake gold mine, to retrieve core samples prior to reclamation. In 2001, it also visited the Marble Island site near Rankin Inlet, and the Wager Bay area. Both are currently protected areas; DIAND is assessing major geological features as potential eco-tourism attractions and for basic instruction in earth sciences.

On April 1, 2001, DIAND officially opened its Mineral Resources section in Iqaluit. Jason Sharp, formerly of the Northwest Territories office in Yellowknife, has taken the position as Manager, Mineral Resources Section. Staffing of two District Geologist positions, with Jurate Gertzbein for the Kivalliq Region and Robert Carpenter for the Kitikmeot Region, as well as an Archive Geologist position filled by Natalie Hamm, has been completed. All Nunavut-related duties, files and geological data were transferred to the Iqaluit office by April 2001. A Mining Recorder's office has also been established, including facilities for registering claims and selling claim disposition maps.

Work on DIAND's databases, the KIDD (Kimberlite Indicator Diamond Database) and NORMIN (Northern Minerals) databases, continued throughout 2001. This work is based in Yellowknife; however the Iqaluit office is progressing towards involvement in upgrading of the NORMIN database.

Government of Nunavut

The Minerals, Oil and Gas Division (MOG) of the Nunavut Department of Sustainable Development is continuing to promote and introduce the fundamentals of general geology and prospecting methods to the people of Nunavut. Introductory prospecting courses are very popular both for prospectors and for people with a general interest in mineral deposits. In 2001, 14 courses were held in 13 communities with 143 graduates.

Additionally, through the Nunavut Prospectors' Program, prospectors can apply for a contribution of up to \$5000, which can be used for prospecting, claim staking and rock sampling within a specified region or property. In 1999 and 2000, several interesting mineral showings were reported in all regions of Nunavut. In 2001, a total of 33 applicants received funding, of which 26 received the full \$5000 allotment. The resulting programs also led to numerous potentially prospective mineral discoveries.

Also in 2001, MOG spearheaded the "Mineral Exploration Field Assistant's Course," a pilot program intended to prepare students for private-sector employment and to provide incentive for further education and training. This "pre-employment course" consisted of six one-week classroom units on a variety of subjects including "Introduction to Geology," "Technical Communication" focusing on introductory computer usage, and "Small Engine Repair." The classroom

units were followed by a 10 to 14-day field placement in the Committee Bay project operated by C-NGO. All eight students who completed the course were also placed for two to three weeks in private-sector mineral exploration camps. This program was a multi-partnership effort between the training sectors of the regional Inuit associations, Nunavut Tunngavik Incorporated (NTI), MOG, the Department of Education of Nunavut, DIAND, C-NGO, Nunavut Arctic College, First Air, and Canadian North. Students were placed with BHP World Exploration Inc., De Beers Canada Inc., Kinross Gold Corp, Falconbridge Limited, Noranda Inc., Starfield Resources Inc., and Hudson Bay Exploration and Development Ltd., all of which were generous with their assistance. Program results are currently under review and recommendations for future courses will be forwarded.

Projected Exploration and Market Trends within Nunavut

Nunavut is being increasingly recognized by industry as an “under-explored” region with very high economic mineral potential. Several reconnaissance programs were conducted in 2001, including, among others, diamond exploration by BHP Billiton and Kennecott Canada Exploration Inc., base-metal exploration by Hudson Bay Exploration and Development, and copper-nickel-PGM exploration by Falconbridge. Advanced gold exploration programs are ongoing. This is particularly encouraging, considering current depressed commodity prices for gold and base metals. The mineral investment community, including major mining companies, recognizes that Nunavut remains sound for mineral investment despite obvious climatic and infrastructure disadvantages. Mining is possible in Nunavut, as demonstrated by the success of the Polaris and Nanisivik zinc mines and the Lupin gold mine. Diamonds are successfully mined at BHP Billiton Diamonds Inc.’s Ekati mine in the neighbouring Northwest Territories.

Gold continues to be a leading exploration commodity with ongoing advanced exploration of several large, possibly world-class, deposits in Nunavut, including the Hope Bay belt and Meadowbank deposits. The sale of the George Lake project to Kinross Gold indicates the latter’s faith in the project’s viability; Kinross was the operator prior to the sale.

In 2000, PGM prices, particularly for platinum and palladium, surged to unprecedented levels, partly due to increased demand for vehicle pollution-control devices and to Russia’s inability to supply world markets. Platinum demand for jewellery is also on the rise. In 2001, prices fell back considerably but have recently stabilized at or above pre-1999 levels due to sustained demand. The PGMs commonly occur within magmatic copper-nickel mineralization providing a multiple commodity setting. Thus, renewed interest in copper-nickel-PGM mineralization, such as at the Muskox and Ferguson Lake projects, has occurred. Companies engaged in magmatic copper-nickel or PGM exploration, or both, are likely to increase exploration activities in Nunavut in the future.

A number of world-class zinc mines, including two in Nunavut, are becoming depleted in resources. Although current zinc demand is low, grass-roots base-metal exploration is continuing in Nunavut. Some grass-roots exploration for zinc is under way by BHP Billiton and Hudson Bay Exploration and Development. Wolfden Resources is continuing advanced copper exploration and Noranda is continuing with mid-stage exploration for the red metal.

Diamond markets remain strong. Recent success by Kennecott and Ashton shows that diamond potential is very high in western Nunavut. Diamond-bearing kimberlite pipes have recently been discovered on Baffin Island and interesting structures have been found on the Boothia Peninsula.

3. Canadian Exploration Activity Around the World

3.1 INTRODUCTION

This section provides an overview of Canadian exploration¹ activity abroad. It also highlights the domestic and foreign components of the larger-company exploration market in Canada. The information in this review² was current as at July 2001.

3.2 GLOBAL MARKET FOR MINERAL EXPLORATION

In 2000, the value of exploration programs planned around the world by companies of all sizes for precious metals, base metals and diamonds fell to an estimated \$3.8 billion (US\$2.6 billion), down by 7% from the \$4.1 billion (US\$2.8 billion) planned the previous year.³ Exploration programs were reduced in most countries, but were postponed or abandoned entirely in others.

3.3 WORLD'S LARGER COMPANIES

Global trends in mineral exploration are based largely on data for the world's larger companies. These companies are defined here as those with annual exploration budgets of more than \$4.4 million in 2000 (US\$3 million). The larger companies are the only ones for which there are consistent data on worldwide exploration activity spanning a period of almost 10 years. In 2000, 121 companies based around the world each planned to spend more than \$4.4 million on exploration, down from a record 279 companies in 1997.

During 2000, the world's larger companies were expected to undertake exploration programs with a combined value of \$2.9 billion (US\$2.0 billion) in 106 countries. The larger companies represent only about 18% of the more than 650 companies of all sizes that were active in mineral exploration worldwide in 2000. However, they account for over 80% of the value of all mineral exploration programs carried out around the globe.

¹ Most of the information on the larger-company mineral exploration market worldwide is based on *Corporate Exploration Strategies: A Worldwide Analysis*, published annually by the Metals Economics Group (MEG), Halifax, Nova Scotia. MEG counts, as exploration, work from the earliest stage through perimeter drilling, reconnaissance and evaluative forays, as well as work to further quantify and define an identified orebody once the target outline stage has been completed. It also counts as exploration all feasibility work up to the point of a production decision.

² Chapter 3 is based on an article from the 2000 *Canadian Minerals Yearbook* published by Natural Resources Canada (available on the Internet at <http://www.nrcan.gc.ca/mms/cmy/content/08.pdf>).

³ All currencies in this review are expressed in Canadian dollars unless otherwise indicated.

3.4 LARGER CANADIAN-BASED COMPANIES

There are more mineral exploration companies based in Canada than in any other country (**Figure 40**). In spite of generally low prices for mineral commodities and the difficulty in raising capital, 48 Canadian-based companies each planned to spend more than \$4.4 million on exploration in 2000, about the same as in 1999. In 1996, mining companies listed on Canadian stock exchanges raised a record amount of capital.⁴ As a result, 141 Canadian-based companies each planned to spend more than \$4 million on exploration programs around the world in 1997. Their aggregate budgets for exploration, adjusted for inflation, reached an all-time value of over \$2.0 billion during that year.

In 2000, the total value of the exploration programs that the larger Canadian-based companies planned to undertake in both Canada and elsewhere around the world stood at almost \$887 million (**Figure 41**), down slightly from the \$916 million budgeted in 1999. The programs that Canadian-based companies planned to undertake during 2000 represent more than 30% of all larger-company exploration programs around the world. Canadians account for the dominant share, by far, of all worldwide mineral exploration activity. Their closest rivals, the Australians, account for about 20%. In 1997, Canadian programs accounted for a record 35% of the value of all exploration planned worldwide.

The larger Canadian-based companies tend to have exploration budgets that are smaller than those of the industry worldwide. In 2000, these Canadian companies had average exploration budgets with a mean of \$18.5 million and a median of \$8.8 million, about 20% smaller than the global averages of \$23.8 million and \$11.0 million, respectively.

Although, on a company-by-company basis, there can be significant variations between budgets and expenditures, aggregate exploration budgets generally provide a reliable estimate of actual sums spent worldwide in the field. In the case of the larger Canadian companies, actual expenditures in 1999 were about 7% lower than budgeted, roughly the same departure as in the previous year.⁵

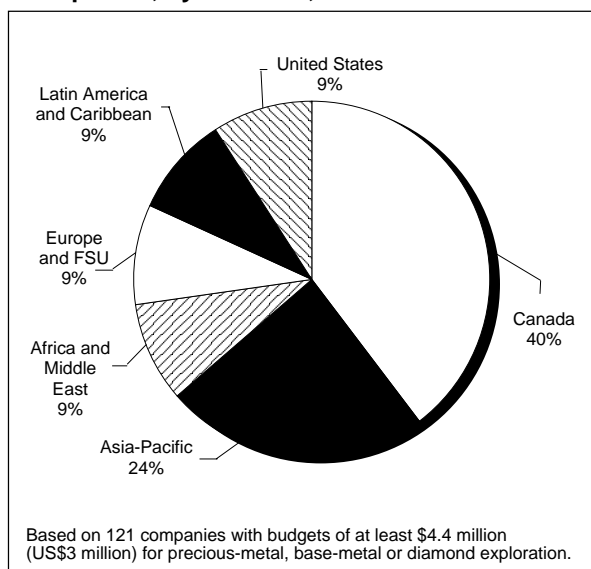
At the end of 2000, companies of all sizes listed on Canadian stock exchanges held interests in a portfolio of more than 6300 properties (**Figure 42**) located in Canada or in more than 100 other countries around the world.⁶ Most of this portfolio is at the early exploration stage of the mineral development cycle.

