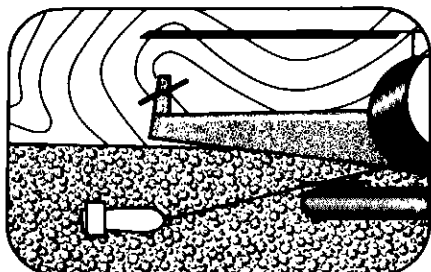


Articles



The Canadian Mining Geophysical Industry – Diagnosis and Prognosis

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How Did It Come To Be?

The flowering of the mining geophysical industry in Canada in the post war years was no accident but the natural results of a number of favourable circumstances. The worldwide thirst for metals brought about by pent up civilian requirements concentrated the attention of the major mining companies, Canadian and international, on Canada. We were politically and fiscally stable, didn't discriminate against foreign interests in our natural resources, didn't levy severe royalties on production, didn't restrict the form in which minerals or metals could be exported and, best of all, even gave quite favourable tax treatment to all

mining companies, including a three year start-up tax holiday on new mines and liberal depletion allowances. To top it off, we had the right geology and lots of it, mostly unexplored and thinly covered with overburden. And so the race began.

The resulting intense competition made it imperative to develop the tools and talents for the search. In the hardware development we were greatly assisted by our direct access to the latest US electronic technology. Airborne systems were conceived and built to speed up the search. Airborne electromagnetic devices became a peculiarly Canadian contribution to the geophysical arsenal. Companies manufacturing geophysical tools and others providing services sprang up rather quickly. Some prospered and survived, others fell victim to the periodic droughts in mineral exploration which seem to occur every four or five years.

What Constitutes the Industry Today?

A group of about fifteen companies presently constitute the commercial side of the Canadian Mining Geophysical Industry, excluding individuals who act primarily as consultants or operate one or two contracting parties intermittently. Of these companies, four are located in the vicinity of Ottawa and the remainder near Toronto. Seven of these companies offer contract services only, four span the full gamut

from instrument production to contract services and four mainly confine their activities to instrument production. All fifteen carry out some activities that fall into the research category but the bulk of the R & D expenditure is made by the mixed instrument/service companies.

In the year 1973, these companies had an estimated total volume, in geophysical goods and services, domestic and foreign, of about \$18,000,000, broken down approximately as shown (expressed both in millions of dollars and as a percentage of the total sales) in Table I.

The importance of the foreign market to this industry is readily apparent, providing 53 per cent of its total sales in 1973. In ground surveys 65 per cent of sales and for instruments 58 per cent of its sales are foreign. There are few Canadian industries that are so export minded.

Although few individual figures have been made available to me, I estimate that no one company has more than 25 per cent of the total Canadian industry volume, with the three largest companies each having gross geophysical sales of between 3.5 million and 4.5 million dollars each. Only four other companies have 1973 sales in excess of one million dollars. At the present time, therefore, the industry is certainly not dominated in all its aspects by any one company although individual companies may excel in individual areas.

Table I

Activity	Domestic	Foreign	Total
Aerial Survey	5.4 (30.0%)	4.8 (27.0%)	10.2 (57%)
Ground Survey	1.2 (6.7%)	2.1 (11.7%)	3.3 (18%)
Instrument Sales & Rentals	1.9 (10.6%)	2.6 (14.5%)	4.5 (25%)
Totals	8.1 (47.0%)	9.5 (53.0%)	18.0 (100%)

Some of these companies have other areas of activity, most commonly aerial photography in the case of the larger aerial survey contractors but also such things as geochemistry, oil drilling, marine seismics, pollution monitoring, data acquisition systems and headphone manufacturing.

How Does It Rank on the World Scene?

In trying to determine the relative importance of the Canadian geophysical industry on the world scene, we have difficulty in establishing the proper statistics. The Society of Exploration Geophysicists attempts an annual survey of service activity of which the latest figures published in February 1974 covered the 1972 calendar year. These figures are obviously incomplete and therefore err on the low side. They are however, as follows: *Aerial Survey* – \$25,000,000 of which six million was for petroleum aerial magnetic surveys, *Ground Survey* (mining only) \$13,000,000. The corresponding figures for 1973 are probably slightly higher but not vastly different from those in 1972. It should be noted that these figures provide a measure of the maximum potential geophysical service market and that not all of this market is in fact available to Canadian contractors, being carried out by "in-house" crews or for other reasons that will be discussed later.

