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GOLD MINING IN ONTARIO AND QUEBEC, CANADA

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by

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ABSTRACT

This article, which was requested for a special issue of "International Mining", gives a brief accounting of the history of the Canadian gold mining industry, and current important developments. While the coverage is national, focus is placed on the provinces of Ontario and Quebec, in which much of the present renewed activity is taking place. Key needs for technological developments are also mentioned.

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Keywords

British Columbia, Canada, Casa Berardi, Central Canada, gold, gold mining, Hemlo, Maritime provinces, mining, mining technology, Ontario, Quebec, Timmins, Val d'Or

MINAGE POUR L'OR EN ONTARIO ET AU QUÉBEC, CANADA

par

John E. Udd* et Noel Billette**

RÉSUMÉ

Le présent article, rédigé pour un numéro hors-série de la revue "International Mining", donne un bref aperçu de l'industrie minière canadienne dédiée à l'exploitation d'or, ainsi que de l'importante évolution en cours. Bien que couvrant l'ensemble du territoire, l'emphase est mise sur les provinces de l'Ontario et du Québec, où est concentrée une partie importante de l'accroissement de production. Les principaux besoins de développement technologique sont également mentionnés.

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Mots-clés

Canada, Canada central, Casa Berardi, Colombie Britannique, exploitation d'or, Hemlo, minage, provinces maritimes, Ontario, or, Québec, technologie minière, Timmins, Val d'Or

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THE CANADIAN MINING INDUSTRY, AN OVERVIEW

According to preliminary figures from the Mineral Policy Sector of the federal Department of Energy, Mines and Resources, Canada's mining industry contributed 14.6 billion dollars to its economy in 1987. The economic contribution when "Smelting and Refining", "Semi Fabricating", and "Fabricating" are added was 56.4 billion dollars, almost 6% of GDP.

In 1987, 75,750 people were employed in Canada's mines (0.5% of total employment). The mining part of the industry accounted for 2% of all new investment, and contributed 5.3 billion dollars to the balance of trade.

On a per-capita basis, Canada ranks first among minerals producing countries. It is the world's leading producer of uranium and zinc and an important producer of many other metals and minerals. In 1986, it was third-ranked as a world gold producer (after South Africa and the U.S.S.R.). Canada's production of gold is increasing rapidly and the all-time high of 166t (established in 1941) may be surpassed in the not-too-distant future.

THE PLACE OF GOLD IN CANADIAN MINING

Apart from the discovery of gold in the valley of the Chaudière River, in Quebec Province in 1823, and irregular attempts to mine it in the 1840's and 1850's, Canadian production of gold on a significant scale did not begin until the discovery of important placer deposits in British Columbia in 1858. Subsequently, in 1862, underground mining commenced in Nova Scotia. During the earliest period for which production statistics are available (1858-1896), the highest annual output was almost 6.3 million gms (6.3t), in 1864.

In 1896, gold was discovered in the Klondike area of the Yukon Territory and one of history's greatest gold rushes began. Another production peak, of almost 42t, was established in 1900.

In 1909, important deposits of vein gold were discovered in the Porcupine area of northeastern Ontario. Canadian gold production then entered a third phase, which resulted in Canada's all-time high of 166t, in 1941, with the addition of many producers along the Cadillac-Porcupine fault of the Precambrian Superior Province.

During the years of the second world war, production fell by 50%, to about 84t, in 1945. Post-war prospecting and the return of miners and the entry of others to the workforce resulted in a resurgence of production to nearly 140t/year throughout the entire period 1950-1961, inclusive.

There then followed a long period of decline, which brought the lowest annual production since the 1920's, at approximately 50.6t, in 1980.

From that point on, however, there has been a complete reversal in the fortunes of the gold sector. The explosive increase in prices, which peaked in 1980, has had the predictable effect on production. Previously closed mines have been rehabilitated and brought back into production. Reserves of proven ore have increased as cut-off grades have been greatly reduced. The application of large scale bulk mining methods and the replacement of expensive selective methods by these have reduced mining costs substantially - having a still further effect on mineable reserves. New methods of financing, namely "flow-through shares", have stimulated exploration to the point that three-quarters of exploration expenditures in 1986 was said to have been directed at precious metals (mostly gold). By all standards, Canadian gold mining is becoming modernized, highly efficient, and vibrant.

