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Ontario Economic Council.

A program for

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A PROGRAM FOR DEVELOPMENT

IN

NORTHERN ONTARIO


June 2, 1967

Ontario Economic Council

Ontario
Ministry of Finance
gkyx
JUL 15 2004
Research and
Information Services

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Northern Development

That portion of Ontario lying north of the French River contains natural resource assets potentially as great if not greater than any similar region in the world.

For too long this treasure-house, which represents well over three-quarters of the total provincial land mass, has remained largely undeveloped.

To a large number of people northern Ontario is simply a vast, sub-Arctic area. This type of thinking has been fostered by the alleged remoteness of the area and failure to provide adequate access to it.

It is seldom recognized that the most northern boundry of Ontario lies latitudinally south of many major Canadian and European cities such as Saskatoon, Edmonton, Prince Rupert, Glasgow, Edinburgh, Copenhagen, Stockholm, Oslo, and Leningrad. Moosonee, the northern terminus of the Ontario Northland Railway is approximately the same latitude as Calgary, London and Warsaw and south of both Berlin and Moscow.

The climate throughout the region in general is no more extreme than that of Edmonton.

Among the yet to be developed natural resources of the area are:

1. Minerals

- i) deposit of iron ore at Spirit Lake, some 170 miles north of Dryden, capable of sustaining a pelletizing operation of some 2½ million tons annually;
- ii) a potential for economic development of zinc, lead and silver deposits at Favourable Lake some 115 miles north of Red Lake;
- iii) numerous occurrences of gold, silver and copper at Round Lake, 155 miles north of Sioux Lookout;
- iv) some 150 million tons of gypsum in one deposit on the Cheepash River near Moose River Crossing on the ONR. This deposit lies on or near the surface with little overburden;
- v) a deposit of kaolin and silica sand estimated to be in excess of 100 million tons situated on the Mattagami River near Kipling Falls. The kaolin in this deposit is comparable to Cornwall (English) China Clay and the silica at 99.8% pure is of highgrade plate glass quality;

- vi) a deposit of Columbian 18 miles east of Moose River crossing. This ore-bed has been already defined to cover an area $1\frac{1}{2}$ miles in length by 300 to 500 feet in width and to a depth in excess of 700 feet;
- vii) a deposit of lignite at Onakawana on the ONR estimated to contain from 96-140 million tons of brown coal. This deposit is currently being explored by the Alberta Coal Company;
- viii) in addition to the foregoing there is a potential for discovery of petroleum products including oil and natural gas, coal and diamonds, all within the Hudson and James Bay Lowlands.

Petroliferous limestones have for some time been identified at Onakawana as have two coal seams.

Recent identification of kimberlite, the "host bed" for diamonds, at Coral Rapids on the ONR could lead to exciting possibilities for this area.

2. Timber

An enormous potentially exploitable area of timber lies unused. In northern Ontario today there is sufficient timber to double our current annual allowable cut of 500 million cubic feet. The latter is the approximate volume now required annually by the province's forest-based industry.

3. Hydro Power

Throughout the northern part of our province there is a potential for 8.9 million BHP in new hydro power development.

4. Tourism

The potential for tourist development throughout the area is almost unlimited at this time.

5. Human Resources

In addition to a European population of some 722,000 living north of the French and Mattawa Rivers, there are 20,000 to 25,000 Indians. Our failure to capitalize on this latter human asset has resulted in a segment of the population largely isolated from society and contributing little to the economy. The Indian population, moreover has a birth rate approaching 50 per 1,000, higher than that of India, and nearly double that of the rest of Canada. The mortality rate differs little from the national average.

These are but a few of Ontario's known undeveloped resources. Experts predict many more would be uncovered if access becomes available to this vast resource storehouse.

This enormous wealth is claimed as part of the Province's inheritance but unless we are prepared to develop it we could lose it by default.

If we accept our responsibility and undertake a program to stimulate economic growth in the north we should take a studied, orderly approach to achieve the maximum economic benefit for the efforts expended.

On this basis the following proposal is set out as a means of achieving our goal.

THE PLAN

Aim

To stimulate and accelerate by means of a flexible and realistic resource development program economic growth in northern Ontario and to enhance the well-being of the people of the area and the citizens of all of Ontario.

Phase 1

Resource Inventory

Before an economically practicable plan for resource development can be evolved, a detailed inventory of the natural assets of northern Ontario must be set out.

