SOME USES OF MINERAL RESOURCE DATA FOR POLICY ANALYSIS

by

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ABSTRACT

The National Mineral Inventory and Corporate Records are two of the databases maintained by the Mineral Policy Sector of Energy, Mines and Resources Canada.

These databases have provided much of the information needed for a large number of analyses and studies carried out over the past 15 to 20 years for the formulation of mineral policies for Canada.

Such studies have included: estimations of Canada's mineral resources, the selection of sites for national parks, assessments of proposed transportation routes, examination of the rates and costs of discovering mineral deposits in Canada, evaluations of the relative successes of junior and senior exploration companies, looking at trends in the numbers of promising mineral deposits in Canada, assessing patterns of change in the levels of Canadian ore reserves, and the making of forecasts of Canadian production capability for certain major metals.

These databases have also found certain applications in the private sector, notably as tools for the selection of deposit-specific and regional targets by mineral exploration companies.

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INTRODUCTION

One of the objectives of this conference is to encourage the exchange of ideas and experiences among the many of us here today who are involved in the collection, dissemination, management or utilization of geoscience information. In this particular session, we are going to hear about resource databases and their use in decision making. This paper deals specifically with databases related to mineral resources.

The authors of this paper are employed by the Mineral Policy Sector of the Canadian federal government Department of Energy, Mines and Resources. The Mineral Policy Sector collects mineral resource and resource-related data which it makes available in various formats to other government agencies, to exploration and mining companies, to industry associations, to academia and to the general public.

However, the Mineral Policy Sector is also a prime user of the data that it collects. The variety of uses of mineral-resource and related data within the Mineral Policy Sector is the main focus of this paper.

THE NATIONAL MINERAL INVENTORY OF CANADA

The National Mineral Inventory of Canada and Corporate Records are two of the major databases maintained by the Mineral Policy Sector.

Many of you will have already discovered the National Mineral Inventory exhibit located in the commercial exhibition area of this conference. Mr. Andy Sozanski, the manager of the National Mineral Inventory, will be pleased to show you sample reports prepared from the Inventory and to answer any questions that you may have about this database. For the benefit of those who have yet to visit the exhibit, we will briefly describe the main features of the National Mineral Inventory.

The National Mineral Inventory contains selected information on almost 30,000 mineral occurrences, mineral deposits as well as current or former mines in all provinces and territories of Canada. **Figure 1** shows both sides of a typical National Mineral Inventory record. A typical record contains:

Property Name
Main mineral commodity and associated commodities
Province or territory
Feature located
Latitude and longitude
Mining division, mining district, township
National topographic system reference
Brief geological description of deposit
Exploration and development history
Production history: (tonnage mined, average grade, etc.)
Bibliographic sources of data
Map references
Date of compilation, compiler's name
Other information

National Mineral Inventory records are used to produce a variety of summary and index reports of interest to the Canadian exploration industry. Among the more widely used recent ones are "Canadian Mineral Deposits Not Being Mined in 1989", which lists some 1,600 known Canadian mineral occurrences for which tonnage and grade have been determined; Map 900A- (39th edition) "Principal Mineral Areas of Canada"; "Gold Deposits and Occurrences in Canada- February 1989" and "Base Metal Deposits and Occurrences in Canada- February 1989". The latter two publications are computerized indexes to all deposits contained in the National Mineral Inventory card file reported to contain gold or base metals respectively.

CORPORATE RECORDS

Over the past 100 years or so, the Mineral Policy Sector and its predecessor organizations have assembled a comprehensive collection of company annual reports, press releases, stock exchange and securities commission reports, articles clipped from mining and business periodicals and other related data. This collection, which is organized on a company-by-company basis, has grown over the years and currently occupies almost 300 metres of shelf-space in our Ottawa offices.

For small companies, these records are normally attached chronologically in a file folder. However, large companies have specific files for each of the main categories of records listed above. The largest collection of company records is that for Inco Limited and its predecessor companies which contains material dating back to 1903 and occupies some 1.5 metres of shelf space. It is not uncommon to have to search files for the early 1900s for information relevant to current mineral policy topics.

Apart from being accessible to the general public, this collection of corporate records is an indispensable source of basic information for the preparation of National Mineral Inventory records. It is also an essential source of information in the day-to-day work of many of us in the Mineral Policy Sector. The authors are probably the two largest users of information from corporate records in the Department.

POLICY ANALYSIS

The National Mineral Inventory and Corporate Records have provided essential data for studies leading to mineral policy decisions. Experience has shown that the exploration, development and production histories are usually the most useful items of National Mineral Inventory information.

National Mineral Inventory records are assembled from a wide range of sources and the resulting histories of exploration, development and production are often the only comprehensive source of information that exists for most Canadian mineral deposits or mineral occurrences.

Data contained in the National Mineral Inventory and in Corporate Records have been used extensively in studies designed to answer questions such as:

Are we now finding the many mineral commodities produced in Canada at rates comparable to those of the past?

Is it becoming more expensive to discover ore in Canada?

Can we expect to discover new orebodies in the future at rates and costs that will enable Canada to remain a competitive producer of minerals?

What level of mineral-exploration expenditures is required to maintain current Canadian production or to maintain world market share?

Are there specific mineral commodities for which Canadian mineral-exploration efforts should be concentrated in order to maintain Canadian output and concentrate feed for Canadian smelters?

Are junior companies or senior companies more effective at finding mineral deposits?

What have historical rates of ore discovery been in the various mining districts in Canada? Have rates of discovery been declining so as to indicate resource depletion in specific mining districts? Can we still count on mining as a major source of employment in such districts or should alternatives be sought?

A few of the policy-oriented projects that were carried out over the past 15-20 years using National Mineral Inventory and Corporate Records are described below.

1. Resource Assessment

In the early 1970s, a major project was undertaken to evaluate Canada's resources of the major metals. This project relied on expertise from the Canada Centre for Mineral and Energy Technology and from the Mineral Policy Sector, but mainly from the Geological Survey of Canada, which supplied some 10 to 12 scientists, all of them specialists in mineral-deposit geology, for several months.

This project resulted in the first compilation of Canada's reserves and known resources and estimates of as-yet-undiscovered resources of copper, nickel, zinc, lead, molybdenum, uranium and iron ore. Reserves and resources were subdivided into different economic categories.

Listings of Canadian mines, known mineral deposits, production, tonnages, grades and the like were obtained largely from the National Mineral Inventory.

2. Site Selection for National Parks

During the 1970s and 1980s, the Department of Energy, Mines and Resources was asked for advice concerning possible locations of new national parks. Evaluation by the Geological Survey of Canada of the mineral potential of such sites was one of the elements contributing to such policy decisions. The National Mineral Inventory provided data that were important in the selection of park locations and park boundaries.

3. Mineral Area Planning Study

In the late 1960s and early 1970s, the Government of Canada received many requests for the funding of certain mineral-

related activities. Setting priorities for available funds was a major problem faced by decision makers. A major study was carried out in the Department of Energy, Mines and Resources to provide the background needed to help in setting priorities. Much of the analysis of mineral potential was based on data from the National Mineral Inventory.

Figure 2 is a mineral potential map of the different geological regions of Canada. This map is one of over 60 illustrations found in the "Mineral Area Planning Study" prepared, in April 1975, by the Mineral Policy Sector.

The Mineral Area Planning Study was meant to answer questions such as:

> What are the forecast domestic and export requirements for copper, nickel, lead, zinc, molybdenum, iron ore, and uranium -- the major metallic mineral commodities mined in Canada?
>
> What is the forecast availability of each of these minerals to the year 2000, both from current Canadian mines and from mines likely to be developed from currently-known deposits?
>
> What quantities of additional reserves will have to be generated in Canada to meet the forecast domestic and export requirements, and when?
>
> In which mineral-producing regions of Canada will levels of production capability expand or decline? Where and when are mine closures due to depletion likely to cause regional problems?
>
> For what commodities, in which regions, and in what way could efforts be directed toward developing mineral potential?
>
> For what commodities and in which regions could development efforts be deferred?

4. Transportation Planning

We have already mentioned the periodic National Mineral Inventory publication "Canadian Mineral Deposits Not Being Mined". There have been six editions to date, in 1976, 1978, 1980, 1983, 1986 and the latest in 1989. Some 8,000 copies have been distributed over the past fourteen years.

The first edition was prepared in 1975-76 because a catalogue of known but unmined Canadian mineral deposits was

needed to assist with the making of policy decisions concerning new transportation routes such as the then-proposed oil and gas pipelines from the Arctic, a proposed railroad for the Yukon and proposed new northern roads, in all of which the federal government was to be involved.

Prior to the compilation of the first edition of "Canadian Mineral Deposits Not Being Mined", there was no single easily-accessible inventory of the mineral deposits located near the proposed routes. Such deposits could benefit from changes to the proposed routes or might provide additional sources of freight.

5. Canadian Ore Discovery Rates

Over the years, five different studies of ore-discovery rates and discovery costs in Canada have been prepared in the Mineral Policy Sector and predecessor organizations (Cranstone and Martin, 1973; Cranstone, 1980a, 1980b; Cranstone, 1982; Cranstone, 1985; Cranstone and Lemieux, 1988; Cranstone, 1989; Cranstone and Whillans, 1989). Without the National Mineral Inventory and Corporate Records to complement exploration-expenditure data collected by Statistics Canada and the Department of Energy, Mines and Resources, none of these studies would have been feasible.

Annual exploration-expenditure statistics for Canada were first gathered by the Government of Canada for the year 1946. Such data are not available for prior years. Although quantities of metal discovered in Canada can be analyzed starting with the first orebody that was discovered in 1845, Canadian ore-discovery costs can be measured only for the period after 1945.

National Mineral Inventory and Corporate Records were the major sources of information used to prepare comprehensive lists of Canadian mineral deposits and mines. These records were also invaluable in assigning a year of discovery to each of the more than 2,500 metallic mineral deposits (excluding deposits of iron) that have been discovered in Canada over the past 150 years. They were also indispensable in compiling past production and determining remaining ore reserves for each deposit.

The following illustrations are taken from the most recent of the three analyses of overall Canadian rates of ore discovery and ore-discovery costs. This study covers the period 1946 to 1982 inclusive. For further details concerning this or other studies, see the attached list of references.

Figure 3 (Cranstone, 1989) shows the value of metal contained in Canadian mineral deposits discovered over the period 1946-1982. The amount of each metal contained in each of the deposits discovered over this period has been multiplied by a corresponding market price (adjusted for inflation) in order to be able to add together the value of various quantities of copper, zinc, silver, gold, and so on, measured in tons or ounces, depending on the metal.

The years 1954-1956 mark an anomalously-high period of discovery. Major discoveries took place during that period, most likely because of the application of newly-developed airborne geophysical techniques and because the first thorough exploration programs were then successfully carried out in what subsequently became major Canadian mining districts.

While **Figure 3** shows the results of exploration, it does not take mineral-exploration expenditures into account. **Figure 4** (Cranstone, 1989) portrays Canadian exploration expenditures over the same three-year periods, adjusted to remove the effects of inflation.

Figure 5 (Cranstone, 1989) shows the value of metal discovered in Canada per dollar spent on exploration. This is obtained by dividing the value of discoveries by the amount spent on exploration for each three-year period. Two features stand out: (1) an anomalous discovery peak over the 9-year period 1948-1956 and (2) the significantly lower discovery success over 1978-1982 inclusive, the last five years of the study period.

Although the periods 1948-1950 and 1951-1953 did not stand out in the illustration of discoveries (**Figure 3**), they do in **Figure 5** because of the low exploration expenditures during those periods relative to the quantities of metal discovered.

Figure 6 (Cranstone, 1989) shows that only a few major deposits and mining districts contain the major portion of the "value" of metals discovered in Canada over the period 1946-1982. **Figures 7, 8, and 9** (Cranstone, 1989) show the quantities of copper, zinc and molybdenum discovered in Canada over the period 1946-1982. Similar illustrations were published for 15 metals.

Figure 10 (Cranstone, 1989) depicts the quantities of copper discovered in Canada by the seven geological deposit types of significance for copper occurring in Canada. Similar illustrations were published for zinc, uranium, silver and gold.

The analysis on which **Figure 10** is based required extensive consultation with deposit specialists at the Geological Survey of Canada because the updating of information on deposit type in National Mineral Inventory records had yet to be completed. When the descriptions of deposits are brought up to date, it will be possible to carry out more of this type of analysis using the National Mineral Inventory alone.