PRESENT GOLD MINING ACTIVITY IN CANADA

Because of the present exploration emphasis on gold, there are probably very few geologically-favourable areas in Canada which have not been affected. Claim staking has increased greatly and is expected to continue at a high level of activity. About 80% of the metallic mineral discoveries made in 1986 were gold. Published reserves for the nation have doubled since 1981.

ATLANTIC CANADA

In Nova Scotia, the locale of Canada's first gold camp, the industry has come alive once again with greatly renewed vigour. Operations are being re-opened in deposits that were thought to have been previously depleted. A changed awareness of the geological controls for Meguma deposits, together with improved exploration tactics, has led to heightened optimism in the potential of the region.

Already, Westminer Canada is bringing the Forest Hill and Beaverdam properties into production (the latter a joint venture with Coxheath Gold Holdings Ltd.), while Coxheath Gold Holdings Ltd. is about to mine the Tangier deposit. Several junior mining companies and a few of the majors are active in the province. Northumberland Mines Ltd., in collaboration with INCO, is considering the rehabilitation of old workings at Cochrane Hill. Northumberland is also exploring the Goldenville structure in the vicinity of the former Blue Nose mine.

In neighbouring New Brunswick, Northumberland is planning an open pit and heap leaching plant for the Murray Brook gossan deposit, situated near Bathurst. Gordex Minerals is also planning an open pit and heap leaching operation for a deposit located at Cape Spencer. It has been estimated that reserves are adequate for an operation lasting from 5 to 6 years.

The Hope Brook Gold operations, of BP Selco, situated in south-western Newfoundland, is the most significant precious metals operation to have been opened in Canada's Atlantic Provinces. The first phase, heap leaching of ore from a pit, commenced in mid-1987. The second phase, an underground mine and a mill, will commence operations late in 1988. With a daily-rated treatment capacity of 3,000t, it has been estimated that 3.7t of gold will be produced when operations are fully developed. Reserves are adequate for about 10 years.

PACIFIC AND ARCTIC CANADA

In the west and in the north, gold-related activity is equally strong.

In Manitoba, Pioneer Metals is in the early stages of production at their Puffy Lake property. One thousand tonnes of ore will be milled daily.

In neighbouring Saskatchewan, the Star Lake mine, operated by SMDC, and the first gold mine to be brought into production in the province in almost 50 years, commenced mining in late 1986. Elsewhere, underground drilling is taking place at the JOLU property of Mahogany Minerals and at the Seabee property of Placer Dome and Claude Resources.

British Columbia, the westernmost province, and the area of Canada from which gold was first produced in appreciable quantities, in 1858, has been a locale of intensive-activity. Both Mascot Gold Mines and Mosquito Creek Gold Mines are well advanced with plans; the former, through the development of an open pit mine and mill (with a capacity of about 2,500t/day), the latter through an expansion of capacity. Three other properties are reported to be nearing production status. These are: the Lawyers deposit, of Chevi Gold Mines, at Todoggone; the Golden Bear deposit of North American Metals and Chevron Canada, at Dease Lake; and the Sulphurets deposit, in Stewart Township, which is held by a consortium comprising New Hawk Gold Mines, Lacana Mining, and Granduc Mines. Feasibility studies and/or exploration are taking place at about a dozen other locations in the province. Former gold producers are being re-examined with considerable interest.

The Northwest Territories have contributed significantly to Canadian gold production through the outputs of Giant Yellowknife Mines and Nerco Con Mines (formerly the Con Mine, of Cominco). Both, located at the territorial capital of Yellowknife, have been important producers for many years and both are making significant investments in improved facilities; the former through the construction of a small plant to recover gold from old tailings; the latter through improvements to the mine, mill, and surface plant. Treminco Resources, also operating at the capital, expects to be producing from its Ptarmigan Mine and adjacent properties in 1988. Elsewhere in the NWT; the shaft is being deepened at Echo Bay Mines' property at Lupin; and exploration is in progress at: Giant Bay's Golden Lake property; at the Tundra deposit of Total Resources and Noranda Exploration; and at the Kim/Cass deposit of Echo Bay Mines and Petromet Resources. A number of other exploration efforts are also in progress.