⁴ Keith Brewer and André Lemieux, *Canada's Global Position in Mining - Canadian Financing of the International Mining Industry*, Metals Finance 4th International Conference, Toronto, May 7-9, 1997, Natural Resources Canada, Ottawa, 53 pp. (tel. [613] 995-4577).

⁵ For more information on various aspects of the relationship between exploration budgets and exploration expenditures for the larger Canadian companies, see André Lemieux, "Canada's Global Mining Presence," in the 1998 edition of the *Canadian Minerals Yearbook*, Natural Resources Canada, Ottawa, pp. 7.1 and 7.2; see also André Lemieux, "Canada's Global Mining Presence," in the 1999 edition of the *Canadian Minerals Yearbook*, Natural Resources Canada Ottawa, pp. 7.1 and 7.3 (<http://www.nrcan.gc.ca/mms/cmty/content/1998/08.pdf> and <http://www.nrcan.gc.ca/mms/cmty/content/08.pdf>, respectively).

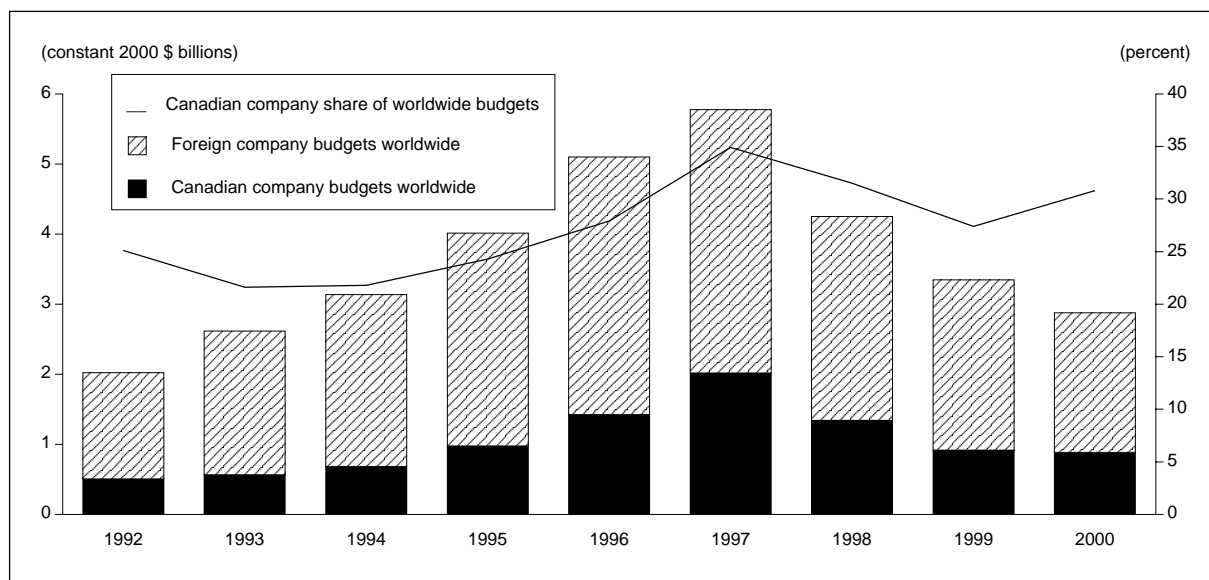
⁶ Most of the data for 1991 through 1997 on the mineral property portfolio of companies of all sizes listed on Canadian stock exchanges are derived from *MIN-MET CANADA*; for 1998 through 2000, they are derived from *InfoMine db*. These databases are products of Robertson Info-Data Inc., Vancouver, British Columbia (tel. [604] 683-2037).

Figure 40
Distribution of the World's Larger Exploration Companies, by Domicile, 2000



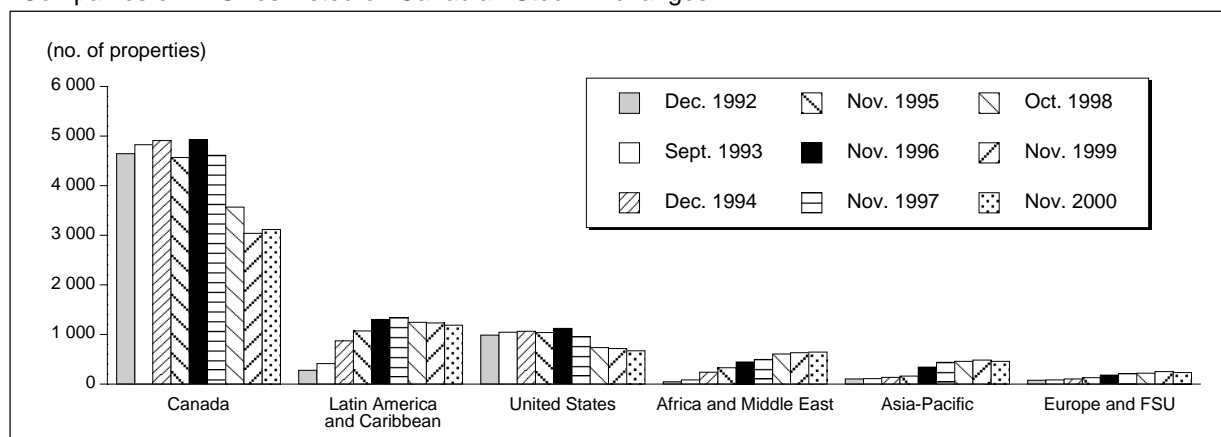
Source: Natural Resources Canada, based on *Corporate Exploration Strategies: A Worldwide Analysis*, Metals Economics Group, Halifax, Nova Scotia.
 FSU: Former Soviet Union.

Figure 41
Exploration Budgets of the World's Larger Companies, by Origin, 1992-2000
 Companies With Worldwide Budgets of at Least \$4.4 Million in 2000 for Precious-Metal, Base-Metal or Diamond Exploration



Source: Natural Resources Canada, based on *Corporate Exploration Strategies: A Worldwide Analysis*, Metals Economics Group, Halifax, Nova Scotia.
 Notes: The worldwide exploration budgets of companies that intended to spend less than \$4.4 million (US\$3 million) in 2000 are excluded. The worldwide exploration budgets for other commodities such as uranium or industrial minerals are also excluded.

Figure 42
Canadian Mineral Property Portfolio Worldwide, by Region, 1992-2000
 Companies of All Sizes Listed on Canadian Stock Exchanges



Source: Natural Resources Canada, based on *MIN-MET CANADA* for 1992-97 and InfoMine db for 1998-2000, Robertson Info-Data Inc., Vancouver, British Columbia, and used under licence.

Note: The decrease in properties in Canada after 1997 is due mainly to the implementation of database features that make it possible to exclude many inactive properties.

3.5 LARGER-COMPANY EXPLORATION MARKET IN CANADA

In 2000, the larger-company mineral exploration market in Canada was valued at almost \$400 million (**Figure 43**), up by \$35 million, or 10% from about \$360 million in 1999. The balance of the Canadian market is held by companies with worldwide exploration budgets of less than \$4.4 million, the activities of which are not addressed specifically here. Canada and, to a lesser extent, New Caledonia, Brazil and South Africa are among the few countries where a significant increase in exploration activity was expected to occur from 1999 to 2000. Canada ranks second, after Australia, in terms of countries where the global mineral exploration industry is the most active. Canada has held that position since 1992.

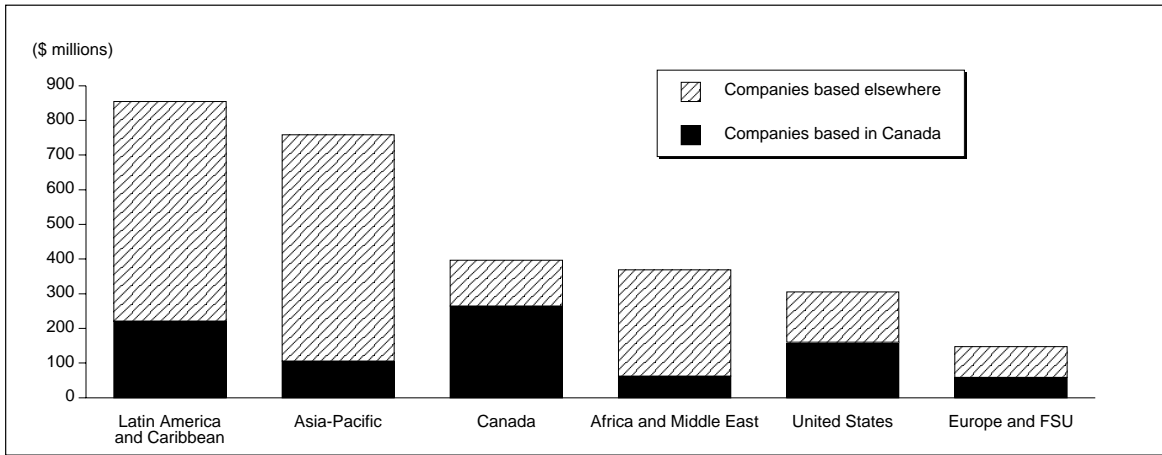
In 2000, 53 of the world's larger domestic-based or foreign-based companies planned to explore for minerals in Canada. As a result, almost 14% of the exploration efforts of all of the world's larger companies were destined for Canada (**Figure 44**), up from about 11% during each of the previous three years. Prior to the large increase in exploration activity that occurred in developing countries starting in the early 1990s, the proportion of worldwide exploration activity taking place in Canada stood at 18%. At the end of 2000, there were more than 3100 mineral properties with recent exploration activity in this country (**Figure 42**).⁷

In 2000, 33 of the larger Canadian-based companies allocated, in total, almost \$265 million for exploration in Canada, up from about \$250 million in 1999. For the first year since 1994, Canadian companies planned to spend more on mineral exploration in Canada than in all of Latin America.