Although exploration-expenditure data go back only to 1946, one can use National Mineral Inventory records to compile discovery rates for the major metals from the beginning of mineral exploration and discovery in Canada. **Figure 11** (Cranstone, 1985) shows gold discovered in Canada per ten-year period from the time of the first Canadian gold discovery. Despite a history of gold exploration in Canada over the past one-and-a-half centuries, the discovery analysis indicates that more gold was found in Canada during the ten-year period 1976-1985 than in any other previous ten-year period.

Figure 12 (Cranstone, 1985) portrays the total quantities of gold that have been discovered in gold deposits and in base-metal deposits since the first Canadian gold discovery.

Figure 13 (Cranstone and Whillans, 1989) shows the names of deposits and quantities of uranium in the measured, indicated and inferred resource categories discovered in Canada per three-year period from 1930, the year the first significant Canadian uranium deposit was discovered (at what became Port Radium) on the east shore of Great Bear Lake in the Northwest Territories.

Figure 14 (Cranstone and Whillans, 1989) indicates rates of uranium discovery by geological deposit type. The Precambrian quartz-pebble conglomerates of Elliot Lake, Ontario, and the deposits related to the unconformity of the late Precambrian Athabasca Basin of northern Saskatchewan stand out. The discovery balance has shifted somewhat since this graph was prepared, because major additional unconformity-type deposits have been discovered in Saskatchewan since 1983.

Table 1 (Cranstone and Whillans, 1989) shows Canadian and Saskatchewan uranium discovery costs over the period 1971-1983. The low discovery costs in Saskatchewan are notable.

6. Relative Exploration Success of Junior and Senior Companies

For many years, the Canadian mining press and the authors of various published papers have claimed that small mineral-exploration companies commonly called "junior companies" had outperformed the senior companies in mineral exploration. It is still widely believed that the juniors have found more mineral deposits than the seniors and that they found them at a lower average cost.

But no solid proof for these opinions had ever been offered. The lack of proof was not surprising, because the preparation of a list of discoveries alone would have been an enormous task. To accurately determine the discoverer and the year of discovery for each deposit would have been a prohibitively time-consuming task.

A partial solution became apparent. The Canadian ore discovery analysis, for which we showed you slides earlier, provided an already-completed list of discoveries with discovery year, tonnages and grades and estimates of how much larger each unmined deposit is likely to be. But this list contained almost 1,000 mineral deposits; determining which of some 1,000 deposits were discovered by a junior company or by a senior company still constituted an impossible task. There was a practical solution: a list of the 123-largest deposits discovered (deposits each with a value of contained metal greater than $1 billion at January 1979 metal prices) accounted for 84% of the total gross value of metals contained in the nearly 1,000 deposits discovered. To facilitate the analysis, the period of analysis was changed from 1946-1982 to 1947-1982 inclusive, yielding four 9-year discovery periods for time-comparison purposes.

Figure 15 (Cranstone, 1988) shows that over the 36-year period 1947-1982, senior companies discovered most of the metal found in Canada. When exploration expenditures made by each of the two groups of companies are taken into account, it turns out that the seniors made 79% of the total exploration expenditures and are responsible for the discovery of 79% of the value of metal discovered. The juniors incurred 21% of the exploration expenditures and found 21% of the metal discovered. The statistics that are the basis for **Figure 15** are presented in **tables 2 and 3** (Cranstone, 1988).

7. Are Ore Grades Declining in Canada?

Martin and Jen (1988) examined grades of ore produced in Canadian copper, zinc, lead, nickel, molybdenum, silver and gold mines at approximately ten-year intervals from 1939 through

1979. Estimates were made for 1989, based on expected production from existing mines, deposits then being prepared for production and likely extensions to then existing mines.

The historical production data needed for this study were gathered from various sources including National Mineral Inventory and Corporate Records. The study found that, despite significant growth in Canadian mineral production in general, there was no clear decline in the average grade of metal ores mined in Canada over the 50-year period 1939 to 1989. Depletion had not had any clearly identifiable effect on grades of ores mined.

In their analysis, Martin and Jen considered porphyry-type copper ores and non-porphyry copper ores separately. They found that for each type considered alone, there had not been a significant grade decline over 50 years. If tonnages and grades of porphyry and non-porphyry-type ores are combined, then the average grade of copper ores mined in Canada had declined, but this was because of the discovery of low-grade porphyry-type copper deposits mined using low-cost mechanized open-pit methods. Such low-grade deposits became profitably mineable and resulted in significantly-increased Canadian copper production: Overall copper ore grades declined because it became profitable to mine lower-grade ore.

Similarly, during the late 1970s and early 1980s, the average grade of gold ore mined in Canada declined temporarily, but only because the considerable increase in the price of gold made it profitable to mine lower gold grades.

Martin and Jen concluded that, over the 50-year period 1939-1989, Canadian exploration geologists have managed to continue discovering mineral deposits comparable in quality to previous discoveries.

8. Promising Canadian Mineral Deposits

Apart from the large number of mineral occurrences where exploration is progressing towards the calculation of a tonnage and grade, there are in the order of 1,000 already-recognized metallic mineral deposits currently being worked on in Canada. While some of these deposits are close to production decisions, many are still in the early stages of exploration.

Corporate Records are indispensable for a first assessment of which of this overwhelming number of deposits are likely candidates for mine development in the foreseeable future, what metal production they might sustain, in what areas of the country new mines are likely to be developed, the likely size of

new operations, and the earliest date when production might start. **Figure 16** (Lemieux, 1990) is taken from a 14-page table listing 268 mineral deposits from which production is most likely to come in the foreseeable future.

9. Canadian Ore Reserve Trends

Copper, nickel, lead, zinc, molybdenum, silver and gold production represents about 85% of the total $13.3 billion value of the more than two dozen non-fuel metals produced in Canada in 1989.

The level and trend of reserves of these metals has important implications for future production. **Figure 17** (Lemieux, Jen, Cranstone and Bouchard, 1990) shows the declining trend in reserves of base metals and the meteoric rise in reserves of gold since the early 1980s. These reserve estimates are based on a federal-provincial survey of mines and concentrators that is supplemented considerably with data from Corporate Records.

10. Production Capability for Major Metals

Figure 18 (Cranstone and Lemieux, 1988) depicts expected Canadian production for copper based on data available during the early part of 1988. It shows that production of copper is expected to decline considerably after 1993. This has, among other considerations, important implications with respect to exploration if Canada is to maintain production and market share in the years to come. This study, which also examined the situation for zinc and lead, could not have been done without data on undeveloped deposits and additional data on reserves contained in Corporate Records as a supplement to a federal-provincial survey of mines and concentrators.

Figures 19, 20 and 21 (Cranstone and Lemieux, 1988) and **Figure 22** (Cranstone, 1989) indicate historical rates of Canadian copper, zinc, lead and nickel discovery per 10-year period from 1846 to 1985. These were used (Cranstone and Lemieux, 1988; Cranstone, 1989) in conjunction with **Figure 18** (copper) and comparable graphs for zinc, lead and nickel to assess how likely it will be that sufficient quantities of these metals can be found in the near future to sustain current Canadian production levels from the 1990s into the next century.

PRIVATE SECTOR USE OF THE NATIONAL MINERAL INVENTORY AND CORPORATE RECORDS

Complete sets of National Mineral Inventory records are available for examination at no charge in Ottawa at the offices of Mineral Policy Sector, at the Geological Survey of Canada and at the National Library of Canada. Copies of these records can also be purchased from the Mineral Policy Sector. Copies on paper for most deposits currently cost 25 to 50 cents, depending on the amount of information that they contain.

National Mineral Inventory records and Corporate Records have also found uses in the private sector. Some large Canadian mining companies maintain their own files of National Mineral Inventory records. Other companies order specific records as they need them.

The Canadian exploration industry could probably make more profitable use of the National Mineral Inventory. Many new Canadian mines have been developed subsequently from deposits that were available for staking and were listed in the National Mineral Inventory.

As well, industry has made some use of the Mineral Policy Sector's Corporate Records. Many Canadian mining companies have their head offices in Toronto, and until this year, they have had access to corporate files maintained by The Northern Miner, Canada's weekly mining newspaper. Reference to the Mineral Policy Sector's Corporate Records could well increase in the future, as a result of the recent decision of the Northern Miner to limit public access to its corporate files.

CONCLUSIONS

The studies described in this paper are all based on the Mineral Policy Sector's National Mineral Inventory and Corporate Records. These studies represent but a sample of the many policy-related uses that have been made from the National Mineral Inventory and from Corporate Records.

What is clear is that these two databases are essential for the formulation of mineral policy for Canada. Comparable databases would no doubt yield equally-useful results for other mineral-producing countries. It is never too late to start assembling such data. Databases that, at inception find little use, rapidly become tools essential for policy uses.

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Figure 1(a)

A TYPICAL NATIONAL MINERAL INVENTORY RECORD

PRODUCT *PRODUIT*	PROVINCE OR TERRITORY *PROVINCE OU TERRITOIRE*	N.T.S. AREA *RÉGION DU S.N.R.C.*	REF. *RÉF.*
GOLD	Ontario	41 O/9	AU 1

NAME OF PROPERTY *NOM DE LA PROPRIÉTÉ*: JEROME MINE

OBJECT LOCATED – *OBJET LOCALISÉ*: Claim S 32071.

UNCERTAINTY *FACTEUR D'INCERTITUDE*: (Shaft area) Lat. 47°37'10" Long. 82°14'30"

Mining Division *Division minière*	Sudbury	District *District*	Sudbury
County *Comté*		Township *Canton*	Osway, Huffman
Lot *Lot*		Concession or Range *Concession ou rang*	
Sec *Sect.*	Tp. *Ct.*	R. *R.*	

OWNER OR OPERATOR */PROPRIÉTAIRE OU EXPLOITANT*

DESCRIPTION OF DEPOSIT */DESCRIPTION DU GISEMENT*

Rock exposed on the property is for the most part grey-wacke, with some conglomerate. These have been extensively intruded by dykes and bodies of syenite porphyry. According to Moorhouse (1949, p. 21), "The mineralized zone is complex in structure and composition. It comprises a zone of cherty bluish-grey quartz from 3 to 4 feet wide on the north wall, and on the south wall a discontinuous vein zone, in places consisting of stringers of bluish quartz." The zone lies at or near the contact of the sediments with a tongue of porphyry or highly phorphyritized sediments. In addition to its lenticular nature, which is a primary feature of the vein structure, the mineralized zone is further broken up by numerous faults. The main vein is fairly persistent, varies in width from 5 to 75 feet, and is locally interrupted. Mineralization consists of native gold in association with pyrite, chalcopyrite, tetrahedrite, galena, sphalerite and molybdenite. Not all of the mineralized vein material constituted ore.

Associated minerals or products – *Minéraux ou produits associés*: Silver, molybdenite.

HISTORY OF EXPLORATION AND DEVELOPMENT
HISTORIQUE DE L'EXPLORATION ET DE LA MISE EN VALEUR

The property consists of a group of 62 patented claims and surface rights on 2 others, located in Osway and Huffman townships.

The vein zone on which most of the development has been done was discovered by Bert Jerome in 1938, while prospecting for Mining Corporation of Canada, Limited. On February 23, 1939, Jerome Gold Mines, Limited was incorporated acquiring from Mining Corporation 48 claims in Osway and Huffman township. During the winter and early spring of 1939 exploration and diamond drilling were carried out and a mining plant installed and shaft sinking begun on claim S 32070.

In 1941 the remaining claims making up the present property were acquired by purchase and staking. The erection of a 500-ton cyanide mill begun early in the year was completed and began operation on August 20. The mill continued to operate until August 31, 1943. Underground development continued until June 1945 when all operations ceased.

The underground workings consist of a 3-compartment vertical shaft to a depth of 1,138 feet. Lateral development consists of the following:-

Level	Drifts (ft.)	Crosscuts (ft.)	Raises (ft.)
200	3,736	658	758
350	4,685	986	995
500	4,489	447	895
650	3,651	214	549
725 (Loading Pocket)			205
800	2,521	193	
950 (Station only)			
1,100	2,018	647	

At the time work ceased reserves were calculated by the company, allowing for a 10% dilution factor, at 344,000 tons averaging 0.19 oz/ton gold. (CMH 1946, p. 159). In 1969, Jerome's charter was cancelled. In 1975, E.B. Eddy Forest Products Ltd. owned the property.