The Department of Lands and Forests publishes a detailed forest inventory. The Department of Mines has a reasonable knowledge of the geology of the major portion of northern Ontario. The HEPC has undertaken its own studies of the hydro power potential.

Each of these organizations has fulfilled its obligations within its area of responsibility but it appears that there has yet to be a totally coordinated approach to setting out the actual resource potential within any given area.

The coordinated inventory should include undeveloped natural resources (and certain developed resources) whether they are held by the Crown or under private license. The Crown portion of the inventory should be readily available.

No difficulty is anticipated in setting out the inventory of resources held under license but the cooperation of the private sector should be assured in advance. This might well mean selling in advance to the private sector a planned approach to northern development.

In this latter regard, it might be possible to achieve a higher degree of cooperation from the private sector if the inventory was carried on outside government.

Complementary to the inventory of natural resource assets, an inventory of human resources throughout the undeveloped areas should be undertaken with a view to optimizing the use of these people in the program.

It is estimated that a minimum period of six to nine months would be required to set out a satisfactory inventory of resources in northern Ontario.

Phase 2

Conditional Assessment of Economic Potentials of Resources

As individual resources became inventoried, feasibility studies would be undertaken to establish each resource's competitive position in relation to other developed sources of supply.

Each study would be made on the assumption that access, at no cost to the development, would be available in some form during exploration, development and production.

When a study indicated that a resource could not be developed and be competitive without the aid of incentives, further analysis would be undertaken to establish at what point the application of incentives made development economically attractive.

This analysis could involve the progressive application of the following incentives available to the provincial government, but not necessarily in the order set out below:

- i) reduced royalties or crown dues
- ii) attractive resource rights
- iii) technical and/or research assistance
- iv) skill training assistance
- v) development capital

When it can be established what incentives might be required to bring a specific resource into production, approval would be obtained from the appropriate governmental authority to set these incentives as the basis for later negotiation with the private sector.

This economic feasibility phase of the program could be more advantageously undertaken by an impartial body. On this basis, resource development consultants, mutually acceptable to both the public and private sectors, might be required.

Provided sufficient experienced personnel could be available, it is estimated that this phase of the program could be completed within 3-4 months of the completion of phase one.

Phase 3

Planned and Phased Access and Supporting Services for Northern Ontario

This phase is the heart of the program, and involves setting out a realistic and economically practicable plan of access to our northern resources. It can only be undertaken when phases one and two have been completed.

A plan of "corridors" to resources would be devised, along which phased access would be guaranteed to the private sector. Access would be provided progressively to meet all the stages required to unfold resources - exploration, development and production.

Each "corridor" would be laid out to maximize the development potential within a given area to provide, on a longer term basis, the best economic return to both the public and private sectors. They could involve access to mineral, forest, tourist and water resources.

Phasing would be established in joint consultation with those in the private sector who have indicated interest in resource development. Initial access along a corridor could take the form of gravel airstrips, an access road or a highway. (It might be noted that in the view of the Deputy Minister of Mines all development roads in northern Ontario, with one minor exception, have so far paid off the full cost of the provincial investment.)

Defining the corridors to achieve an optimum of resource development will, of necessity, involve a great number of variable factors both locally, nationally and in some cases, internationally.

However the general nature of all of these problems is the same. A group of limited resources must be shared among a number of competing demands, and all decisions will be interlocking, because all have to be made under the common set of fixed criteria. On this basis it is felt the major portion of this phase can be calculated through a mathematical or linear programming technique.

In conjunction with the resource aspects of this phase of the study, townsite, water, sewage and hydro planning could be undertaken.

Townsite planning and provision of related services would be undertaken on the basis of "northern communities" to minimize development costs, reduce haphazard settlement and provide as many as possible communal amenities already available in urban areas.

It is estimated that this phase of the program would take a minimum period of six months to complete.

Phase 4

Implementation of the Program

To ensure that the highest possible degree of participation is achieved, corridor development should be approached singly. That is to say that development should be concentrated in one corridor at a time. The order in which individual corridors might be approached could be established during the planning studies on the basis of most rapid, sustained economic return.

If the program is to be successful, maximum participation from the private sector will be required. To achieve a high degree of cooperation, considerable publicity should be given to the program, nationally and internationally, but only after a working plan has been established.

An aggressive selling campaign might be undertaken provincially, nationally and internationally, by a "resource development mission", made up of persons knowledgeable in our northern assets and convinced of the practicability of the program. This campaign, if instituted, should not be left entirely to the public sector. Participation by the private sector should be encouraged.