Even taking these figures as being valid for 1973, we conclude that Canadian firms were successful in obtaining about 40 per cent of the world aerial survey work and 26 per cent of the ground survey work in that year. In respect of instrument sales however we have no overall figures. A subjective judgement, based upon personal visits around the world, suggests that Canada currently supplies about 75 per cent of the world's mining geophysical instruments of all types, to all countries outside the Soviet Union.

To facilitate service and instrument sales into foreign areas and in recognition of the importance of having a local presence for sales and execution of surveys, Canadian companies maintain branch offices or subsidiary companies, sometimes

with local participation, in such countries as USA, Mexico, Venezuela, Brazil, Australia, the Philippines, Singapore, South Africa, Nigeria and the Ivory Coast.

Who Are Our Competitors?

We have different competitors in different technical areas around the world. In geophysical instrumentation the most formidable potential competitor is the Soviet Union with a massive catalogue of prospecting tools. Fortunately for us, the Soviets are still hampered by a limited range of electronic components and therefore produce bulky, somewhat antiquated and insensitive equipment. In addition, they do not try very hard to sell outside of their own borders, let alone outside the Socialist Block. Serious competitors, each with a limited range of products, exist in the USA and Sweden, and lesser competitors exist in the UK, France, Czechoslovakia, Finland and Australia.

The foreign competitive situation is fluid and in general is becoming more significant as outside groups become more proficient, encouraged by tariff shelters and local politics or funding.

In the area of aerial surveying we certainly are far from dominant, particularly in the large scale aerial magnetic and radiometric field. Here we meet strong competition from large and well equipped groups in the USA, France, UK, Sweden and Germany who operate internationally, as well as smaller organizations operating in more restricted areas such as Australia, Brazil, Argentina and South Africa, etc.

Where we do excel is in the area of airborne electromagnetic surveys where we probably execute over 90 per cent of the world's contract surveys, amounting to 7.5 million dollars in 1972, according to the SEG figures.

In the area of ground geophysics there are local competitors in many countries as well as international competition from companies based in the USA, France, Sweden, UK and Germany. Many of these competitors utilize Canadian-made instruments and have gained their initial experience with Canadian contractors.

What Is The Role of Government in Our Industry?

Firstly, the public sector (governmental agencies and universities, both Canadian and foreign) is assuming an increasing importance as a market for our geophysical goods and services. In Canada, the Federal and Provincial governments generate a significant volume of sales of the industry, sponsoring an estimated \$1.5 million of domestic aerial surveys and about an equal amount in foreign aerial surveys in 1973. The latter are funded by the Canadian International Development Agency who also financed the purchase of about \$600,000 worth of geophysical instrumentation in 1973. Thus various Canadian levels of government, directly or indirectly, provided 28 per cent of the funding for domestic aerial surveys, 31 per cent of the funding for foreign aerial surveys and 23 per cent of the funding for foreign purchases of equipment of Canadian origin.

The trend abroad is to increased governmental purchases and reduced proportionate purchases by the private sector, as governmental agencies in the underdeveloped and even in the developed countries assume a more direct and centralized responsibility for the mineral exploration in their countries. The movement therefore is towards larger unit sales or services in equipment, particularly in the foreign market. This is rather to the benefit of our industry.

The United Nations Development Program has sponsored a large number of mineral exploration programs involving sub-contract for geophysical goods and services over the last 25 years. A total of 89 contracts valued at 21.5 million dollars have been awarded to Canadian firms for services by the UNDP to the end of 1972 and the current annual rate of the UNDP's sub-contract expenditure in this area on goods and services is about \$750,000 annually, excluding personal service contracts with individual experts.

Other international organizations, for example the Organization of American States, occasionally support individual mineral exploration programs in developing countries,

although the long term trend here is not yet clear.