G.F. Ross optioned the claims in October 1979. The following year, Bridgeview Resources Inc. acquired the Ross option and performed linecutting and IP surveying. Diamond drilling, sampling and underground rehabilitation were planned for late 1980.

see Card 2 ....

Mineral Policy Sector, Department of Energy, Mines and Resources, Ottawa
Secteur de la politique minérale, ministère de l'Énergie, des Mines et des Ressources, Ottawa
504541 8

Figure 1(b)

A TYPICAL NATIONAL MINERAL INVENTORY RECORD

HISTORY OF PRODUCTION/*HISTORIQUE DE LA PRODUCTION*

Year	Tons Milled	Gold (oz)	Silver (oz)
1941	58,824	8,756.89	2,439.72
1942	168,628	29,480.65	7,744.27
1943	107,608	18,640.89	4,920.80
Total	335,060	56,878.43	15,104.79

The average recovery grade of the 335,060 tons of ore milled is 0.169 ounces gold and 0.045 ounces silver per ton and in 1956, 14 ounces of gold and 9 ounces of silver were recovered (Gordon, J.B. et al., pp. 293-294, 1975).

MAP REFERENCES/*RÉFÉRENCES CARTOGRAPHIQUES*

Map 1949-2, Township of Osway, (Geol.), Sc. 1":1,000'.

Map P 285, Ridout Sheet, (Geol.), Sc. 1":2 miles.

Map 44 g, Opeepeesway Lake Area, (Geol.), Sc. 1":1 mile.

Map P 2369, Jerome Area (West), (Geol.), Sc. 1:15,840.

Map 2261 G, Opeepeesway Lake, (Aeromag.), Sc. 1":1 mile.

REMARKS/*REMARQUES*

REFERENCES/*BIBLIOGRAPHIE*

Moorhouse, W.W.; Geology of Osway Township; Ontario Department of Mines, Annual Report Vol. 58, 1949, Pt. 5, pp. 18-22.

Brown, W.L.; Jerome Mines; In "Structural Geology of Canadian Ore Deposits"; Can. Inst. Min. Met., 1948, pp. 438-441.

Ontario Department of Mines; Annual Reports: Vol. 49, 1940, Pt. 1, p. 135; Vol. 50, 1941, Pt. 1, p. 57; Vol. 51, 1942, Pt. 1, pp. 120-122; Vol. 52, 1943, Pt. 1, pp. 121-123; Vol. 53, 1944, Pt. 1, pp. 109-111; Vol. 54, 1945, Pt. 2, p. 44; Vol. 55, 1946, Pt. 2, p. 37.

Mineral Policy Sector; Corporation File: "Jerome Gold Mines, Limited"; "Jerome Gold Mines Corporation"; "Muscocho Explorations Limited".

Gordon, J.B., et al.; Gold Deposits of Ontario, Part 2; Ontario Division of Mines, Open File Report 5156, pp. 293-294, 1975.

The Ottawa Citizen, 16/06/83.

Comp./Rev. By / *Comp./rév. par*			RF	RF	VF	VF	VF	JL	JL
Date / *Date*	03-69	03-78	12-78	09-80	04-81	03-83	07-83	12-85	10-88

Figure 1(c)

A TYPICAL NATIONAL MINERAL INVENTORY RECORD

PRODUCT *PRODUIT*	PROVINCE OR TERRITORY *PROVINCE OU TERRITOIRE*	N.T.S. AREA *RÉGION DU S.N.R.C.*	REF. *RÉF.*
GOLD	Ontario	41 O/9	AU 1

NAME OF PROPERTY *NOM DE LA PROPRIÉTÉ*: JEROME MINE

HISTORY OF EXPLORATION AND DEVELOPMENT (continued)
HISTORIQUE DE L'EXPLORATION ET DE LA MISE EN VALEUR

In 1980, the shaft was dewatered, u/g sampling done and 9 drill holes (2,500') put down. This work confirmed the old tonnage and grade figures. One ddh averaged .15 oz/t Au over 60'. The headframe is on the property and ready to be assembled in May. (Personal communication, Phil Brown, North Bay, 23/04/81).

Property could see production in the summer of 1983 (pers. comm. P. Brown, 14/2/83).

Bridgeview ran into financial difficulties and the buildings were seized by the Sherriff of the District. Osway Explorations Limited have made an arrangement to hold the property. Osway owns the adjoining property that has gold, silver values and in 1984 changed its name to Jerome Gold Mines Corporation. Muscocho Explorations Limited optioned 50% of Jerome's interest. There were diamond drilled more than 10,000 feet in 22 holes. Also there were drilled 14 holes along the south zone. The reserves in the Main zone were311 000 tons of 0.201 ounce per ton Au and the South zone has drill indicated 126 320 tons of 0.175 ounce Au per ton. (Northern Miner, July 18, 1988).

Figure 2

A TYPICAL MAP FROM THE MINERAL AREA PLANNING STUDY

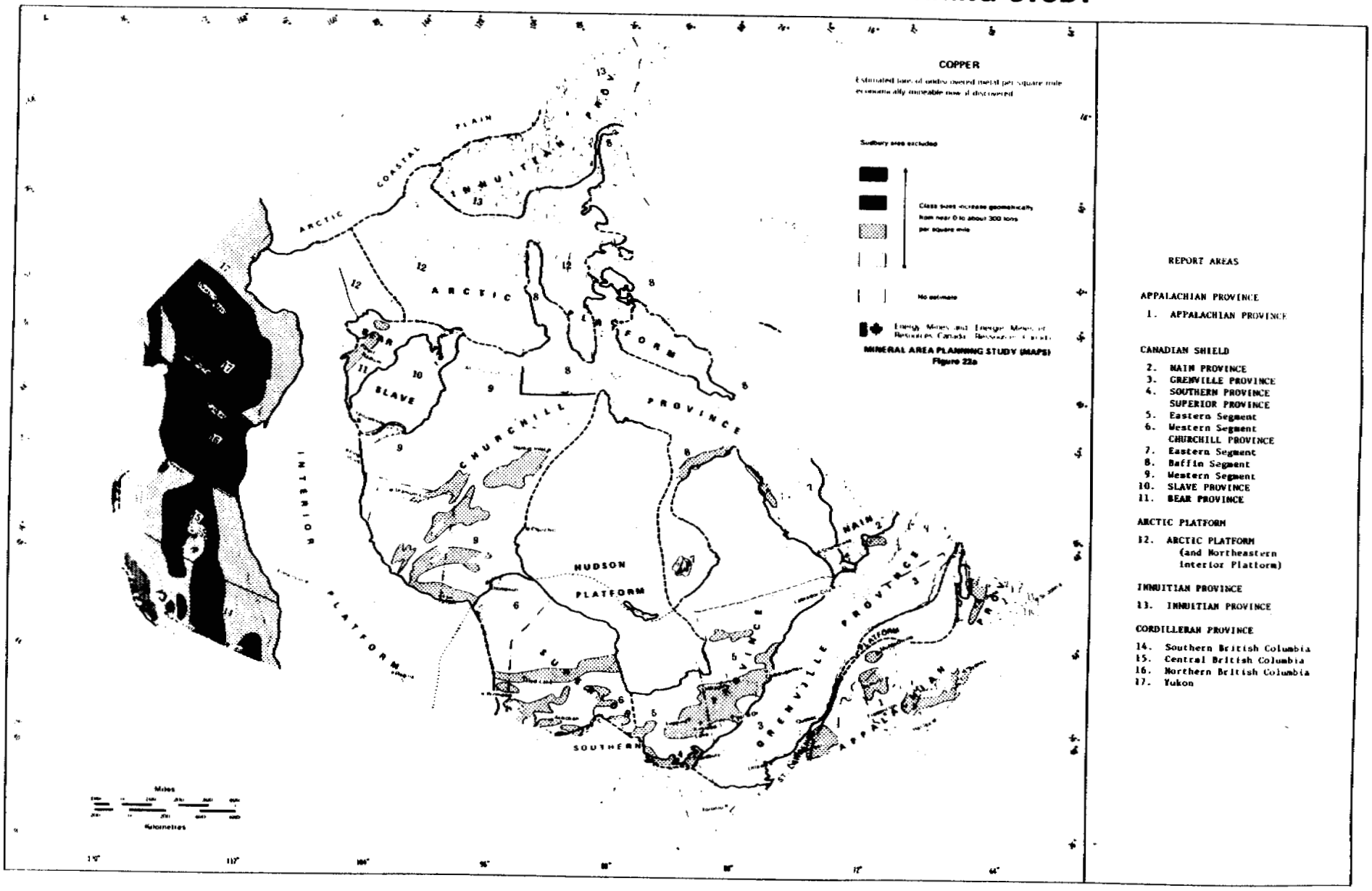


Figure 3. Gross metal value of Canadian mineral discoveries at average prices per three-year period, 1946-82