At the same time all government departments and agencies which might become even slightly involved with the program should be made thoroughly aware of the ramifications and implications of the program as it affects their areas of responsibilities and the provincial economy.

It is felt that a minimum three-month concentrated publicity and salesmanship program would be required before the actual corridor development program could be got underway.

Phase 5

Periodic Evaluation of the Program

A mechanism should be built in to maintain the program aim and/or impetus. Its potential magnitude is such that a singleness of aggressive purpose would have to be achieved to guarantee success.

Progress should be reviewed by an evaluating agency, reporting to an appropriate governmental authority, at intervals not exceeding one year. A six-month review might be even more desirable.

In this regard the broad cross-section of knowledge of the country's economy available in the Ontario Economic Council might make that body appropriate for carrying on such a periodic assessment.

Appendix 'A'

The Economic Rationalization

for

A Program of Northern Development

in Ontario

General

Any program of resource development for northern Ontario should first review those forces which, in normal circumstances, create a growth climate.

One is then able to understand the forces most likely to foster development which might be influenced positively.

The development of any product is dependent on demand. However demand by itself is not necessarily the only criterion.

For example, at this time, some three-quarters of the world's population faces, to a degree, under-nourishment. This fact, by itself, indicates that there is an enormous potential for increased food production.

However it does not necessarily follow that massive increases in world food production are imminent. There must be available:

- i) sufficient capital - human, resource, financial and equipment - to produce
- ii) necessary channels of distribution, and
- iii) an adequate distribution of wealth and income.

If any of the above ingredients are missing, the potential for a product will remain undeveloped. That is to say, the market conditions are not favourable.

Provided there is demand for a product and the market conditions are favourable, a climate for development is present.

A further factor in successfully exploiting regional resources is the production of marketable work on an economically competitive basis. Other sources of supply may furnish competition that has to be met.

A climate for development might also exist when a resource is sufficiently in demand that development is necessary, regardless of cost. A case in point is the extraction of radio-active ores from the North West Territories during World War II. The conditions then prevailing were exceptional and such situations will not be considered in this review.

When one looks at northern potential in the light of present market conditions, one sees that a demand exists for many of already known resources. There is, in general:

- i) capital available for development; and
- ii) a reasonable advanced economic base.

However access to the resources is almost totally lacking. The necessary channels of distribution do not exist. The total climate for development, therefore, is not present.

The Importance of Transportation

Access is a prerequisite to development in any part of the province but particularly so in the north.

There are now three major road & rail, air and water communications "hubs" in Ontario - Toronto, Sudbury-North Bay and the Lakehead. Through these pass most goods and services. They indicate the degree to which the areas surrounding them are developed economically.

The communications net radiates from Toronto in all directions; from Sudbury-North Bay the directions are primarily east-west and north-south; and from the Lakehead, east-west only.

Further development from the Sudbury-North Bay and Lakehead hubs is necessary if northern development potential is to be realized.

If northern development is to take place on the most efficient and economic basis, access routes must be closely tied to relatively immediately exploitable resources.

The building of the Ontario Northland Railway, initially designed to create a salt-water port at James Bay, is a case in point. It has taken 35 years for development along the length of this route to begin to pay off.

Access routes must be planned and phased to give both the public and private sectors the quickest and best returns.

The public and private sectors should first co-operatively examine, as far as possible, the cost components of:

- i) exploration
- ii) development
- iii) production
- iv) distribution
- v) maintenance

Incentives and Subsidies

No doubt, even under an assumption that access would be available, some of our resources could well prove to be marginally economic by reason of their distances from markets. However, it should not be overlooked that they might be made competitive if subsidies or incentives were available.

Subsidies are more generally direct financial contributions to underwrite, in whole or in part, a less competitive or uneconomic enterprise. For this reason they are generally unacceptable in our competitive environment, except in the case of public corporations, agencies or utilities.

Incentives are more acceptable as a means of encouraging development. They are generally set out to give either of two results:

- i) to reduce the risk in capital investment, or;
- ii) to increase the chance for return from high-risk capital investment.

The latter aspect is more generally applicable to resource development.