The Yukon, the scene of the famous Klondike rush, has also continued to be a significant gold producing area; largely from placer operations in the Dawson area. Recently, however, two underground hard-rock mines have commenced production. These are: the Mount Skukum Mine of Erickson Gold Mines Ltd., located south of Whitehorse, the territorial capital; and the Ketzka River Mine of Canamax and Pacific Trans Ocean Resources, located near Ross River.

CENTRAL CANADA

The discovery of gold in the Porcupine District of northeastern Ontario, in 1909, resulted in a period of intensive exploration in the area. In 1911, gold was discovered at Kirkland Lake, about 200 miles to the east and about 50 miles from the Ontario/Quebec border. Today, after decades of geological mapping, it is known that these deposits are associated with a belt of lavas and sediments which extends across northeastern Ontario and northwestern Quebec. The discoveries were tremendously significant for, in 1931, 75% of Canadian gold production came from the mines of the Porcupine and the "Golden Mile" of Kirkland Lake.

In 1924, gold was discovered to the east, in Quebec, at both Rouyn and near what is now known as Val D'Or. By 1942, some 15 mines were operating in the "Rouyn-Harricana gold belt" and an additional 5 were in production in Cadillac Township. Today, it is recognized that many of these deposits were controlled by a famous structure known as the "Cadillac Break". The gold occurred in fracture fillings. A notable exception was the famous Horne Mine, of Noranda, in which the gold was recovered as a by-product in a copper sulphide deposit. At one stage, when copper prices were greatly depressed, the Horne Mine was known as a gold mine rather than as a copper mine!

Since that time, the area across the provincial boundary has been the very "heart" of the Canadian gold industry. The decline of the industry, which reached its nadir in 1980, had a predictably severe effect on the prosperity of the entire region. The stable price of gold and ever-increasing costs of production in highly selective and labour-intensive mining gradually forced most of the early operations to be closed. Many operations were so marginal that no investment could be made in newly-developing technology.

In the roughly twenty-five year period after the end of the Second World War (1945-1970), there were some notable discoveries of gold in Canada. Foremost among these were: the Red Lake area of northwestern Ontario (Campbell Red Lake and Dickenson mines); a number of "strikes" in the Quebec gold belt (Malartic Hygrade, Kiena, Camflo, Agnico-Eagle); Agassiz, in Manitoba; and the Giant Yellowknife, Discovery, and Lupin orebodies in the Northwest Territories.

In the early 1970's the price of gold was freed from the level at which it had been fixed for nearly four decades. Accelerating rapidly, the all-time high established in 1980, was about twenty-five times greater than the most recent historic (i.e., 35 \$U.S.) fixed price. The immediate impact of the increased prices were that much lower grade ores could be mined economically. Consequently, there was a drive towards both developing previously uneconomic areas in existing mines (in those which had survived) and in bringing the deposits either into production or back into production. The pace of exploration for gold has continued unabated up to the present.

Expansions and renovations are in progress at many of the well-known major gold mines in Ontario. Lac Minerals has sunk a new shaft and is expanding the mill at its Macassa operation. Mill expansion and modernization is also in progress at: Campbell Red Lake Mines, in Red Lake; at the 76-year old Dome Mine, in South Porcupine; and at the A.W. White Mine, of Dickenson Mines. The latter operation is also increasing capacity to 1000 short tons/day. The Kerr Mine, formerly Kerr-Addison and now owned by Golden Shield Resources, continues a long history as a gold producer. Giant Yellowknife Mines, now the owner of several properties in Ontario with familiar names (Delnite and Pamour), is also producing.

The Detour Lake deposit, originally discovered (in 1974) and owned by Campbell Red Lake Mines Ltd. and now held by the Placer Dome group, was the first major gold mine brought into production in Ontario since the 1940's. The mine is now converting from an open pit to an underground operation and expanding to a capacity of 2000 t/day.

Smaller operations which have commenced production in recent years are: Eastmaque Gold Mines; the Bell Creek Mine of Canamax Resources and Pamorex Minerals; the Hoyle Pond and Owl Creek Mines of Falconbridge Ltd.; and the Renabie Mine (which has been reopened).

In 1981, the famous discovery at Hemlo, near the north shore of Lake Superior, was made. This ranks as one of the greatest strikes in Canadian history and has resulted in three mines (in essentially the same orebody) being brought into production. These are: the Golden Giant Mine, of Noranda; the David Bell Mine, which is owned equally by the Teck Corporation and International Corona; and the Page-Williams orebody, which is being mined by Lac Minerals pending a settlement of a lengthy dispute with International Corona.