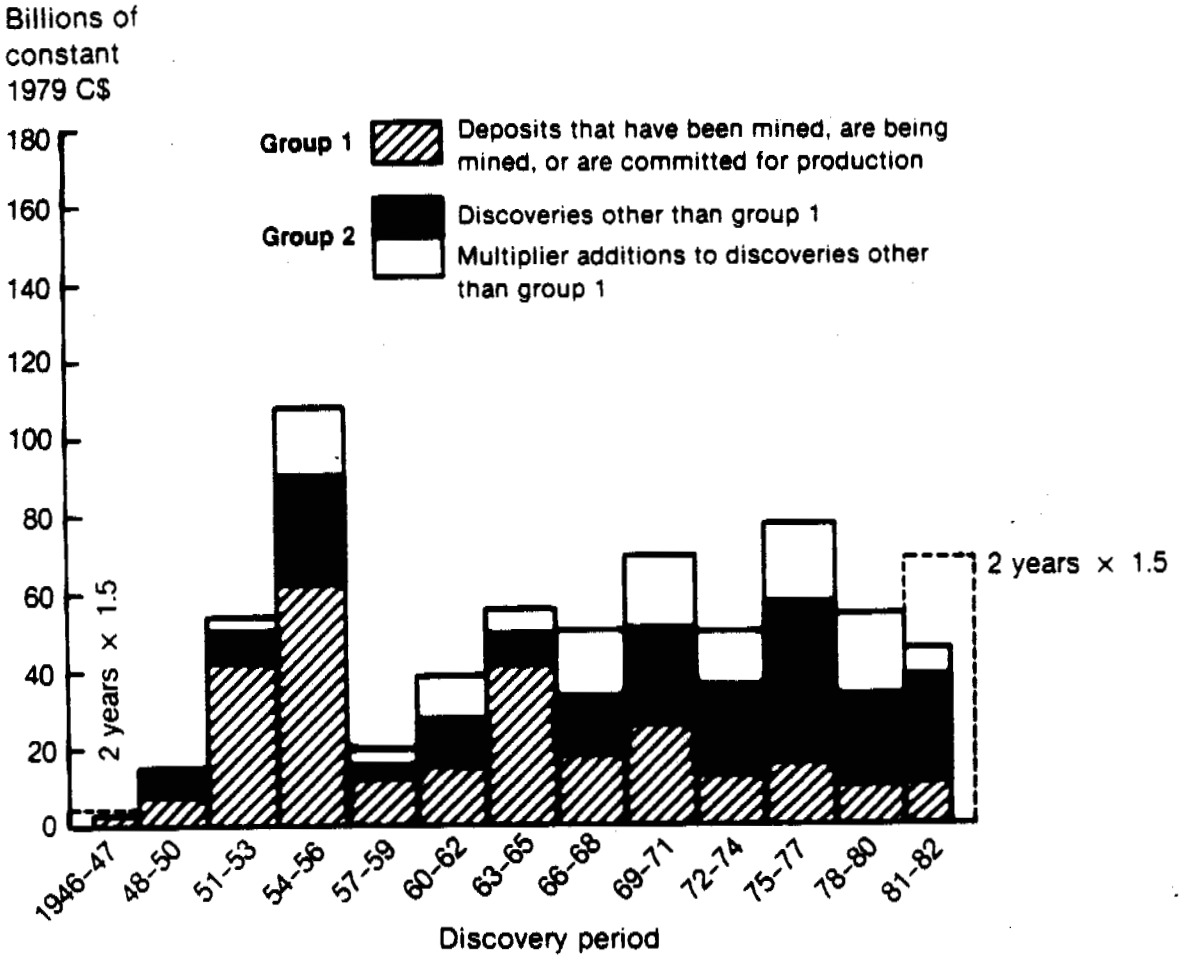


Figure 4. Canadian exploration expenditures per three-year period, 1946-82

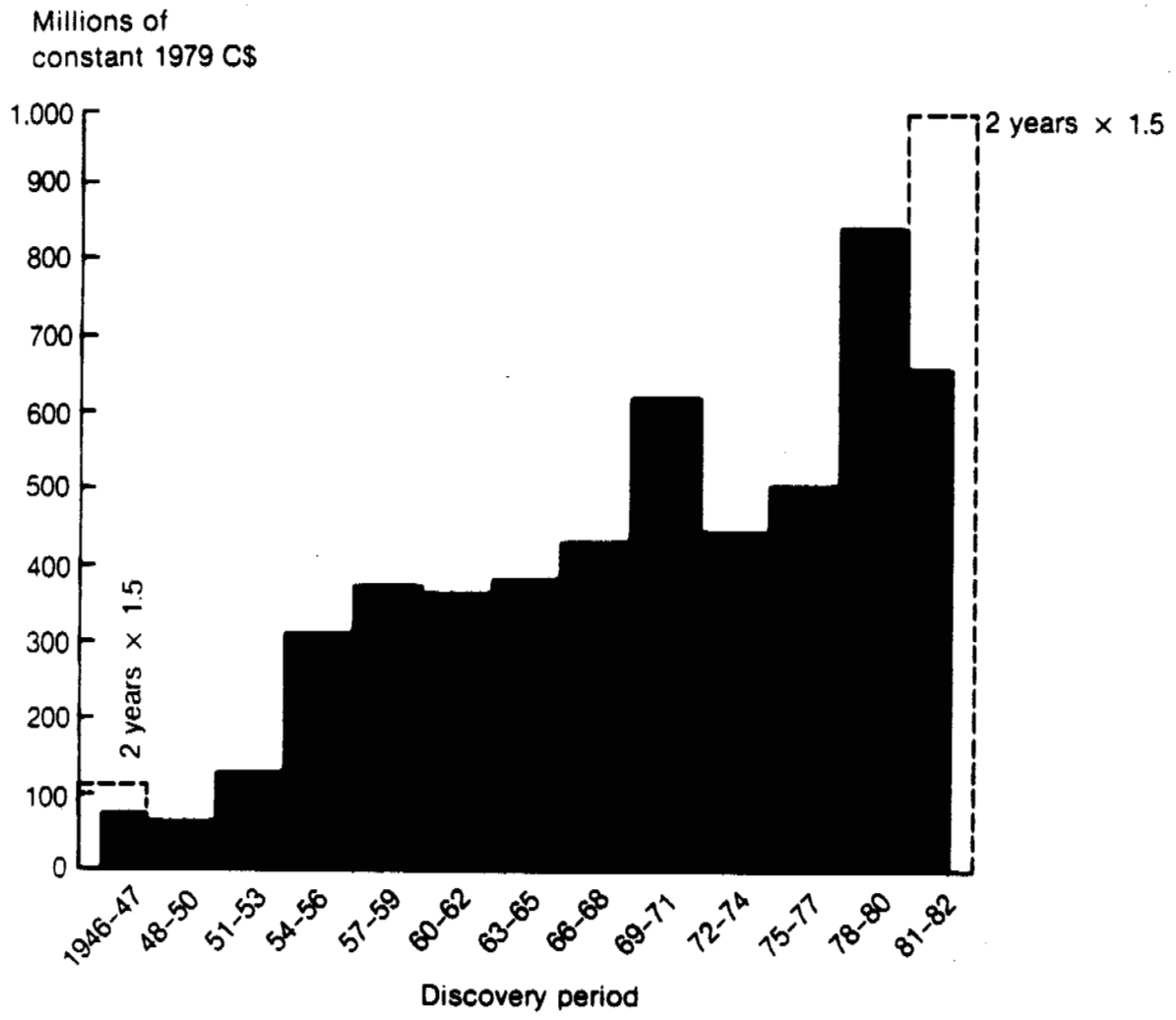


Figure 5. Canadian mineral discoveries: metal value discovered per exploration dollar at average prices per three-year period, 1946-82

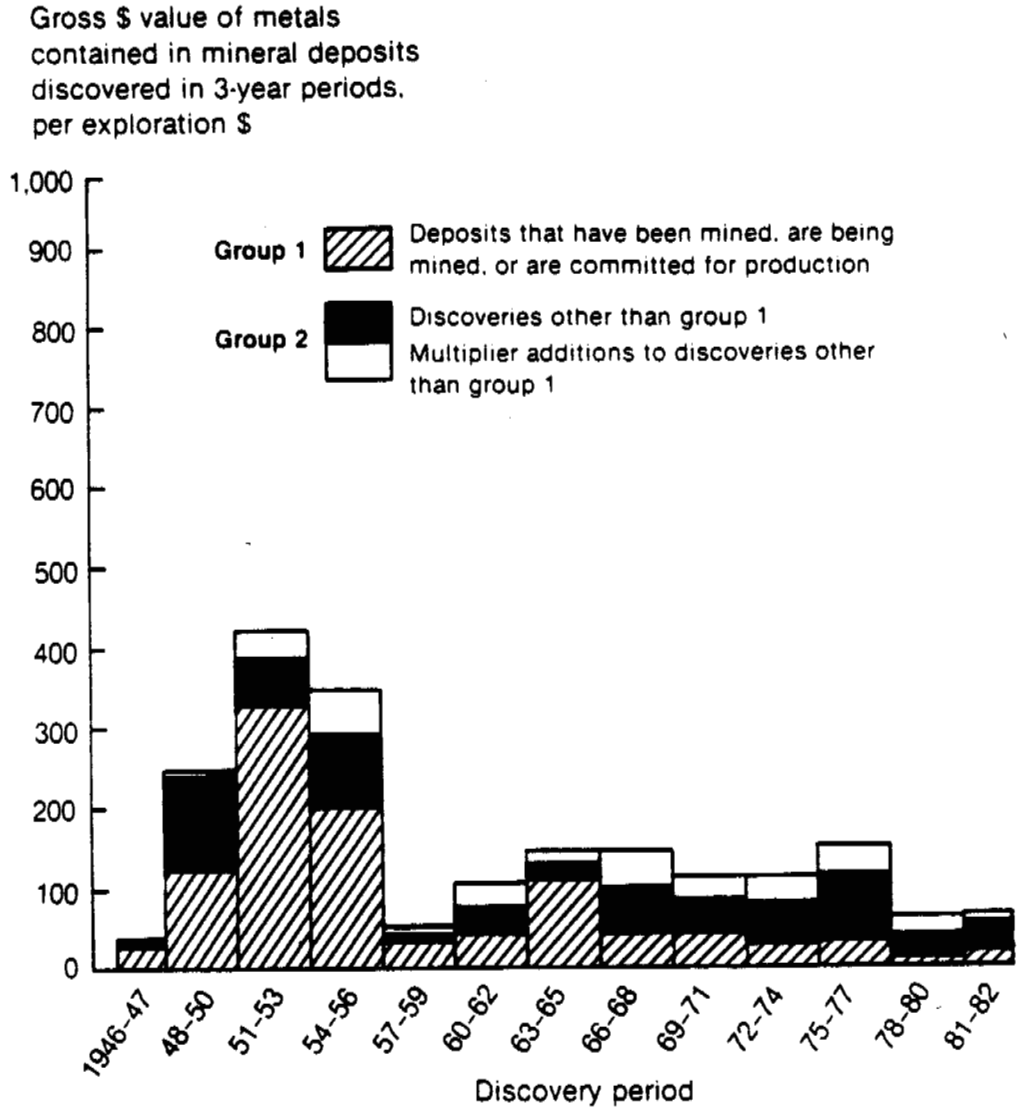


Figure 6

PROPORTION OF TOTAL VALUE OF DISCOVERIES CONSISTING OF DEPOSITS IN MAJOR MINING DISTRICTS AND OF MAJOR INDIVIDUAL DEPOSITS