Incentives can take various forms or combinations of forms, the most common being:

- i) tax concessions
- ii) preferential tariffs
- iii) guaranteed markets
- iv) favourable royalties or crown dues
- v) resource concessions
- vi) technical and/or research assistance
- vii) skill training assistance
- viii) arranging development capital, of which items (iv) to (viii) are tools more readily usable by provincial governments.

Human Requirements

Regardless of all of the foregoing, the greatest single factor in northern development will be people.

One must have people who have sufficient faith to promote and encourage northern development. Persons knowledgeable in northern Ontario will be required to get out and sell undeveloped resources nationally and internationally.

Sufficient enticement must be given to encourage people to work in the north. There must not only be an available work force but wages will have to be sufficiently attractive to draw workers into the area.

People will be required to live in the north. Salaries, services and amenities available to northern residents will have to be equal to or exceed those enjoyed in our southern urban areas.

And of no less importance, an atmosphere of mutual understanding, trust and cooperation will have to be built up amongst all of those from both the public and private sectors involved with and participating in the plan.

If one cannot satisfy the human requirements, no program of northern development will succeed.

Federal Participation

Finally, it should not be overlooked that economic growth in northern Ontario would benefit all of Canada. On this basis, an attempt should be made to encourage some form of federal participation when Ontario's program for northern development has been set out.

Participation might take the form of an extension to the designated-areas program, assistance under ARDA or inclusion in the recent federally-announced development program for Yukon and the North West Territories. This latter program provides financial assistance up to 40% of exploration costs and income tax benefits.

Summary

If development in northern Ontario, much of which will be natural resource related, is to be accelerated, the provincial government must in the order set out below, be prepared to:

1. Assess, jointly with the private sector, the economic competitiveness of our major known but yet undeveloped northern resources.

2. Provide a planned and phased program of access into the north, based on the above economic feasibility studies.
3. Within its area of responsibility, provide incentives as may be required to encourage northern development.
4. Take into account the human factor in northern development.
5. Negotiate with federal authorities for cost-sharing in such development.

Appendix 'B'

Organizational Approaches

for

A Program of Northern Development

in Ontario

Organizational Approaches to Northern Development

General

If the government of Ontario accepts the need for and is prepared to undertake a comprehensive plan of northern resource development, it should recognize at the outset that there will be no short-term solution. Some new form of organization will be required to maintain continuity of action.

Provided development action can be kept aggressive, a minimum initial 3 to 5 year program is envisaged. At the end of this period, the over-all progress of the plan would be assessed with a view to determining its effectiveness on a longer term basis.

Basically, four alternative types of organization are available:

- i) a new government department
- ii) an in-government organization
- iii) a joint public-private organization
- iv) a development commission

A New Department

The type of organization required to deal with northern development thought of most immediately is probably the formation of a new government department. While this approach might have some merit, it would appear that the disadvantages outweigh the advantages.

Regardless of the priority that a new department might be given, it would be functionally no more than an equal to any other operating department. It could only perform by assuming or overlapping the already delegated responsibilities of other departments.

Both courses appear impracticable. An assumption of the responsibilities of other departments in certain areas of the north would duplicate already available services. Overlapping could largely undercut decision-making ability.

Accordingly this organizational approach is not recommended.

In-Government Organization

This organization is seen as one composed of a directing group perhaps known as a Northern Development Board. The Board would be drawn from the senior levels of those departments

most directly concerned with northern development and limited to a maximum of seven members. Proposed membership would include representatives from the:

Department of Lands and Forests

Department of Mines

Department of Tourism and Information

Department of Economics and Development

Department of Energy and Resource Management

Department of Highways

Ontario Economic Council

The Board would answer directly to a Cabinet Committee and would be required to initiate resource studies and assess, implement and evaluate development plans.

A sub-committee to the Board made up of representatives from the operating Departments and agencies would assist the Board by setting out plan proposals and managing the programs as they evolved.

Membership in the sub-committee would be set generally on an ad hoc basis and, in addition to representation from those Departments forming the Board, could be drawn from:

Department of Education

Department of Labour

Department of Municipal Affairs

Hydro Electric Power Commission
Ontario Development Corporation
Ontario Housing Corporation
Ontario Northland Railway
Ontario Research Foundation
Ontario Water Resources Commission

Joint Public-Private Organization

An organization of this type would be similar to an "in-government" organization, but a directing group of public-minded citizens would replace the senior civil servants proposed in that type of organization. It might be known as a Northern Resource Development Council.

The organization would be almost identical with the existing Northern Development Committee of the Ontario Economic Council which might, itself, assume responsibility for a northern development program.