Coming into production shortly will be: the Holt-McDermott Deposit, of American Barrick; the Dona Lake orebody at Pickle Lake, of Placer Dome; and the renovated Pickle Crow Mine, now to be operated by Noramco and to be known as the Golden Rose Mine.

Exploration is at an advanced stage at a number of Canamax properties, and at the Duport property of Consolidated Professor Mines. There are many major and junior mining companies which are presently active in Ontario. Future announcements of finds and production decisions are likely.

In Quebec, there has been an impressive number of gold mines brought into production since 1960. These include; Malartic Hygrade; Kiena; Camflo; the Telbel Mine of Agnico-Eagle; Doyon; Thompson Bousquet; Lac Shortt of Minnova; Bachelor Lake; Federber and Dumont, of Belmoral Mines; and Montauban, of Muscocho Explorations. Both Agnico-Eagle and Doyon (equally owned by Lac Minerals and Cambior) are upgrading their facilities. The production capacity at Doyon is being doubled to 3000 t/day.

Equally impressive is the number of properties which are being prepared for production. The Golden Pond Mine at Casa Berardi, which is jointly owned by INCO Gold and Golden Knight (of the Teck group), is at an advanced state of preparedness. Shaft sinking has been completed at Agnico Eagle's Dumagami, at Cadillac, while Lac Minerals is developing an underground mine at Bousquet Number 2. D'Or Val Mines is planning to bring the Beacon deposit into production at an initial rate of 450 t/day, while Aur Resources has similar plans for its First Canadian property.

Exploration is at an advanced stage at the Sleeping Giant property of Perron Gold, Noranda, and Cogesco Mining; Mine Yvan Vezina, of Cambior; and the Golden Hope deposit, which is owned by the Noramco group and operated by Teck Corporation at Estrades. As in Ontario, there are many companies - both junior and major - active in the province.

One can not discuss gold in Quebec without at least mentioning the important sulphide deposits (chiefly copper) of which gold is an important by-product. Apart from the famous Horne deposit, of Noranda, the Springer Mine of Opemiska, the Copper Rand and Portage Mines of Northgate Patino (in Nibougamau), the Henderson Mine of Camchib (also in Chibougamau), and the Selbaie Mine of BP Selco, are all important producers of gold.

Since 1984, the Chadbourne Division of Noranda has been mining the remnants of the Noranda Mine (hence the name "Remnor" Mine) for smelter flux and gold. The Lamacque Mine may be re-opened while its neighbour, Sigma, has been in continuous production since the 1930's.

THE FUTURE FOR CANADA'S GOLD INDUSTRY

No sector of Canada's mining industry has escaped tough circumstances in the past two decades. While base metal producers have suffered mostly from the depressed metals prices of the early 1980's, gold producers preceded them when caught between fiscal prices for products and rising costs in the 1960's and 1970's. The lesson that has been learned by the entire industry is that, while the prices obtained for products can not be controlled, the costs of production can be.

In the aftermath of the recent experiences, the entire industry is driving hard towards modernization. Where possible, selective mining is being replaced by bulk methods. In doing this, there are special challenges for the precious metals sector. Lode deposits are often narrow vein and thus, if dilution is to be minimized, mining widths must be kept as narrow as possible. A key technological challenge is the modernization of equipment and methods for narrow vein mining. Efforts must also be made to reduce the components of costs which are normally disproportionately higher for small-scale narrow-vein operations (such as power, ventilation, heat, explosives).