The larger Canadian-based companies control two thirds of the larger-company market in Canada. The only other countries where domestic companies control more than half of the

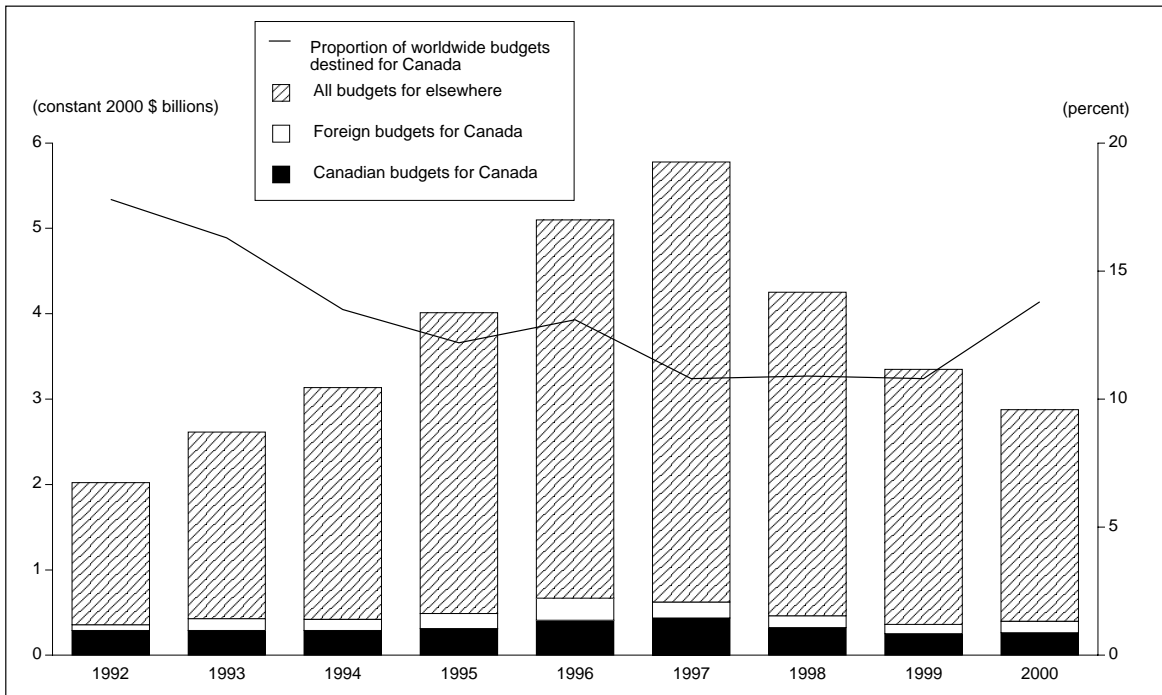
⁷ For trends in mineral deposit appraisal activity in Canada over the interval 1982-97, and for a list of projects at the deposit appraisal stage in early 1997, see André Lemieux, "Canada's Global Mining Presence," in the 1996 edition of the *Canadian Minerals Yearbook*, Natural Resources Canada, Ottawa, pp. 8.9 and 8.11-8.22 (<http://www.nrcan.gc.ca/mms/cmy/content/1996/08.pdf>).

Figure 43
Exploration Budgets of the World's Larger Companies for Selected Regions of the World, 2000
 Companies With Worldwide Budgets of at Least \$4.4 Million for Precious-Metal, Base-Metal or Diamond Exploration



Source: Natural Resources Canada, based on *Corporate Exploration Strategies: A Worldwide Analysis*, Metals Economics Group, Halifax, Nova Scotia. Notes: The worldwide exploration budgets of companies that intended to spend less than \$4.4 million (US\$3 million) in 2000 are excluded. The worldwide exploration budgets for other commodities such as uranium or industrial minerals are also excluded. FSU: Former Soviet Union.

Figure 44
Exploration Budgets of the World's Larger Companies for Canada and Elsewhere, 1992-2000
 Companies With Worldwide Budgets of at Least \$4.4 Million in 2000 for Precious-Metal, Base-Metal or Diamond Exploration



Source: Natural Resources Canada, based on *Corporate Exploration Strategies: A Worldwide Analysis*, Metals Economics Group, Halifax, Nova Scotia. Notes: The worldwide exploration budgets of companies that intended to spend less than \$4.4 million (US\$3 million) in 2000 are excluded. The worldwide exploration budgets for other commodities such as uranium or industrial minerals are also excluded.

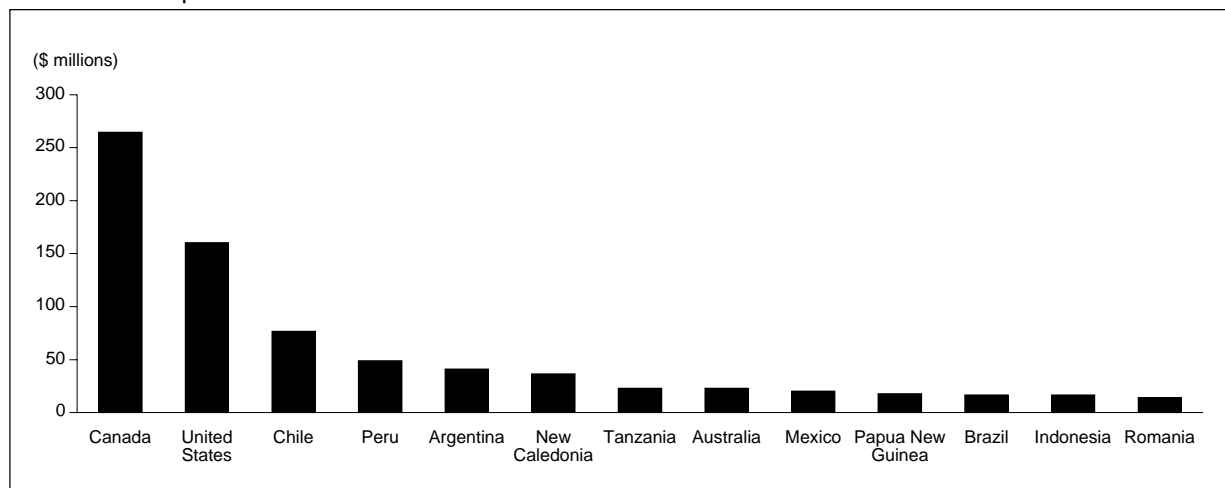
larger-company market for mineral exploration are Australia, Japan and South Africa. In 1992, Canadian-based companies controlled 80% of the larger-company market in Canada but, with increasing globalization, their share has fallen gradually as foreign-based companies have increased their investment in this country. Since the early 1990s, the share of the exploration market controlled by the larger domestic firms has also fallen gradually in the United States and Australia. Still, Canada remains the country where Canadian-based companies conduct, by far, the most mineral exploration (**Figure 45**).

During 2000, 20 of the larger foreign-based companies planned to spend, in total, over \$130 million on mineral exploration in Canada (**Figure 44**). This represents one third of all activity planned for this country. Compared with the previous year, the budgets of foreign-based companies for Canada increased by more than \$32 million in 2000.

In 2000, the larger foreign-based companies active in mineral exploration in Canada included: Ashton Mining Ltd., The Broken Hill Proprietary Company Limited (BHP), Normandy Mining Ltd., Pasminco Limited and WMC Limited, all based in Australia; Battle Mountain Gold Company, Echo Bay Mines Ltd., Freeport-McMoRan Copper & Gold Inc., Homestake Mining Company, Newmont Mining Corporation and Phelps Dodge Corporation, all based in the United States; Anglo American plc, AngloGold Limited, Billiton plc, Outokumpu Oy and Rio Tinto plc, all based in Europe; Anglo American Platinum Corporation Limited, De Beers Consolidated Mines, Limited and Impala Platinum Holdings Limited, all based in South Africa; and the Mexican mining consortium, Grupo Mexico S.A. de C.V.

In 2000, De Beers had an estimated exploration budget for Canada of almost \$50 million, the largest of all domestic and foreign companies operating in this country. Grupo Mexico's exploration budget for Canada is the result of its takeover of ASARCO Incorporated, which planned to spend almost \$3 million looking for base metals in this country.

Figure 45
Exploration Budgets of the Larger Canadian-Based Companies, 2000 –
Countries Accounting for 90% of Canadian Budgets
 Companies With Worldwide Budgets of at Least \$4.4 Million for Precious-Metal, Base-Metal or Diamond Exploration



Source: Natural Resources Canada, based on *Corporate Exploration Strategies: A Worldwide Analysis*, Metals Economics Group, Halifax, Nova Scotia.
 Notes: The worldwide exploration budgets of companies that intended to spend less than \$4.4 million (US\$3 million) in 2000 are excluded. The worldwide exploration budgets for other commodities such as uranium or industrial minerals are also excluded.

3.6 LARGER CANADIAN-BASED COMPANIES ABROAD

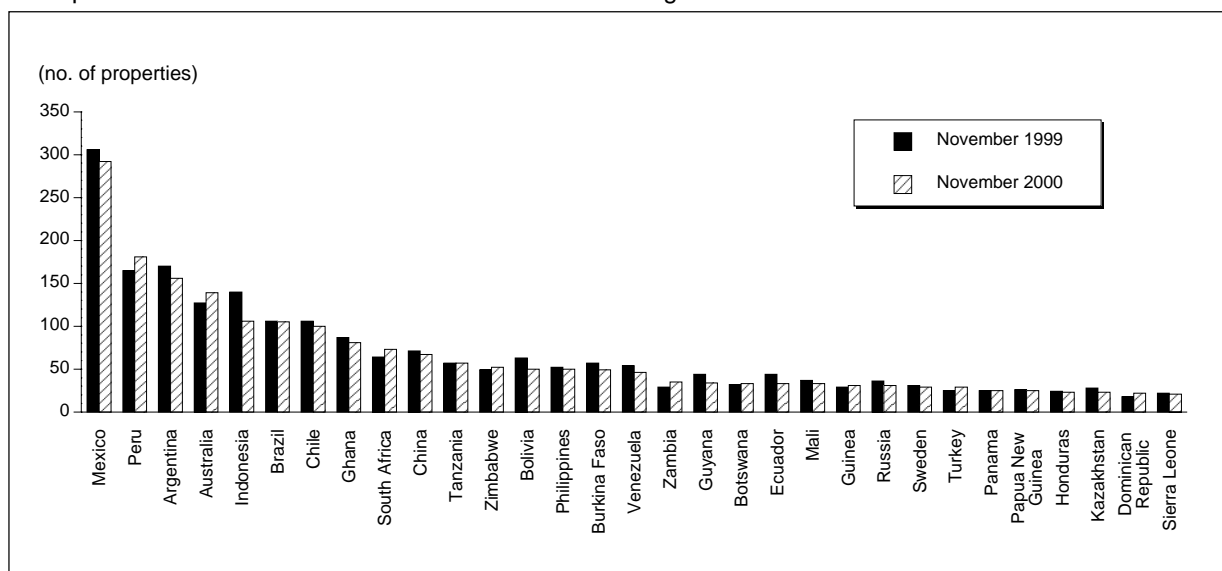
In 2000, the larger Canadian-based companies planned to spend more than \$620 million on mineral exploration outside Canada (**Figure 43**), down by 6% from the more than \$665 million they had planned to spend in 1999. About 70% of their worldwide budgets for 2000 were allocated to programs abroad. Their foreign programs, as a proportion of all of their programs, peaked at over 78% in 1997. In 1992, that proportion was only slightly more than 40%.