Again, a sub-committee drawn from representatives of operating departments would be established to work with the Development Council (Committee).

Development Commission

This type of organization could take the form of a small, full-time commission or agency, limited possibly to a Commissioner of Northern Development and a deputy. The commissioner, a private citizen with recognized prior experience in resource development, could be appointed for a fixed term with sufficiently broad powers to interpret and have implemented the government's policy plan for northern development.

The general organization is envisaged as being a much reduced version of the Expo '67 organization.

To achieve the broadest possible support, the commissioner would report directly to a senior member of cabinet although reporting to a minister without portfolio should not be overlooked.

Conclusions

Each of the foregoing organizations have merit, however, members of "in-government" or "joint public-private" organizations will always treat northern development, as a total concept, as an area of secondary interest by reason of their prior responsibilities in their primary fields.

If a northern development program is to succeed, those directly involved with the plan must approach it as an area of major personal concern.

Accordingly, it would appear that an organization based on a Northern Development Commission might be best suited to carry forward a provincial approach to northern growth.

Appendix 'C'

Map:

Geology and Principal Minerals

of

Ontario

HC/117/.06/.P76/1967

Ontario Economic Council.

A program for

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All that glisters...



*'All that glisters is not gold'

to quote from the 'Merchant of Venice.'

And 'All that glisters is not gold'

suits this illustration too,

for here, like a vast treasure trove,

myriad deposits of diverse and

valuable minerals lie in glittering strands

across the map of Ontario.

Minerals from salt to silver

and talc to tungsten,

from homely iron to exotic palladium,

create for us a trove which we all share.

The presence of this mineral wealth

is responsible to a large degree

for Ontario's thriving industrial complexes

and its continuing prosperity.

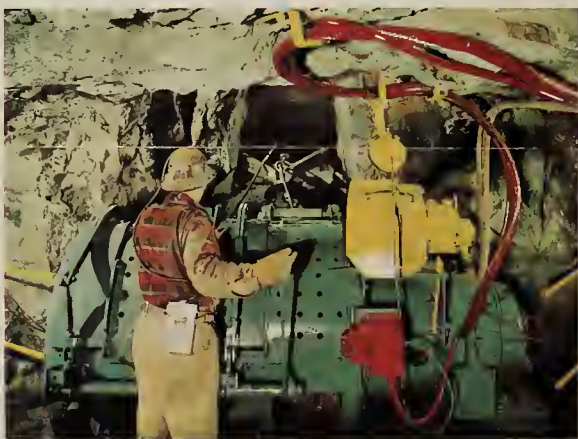
Mining and You



ONTARIO'S INDUSTRY manufactures about half of Canada's goods. Her great industrial complexes, such as those that ring Lake Ontario from Niagara Falls to Oshawa in the famous Golden Horseshoe, make the appliances and fixtures that furnish the nation's homes and keep Canada's factories running. But these plants would be empty shells were it not for the continuous flow of raw materials from the mines of the Canadian Shield far to the north.

The voracious smelters, blast furnaces, mills and refineries in centres like Hamilton, Sault Ste. Marie and Sudbury gorge themselves on nearly a thousand million dollars' worth of Ontario's minerals a year; fabricating wire, rod, strip, plate and alloys vital to the home, to the handyman and the space-age craftsman alike.

Nickel, platinum—a dozen metals—are yielded by the Sudbury camp, Ontario's greatest mining community and the world's major source of nickel. Gold from the Porcupine, Kirkland Lake and Red Lake; silver from Cobalt; copper, zinc and lead from Manitouwadge or the great new Kidd township orebody; uranium from Elliot Lake; iron from Steeprock, Wawa and Boston Creek, are some of the more obvious products of our better known northern mining communities. Southern Ontario adds its contribution of salt, oil and gas, construction materials, industrial minerals and iron.