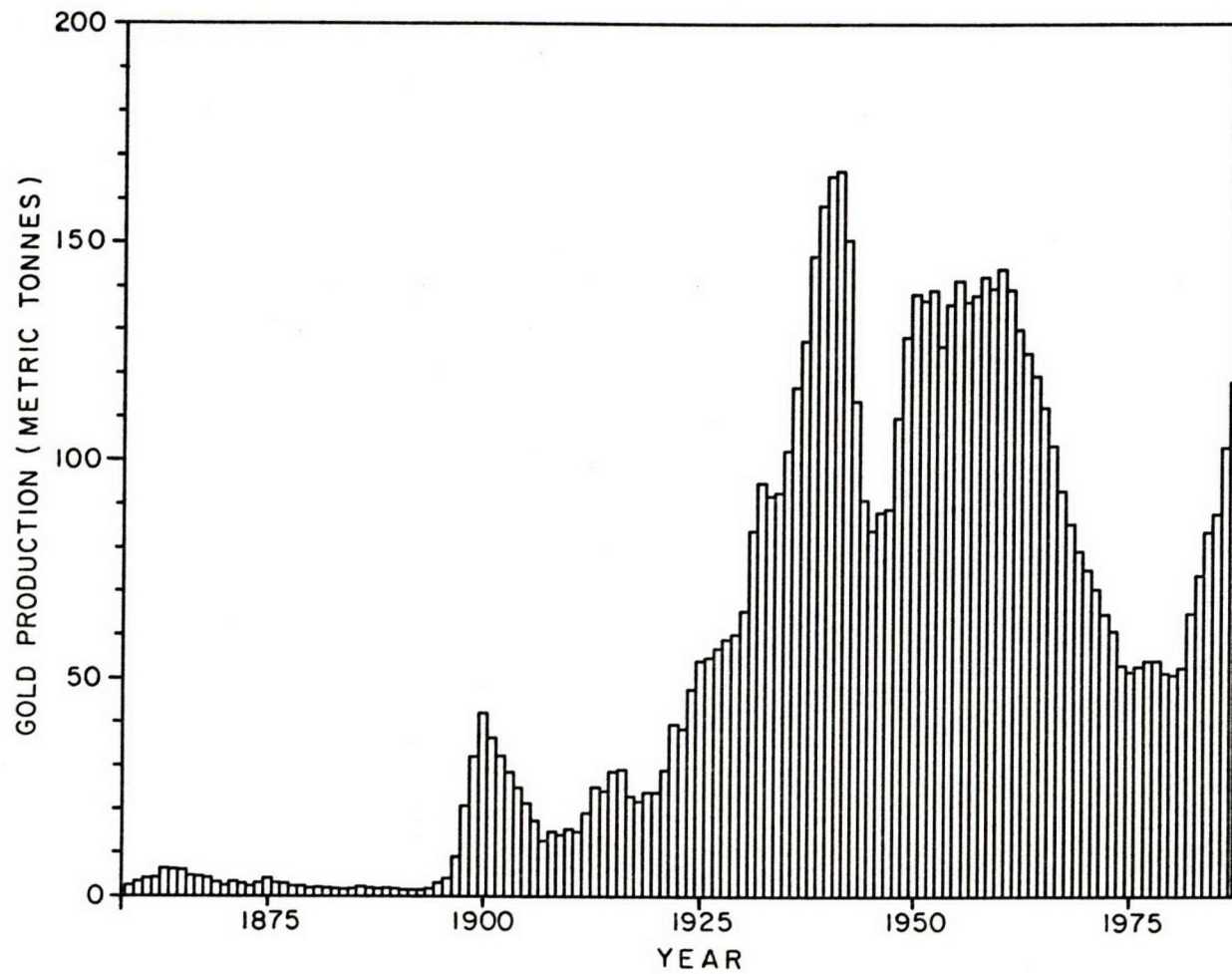
A no less important challenge is the recruitment and training of miners with an aptitude for small scale mining and ability to follow veins. It has been said that, as the result of the mine closures in the 1960's and 1970's, a whole generation of narrow-vein miners was lost to the industry.

Notwithstanding these two important constraints, the Canadian gold mining industry, through successes in exploration and achieving economies in production, is entering a "golden era" in which previous production records will be shattered. The centre of the action is in Ontario and Quebec provinces.