Bilateral aid programs between a developed and developing nation, designed to assist the latter in the exploration for its mineral resources, are becoming increasingly more common. When the donor country is Canada, then CIDA becomes involved and Canadian goods and services are called upon by statute (to 85 per cent or so). By the same token, Canadians are excluded from bilateral programs involving such donor countries as the UK, USA, Germany, France, the Netherlands and Socialist states such as the USSR, Poland and Czechoslovakia, Romania, Hungary, Yugoslavia. All of these countries, with the exception of Canada, the USA and UK, maintain one centralized geophysical service organization which is largely, if not wholly, government owned. Even in some of these instances we may still manage to get a piece of the action through supply of the field equipment to be operated by donor personnel or through the sub-contract of airborne electromagnetic surveys.

What About Research and Development?

Between \$1,500,000 and \$2,000,000 are spent annually by the industry on the development of new exploration techniques and tools for airborne, ground and borehole use. This is an extraordinary amount since it constitutes about 10 per cent of the gross sales of the industry, which is high for any industry, particularly in Canada. An increasing portion of this total is government supported through various schemes for R & D incentive such as the IRDIA and PAIT of the department of Industry, Trade and Commerce and IRAP of the National Research Council of Canada. In addition, because of the Federal Government's recently established policy of farming out new research and development programs rather than undertaking them in-house, the industry is receiving full funding for certain programs of interest to Federal Government agencies.

Most of the current research and development is carried out by the instrument manufacturers, and

particularly those who are also involved in providing contract services. Advances, major and minor, have been achieved in techniques and instrumentation in many fields including airborne electromagnetics, radiometrics, induced polarization, magnetics, gaseous detection and activation analysis of geologic materials.

Who Owns the Industry?

Of the fifteen companies of importance in our industry, six are wholly or primarily foreign owned, including USA, UK and French interests. These companies control about 50 per cent of the industry volume. The three largest of the Canadian owned group are divisions of public companies and the remainder are private companies. As this is written a fourth member of the Canadian group is about to be absorbed into a Canadian public company.

What Are The Industry's Problems?

The industry's problems are primarily related to its fragmentation and over capacity. The former leads to wasteful duplication of R & D and marketing efforts and the latter results in low prices, poor rewards for employees and losses for investors.

Our industry was born in response to a Canadian demand for goods and services, generated by the favourable conditions existing in Canada for mineral exploration in the period 1946-1968. Many of these conditions are no longer so favourable. For one thing we are at a relatively mature stage of exploration for certain types of deposits in the more accessible areas of Canada and are now looking for the deeper, more obscure or more remote ones, all of which means greater proportionate cost.

Federal and provincial governments alike in Canada seem now intent on treating the extractive industries less favourably, rather than more favourably than manufacturing industries for taxation purposes. Restrictions on foreign ownership are being imposed in respect of some commodities as well as restrictions regarding the export of metal in concentrate form. Worse still, we have

just seen provincial legislation in British Columbia whereby a graduated ad valorem royalty is to be levied, which will mean that the same ore is worth less in BC than elsewhere in Canada.

These factors have progressively reduced the attractiveness of Canada as a place for exploration by the private mining sector, both Canadian and foreign. The reasons why our industry is currently earning 53 per cent of its sales dollars abroad is only partly because the foreign market has grown but also because the domestic market has shrunk. Foreign sales are now a means of survival for many companies in our industry.

The relative shrinking of our domestic market over the past five years has been superimposed on a sharp slump in mineral prices in 1970-71, which caused a world-wide recession in exploration from which we are only now recovering. The industry has had major overcapacity in the past three years, resulting in severe competition, price cutting and, inevitably, losses. There is little doubt that our industry lost money as a whole in the years 1971-72 and probably just about broke even in 1973.

Even today, it is quite possible to purchase a line mile of airborne or ground geophysical survey at 1960 prices, even though all constituent costs have just about doubled since then!

As a corollary, during this period of gloom, there has not been adequate reward either to the shareholders or employees of our industry. In respect of the latter we have not properly compensated our field staff for the physical hardships, long and irregular hours, isolation and primitive living conditions that they are asked to endure to obtain our survey data. While the ruinous competition and low rates prevail this condition is likely to persist.