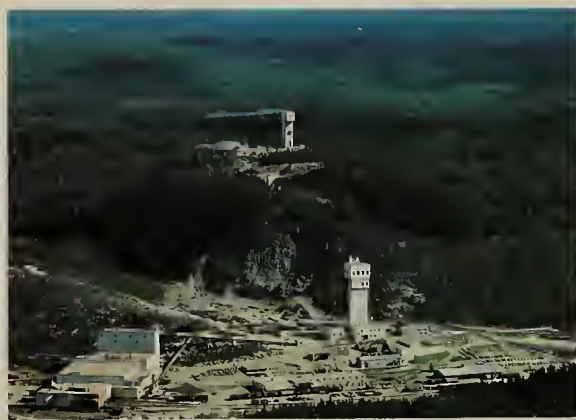


How then did these mines come into being, bringing with them today's civilization into yesterday's inhospitable wilderness? Some were found by accident. Many more were found by experienced prospectors, scouring the land for precious metals. Science now provides exploration teams with sophisticated tools that their forerunners would have envied, like the airborne magnetometer with its 'bird' suspended beneath the aircraft (see the picture below), seeking out anomalies in the earth's magnetic field. The Ontario Department of Mines stimulates exploration both by sponsoring such airborne surveys and increasing the number of geologists and students of the earth sciences that it sends into the field on its annual mapping programs.



The twentieth century demands the very latest techniques and applications, especially in mining. The slusher (shown to the left) is indicative of modern trends in an ancient craft. Not only are mine workings reaching greater depths (some Ontario mines reach more than 8000 feet deep) but they are larger, better-lit and better ventilated. Manual work is reduced to the minimum. Multiple-drill jumbos drill the ores so that they can be blasted out by explosives. Electric trains, conveyors, fast travelling skips and high-speed hoists bring the ore to the surface. The mining industry co-operates closely with the professional engineers of the Ontario Department of Mines to ensure a safe and healthy working environment.

Thirteen out of every hundred Canadian workers work in some way for the mineral industry. One great advantage enjoyed by the modern Ontario miner and his family is their chance to live in an up-to-date house in a well equipped community set in unspoiled countryside with hunting, fishing and winter sports on their doorstep.



The individual prospector still has a significant role to play. Guided by Ontario Department of Mines geological maps and reports, and encouraged to explore his province by sensible staking regulations and free assays of the minerals he finds, he uses instruments to detect ground magnetism, rock conductivity, gravity and radioactivity.

Since development of the modern Canadian hard-rock mine calls for great sums of money along with financial courage and advanced engineering know-how, the prospector usually sells his claims for cash or stock in a mining company that is prepared to develop his prospect. Prospectors, geologists, engineers, miners, developers and brokers all play their part in bringing us the minerals and metals without which our way of life could not be supported. No less vital is the contribution of a quarter of a million Canadian citizens who support the development of the province by investing in mining companies, many of which are operating in Ontario.

Overleaf – a gift map of Ontario by the Ontario Department of Mines showing in layman's terms the rocks of the Province of Opportunity and the minerals they contain.



Map 2103
ONTARIO
GEOLOGY AND PRINCIPAL MINERALS



LEGEND
This map shows the types of bedrock underlying Ontario. Geological map legends are usually arranged with the youngest rocks at the top and the oldest rocks at the bottom, but many of the Precambrian rocks are so old and complex that their true age is not known, so they are grouped by similar characteristics rather than by age.

THE CENOZOIC ERA
(the age of recent life)
Five epochs left their deposits on western Canada, while Ontario stood high and dry. The giant glaciers of the Pleistocene epoch followed. The sands, gravels and clays now covering Ontario were left by four ice ages, the most recent unthawing 10,000 years ago. They do not have a separate colour on the map.

THE MESOZOIC ERA
(the age of middle life)
Cretaceous rocks of clay, sand and brown coal were laid down in warm, shallow waters that covered northern Ontario, while in Europe the white cliffs of Dover were forming. A source of pottery clay and fuel. This era saw the rise and fall of the dinosaurs.

THE PALEOZOIC ERA
(the age of ancient life)
Devonian and Mississippian limestones, sandstones and shales were formed under warm seas teeming with marine life, while the first dry land creatures emerged. Fossil remains of animals and plants, trapped in porous rock, became oil and natural gas.

Silurian rocks, well exposed in Niagara's gorge, were once sands, muds and lime deposits that formed on a seashore crawling with sea scorpions, while plant life first took firm hold on dry land. These rocks yield oil and gas.

The Ordovician rocks, now washed in Niagara's Whirlpool Gorge, formed under tranquil waters in which plant squids flourished. Their ancient limestones give up oil and gas and their shales are made into brick and tile.

Cambrian sandstones are the earth's oldest formations that bear fossils indicating abundant marine life, mostly remains of hard-shelled creatures. These rocks formed under continental seas, the home of jellyfish and sponges.