At the end of 2000, companies of all sizes listed on Canadian stock exchanges held interests in a portfolio of over 3200 mineral properties located abroad (**Figure 42**). Foreign properties represent slightly more than half of the total mineral property portfolio held by these companies, up from about 25% in 1992. Apart from the United States, where companies of all sizes listed on Canadian stock exchanges have a substantial mining presence, about 30 other nations, spread across the globe, account for most of the balance of their mineral property portfolio held abroad (**Figure 46**).

Canadian companies have interests in over 200 mines, smelters, refineries, plants under construction or projects awaiting the results of a final production feasibility study in almost 60 foreign countries. They also have hundreds of other projects at the early stages of exploration in these countries, and in more than 40 others. The activities of Canadian mining companies in Canada and abroad have fostered the development in this country of over 2200 suppliers of specialized mining goods and services.⁸

⁸ For a discussion of the global market for mining goods and services and the role played by Canadian companies, see André Lemieux, *Canadian Suppliers of Mining Goods and Services: Links Between Canadian Mining Companies and Selected Sectors of the Canadian Economy*, Natural Resources Canada, Ottawa, September 2000, 84 pp. (<http://www.nrcan.gc.ca/mms/pubs/services-mines-e.pdf>).

Figure 46
Canadian Mineral Property Portfolio Abroad, 1999 and 2000 – Countries Accounting for 80% of Canadian Holdings Located Outside the United States in 2000
 Companies of all Sizes Listed on Canadian Stock Exchanges



Source: Natural Resources Canada, based on InfoMine db, Robertson Info-Data Inc., Vancouver, British Columbia, and used under licence.

3.6.1 United States

In 2000, the larger-company mineral exploration market in the United States was valued at over \$300 million (**Figure 43**), or about 11% of the \$2.9 billion larger-company market worldwide. In spite of general global retrenchment, 17 of the larger Canadian-based companies planned to spend, in total, about \$160 million in the United States, only about 6% less than in 1999.

Companies based in most countries considerably reduced their exploration programs for the United States in recent years while those based in Canada increased theirs. As a result, the share of the larger-company exploration market held by Canadian-based companies in the United States has grown to over 50%. Canadian-based companies have increased their share of the exploration market in the United States almost every year since the early 1990s. The United States ranks second after Canada in terms of countries where Canadian companies are the most active in mineral exploration (**Figure 45**).

Canadian companies planned to spend almost \$80 million more than U.S. companies in the United States during 2000. American companies have budgeted decreasing amounts for mineral exploration in their country most years since the early 1990s. Although American companies accounted for almost 60% of the value of all exploration programs in their country in 1992, they accounted for only 27% in 2000.

In late 2000, companies of all sizes listed on Canadian stock exchanges held about 675 mineral properties in the United States (**Figure 42**). They had projects located in 22 states, concentrated mainly in the western part of the country in Nevada, Alaska, California, Arizona, Montana, Idaho, Wyoming, Colorado, Washington, Utah and South Dakota. Nevada alone accounted for more than 250 of their mineral properties, or almost 40% of the total Canadian portfolio in the United States.

Although Canadian companies have considerably expanded their activities in Latin America, Africa and Asia since the early 1990s (**Figure 42**), the United States is likely to remain, for the foreseeable future, the foreign country where they hold their largest portfolio of mineral properties. At the end of 2000, the United States accounted for over 20% of all properties held abroad by companies of all sizes listed on Canadian stock exchanges.

Of all the Canadian-based companies, Placer Dome Inc., Teck Corporation, Cominco Ltd., Barrick Gold Corporation and Kinross Gold Corporation planned the largest mineral exploration programs in the United States during 2000. Together they planned to spend more than \$135 million, equivalent to over 80% of the value of all Canadian programs for that country.

Placer Dome planned to spend about two thirds of its \$44 million exploration budget for the United States at the Getchell gold mine in Nevada. This budget was the largest of all domestic and foreign companies operating in that country in 2000. Teck planned to spend much of its \$28 million budget for the United States at the Pogo gold deposit in Alaska. Cominco planned to spend a good portion of its \$25 million American budget in proximity to the Red Dog zinc-lead-silver mine in Alaska and at the Pend Oreille zinc-lead deposit in Washington State. Barrick planned to spend much of its \$25 million budget for the United States on further exploration for gold at the Goldstrike mine, the Pinson mine, at the Rossi deposit and the Dee property, all in Nevada. Kinross planned to spend much of its \$13 million American budget at or near the Fort Knox gold mine in Alaska.

3.6.2 Latin America and the Caribbean

In 2000, the larger-company mineral exploration market in Latin America and the Caribbean was valued at over \$850 million (**Figure 43**), or almost 30% of the \$2.9 billion larger-company market worldwide.

During 2000, the larger Canadian-based companies planned to spend over \$220 million there, down by \$60 million, or roughly 20%, compared with 1999. After Canada, Latin America has become the region of the world where Canadian companies are the most active in mineral exploration. However, from 1995 to 1999, Canadian companies spent more on exploration in that region than in Canada. In 2000, Canadian companies held slightly more than one quarter of the larger-company market in Latin America and the Caribbean, ranking a close second to companies based in that region.

At the end of 2000, companies of all sizes listed on Canadian stock exchanges held interests in almost 1200 mineral properties in Latin America and the Caribbean. Since 1996, the total number of mineral properties held by Canadian companies in the region has exceeded the number held in the United States (**Figure 42**).

3.6.2.1 Mexico

In 2000, the larger-company mineral exploration market in Mexico was valued at almost \$120 million, or 4% of the \$2.9 billion larger-company market worldwide. Eleven of the larger Canadian-based companies planned to spend, in total, \$20 million in that country, equivalent to almost 17% of the market. Mexico ranks fourth in Latin America and ninth in the world in terms of countries where Canadian companies are the most active (**Figure 45**).

During 1994, there was a significant increase in the mineral property portfolio held in Mexico by companies of all sizes listed on Canadian stock exchanges. At the end of 2000, these companies held interests in almost 300 properties in 20 of the country's 31 states and district.

Teck and Noranda Inc. planned the largest Canadian exploration programs in Mexico during 2000. Teck planned to spend a good portion of its \$10 million budget for Mexico to study the feasibility of bringing into production the San Nicholas copper-zinc deposit and on delineating reserves at the Los Filos gold deposit. Noranda planned to spend \$4.7 million on grass-root exploration for base metals at the El Gordo, Lobo 6, Gavilanes, Aire Libre, La Joya and other properties.

3.6.2.2 South America

In 2000, the larger-company mineral exploration market in South America was valued at over \$680 million, almost one quarter of the \$2.9 billion larger-company market worldwide. Twenty-four of the larger Canadian-based companies planned to spend \$185 million in total in the region, which represents 27% of the market there. Canadian companies held the dominant share of the market in both Chile and Argentina.

Chile is the South American country where Canadian-based companies conduct the largest portion of their exploration programs (**Figure 45**). It ranks third in the world in terms of countries where Canadian companies are the most active in exploration. In 2000, Barrick planned to spend \$35 million in Chile, equivalent to almost 17% of the value of all exploration programs planned for that country. The company planned to allocate most of its budget there to increase reserves on the Pascua portion of the Pascua-Lama gold-silver deposit, which straddles the Chile-Argentina border. In addition, Barrick planned to spend most of its \$32 million budget for Argentina on the Lama portion of the Pascua-Lama deposit. The exploration programs planned by Barrick for Chile and Argentina were the largest in both of these countries.

At the end of 2000, companies of all sizes listed on Canadian stock exchanges held more than 750 mineral properties throughout South America. They held about 180 properties in Peru, more than 150 in Argentina, more than 100 in each of Brazil and Chile, and about 50 in each of Bolivia and Venezuela.

3.6.2.3 Central America

In 2000, the larger-company mineral exploration market in Central America was valued at about \$7 million, or less than 1% of the \$2.9 billion larger-company market worldwide. Two of the larger Canadian-based companies were expected to conduct about one quarter of all exploration programs in the region.

Breakwater Resources Ltd. planned to spend roughly \$2 million at the El Mochito zinc-lead-silver mine in Honduras. Although this is a relatively small program, it represents more than 40% of the larger-company mineral exploration market in that country.

At the end of 2000, companies of all sizes listed on Canadian stock exchanges held about 100 mineral properties throughout Central America. They held 20 or more in each of Panama and Honduras.

3.6.2.4 Caribbean

In 2000, the larger-company mineral exploration market in the Caribbean was valued at about \$6 million, or less than 1% of the \$2.9 billion larger-company market worldwide. Northern Orion Explorations Ltd. is the only larger Canadian-based company that reported an exploration program for the Caribbean. The company planned to spend \$0.3 million in Cuba on a study of the feasibility of bringing the Mantua copper-gold deposit into production.

At the end of 2000, companies of all sizes listed on Canadian stock exchanges held about 40 mineral properties in the Caribbean, most of them in the Dominican Republic and Cuba.

3.6.3 Europe and the Former Soviet Union

In 2000, the larger-company mineral exploration market in Europe and the Former Soviet Union (FSU) was valued at almost \$150 million (**Figure 43**), or slightly more than 5% of the \$2.9 billion larger-company market worldwide. The larger Canadian-based companies planned to spend about \$60 million in the region, equivalent to almost 40% of the market. At the end of 2000, companies of all sizes listed on Canadian stock exchanges held almost 240 mineral properties in Europe and the FSU.

3.6.3.1 Western Europe

In 2000, the larger-company mineral exploration market in western Europe was valued at almost \$70 million, or slightly more than 2% of the \$2.9 billion larger-company market worldwide. The larger Canadian-based companies planned to spend more than \$20 million there, equivalent to more than one third of the market.

Canadian-based companies held the dominant share of the market in two countries of western Europe. In Greenland, Crew Development Corporation planned to spend almost \$4 million on advanced exploration at the Nalunaq gold deposit, the largest program in that country. Crew also planned to spend \$1.5 million at the Røros zinc-copper complex in Norway.