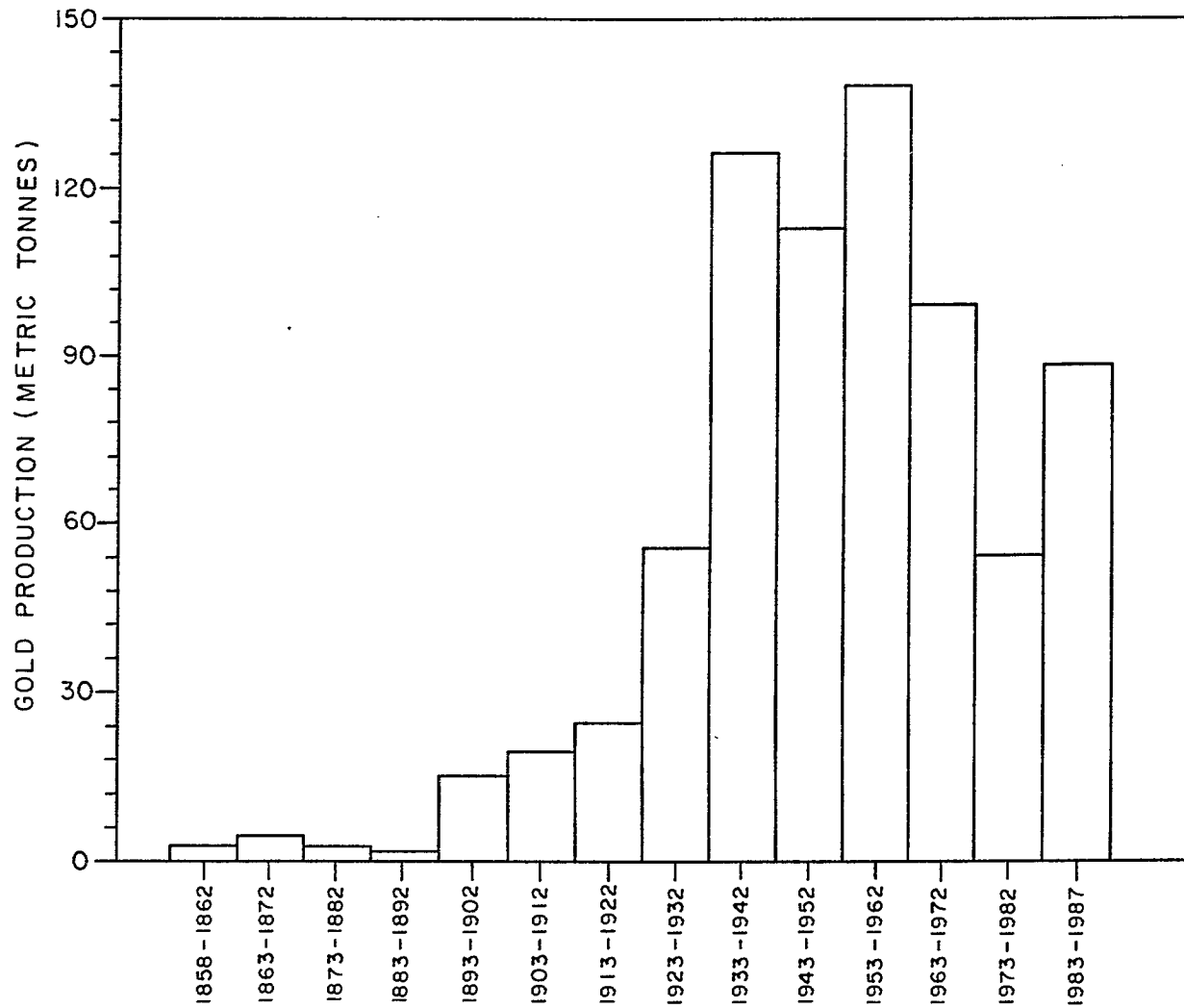


Ontario and Quebec
Gold Producers by Area

- ① Arthur W. White Mine
Campbell Red Lake
- ② Golden Rose
St Joe Gold Mine
- ③ David Bell Mine
Golden Giant Mine
Page-Williams Mine
- ④ Renabie Mine
- ⑤ Dome Mines
Pamour Inc
- ⑥ Bell Creek Mine
Hoyle Pond Mine
Owl Creek Mine
- ⑦ Detour Lake Mine
Inco Gold
- ⑧ Ross Mine
- ⑨ Lake Shore Mine
Macassa Mine
Mirado Mine
- ⑩ Norstar Mine
- ⑪ Kerr Mine
Omega Mine
- ⑫ Agnico-Eagle
- ⑬ Aiguebelle Resources
Francoeur Mine
Remnor Mine
- ⑭ Bousquet Mine
Carnflo Mine
Doyon Mine
Dumagami
Malartic Hygrade
- ⑮ Kiena Gold Mines
Sigma Mines
- ⑯ Belmoral Mine
Chimo Mine
- ⑰ Bachelor Lake Mines
Lac Shortt Mine
- ⑱ Cedar Bay Mine
Henderson Mines
Joe Mann Mine
S-3 Mine
Westminer Canada Mines
- ⑲ Muscocho Explorations