PRECAMBRIAN ROCKS
Dark crystalline, basic intrusive rocks that once forced their molten way through cracks and beds of older rocks, bringing with them the nickel of Sudbury some 1600 million years ago and the silver of Cobalt over 2 billion years ago.

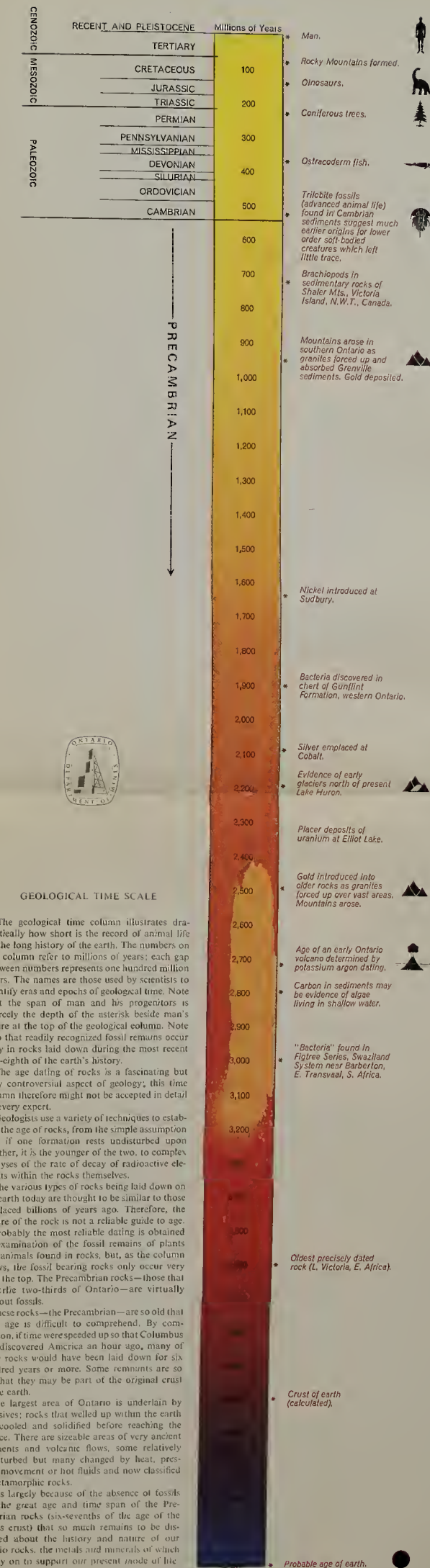
Ancient sediments and volcanics. The Anikiee of Nipigon and the Keweenaw north of Sault Ste. Marie are relatively undisturbed. The Grenville rocks of southern Ontario, soaked by hot fluids, deformed and changed by intruding magmas about a billion years ago, yield uranium, nepheline syenite, feldspar, fluorite, apatite, mica, iron and gold.

The Huronian sediments north of Lake Huron are the source of iron ore. The Huronian rocks of Cobalt's silver, transported by water, ice and wind and assembled over a period of a billion years, have remained relatively undisturbed for the last 1600 million years.

Light coloured crystalline granite rocks, often with darker banding, that cover much of Ontario. Hot magmas welled up within the earth, distorting and recrystallizing older rocks, and introducing gold-bearing quartz veins. They are associated with the formation of mountains 2500 million years ago (Algonquin age) and 1000 million years ago (Grenville).

Very ancient dark colored basic intrusive rocks, often called Haileburian. They brought with them iron and base metals. A source of asbestos.

Ontario's oldest rocks, probably older than 2700 million years. The ancient volcanic flows and sediments are known as Keweenaw rocks, and slightly younger sediments as Timiskaming. Highly distorted, their beds vertical or overturned, they are the best rocks of Ontario's silver and iron deposits, and the prospector's most interesting formations.



GEOLOGICAL TIME SCALE

The geological time column illustrates dramatically how short is the record of animal life in the long history of the earth. The numbers on the column refer to millions of years; each gap between numbers represents one hundred million years. The names are those used by scientists to identify eras and epochs of geological time. Note that the span of man and his progenitors is scarcely the depth of the asterisk beside man's figure at the top of the geological column. Note also that readily recognized fossil remains occur only in rocks laid down during the most recent one-eighth of the earth's history.

The age dating of rocks is a fascinating but very controversial aspect of geology; this time column therefore might not be accepted in detail by every expert.