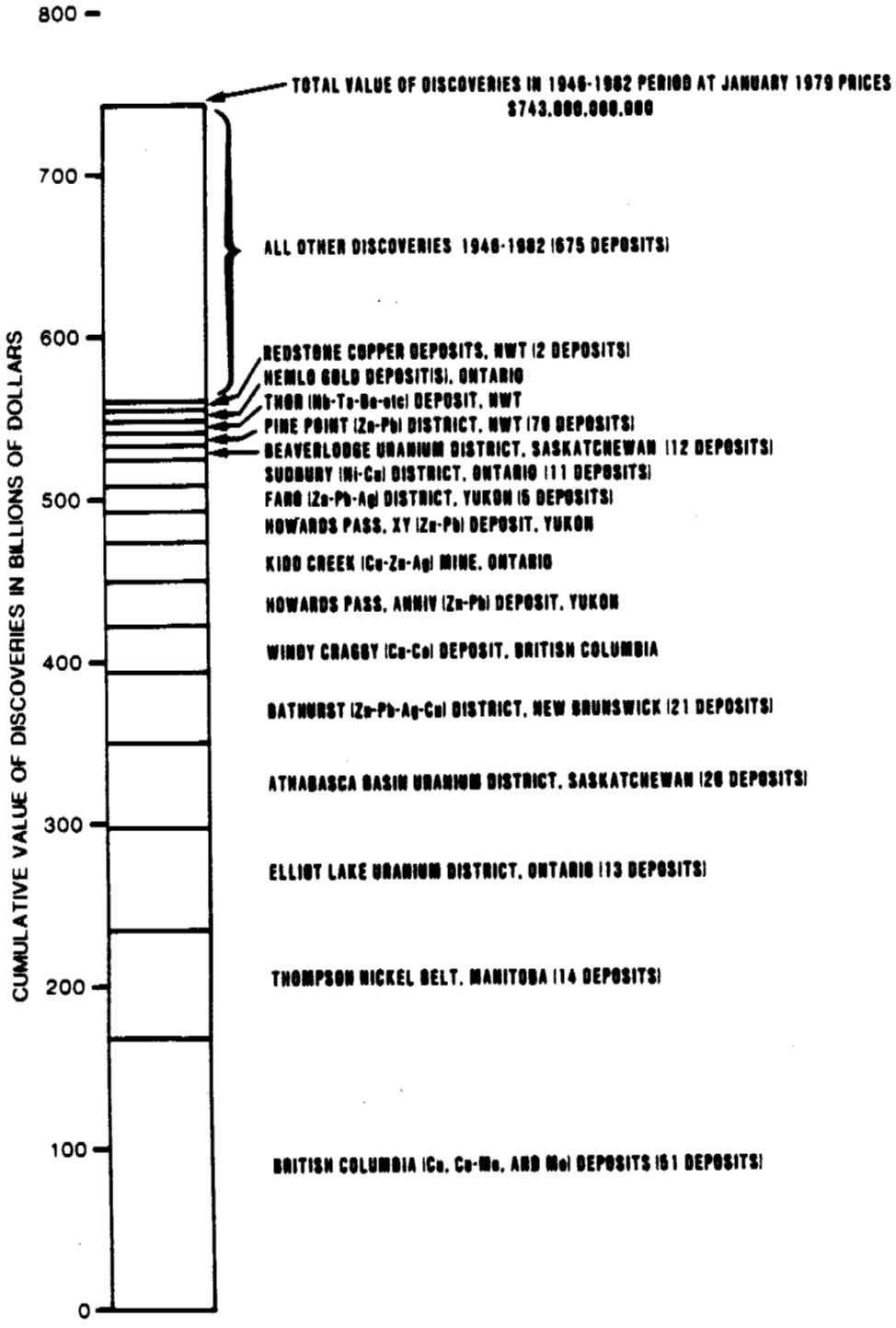


Figure 7.Copper discovered in Canada per three-year period,1946-82

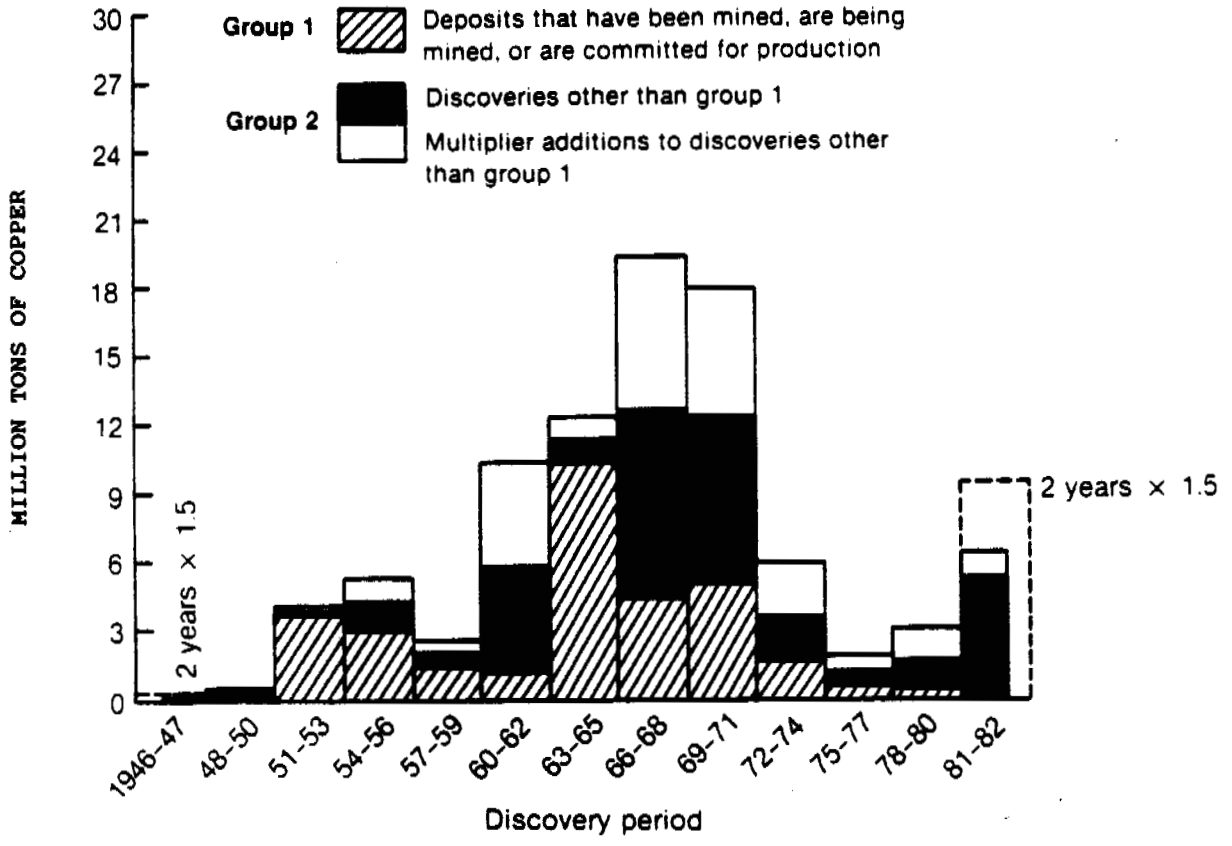


Figure 8. Zinc discovered in Canada per three-year period, 1946-82

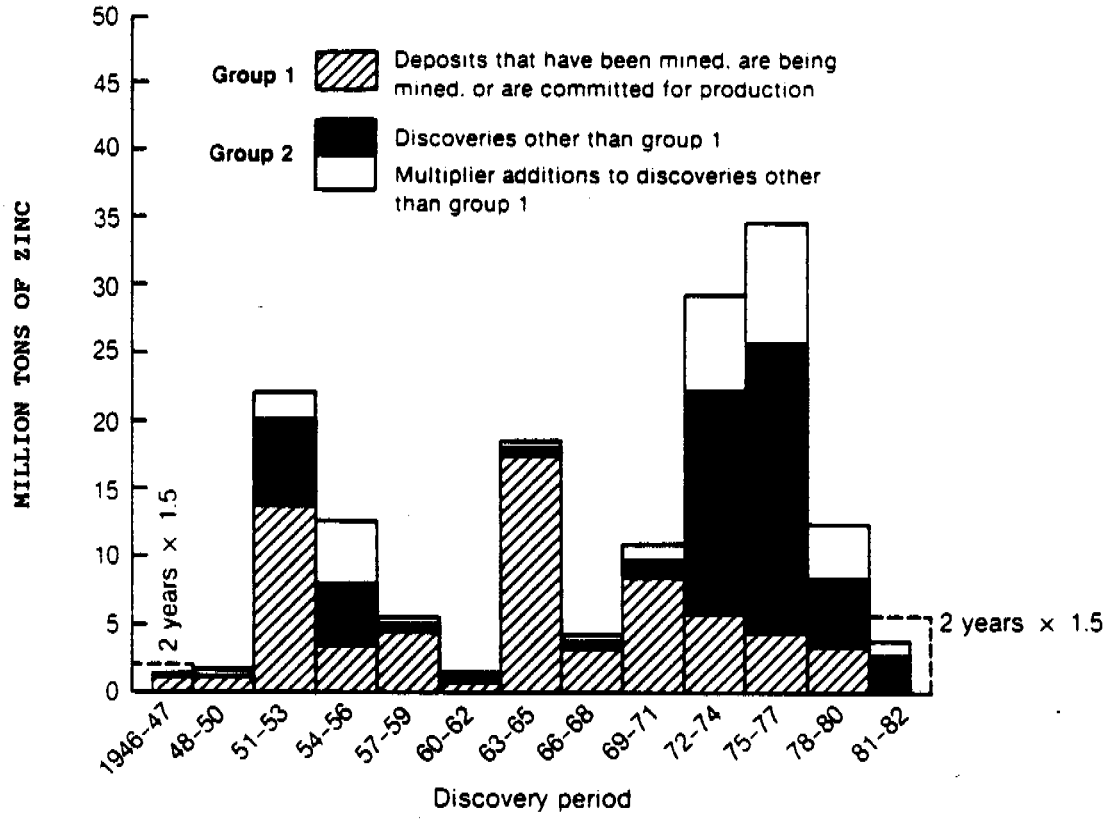


Figure 9. Molybdenum discovered in Canada per three-year period, 1946-82

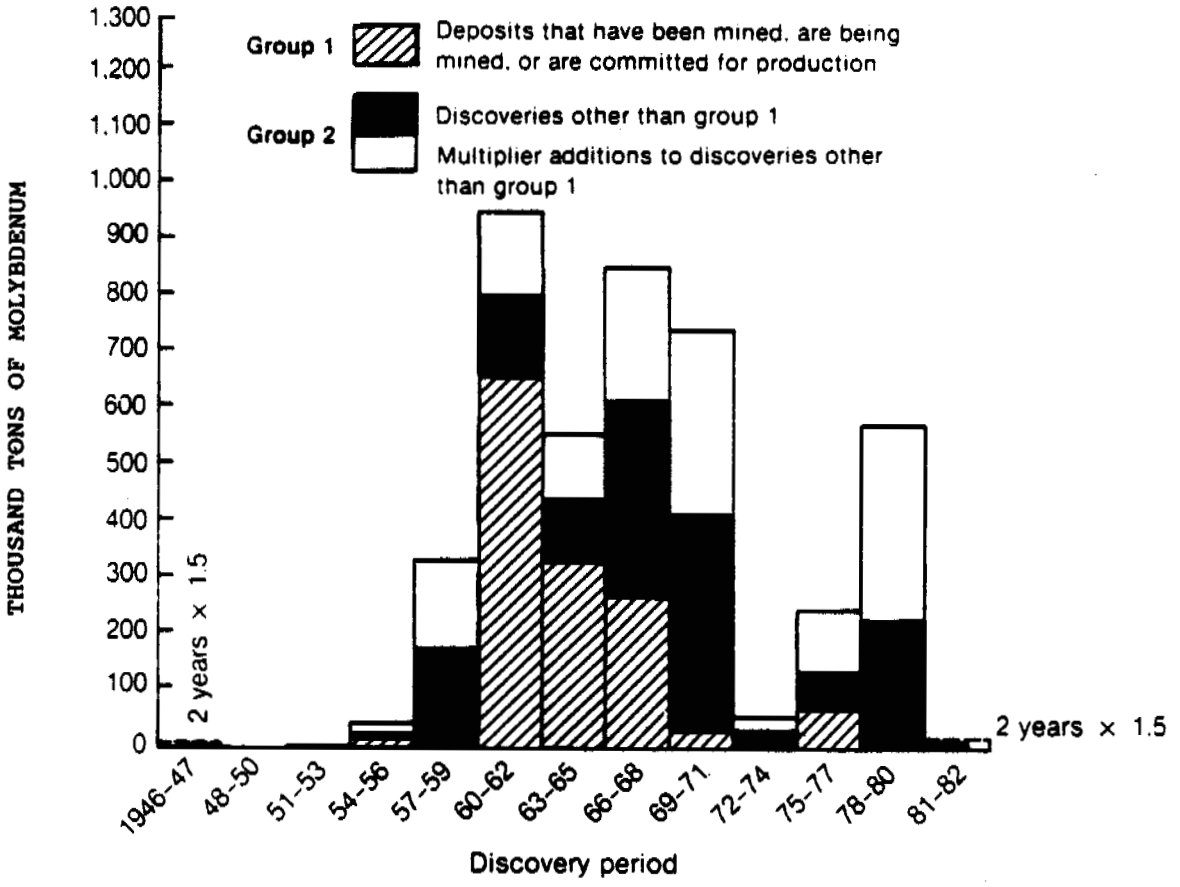


Figure 10. Copper discovered in Canada per three-year period, 1946-82, by geologic deposit type