ANNUAL GOLD PRODUCTION 1858 - 1987



ANNUAL GOLD PRODUCTION AVERAGED OVER TEN-YEAR PERIODS 1858-1987

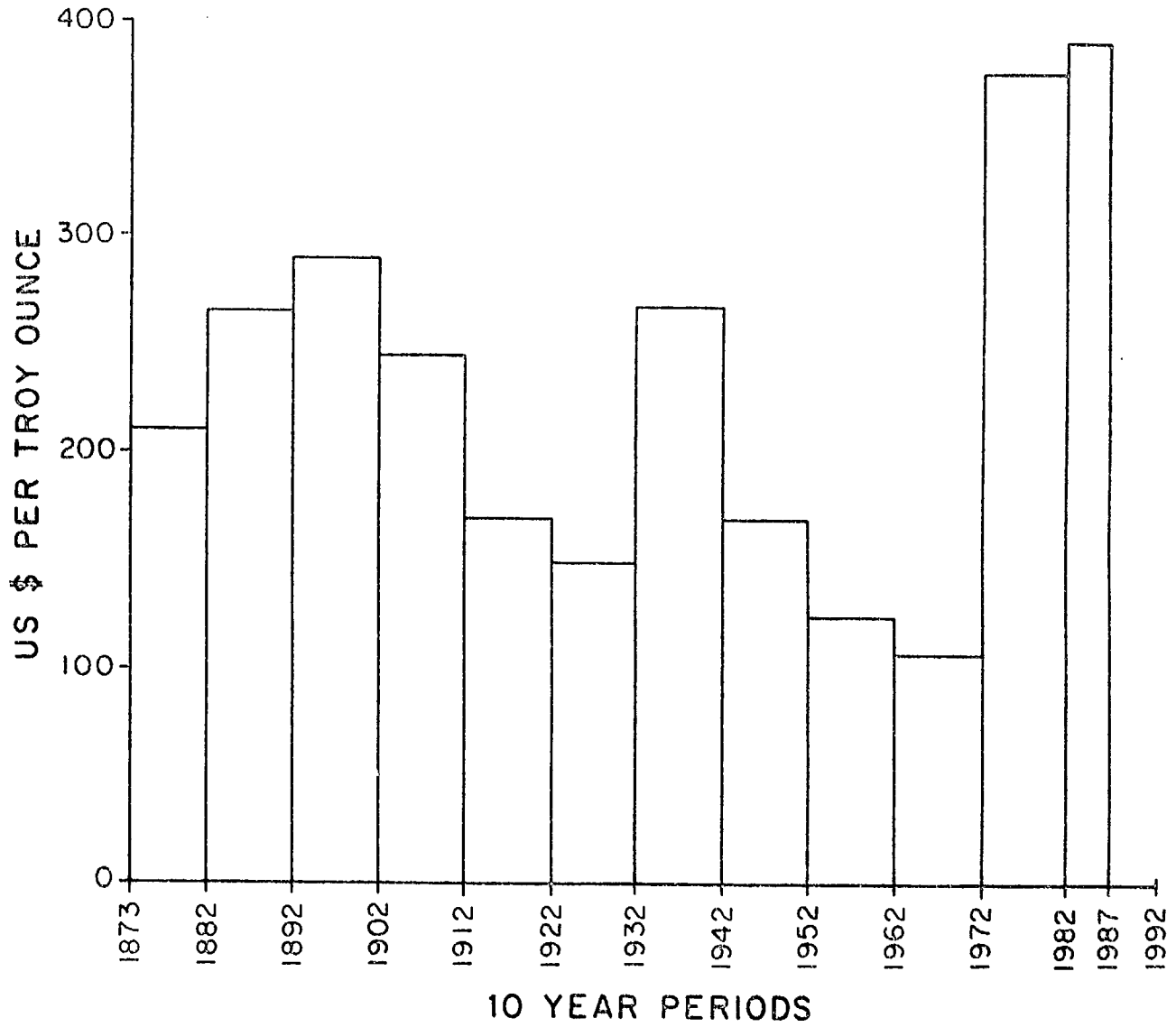


Fig. - 10 YEAR AVERAGE GOLD PRICE IN CONSTANT 1982 DOLLARS