Geologists use a variety of techniques to establish the age of rocks, from the simple assumption that if one formation rests undisturbed upon another, it is the younger of the two, to complex analyses of the rate of decay of radioactive elements within the rocks themselves.

The various types of rocks being laid down on the earth today are thought to be similar to those emplaced billions of years ago. Therefore, the nature of the rock is not a reliable guide to age. Probably the most reliable dating is obtained by examination of the fossil remains of plants and animals found in rocks, but, as the column shows, the fossil-bearing rocks only occur very near the top. The Precambrian rocks—those that underlie two-thirds of Ontario—are virtually without fossils.

These rocks—the Precambrian—are so old that their age is difficult to comprehend. By comparison, if time were speeded up so that Columbus had discovered America an hour ago, many of these rocks would have been laid down for six hundred years or more. Some remnants are so old that they may be part of the original crust of the earth.

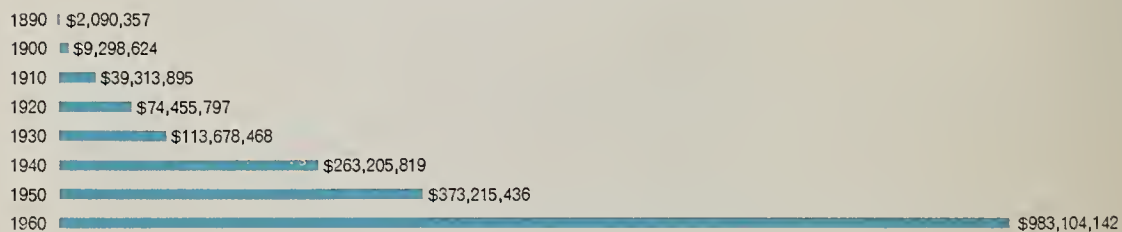
The largest area of Ontario is underlain by intrusives; rocks that welled up within the earth and cooled and solidified before reaching the surface. There are sizeable areas of very ancient sediments and volcanic flows, some relatively undisturbed but many changed by heat, pressure, movement or hot fluids and now classified as metamorphic rocks.

It is largely because of the absence of fossils and the great age and time span of the Precambrian rocks (six-sevenths of the age of the earth's crust) that so much remains to be discovered about the history and nature of our Ontario rocks, the metals and minerals of which we rely on to support our present mode of life.

MINERALS AND METALS PRODUCED IN ONTARIO

Actinolite, arsenic, asbestos, barite, barium, beryl, bismuth, calcium, celestite, cement, cerium, chromite, clay products, cobalt, copper, corundum, diatomite, feldspar, fluorspar, garnet, gold, graphite, gypsum, iridium, iron, lead, lime, magnesium, marble, marl, mica, mineral waters, molybdenum, natural gas, nepheline syenite, nickel, palladium, peat fuel, peat moss, petroleum, phosphate (apatite), platinum, quartz, rare earths, rhodium, ruthenium, salt, sand and gravel, selenium, silica, silver, stone, sulphur, talc, tellurium, thorium, tungsten, uranium, yttrium, zinc.

GROWTH OF MINERAL PRODUCTION IN ONTARIO



PHOTOGRAPHS

FRONT COVER: *An extremely thin slice of a basic intrusive rock (Elliot Lake area) enlarged x 166. The gold coloured crystals are probably labradorite set in pyroxene. Photomicrographed through a quartz wedge. F. W. Beales, University of Toronto.*

PHOTOGRAPHS ACCOMPANYING "MINING AND YOU" top to bottom: *Hamilton. Ore carrier unloading at a steel production plant. ● Copper Cliff. Metal being refined in a converter aisle. (Courtesy of the International Nickel Company of Canada Ltd.). ● Sudbury camp. A "slusher" removing ore from the mining area. (Courtesy of the International Nickel Company of Canada Ltd.). ● Manitouwadge. Head frames and mill. (Courtesy of Geco Mines Ltd.). ● Kapuskasing area. An aeromagnetic survey in progress.*

SOCIETIES AND PUBLIC BODIES FURNISHING INFORMATION ON MINING IN ONTARIO

The Canadian Institute of Mining and Metallurgy ● The Mining Association of Canada ● Department of Mines and Technical Surveys (Ottawa) ● Ontario Department of Mines ● Ontario Department of Energy and Resources Management ● Ontario Mining Association ● Prospectors and Developers Association.




Gardner
Minister

ONTARIO DEPARTMENT OF MINES

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