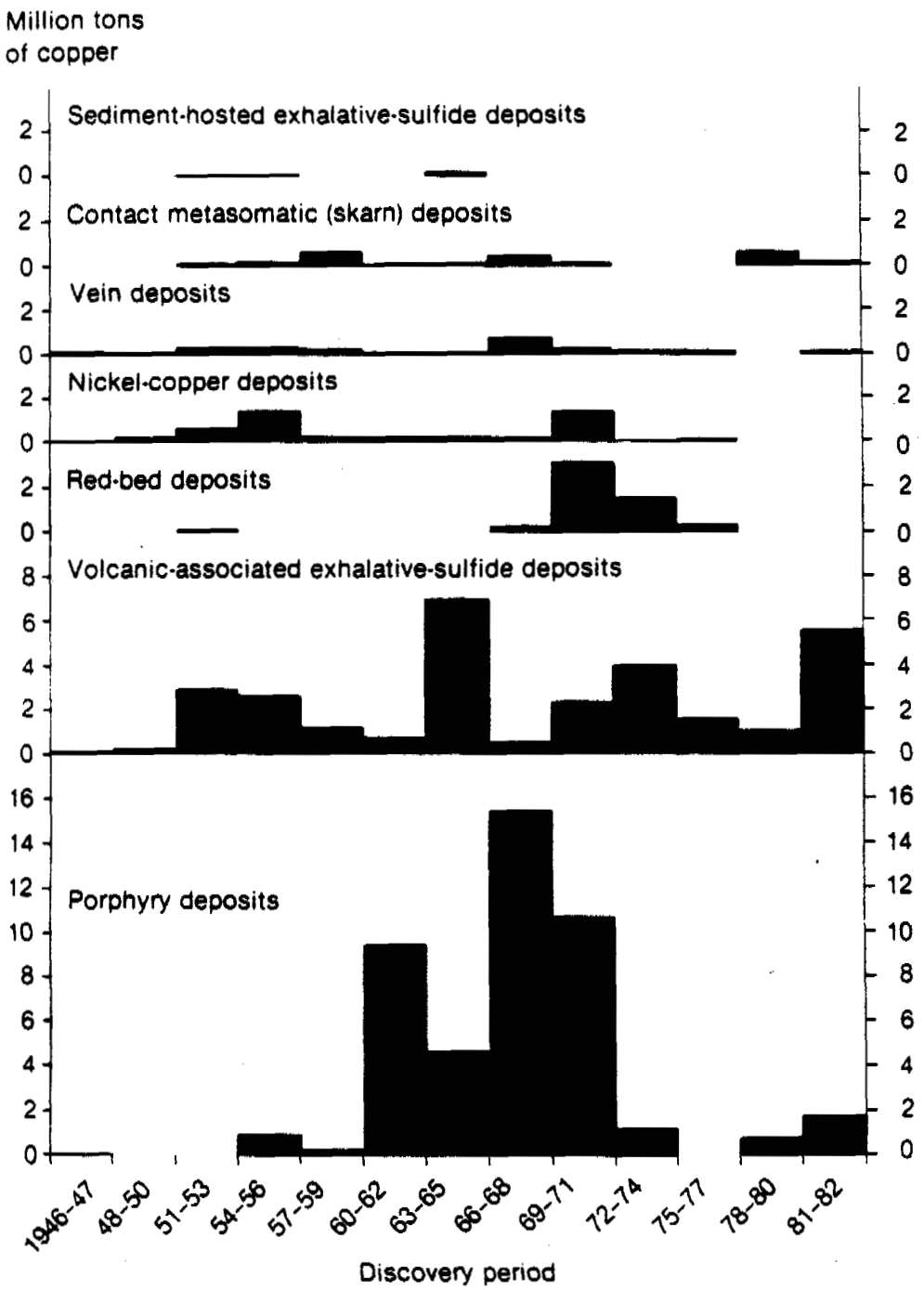


Figure 11

GOLD DISCOVERED IN CANADA PER 10-YEAR PERIOD

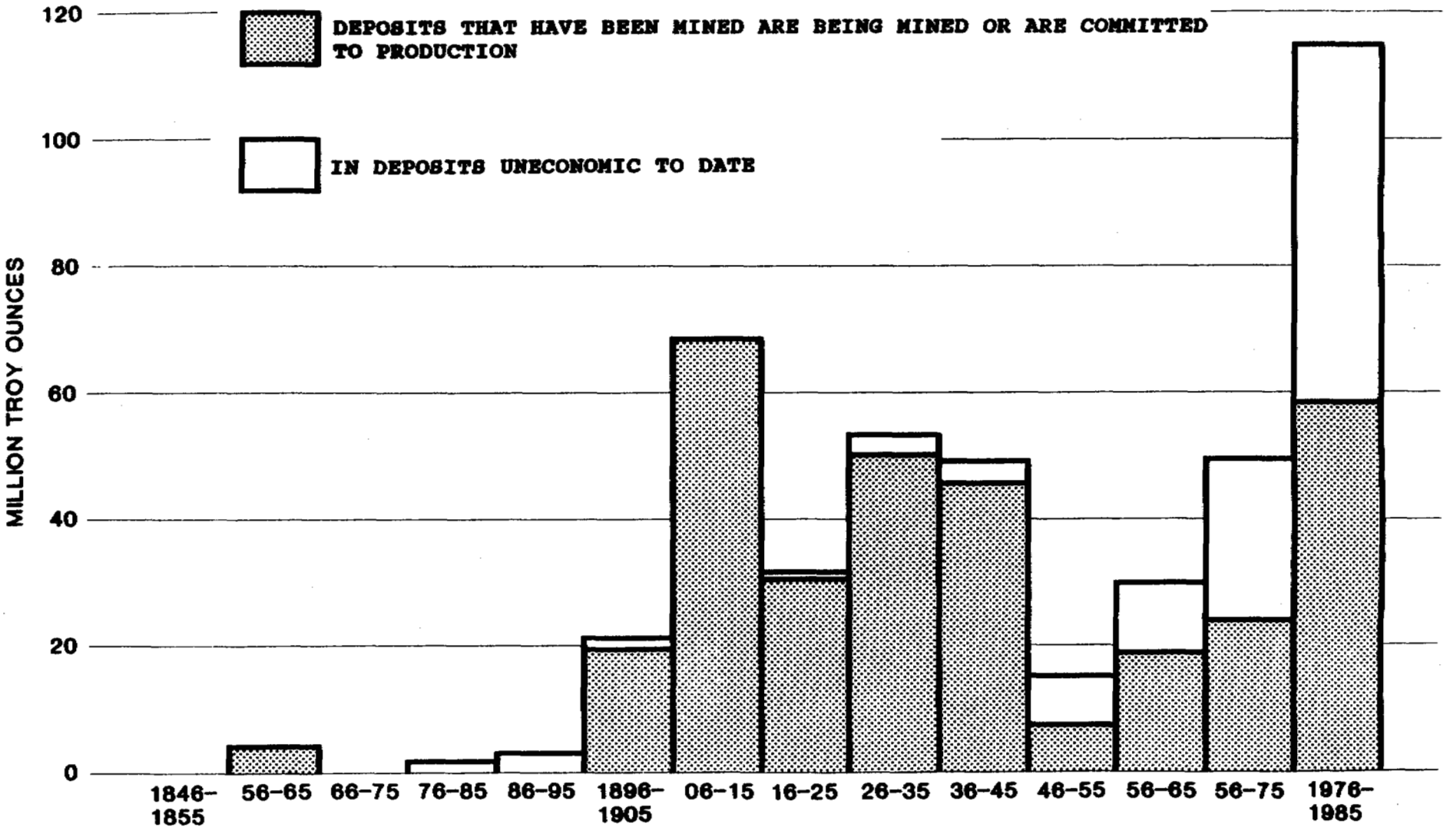


Figure 12

NUMBER OF DISCOVERIES CONTAINING MORE THAN 1 MILLION OUNCES OF GOLD

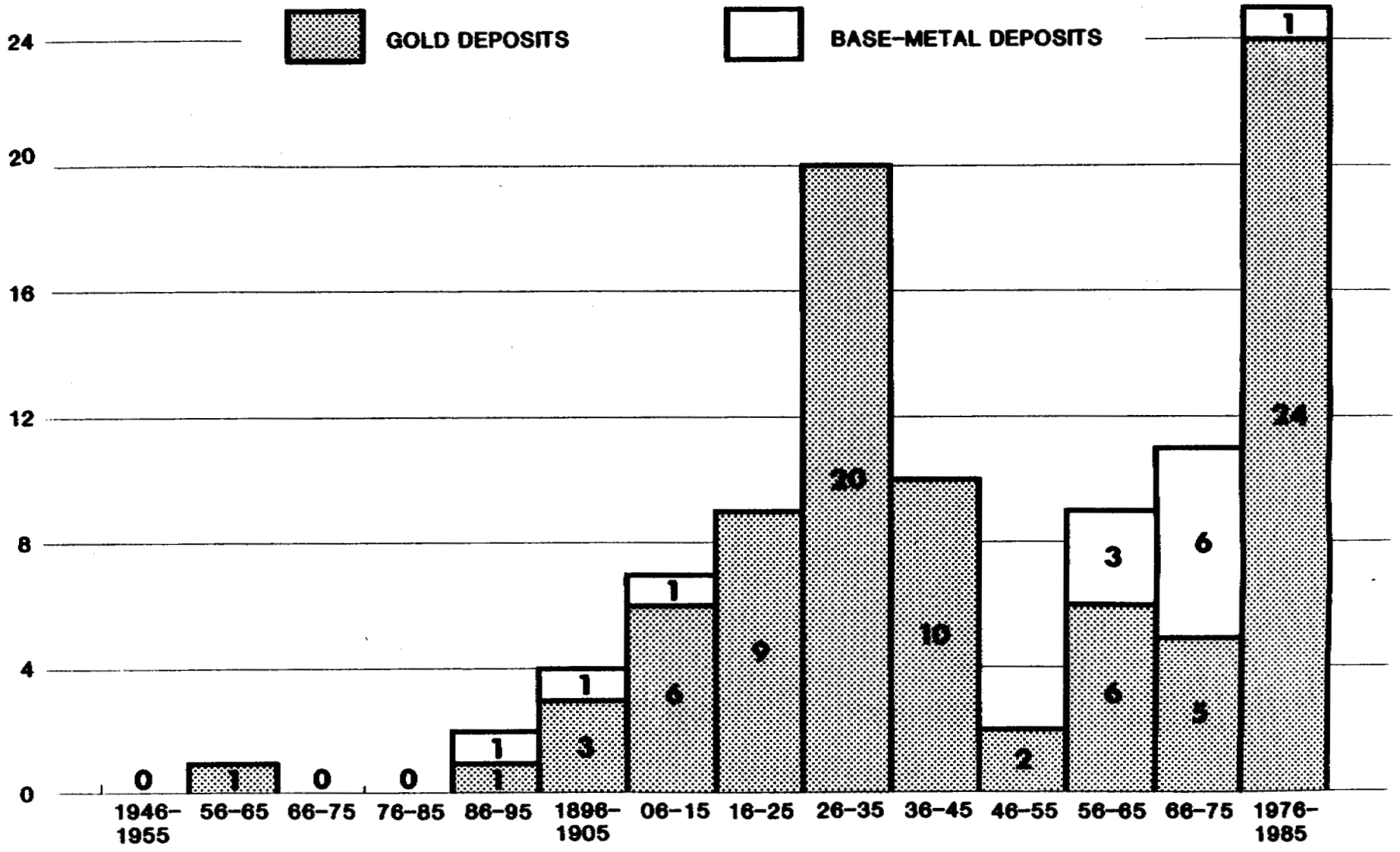


Figure 13

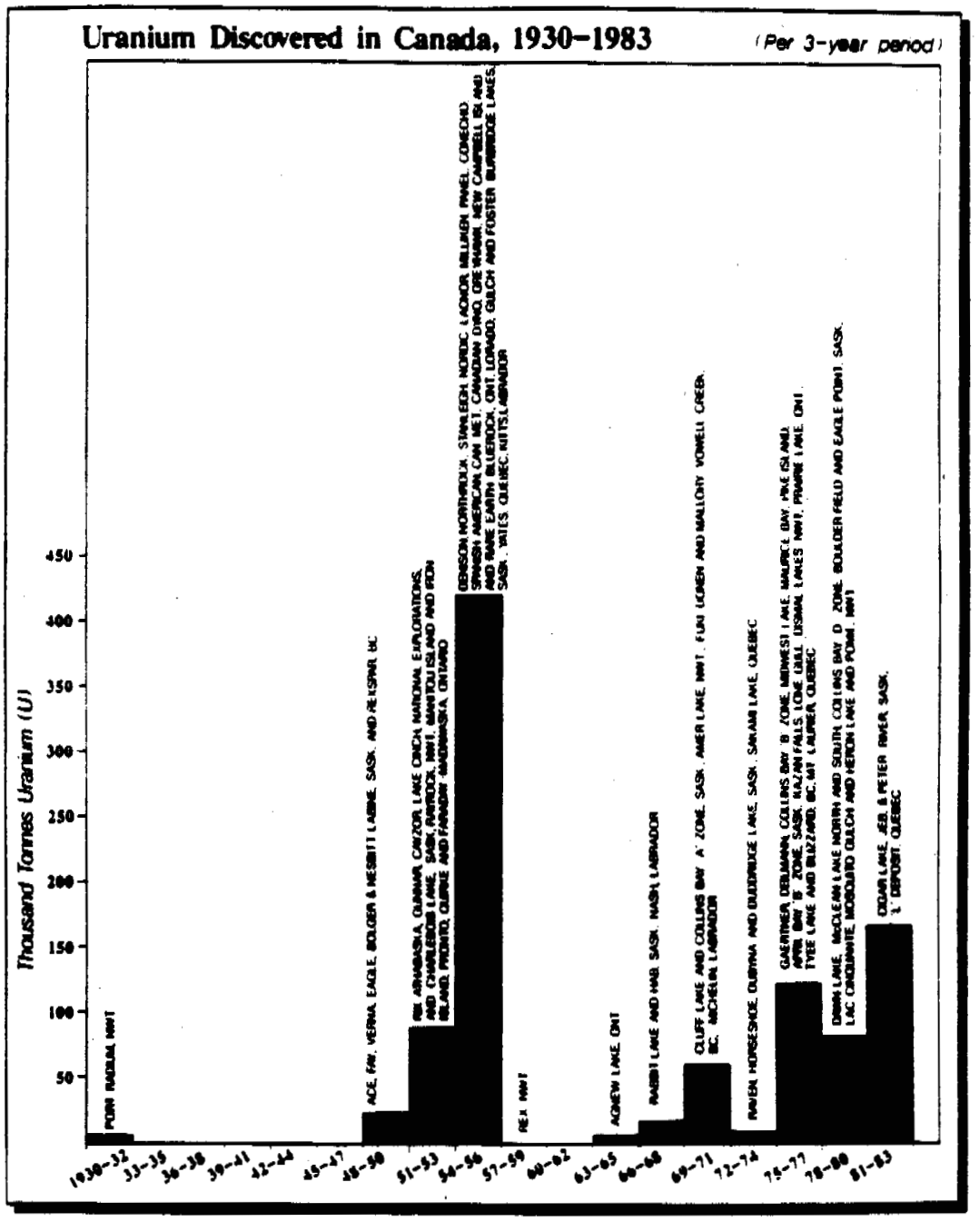

Uranium Discovered in Canada, 1930–1983
(Per 3-year period)
Thousand Tonnes Uranium (U)
450
400
350
300
250
200
150
100
50
PORK RADIUM, NWT
ACE, FAY, VERNA, EAGLE, BOLGER & NESBITT LABINE, SASK. AND RETSHNR, BC
RIX ARNBASHIA, GUNNAR, CANZOR, LAKE ONEIDA NARONAM, EXPLORATIONS, AND CHARLEBOIS LAKE, SASK, RABBOCK, NWT, MANITOU ISLAND AND IRON ISLAND, PRONTO, QUIRKE AND FANDOR MANITOBA, ONTARIO
DENISON NORTHROUX, STANLEIGH, NORDIC, LAMOR, MILLIKEN, PANEL, COMEDIO, SPANISH AMERICAN, CAN MET, CANADIAN DYNO, DREYMAR, NEW CAMPBELL ISLAND AND RARE EARTH, BLUEROCK, ONT, LORADO, GULCH AND FOSTER BURNRIDGE LAKES, SASK., YATES, QUEBEC, KUTTS, LABRADOR
REA, NWT
AGNEW LAKE, ONT
RABBIT LAKE AND HAB, SASK, NASH, LABRADOR
CLIFF, LAKE AND COLLINS BAY 'A' ZONE, SASK., AMER LAKE, NWT., FUKI, LOREN AND MALLOHY, YONELI, CREEK, BC, MCKELVIE, LABRADOR
RAVEN, HORSESHOE, DUBYNA AND DUDDRIDGE LAKE, SASK., SAKAMI LAKE, QUEBEC