At the end of 2000, companies of all sizes listed on Canadian stock exchanges held more than 100 mineral properties in western Europe. They held almost 30 in Sweden and more than 10 in each of Portugal, Greenland and Spain.

3.6.3.2 Eastern Europe

In 2000, the larger-company mineral exploration market in eastern Europe was valued at almost \$30 million, or less than 1% of the \$2.9 billion larger-company market worldwide. The larger Canadian-based companies planned to spend more than \$20 million there, equivalent to 85% of the market.

Canadian-based companies held the dominant share of the market in two countries of eastern Europe. In Romania, Gabriel Resources Limited planned to spend over \$14 million, about 70% of it to study the feasibility of bringing the Rosia Montana gold-silver deposit into production, while in Turkey, Eldorado Gold Corporation planned to spend roughly \$4 million on advanced exploration for gold.

At the end of 2000, companies of all sizes listed on Canadian stock exchanges held almost 70 mineral properties in eastern Europe. They held almost 30 in Turkey.

3.6.3.3 Former Soviet Union

In 2000, the larger-company mineral exploration market in the countries of the FSU was valued at almost \$40 million,⁹ or slightly more than 1% of the \$2.9 billion larger-company market worldwide. The larger Canadian-based companies planned to spend about \$6 million in these countries.

At the end of 2000, companies of all sizes listed on Canadian-based stock exchanges held interests in almost 70 mineral properties in six countries of the FSU.

Russia is the country of the FSU where the larger Canadian-based companies are the most active. In 2000, they planned to spend about \$5 million on exploration there, equivalent to about 30% of the market. Kinross, whose budget for Russia was the largest of all larger companies operating there, planned to spend almost \$3 million, mainly at or in the vicinity of the Kubaka gold-silver mine. The number of properties held in Russia by companies of all sizes listed on Canadian stock exchanges increased significantly starting in 1996 and now stands at over 30.

3.6.4 Africa and the Middle East

In 2000, the larger-company mineral exploration market in Africa and the Middle East was valued at almost \$370 million (**Figure 43**), or almost 13% of the \$2.9 billion larger-company market worldwide. The larger Canadian-based companies planned to spend more than \$60 million in Africa, equivalent to almost 17% of the market on that continent.

3.6.4.1 Africa

In 2000, the larger-company mineral exploration market in Africa was valued at almost \$365 million (**Figure 43**), or almost 13% of the \$2.9 billion larger-company market worldwide.

The larger Canadian-based companies were expected to finance the largest share of the mineral exploration programs in four countries of Africa: in Burkina Faso, SEMAFO Inc. planned to spend more than \$4 million on grass-roots exploration at the Mana property; in Niger, SEMAFO also planned to spend almost \$3 million for advanced exploration at the Libiri gold deposit; in Senegal, IAMGOLD Corporation planned to spend over \$1.5 million on grass-roots exploration for gold at the Bambadji and Daorala-Boto properties; and in Tanzania, Barrick planned to spend almost \$15 million looking for gold, more than half of it at the Bulyanhulu mine.

At the end of 2000, companies of all sizes listed on Canadian stock exchanges held interests in almost 640 mineral properties in 39 countries on the African continent. They held interests in over 80 properties in Ghana, in over 70 in South Africa, and in 50 or more in each of Tanzania, Zimbabwe and Burkina Faso.

⁹ The mineral exploration market in certain regions of the world is probably underestimated because there are few data available on the extent of exploration programs undertaken by some state agencies.

3.6.4.2 Middle East

In 2000, the larger-company mineral exploration market in the Middle East was valued at about \$5 million. The larger Canadian-based companies planned to spend only \$0.1 million there, equivalent to about 2% of the market in that region.

3.6.5 Asia-Pacific

In 2000, the larger-company mineral exploration market in Asia-Pacific was valued at almost \$760 million (**Figure 43**), or more than one quarter of the \$2.9 billion larger-company market worldwide. The larger Canadian-based companies planned to spend over \$100 million in the region, equivalent to 14% of the market there. Canadian budgets for Asia-Pacific were almost twice as large as in 1999.

At the end of 2000, companies of all sizes listed on Canadian stock exchanges held interests in over 460 mineral properties in Asia-Pacific (**Figure 42**).

3.6.5.1 Southeast Asia

In 2000, the larger-company mineral exploration market in Southeast Asia was valued at over \$200 million, or slightly more than 7% of the \$2.9 billion larger-company market worldwide. The larger Canadian-based companies planned to spend over \$40 million in the region, equivalent to more than 20% of the market there.

In Indonesia, Weda Bay Minerals Inc. planned to spend over \$7 million to study the feasibility of bringing the Halmahera Island nickel-cobalt deposit into production. In Papua New Guinea, Madison Enterprises Corp. planned to spend \$15 million on advanced exploration at the Mount Kare gold-silver deposit. In the Philippines, Crew planned to spend more than \$4 million on advanced exploration at the Mindoro lateritic nickel-cobalt deposit. In Vietnam, Falconbridge Limited planned to spend \$1 million at the Ban Phuc nickel-copper deposit.

At the end of 2000, companies of all sizes listed on Canadian stock exchanges held over 200 mineral properties in Southeast Asia. They held over 100 in Indonesia and more than 50 in the Philippines.

3.6.5.2 East Asia

In 2000, the larger-company mineral exploration market in east Asia, which includes China, Japan, Mongolia, North Korea, South Korea and Taiwan, was valued at almost \$40 million,⁹ or slightly more than 1% of the \$2.9 billion larger-company market worldwide. The larger Canadian-based companies planned to spend about \$5 million there, equivalent to almost 13% of the market.

Since 1993, there has been considerable Canadian interest in the mineral potential of China. In 2000, Placer Dome and Teck each planned to spend about \$0.7 million there. In late 2000, companies of all sizes listed on Canadian stock exchanges held interests in almost 70 mineral properties in that country.

In South Korea, Ivanhoe Mines Ltd. planned to spend about \$1.5 million on grass-roots exploration for base metals. In Mongolia, Cameco Corporation planned to spend almost \$2 million on grass-roots exploration for gold at the Sharingol concession.

3.6.5.3 South Pacific

In 2000, the larger-company mineral exploration market in the South Pacific was valued at over \$500 million, or over 17% of the \$2.9 billion larger-company market worldwide. Australia

accounted for 90% of that market. The larger Canadian-based companies planned to spend almost \$60 million in the region, three times as much as in 1999.

In New Caledonia, Falconbridge planned to spend over \$36 million for advanced exploration at the Koniambo lateritic nickel deposit. This budget is among the largest for a single Canadian project abroad. In Australia, Placer Dome planned to spend over 70% of its more than \$7 million budget for that country looking for additional gold at the Granny Smith mine and at the Kidston mine. Noranda planned to spend a good portion of its more than \$6 million budget for Australia at the Lady Loretta zinc-lead-silver deposit.

At the end of 2000, companies of all sizes listed on Canadian stock exchanges held almost 170 properties in the South Pacific, of which over 80% were located in Australia.

3.6.5.4 South Asia

In 2000, the larger-company mineral exploration market in South Asia, which includes India, Pakistan and Sri Lanka, was valued at about \$13 million, or less than 1% of the \$2.9 billion larger-company market worldwide. The larger Canadian-based companies reported no exploration programs for that region.

3.7 SUMMARY AND OUTLOOK

In 2000, Canadian-based companies planned to conduct mineral exploration programs around the world valued at roughly \$900 million. This is equivalent to more than 30% of all of the activity planned worldwide. Almost 14% of the world's mineral exploration activity was expected to occur in Canada, compared with about 11% in each of the previous three years. Canada is one of the few countries where exploration activity was expected to increase significantly from 1999 to 2000. For the first year since 1994, Canadians planned to conduct more exploration in Canada than in all of Latin America.

Also in 2000, Canadian companies further increased their share of the exploration market in the United States. They planned to undertake over 50% of all exploration activity there. Furthermore, they planned to conduct the largest share of exploration programs not only in Canada, but also in South America, the Caribbean and eastern Europe. Although Canadian companies have diversified their portfolio of mineral projects to well over 100 countries, Canada remains the country where they are, by far, the most active.

Exploration finance markets remain depressed and mineral commodity prices are relatively low, such that a return to the record levels of exploration programs carried out around the world in the late 1990s is not in sight. Many of the smaller companies are inactive because of a lack of funds. Mergers and acquisitions are commonplace.

Although Canadian companies tend to have smaller exploration budgets than those of other developed countries, they are considerably more numerous than companies based elsewhere. As a result, companies based in Canada are likely to continue, for the foreseeable future, to dominate mineral exploration worldwide.

APPENDIX 1

Historical Exploration and Deposit Appraisal Statistics

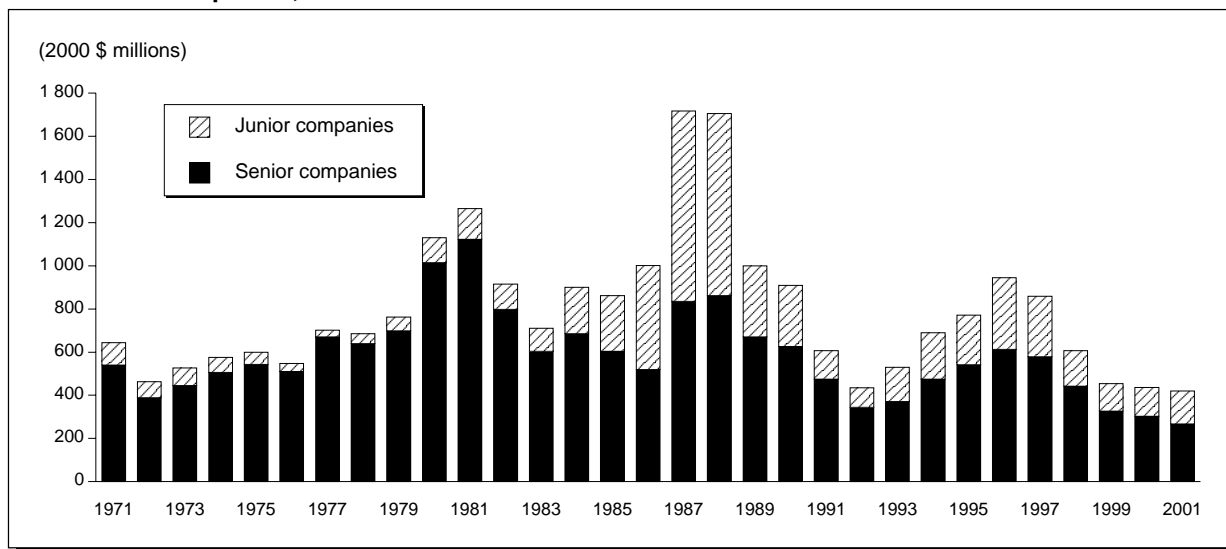
INTRODUCTION

Appendix 1 contains data and analyses that are based on the former survey definitions where only field and overhead costs were considered. While more restricted by this measure of exploration and deposit appraisal activity, the data are available over a much longer time series and provide a statistical basis for studying historical trends.