As you may conclude from the sales figures I have given you earlier, the industry is badly fragmented for such a small world-wide market and especially so in relation to the relatively weak Canadian market. One might defend the existing severe competition as a proper result of the

free enterprise system. This, I agree, can be argued so far as the Canadian market is concerned, but when it is the foreign market which now provides the major *raison d'être* of the industry, the competition is only wasteful. It extends to all aspects, including R & D and marketing, resulting in costly duplication and a reduced level of overall effectiveness.

Where Are We Heading?

Some trends are clear and others are not so. The thirst for metals continues to increase as the present record high prices of gold, silver, copper, zinc, and lead amply demonstrate. Total world-wide expenditure on mining exploration will increase, although with the usual cyclical booms and busts. The energy shortage is well engraved on our minds and its effect on the search for uranium is already apparent and should last for some years.

We therefore look towards a growing world-wide market for exploration equipment and services. It does not necessarily follow that we will be able to maintain our present share of this market in view of the progressive development of competition in a number of technical and geographic areas. We will probably lose ground in a relative sense in airborne magnetics and radiometrics surveys as well as in all types of standard ground surveys.

Canadian governmental activities, both domestic and foreign, are expected to continue to provide a service base of at least \$3,000,000 annually for the next five years, with some likelihood of increase. On the other hand, Canadian industry will find it increasingly difficult to compete openly on the international scene with competitors from the socialist countries and even from western countries with devalued currencies. In this respect we can anticipate a continued rise in the Canadian dollar in relation to the currencies of the USA and Western Europe, in consequence of the increased cost of petroleum. The upward valuation of the Canadian dollar will further erode the competitive capabilities of our industry on the export scene.

Our position in instrument

manufacturing seems somewhat more durable than in services because quality rather than price appears to be the prime consideration. Even here, however, increasing competition will be felt from the USA, France, USSR, and a few of the Socialist countries of Europe. Fortunately, our massive R & D effort ensures a rapid evolution of new instrumentation, to the benefit of our market and our clients but, no doubt, to the detriment of our profitability.

The private sector market in Canada over the next few years will depend, to a great extent, on the actions of the Federal and Provincial governments. Will the other provinces follow BC's lead in introduction of heavy ad valorem royalties? Will the Federal government progressively restrict the ability of the foreign mining companies to develop our mineral resources? Somewhat similar uncertainty clouds future exploration activity of the private sector in many countries of the world, e.g., Australia, where they have been very active in recent times.

In some foreign markets the reduction in the private sector activity is more or less balanced by a greater participation by the public sector, although this has not been true in Canada.

Fortunately there are now movements tending to consolidate the industry into fewer and larger groups. Firstly, there was a merger of two Ottawa based aerial survey companies, one of which was US owned. This has now been absorbed by a Canadian public company. A second US owned aerial surveyor, based in Toronto, has, in quick succession, been purchased by some of its Canadian executives, sold to a Canadian public company and is now on the verge of merging with the last independent Ottawa based aerial survey company. Where we once had five sizeable companies concentrating on aerial geophysical surveys and operating internationally, we will now only have three, two of which will be owned by Canadian public companies.

The Federal Government is encouraging the formation of larger aerial survey groups through its insistence on increased instrumental

complexity (i.e., cost) as well as its policy of contracting out its requirements for both development and survey activity, including those of the Canada Centre for Remote Sensing.

The trend towards repatriation of ownership of the companies in this industry will probably continue, at least partly because of the importance of the Federal Government as a client, with increasing nationalistic tendencies.

The future well being of our industry abroad depends upon two factors. Firstly, we must continue to develop new, improved and proprietary technology which will be in international demand. This in turn means that we must continue our efforts and rate of expenditure on research and development. Secondly, we must be efficient in survey operations and manufacturing. Hopefully the consolidation of the industry into larger units may result in greater efficiency and therefore competitiveness of the industry abroad.

Balancing the various adverse and favourable market trends and barring a major world-wide trade dislocation due to petroleum costs or other sources, I am optimistic for our industry. The course we have set ourselves is constructive and, if continued without complacency, should keep us in good technical and financial health over at least the next few years.

I wish to thank those organizations who provided their sales figures and comments as well as Dr. Peter Hood of the GSC and the Canadian Association of Aerial Surveyors who acted as compilers of this data. This paper originated as an address delivered to the inaugural meeting of the Canadian Geophysical Union, Ottawa, February 22, 1974.

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