GAERTNER, DEBUMANN, COLLINS BAY 'B' ZONE, MINWEST LAKE, MALPEC, BAY, PIKE ISLAND, APEX, BAY 'B' ZONE, SASK, KAZAN FALLS, LONE, GULL, USHAN, LAKES, NWT., PRAIRIE LAKE, ONT., TYEE LAKE AND BLIZZARD, BC, MT LAUPER, QUEBEC
DENN LAKE, McCLEAN LAKE, NORTH AND SOUTH, COLLINS BAY, D ZONE, BOULDER FIELD AND EAGLE POINT, SASK., LAC CRIGNHITE, MORGUITO, GULCH AND HERON LAKE AND POINT, NWT
CIGAR LAKE, JEB, & PETER RIVER, SASK., 'J' DEPOSIT, QUEBEC
1930–32
33–35
36–38
39–41
42–44
45–47
48–50
51–53
54–56
57–59
60–62
63–65
66–68
69–71
72–74
75–77
78–80
81–83

Figure 14

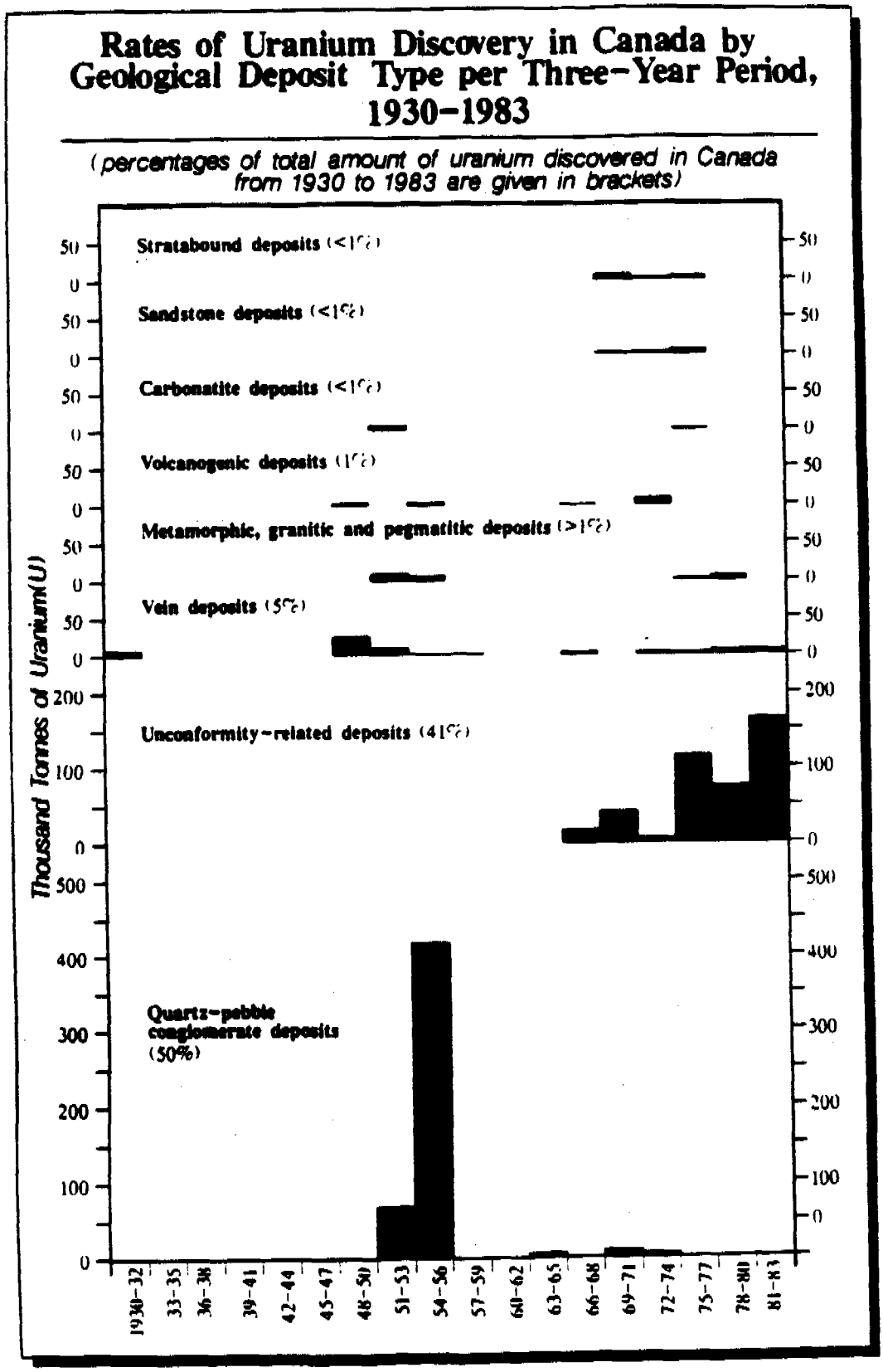

Rates of Uranium Discovery in Canada by Geological Deposit Type per Three-Year Period, 1930-1983
(percentages of total amount of uranium discovered in Canada from 1930 to 1983 are given in brackets)
Thousand Tonnes of Uranium(U)
Stratabound deposits (<1%)
Sandstone deposits (<1%)
Carbonatite deposits (<1%)
Volcanogenic deposits (1%)
Metamorphic, granitic and pegmatitic deposits (>1%)
Vein deposits (5%)
Unconformity-related deposits (41%)
Quartz-pebble conglomerate deposits (50%)
1930-32
33-35
36-38
39-41
42-44
45-47
48-50
51-53
54-56
57-59
60-62
63-65
66-68
69-71
72-74
75-77
78-80
81-83