HISTORICAL SUMMARY

Figure 47 depicts Canadian exploration and deposit appraisal expenditures (field and overhead costs only) in constant 2000 dollars over the period 1971 to 2001. Above-normal expenditures in the 1980-82 period resulted from high prices for gold, silver and copper over much of

Figure 47
Exploration and Deposit Appraisal Expenditures¹ (Field Work and Overhead) in Canada by Junior and Senior Companies, 1971-2001



Source: Natural Resources Canada, based on the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.

¹ Includes on-mine-site and off-mine-site activities.

Notes: Total expenditures for 1975-81 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. Data for 2000 are preliminary; 2001 data are company spending intentions as compiled in January 2001. Expenditures for 1997 to 2001 include both exploration and deposit appraisal costs as per the new survey definitions; up to and including 1996, most of the expenditures now included in the deposit appraisal phase were reported under "exploration," broadly speaking.

that period. Spending declined somewhat in 1983, but generally rose from 1984 to 1988 as a result of the introduction by the federal government, in 1983, of the Mining Exploration Depletion Allowance (MEDA). MEDA was replaced in 1989 and 1990 by the Canadian Exploration Incentive Program (CEIP). By 1987 and 1988, expenditures had reached unprecedented high levels because of MEDA and the high gold prices that had prevailed until the end of 1987. However, spending fell dramatically after 1988 and decreased until 1992, when it reached its lowest inflation-adjusted level since 1966.

Activity picked up gradually in the 1993-96 period. Expenditures increased by 118% from 1992 to 1996, and the 1996 level of \$945 million (2000 dollars) was the highest since 1989. Although exploration and deposit appraisal spending declined somewhat to \$858 million (2000 dollars) in 1997, it still remained relatively strong by historical standards. However, spending dropped significantly in 1998 to \$606 million (2000 dollars), a decline of 29% from 1997. At \$454 million, the 1999 total represents a further drop of 25% from the 1998 level. Preliminary data for 2000 field and overhead costs show a more modest decline of 4% to \$436 million. If accurate, the 2001 forecast of \$420 million (2000 dollars) will replace the 1992 total as the worst exploration and deposit appraisal level since 1966. Therefore, after reaching a peak of \$945 million (2000 dollars) in 1996, field and overhead spending in Canada will have dropped by 56% over the period 1997-2001.

Returning to 1992, the relatively higher expenditure levels that were recorded in ensuing years resulted, to a great extent, from important discoveries of diamond deposits. These discoveries led companies to invest vast sums of money into advanced exploration or deposit appraisal projects and in mine development activities. As indicated in Chapter 1 of this report, close to \$1 billion has been spent on the search (exploration and deposit appraisal only) for diamonds since 1994.

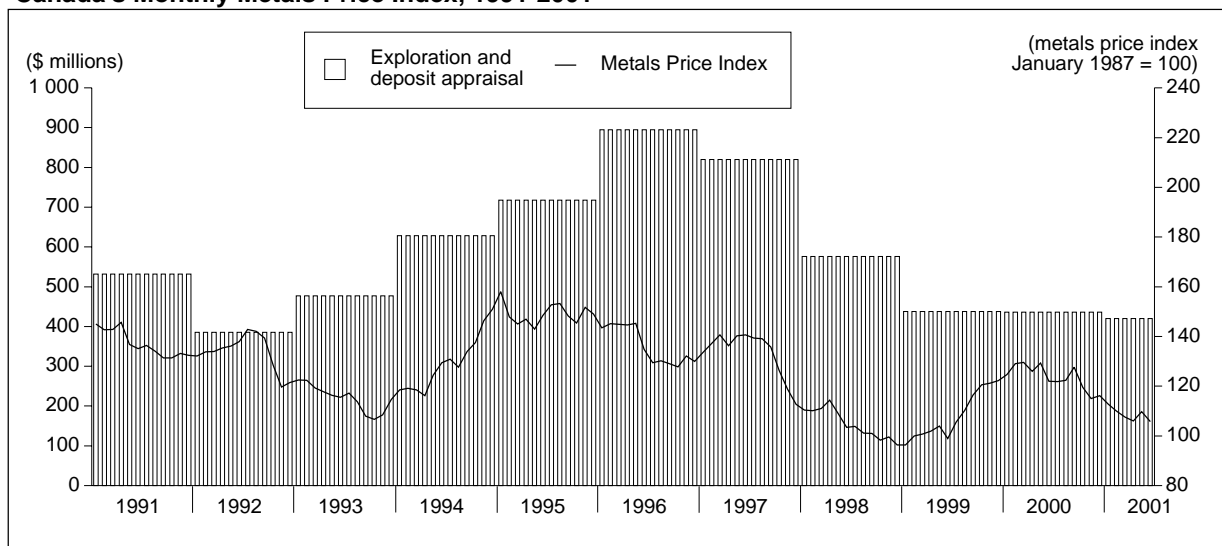
Another major contributor was the late 1994 nickel-copper-cobalt discovery at Voisey's Bay, Labrador, a result of exploration for diamonds in that area, which attracted a lot of attention, especially from junior exploration companies. The resulting flurry of exploration and deposit appraisal activity in the area also had a strong impact on expenditures, particularly in 1995 and 1996.

METAL PRICES AND EXPLORATION AND DEPOSIT APPRAISAL LEVELS

Metal prices are an important factor in determining the level of exploration and deposit appraisal activity. For example, between 1993 and 1995, copper, nickel and lead prices increased by over 60%, while zinc and gold prices increased by 14%. Over the same period, field and overhead exploration and deposit appraisal spending (current dollars) increased by 50%. However, since early 1995, metal prices have generally been on a downward trend as reflected by Natural Resources Canada's monthly metals price index (**Figure 48**). After peaking in January 1995, the index began a generally decreasing trend and had fallen by 39% by January 1999, when it reached its lowest level since at least January 1989. The index generally increased from January 1999 to March 2000 when it was about 35% above the level of January 1999. It then began a downward trend and, in June 2001, generally weak metal prices had brought the index to a level that was only about 10% higher than the low of January 1999.

As outlined in Chapter 1, there is a relationship between the level of spending in a particular year and metal prices in earlier years. The decreasing trend in metal prices that began in 1995 was not reflected in spending levels before 1997, partly because of that relationship and partly because of the expenditures on the search for diamonds, which added an element of stability to exploration and deposit appraisal levels. Expenditures (field and overhead costs only) peaked in 1996, started declining in 1997, fell even more in 1998, 1999 and 2000, and, based on company spending intentions, are expected to reach an historical low in 2001. This relationship outlines the importance of improving metal prices in enticing higher exploration and deposit

Figure 48
Exploration and Deposit Appraisal Expenditures (Field Work and Overhead) and Natural Resources Canada's Monthly Metals Price Index, 1991-2001



Source: Natural Resources Canada, based on the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.
 Notes: Exploration and deposit appraisal data for 2000 are preliminary; 2001 data are company spending intentions as compiled in January 2001. For comparison with pre-1997 years, the data include only field and overhead expenditures.

appraisal spending levels. In September 2001, the price of gold averaged US\$283/oz while copper (US\$0.65/lb), nickel (US\$2.28/lb), zinc (US\$0.36/lb), lead (US\$0.21/lb) and silver (US\$4.38/oz) were also at levels not conducive to a significant increase in exploration and deposit appraisal activity.

EXPLORATION AND DEPOSIT APPRAISAL EXPENDITURES BY JUNIOR COMPANIES

As shown in **Figure 47**, junior companies have traditionally played an important role in Canadian mineral exploration and deposit appraisal activity. However, their contribution really expanded in 1984, a year after the introduction of MEDA, when their spending accounted for almost 24% of total exploration and deposit appraisal expenditures. That proportion had more than doubled by 1987 when junior companies accounted for \$883 million (2000 dollars), or 51% of the total of \$1.72 billion spent during that year. Junior spending was also very important in 1988 with almost 50% (\$844 million) of total expenditures. Their proportion of total spending then started to gradually decrease until it reached 21% in 1992.

The levels of spending recorded by junior companies in the 1986-88 period are even more impressive when taking into account the fact that, during that period, considerable contributions were made by junior companies to joint-venture projects operated by senior companies. These contributions were counted as part of senior companies' spending, thus overstating senior expenditures and understating junior expenditures.

Since 1993, junior spending has represented approximately 30% of total expenditures, following basically the same trends as senior company spending. The discovery of diamonds in Canada's North and of nickel-copper-cobalt at Voisey's Bay were the two most important positive factors affecting junior spending between 1993 and 2001. Low metal prices, a slowing world economy and difficulties in raising financing are at the source of the recent decline in junior expenditures, which rose from \$90 million (2000 dollars) in 1992 to \$332 million in 1996 and then

dropped to \$133 million in 2000. At \$152 million (2000 dollars), junior company spending intentions reveal that, despite an important reduction in their number, junior companies are expected to increase their relative importance by contributing 36% of total 2001 exploration and deposit appraisal field and overhead expenditures.

EXPLORATION AND DEPOSIT APPRAISAL EXPENDITURES BY PROVINCE AND TERRITORY

Tables 21 and 22 show exploration and deposit appraisal expenditures (field and overhead costs only) by province and territory in terms of current dollars and 2000 constant dollars. Both tables cover the period 1989 to 2001, which includes the period when MEDA was replaced by CEIP, the difficult period that led to the trough of 1992, the exciting discoveries of 1993 and 1994 and the ensuing increase in spending up to 1996, and finally, the latest downward trend that has brought exploration and deposit appraisal spending down to historical lows.

TABLE 21. EXPLORATION AND DEPOSIT APPRAISAL EXPENDITURES (FIELD WORK AND OVERHEAD) IN CANADA, BY PROVINCE AND TERRITORY, 1989-2001 (CURRENT DOLLARS)

| Province/Territory | Total Exploration and Deposit Appraisal ¹ | | | | | | | | | | | | |
|--------------------------------------------------------------------|------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------------------|-------------------|
| | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 ^p | 2001 ^f |
| | (\$ millions) | | | | | | | | | | | | |
| Newfoundland and Labrador | 36.2 | 23.3 | 12.1 | 11.1 | 8.9 | 12.4 | 71.1 | 92.5 | 58.4 | 40.8 | 29.3 | 23.3 | 23.4 |
| Nova Scotia | 21.4 | 11.0 | 4.5 | 3.3 | 1.8 | 1.7 | 2.8 | 6.9 | 6.7 | 4.8 | 3.6 | 2.7 | 3.6 |
| New Brunswick | 13.6 | 16.5 | 15.8 | 12.2 | 11.1 | 10.0 | 12.7 | 14.8 | 12.2 | 10.0 | 10.0 | 10.4 | 10.2 |
| Québec | 185.0 | 196.4 | 138.1 | 94.1 | 106.1 | 130.3 | 123.4 | 137.2 | 168.6 | 123.5 | 103.4 | 95.7 | 65.6 |
| Ontario | 217.8 | 152.6 | 109.7 | 77.4 | 75.6 | 113.0 | 129.7 | 194.9 | 176.5 | 111.3 | 81.1 | 86.5 | 96.2 |
| Manitoba | 37.0 | 41.2 | 29.7 | 32.0 | 27.4 | 40.5 | 32.6 | 41.2 | 40.3 | 29.5 | 22.6 | 27.1 | 30.1 |
| Saskatchewan | 63.3 | 42.2 | 31.5 | 25.9 | 53.1 | 50.6 | 43.8 | 50.6 | 49.9 | 57.8 | 36.0 | 34.8 | 38.3 |
| Alberta | 6.2 | 10.7 | 6.6 | 5.4 | 7.3 | 9.4 | 10.6 | 10.8 | 20.5 | 21.6 | 11.4 | 7.3 | 7.2 |
| British Columbia | 186.6 | 226.5 | 135.7 | 71.6 | 66.0 | 85.0 | 79.4 | 104.9 | 95.8 | 44.3 | 33.4 | 28.4 | 37.5 |
| Yukon | 15.1 | 18.4 | 16.5 | 9.7 | 19.2 | 25.7 | 39.3 | 46.4 | 40.6 | 17.5 | 12.2 | 8.9 | 10.0 |
| Northwest Territories | 45.7 | 36.0 | 31.6 | 42.7 | 100.7 | 149.5 | 172.2 | 194.5 | 150.7 | 114.8 | 61.0 | 53.4 | 48.1 |
| Nunavut | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 33.8 | 57.6 | 49.6 |
| Total field work (excluding overhead) | 703.5 | 660.3 | 439.2 | 323.5 | 410.1 | 540.5 | 608.1 | 835.9 | 749.5 | 522.4 | 387.6 | 397.1 | 381.1 |
| Total exploration and deposit appraisal (including overhead) | 827.9 | 774.7 | 531.8 | 385.3 | 477.3 | 628.1 | 717.6 | 894.8 | 820.2 | 575.9 | 437.9 | 436.2 | 419.9 |

Source: Natural Resources Canada, based on the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.

.. Not available; ^f Forecast; ^p Preliminary estimate.

¹ For comparison with pre-1997 years, the data include only field and overhead expenditures. They do not include other related expenditures such as those for engineering, economic and feasibility studies, environment and land access. Note: Numbers may not add to totals due to rounding.

TABLE 22. EXPLORATION AND DEPOSIT APPRAISAL EXPENDITURES (FIELD WORK AND OVERHEAD) IN CANADA, BY PROVINCE AND TERRITORY, 1989-2001 (2000 DOLLARS)

| Province/Territory | Total Exploration and Deposit Appraisal ¹ | | | | | | | | | | | | |
|--------------------------------------------------------------------|------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000p | 2001f |
| | (2000 \$ millions) | | | | | | | | | | | | |
| Newfoundland and Labrador | 43.7 | 27.3 | 13.8 | 12.6 | 9.9 | 13.6 | 76.4 | 97.7 | 61.2 | 42.9 | 30.4 | 23.3 | 23.4 |
| Nova Scotia | 25.8 | 12.9 | 5.1 | 3.7 | 2.0 | 1.9 | 3.1 | 7.3 | 7.0 | 5.1 | 3.8 | 2.7 | 3.6 |
| New Brunswick | 16.4 | 19.4 | 18.0 | 13.8 | 12.3 | 11.0 | 13.7 | 15.6 | 12.7 | 10.5 | 10.4 | 10.4 | 10.2 |
| Québec | 223.5 | 230.3 | 157.7 | 106.0 | 117.8 | 143.1 | 132.5 | 144.9 | 176.4 | 130.0 | 107.1 | 95.7 | 65.6 |
| Ontario | 263.1 | 179.0 | 125.3 | 87.3 | 83.9 | 124.1 | 139.4 | 205.9 | 184.7 | 117.1 | 84.0 | 86.5 | 96.2 |
| Manitoba | 44.7 | 48.3 | 33.9 | 36.0 | 30.4 | 44.5 | 35.0 | 43.6 | 42.2 | 31.0 | 23.4 | 27.1 | 30.1 |
| Saskatchewan | 76.5 | 49.5 | 36.0 | 29.2 | 59.0 | 55.6 | 47.1 | 53.4 | 52.3 | 60.8 | 37.2 | 34.8 | 38.3 |
| Alberta | 7.5 | 12.5 | 7.5 | 6.1 | 8.1 | 10.3 | 11.4 | 11.5 | 21.4 | 22.7 | 11.8 | 7.3 | 7.2 |
| British Columbia | 225.4 | 265.6 | 154.9 | 80.7 | 73.3 | 93.3 | 85.3 | 110.7 | 100.3 | 46.6 | 34.6 | 28.4 | 37.5 |
| Yukon | 18.2 | 21.6 | 18.8 | 10.9 | 21.3 | 28.2 | 42.2 | 49.0 | 42.5 | 18.4 | 12.7 | 8.9 | 10.0 |
| Northwest Territories | 55.2 | 42.2 | 36.1 | 48.1 | 111.9 | 164.2 | 185.0 | 205.5 | 157.7 | 120.8 | 63.1 | 53.4 | 48.1 |
| Nunavut | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 35.0 | 57.6 | 49.6 |
| Total field work (excluding overhead) | 849.7 | 774.4 | 501.5 | 364.5 | 455.4 | 593.7 | 653.3 | 882.8 | 784.4 | 549.7 | 401.5 | 397.1 | 381.1 |
| Total exploration and deposit appraisal (including overhead) | 1000.0 | 908.5 | 607.2 | 434.3 | 529.9 | 689.9 | 770.9 | 945.0 | 858.3 | 606.0 | 453.5 | 436.2 | 419.9 |

Source: Natural Resources Canada, based on the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.

.. Not available; f Forecast; p Preliminary estimate.

¹ For comparison with pre-1997 years, the data include only field and overhead expenditures. They do not include other related expenditures such as those for engineering, economic and feasibility studies, environment and land access.

Note: Numbers may not add to totals due to rounding.

APPENDIX 2

Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures

HISTORY OF CANADIAN EXPLORATION STATISTICS

In Canada, mineral exploration statistics have been collected, in one form or another, since 1946. From 1946 to 1963, Statistics Canada compiled “cost of prospecting” data for metal mines for Canada and the provinces. Companies were surveyed from 1964 to 1966, but the data were not compiled. However, using the filled-out survey questionnaires for those three years, Natural Resources Canada (NRCan) was able to estimate expenditures for that period. From 1967 to 1987, Statistics Canada compiled and published both mine-site and general exploration expenditures, as well as mine-site development expenditures and other capital and repair expenditures. From 1985 to 1987, NRCan collected detailed field work expenditures. Since 1988, NRCan has been fully responsible for the survey of non-producing entities that have any type of exploration expenses. Statistics Canada continued to survey producing firms until 1997.

A review of survey definitions was carried out in the mid-1990s to improve the quality of the survey. This revision was undertaken by the Federal-Provincial Committee on Mineral Statistics, in consultation with industry, and was completed in 1997. The resulting Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures was designed to better describe the full mineral development cycle (**Table 23**) and to provide more comprehensive measures of investment in the Canadian minerals and metals industry. Statistics from this survey include detailed information on feasibility studies and other more technically related costs that were previously excluded. The redesigned survey also provides a clearer distinction between the primary exploration and deposit appraisal phases, and additional information on associated environmental costs. Since 1997, NRCan has been fully responsible for the coordination of the federal-provincial/territorial preliminary and forecast survey, and partially responsible for the annual survey for both non-producing and producing firms.

SURVEY PROCESS

Two questionnaires are distributed each year. For example, for the survey period 2000/01, the *preliminary* survey was conducted during the last quarter of 2000 and January 2001, while the more detailed *final* survey questionnaires were distributed in early 2001. The results of this *final* survey are being compiled during the course of 2001. The *preliminary* survey provides preliminary results on 2000 exploration and deposit appraisal activity and a forecast for 2001 that is based on company spending intentions. The *final* survey provides a wealth of project-specific information, including the type of commodities explored for, the type of field work undertaken, related overhead expenditures, the type of company involved, joint-venture partners, and other details.