Figure 15

VALUE OF MAJOR DISCOVERIES BY JUNIOR AND SENIOR COMPANIES

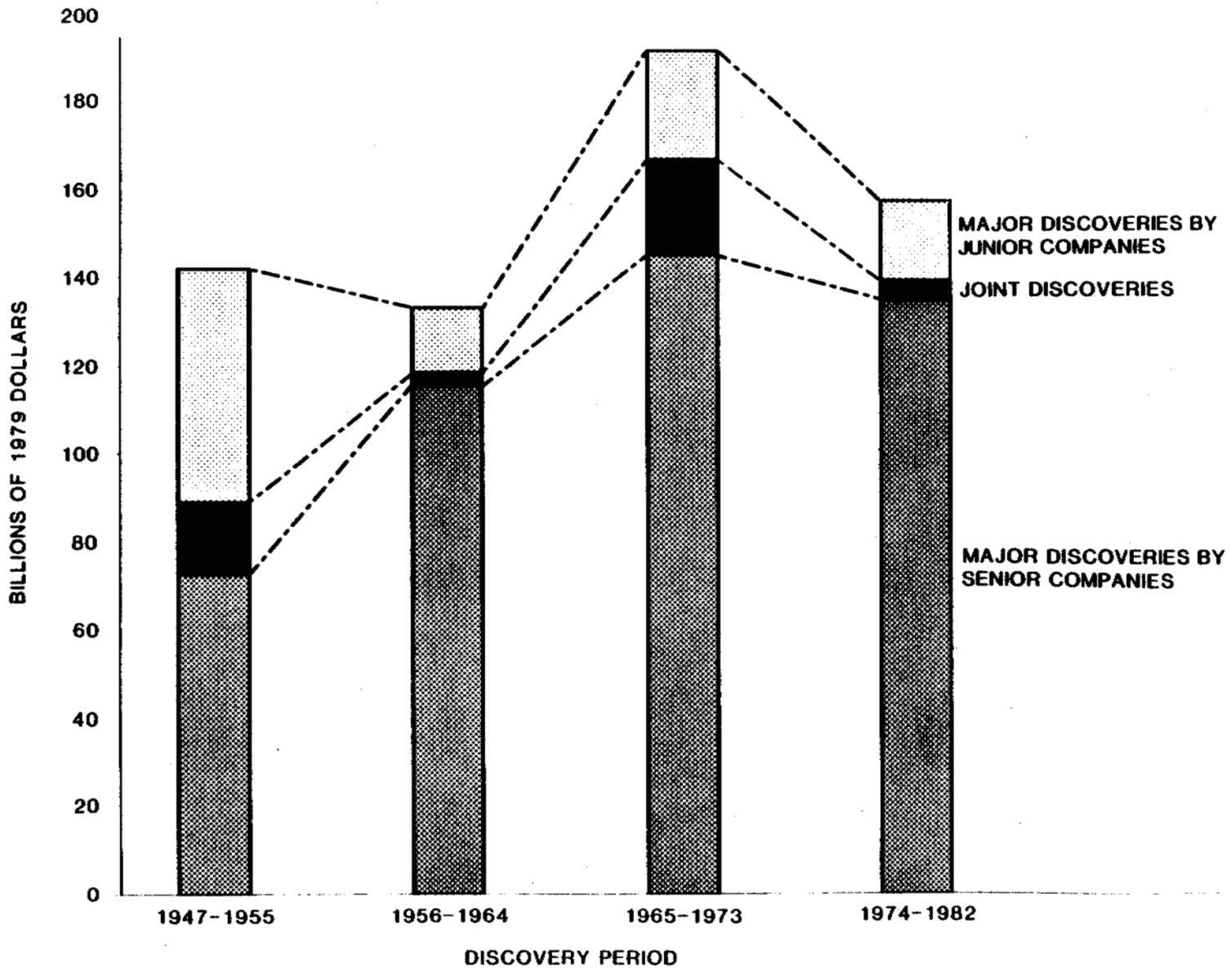


Figure 16

SAMPLE PAGE FROM TABLE OF

PROMISING CANADIAN MINERAL DEPOSITS, DECEMBER 1989

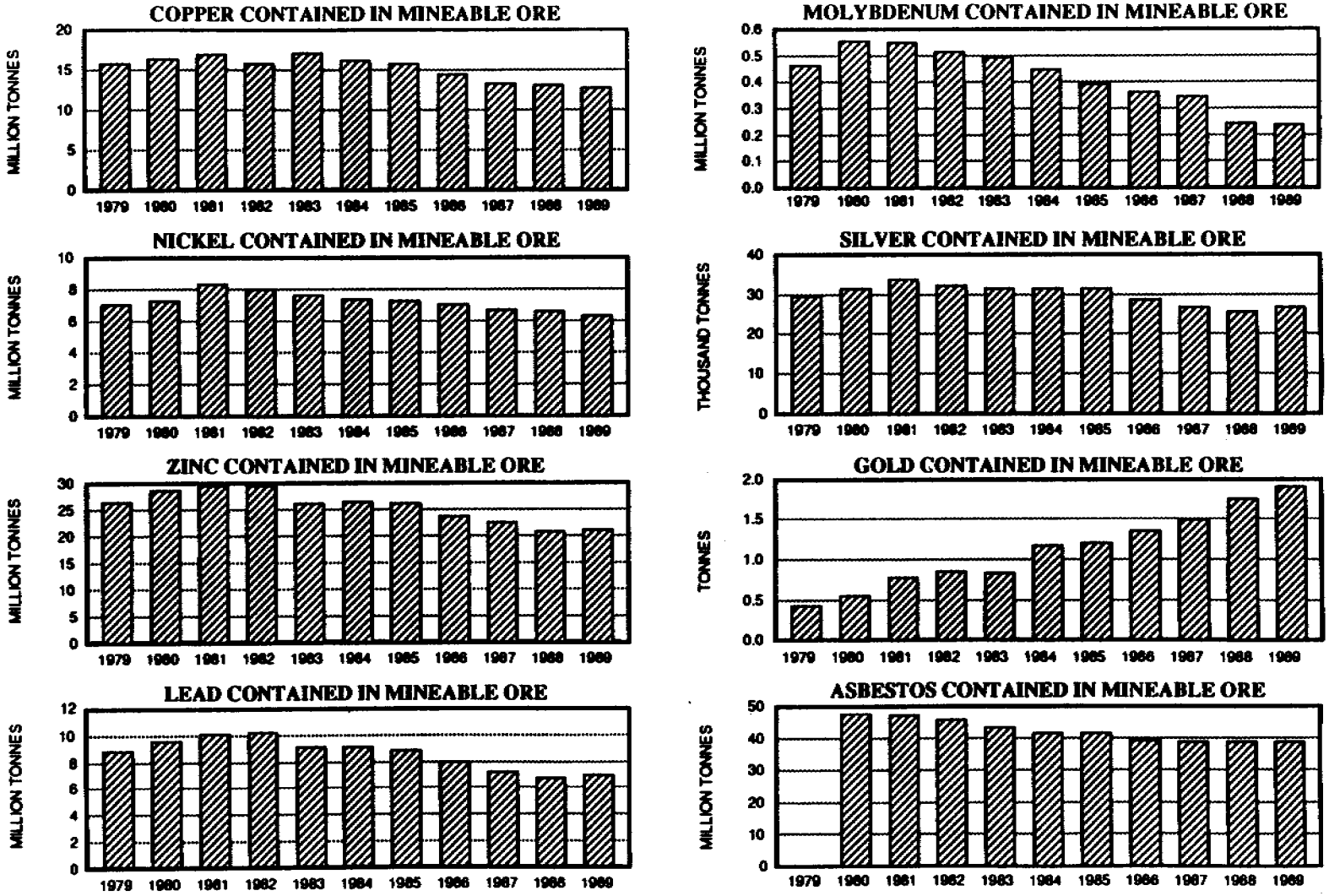
TABLE 6 (cont'd)

DEPOSITS	COMPANIES	TONNAGE AND GRADE DESCRIPTION	TONNAGE (tonnes)[3]	GRADE Cu (%)	Ni (%)	Pb (%)	Zn (%)	Mo (%)	Ag (g/t)[3]	Au (g/t)[3]
SASKATCHEWAN (cont'd)										
Seabee	Claude Resources Inc	Proven, probable, possible and inferred	1 825 000							12 5
Tower Lake East	Golden Rule Resources Ltd Orbital Resources Ltd Cameco - A Canadian Mining & Energy Corporation		2 041 000							3 3
Woody Lake B Zone	Tyler Resources Inc Golden Rule Resources Ltd Cameco - A Canadian Mining & Energy Corporation		363 000							4 8
Woody Lake Golden Heart	Tyler Resources Inc Golden Rule Resources Ltd Cameco - A Canadian Mining & Energy Corporation	Drill indicated	665 700							8 74
BRITISH COLUMBIA										
Abbott Wagner Abbott Zone	Mikado Resources Ltd Golden Arch Resources Ltd		36 998			10 92	12 56		287	1 2
Adams Lake	Rea Gold Corporation	Drill indicated	241 580	0 5		2 2	2 2		73 4	6 5
Addington Mine	Cathedral Gold Corporation	Proven and probable geological	712 680							4 5
Alpine Mine Stockpile	Cove Resources Corporation		23 000							14
Alpine Mine Underground	Cove Resources Corporation		987 000							17
Ashlu Mine	Valentine Gold Corporation Tenquille Resources Ltd	Proven and possible	91 800							8 6
Bralorne	Corona Corporation Imperial Metals Corporation	Proven, probable and possible	965 000							9 2
Canty	Golden North Resource Corporation	Drill indicated geological	595 800							5 28
Central Zeballos Mine	Canalaska Resources Ltd Consolidated Impact Resources Inc	Proven and probable	68 000							12
Chappelle	Multinational Resources Inc	Drill indicated	45 080						175	19
Chu Chua	Minnova Inc Placer Cassiar Limited International Vestor Resources Ltd Quintana Resources Inc		1 043 080	2 97					100 e	0 6e
Coxheath	City Resources (Canada) Limited Barrack Mines Limited	Mineable	23 800 000							2 43
Cuprum	Cusragh Resources Inc Hillsborough Resources Limited		30 000 000			2 2	7 8		46	
Congress	Levon Resources Ltd Veronex Resources Ltd	Geological	608 000							8 23
Dobbin and Yellow	Western Resources Limited Nexus Resources Corporation	Probable	241 000							5 1

Figure 17

CANADIAN RESERVES, 1979-89

QUANTITIES OF METALS OR OF ASBESTOS FIBRE CONTAINED IN MINEABLE ORE IN OPERATING MINES AND DEPOSITS COMMITTED FOR PRODUCTION AS AT JANNUARY FIRST OF EACH YEAR



SOURCE: ENERGY, MINES AND RESOURCES CANADA

Figure 22

NICKEL DISCOVERED IN CANADA BY 10-YEAR PERIOD

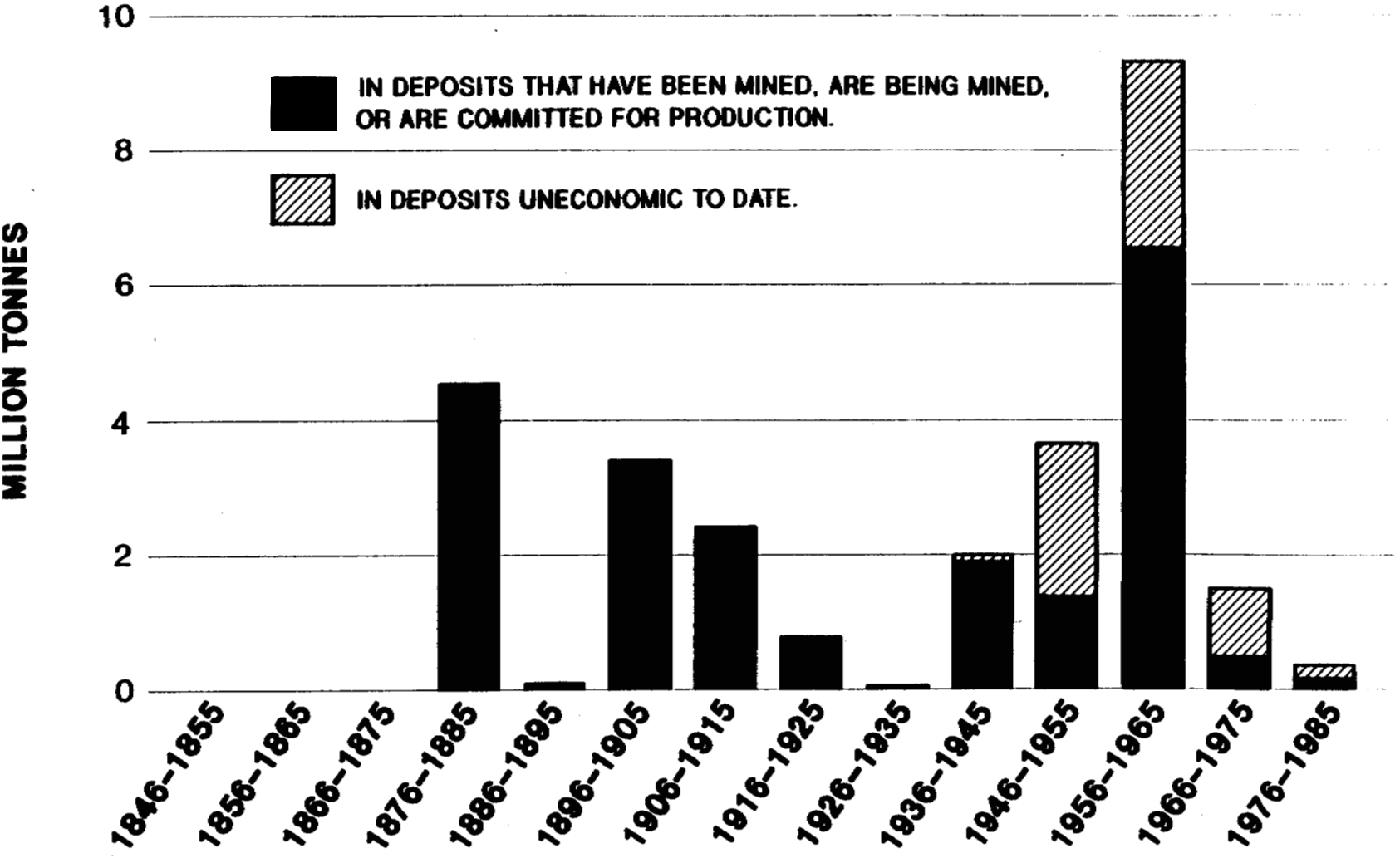


TABLE 1

CANADIAN URANIUM DISCOVERY COST 1971-83 INCLUSIVE

(1988 DOLLARS PER KILOGRAM OF URANIUM)

OVERALL CANADIAN DISCOVERY COST	$ 2.89
SASKATCHEWAN DISCOVERY COST	$ 1.70
COST FOR CANADA EXCLUDING SASKATCHEWAN	$15.11

Table 2

PERCENTAGE OF DISCOVERY VALUE AND PERCENTAGE OF EXPLORATION EXPENDITURES BY SENIOR AND BY JUNIOR COMPANIES

DISCOVERY PERIOD	PERCENTAGE OF DISCOVERY VALUE* BY**		PERCENTAGE OF EXPLORATION EXPENDITURES BY***	
	SENIOR COMPANIES	JUNIOR COMPANIES	SENIOR COMPANIES	JUNIOR COMPANIES
1947-55	57.0%	43.1%	62%	38%
1956-64	87.8%	12.2%	76%	24%
1965-73	81.6%	18.4%	75%	25%
1974-82	87.5%	12.5%	87.5%	12.5%
36 YEARS 1947-1982	78.8% (70%)****	21.2% (30%)****	79%	21%

* Of the 123 major discoveries with a metal content of at least $1 billion (1979 dollars).

** For any discovery made jointly by junior and senior companies, half the value was assigned to each.

*** For all metals.

**** Figure in parentheses refers to value of discoveries that have become mines.

TABLE 3. MAJOR DISCOVERIES* BY SENIOR AND JUNIOR COMPANIES IN CANADA, 1947-1982

Value of contained metal in $ billions

Discovery Period	DISCOVERIES BY SENIOR COMPANIES		JOINT DISCOVERIES BY JUNIOR AND SENIOR COMPANIES		DISCOVERIES BY JUNIOR COMPANIES		TOTALS DISCOVERIES	
	Value $	No. of Discoveries	Value $	No. of Discoveries	Value $	No. of Discoveries	Value $	No. of Discoveries
1947-55	73.0 (51%)	12	16.3 (12%)	2	53.3 (37%)	11	142.6	25
1956-64	116.0 (87%)	19	2.5 (2%)	1	15.1 (11%)	5	133.6	25
1965-73	145.5 (76%)	28	21.7 (11%)	6	24.3 (13%)	7	191.5	41
1974-82	135.7 (86%)	26	3.9 (3%)	5	17.8 (11%)	5	157.4	32
1947-82	470.2 (75%)	85	44.4 (7%)	10	110.5 (18%)	28	625.1	123

*Those with a metal content of at least $1 billion (1979 dollars). The value of the metal content in these 123 major deposits is 84% of that in all 1,000 or so deposits discovered in the period 1947-1982.