TABLE 23. Generalized Model of the Mineral Resource Development and Mining Process

| PHASE | MINERAL RESOURCE ASSESSMENT | MINERAL EXPLORATION | | | | | MINERAL DEPOSIT APPRAISAL | | | | MINE COMPLEX DEVELOPMENT | MINE PRODUCTION | ENVIRONMENTAL RESTORATION |
|----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| | | GRASSROOTS EXPLORATION | | | | | DA-1 | DA-2 | DA-3 | DA-4 | | | |
| STAGE | MRA | EX-1 | EX-2 | EX-3 | EX-4 | EX-5 | | | | | | | |
| | | Various surveys, research and synthesis. | Exploration planning. | Regional reconnaissance and surveys. | Prospecting and ground surveys of anomalies. | Verification of anomalies and showings. | Discovery and delimitation of a mineral deposit. | Mineral deposit definition. | Project engineering. | Project economics. | Feasibility study, production decision. | Mine development, construction of processing plant and infrastructure. | Production, marketing and renewal of reserves. |
| OBJECTIVES | Supply information and tools required to develop the mineral potential of the nation for economic benefit, in the perspective of sustainable development. | Select target commodities. Establish exploration objectives and strategies. Select target areas and sites. Acquire claims or permits if appropriate. | Seek anomalies of interest over wide areas by various survey methods. Select the more promising targets. Acquire claims or permits. | Confirm the presence, exact location and characteristics of anomalies. Acquire claims, leases and properties. | Investigate the cause of anomalies. Find mineral showings. Acquire additional claims, leases and properties. | Discover, delimit and interpret grade, quality and tonnage of a new mineral deposit. Determine if it constitutes a mineral resource of "potential economic interest" to justify more intensive and detailed work. | Define the limits, controls and internal distribution of grades, mineralogy and mineral processing characteristics of the deposit. Acquire all data required for project engineering and cost estimation. | Determine, in an iterative fashion, the design, plans, schedules, capital cost and operating cost estimates for all aspects of the project. Establish technical feasibility and costs thoroughly and realistically. | Obtain all the information required and determine, based on corporate objectives, parameters for the economic, financial and social-political evaluation of the project. | Diligently validate and integrate project data, interpretations, estimations, plans and evaluations to achieve MCD and production objectives. Decide on whether to undertake the mining project. Obtain permits and financing. | Complete mine development and construction on schedule and within budgets and specifications. Ensure efficient and timely mine complex start-up according to schedule, specifications and cash flow forecasts. | Achieve commercial production on schedule and meet cash flow forecasts and quality specifications. Achieve mine profitability and company survival in the perspective of sustainable development. | Restore mine site, outside plant and infrastructure to environmentally acceptable condition. Ensure the future quality of the environment. |
| EVALUATION METHODS | Geoscientific, mineral and economic surveys, research, compilations and synthesis by governments, research institutes, universities and industry. | Metal and mineral market research. Review of geological and ore deposit information and of the legal, fiscal and socio-political context in various areas. | Remote sensing, aerial photography and airborne geophysics. Prospecting, geology and geochemistry. Appraisal, rating and selection of anomalies. | Ground, geological, geochemical and geophysical prospecting and surveys. Compilation, appraisal and selection of significant anomalies. | Geological mapping and other surveys. Trenching, drilling and sampling. Appraisal of results, recommendations for further work, and selection of new targets. | Stripping, trenching, mapping, sampling, drilling and down-hole geophysics. Initial mineral processing tests. Environmental and site surveys. Mineral resource estimation and inventory. | Detailed mapping, sampling and drilling on surface or from underground. Systematic mineralogy and mineral processing tests. Detailed environmental and site surveys. Pre-feasibility studies. | Pilot tests, engineering design and planning. Capital and operating costs for mining, mineral processing, infrastructure, environmental protection and restoration. Technical risk analysis. Pre-feasibility studies. | Market, prices, product development and financial studies. Environmental, economic, financial, and socio-political risk analysis. Pre-feasibility studies. | Exhaustive due diligence review of all data, interpretations, plans and estimates. Evaluation of profitability, given the geological, technical, financial and qualitative risks, and the up-side factors. | Project management methods in a quality assurance perspective. Training program for personnel and detailed start-up plan to meet the requirements of this demanding period. | Production management methods to ensure continuous quality and efficiency improvements. Exploration, deposit appraisal and development of new zones or deposits on-mine-site and off-mine-site. | Mine closure and decommissioning. Environmental restoration and monitoring. |
| RESULTS | Maps, data bases, tools and models. | Exploration projects. | Regional anomalies. | Local anomalies. | Mineral showings. | Mineral deposit. | Deposit appraisal project. | | | Mining project. | Mining complex. | Mineral production. | Restored site. |
| MINERAL INVENTORY | UNDISCOVERED MINERAL POTENTIAL | | | | | INFERRED RESOURCE | DELIMITED MINERAL RESOURCE | | | | MINERAL RESERVE | | |
| | SPECULATIVE | | | HYPOTHETICAL | | | INDICATED | INDICATED AND MEASURED | | | PROVEN AND PROBABLE | | |
| ESTIMATION ERROR (targeted margin of error of tonnage/grade estimates at the 90% confidence level) | | | | | | ± 100% | ± 50% | Indicated: ± 50 to ± 30% Measured: ± 20 to ± 10% (often several sample grid dimensions are used in each category) | | | Proven (feasibility: ± 10%; mining: ± 5%) | | Full compliance |
| INVESTMENTS | Moderate | Low, but increasing multiple investments. | | | | Larger and increasing multiple investments. | | | | Very large industrial investment. | | | |
| RISK LEVEL | Low | Very high, but decreasing risk of failure and financial loss. | | | | High, but decreasing risk of failure. | | | | Moderate to low industrial risk. | | | |

Sources: Modified by D.A. Cranstone, A. Lemieux and M. Vallée, February 25, 1994, from M. Vallée, 1992, *Guide to the Evaluation of Gold Deposits*, CIM Special Volume 45, p. 4, and SOQUEM Annual Report, 1976-77, pp. 4 and 5. Revised by M. Vallée and G. Bouchard, January 2001.

A total of 1363 questionnaires (preliminary survey) were distributed in October 2000. Some companies receive more than one questionnaire depending on the number of provinces/territories in which they are conducting activities. To avoid duplicate reporting, joint-venture participants who are not project operators do not report expenditures on such joint-venture projects. Companies are asked to report expenditures for the calendar year surveyed.

The survey is a full census of all the companies involved in mineral exploration, deposit appraisal and mine complex development in Canada. To protect the confidential data provided by the respondents, only aggregate statistics are released. However, specific information can be added when such information has already entered the public domain.

DEFINITIONS USED IN THE SURVEY

A number of new definitions were introduced in the new survey to more closely reflect the current realities of Canadian mineral exploration and development activities. These definitions were developed and agreed upon by federal, provincial/territorial and industry representatives, and they were tested by companies that volunteered to ensure their relevance and applicability. The following is a summary of the definitions most referred to in this report. For a more comprehensive list of definitions, along with more complete descriptions, the reader is invited to consult the Reporting Guide for the Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Expenditures. This guide is available from NRCan or from provincial/territorial survey partners.

Mineral Development Phases (Work Phases)

Exploration expenditures represent all field activities, including capital, repair and maintenance expenditures, carried out (on- or off-mine-site) to search for, discover and carry out the first delineation of a previously unknown mineral deposit to establish its potential economic value (tonnage and grade) and to justify further work.

Deposit appraisal expenditures represent all field activities, as well as capital, repair and maintenance expenditures, carried out (on- or off-mine-site) to bring a delineated deposit to the stage of detailed knowledge required for a feasibility study to justify and support a production decision and the investment required.

Mine complex development expenditures include all mine development, capital (construction, machinery and equipment), repair and maintenance expenditures carried out on a mine property that is in production or committed to production.

Mine development expenditures include all activities carried out on a property that is in production or committed to production to define, block out, and gain access to the ore and prepare it for production. Mine development also includes drilling, rock work and support to extend the current ore reserves.

Location of Activity

On-mine-site expenditures represent all field activities and capital, repair and maintenance expenditures applied to exploration or deposit appraisal for an additional mineral deposit separate from the current mine reserves and located strictly on an existing mine site in production or committed to production.

Off-mine-site expenditures represent all field activities and capital, repair and maintenance expenditures applied to exploration or deposit appraisal that are not located on a mine site that is in production or committed to production. Off-mine-site includes the sites of temporarily or permanently closed mines and advanced projects not yet committed to production.

A *mine site* is an area than can be accessed and exploited from the current or committed installations; hence, the size of this area will vary depending on the commodity under consideration, attitude (horizontal vs. vertical), type and extent of the deposit(s), and the mining method(s) in use.

For a mine site to be *committed to production*, all of the following criteria must be met: (i) a production feasibility study has been completed; (ii) a formal production decision has been reached by the organization; (iii) the necessary financing is on hand or has been arranged; (iv) all required authorizations and permits have been obtained; and (v) major pieces of production equipment have been purchased or ordered.

Surface and Underground Field Surveys and Work (Includes Field Overhead)

Surface and underground field surveys and work includes expenditures associated with geoscientific surveys, drilling, rock work, other field costs, and engineering, economic and feasibility studies. It includes wages, salaries, fringe benefits, food, accommodation and other services, equipment rentals, all vehicle expenses, transportation costs (for people and equipment), and all related technical activities/services such as planning, data collection, interpretation, mapping and reports. The costs incurred by the project operator and contractor(s), as well as field supervision and management costs, are also included. All surveys and work done for environmental purposes are entered under the environment section. This would apply, for example, to geochemical or geophysical surveys performed to characterize or monitor the environment.

Engineering studies include all expenditures related to the additional studies, tests and pilot work (mining, mineral processing, metallurgy, dewatering, etc.), plans, designs and appraisals required to establish the technical feasibility of a mining project.

Economic studies include all expenditures for economic studies (markets, product development, price studies, financing, etc.) required to establish the economic feasibility of a mining project.

Feasibility studies include all expenditures related to prefeasibility project reviews and to the production of feasibility studies required to develop and mine a deposit, and to obtain the required leases, permits and authorizations (excluding environmental and land access expenditures).

Environment-Related Expenditures

Environmental characterization includes all costs of environmental characterization and assessment (including environmental impact studies).

Environmental permits include all costs related to the process of meeting the legal and regulatory requirements or guidelines for environmental assessment and for obtaining permits (including pre-production permits) required for the work program under consideration.

Environmental protection includes costs for monitoring (additional to normal practices) and complying with laws, regulations and guidelines related to air emissions, liquid effluents, ground pollution, and wildlife and habitat protection. Environmental fines, if any, are included in this category.

Environmental restoration includes all costs of decommissioning, reclaiming and restoring, and monitoring, if required, after the completion of exploration and deposit appraisal field work.

Land Access-Related Expenditures

Land access requirements, permits and damages include all costs related to establishing impact and benefit statements, socio-economic agreements, and other requirements for mine complex

development and mine production, and the costs of rights of way, damages and permits for exploration and deposit appraisal work, including all associated legal fees, but excluding all environment-related costs.

Capital, Repair and Maintenance Expenditures

Capital expenditures for construction, machinery and equipment include expenditures by the company for work performed by contractors or by the company for its own account, such as salaries and wages, materials and supplies, and other charges such as engineering and consulting fees. Environment-related capital expenditures for protection and site restoration are included in this category.

Non-capitalized *repair and maintenance expenditures* consist of the gross non-capitalized repair expenditures on non-residential buildings, other structures and machinery, the costs of maintaining the restored mine site, and the routine care of assets, including environmental monitoring of the restored mine site.