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## **GEOSCIENTISTS AND THE THIRD WORLD: A COLLECTIVE CRITIQUE OF EXISTING AID PROGRAMS**

Edited by  
**A. R. BERGER**

1975



Energy, Mines and  
Resources Canada

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## FOREWORD

*The Geological Survey of Canada is pleased to publish the proceedings of the International Workshop on Earth Science Aid to Developing Countries held at Memorial University, St. John's, Newfoundland on May 18 and 19, 1974. The Workshop was a follow-up to a symposium in Montreal held in conjunction with the 24th International Geological Congress in 1972. It was aimed at recording views on earth science aid programs in order to suggest guidelines for improving their scope and efficiency as well as ensuring that the work and interests in this field continue.*

*Dr. A.R. Berger is to be congratulated for acting as convenor of the Workshop and for his work as compiler and editor of this paper.*

*D.J. McLaren,  
Director.*

*Ottawa, 15 October, 1974*

ABBREVIATIONS USED IN THIS VOLUME:

- ACAST - Advisory Committee on the Application of Science and Technology to Development  
(United Nations)
- CIDA - Canadian International Development Agency
- CCOP - Committee for Co-ordination of Joint Prospecting for Mineral Resources in Asian  
Offshore Areas (ECAFE)
- ECAFE - Economic Commission for Asia and the Far East (United Nations)
- FAO - Food and Agriculture Organization (United Nations)
- IAEA - International Atomic Energy Agency
- IBRD - International Bank for Reconstruction and Development (World Bank)
- ICSU - International Council of Scientific Unions
- IDRC - International Development Research Centre (Canada)
- IHD - International Hydrological Decade
- IUGS - International Union of Geological Sciences
- LDC - less developed country
- MDC - more developed country
- OECD - Organization for Economic Co-operation and Development
- UNDP - United Nations Development Program
- UNESCO - United Nations Educational, Scientific and Cultural Organization
- UNIDO - United Nations Industrial Development Organization
- WHO - World Health Organization

## INTRODUCTION

### Background to the St. John's Workshop

In 1972, a Symposium on Earth Science Aid to Developing Countries was held as a part of the 24th International Geological Congress in Montreal, Canada. This meeting involved some two hundred geoscientists from seventy five countries in what was certainly one of the first non-governmental forums on the role of the earth sciences in international development. Earth scientists have not generally been outspoken in their concern for non-scientific matters, but the spirited debate that took place at Montreal demonstrated that the international geoscience community was not devoid of a sense of social responsibility. Indeed, in the closing minutes of that meeting a proposal was made to establish an international committee to ensure the continuation of this dialogue.

In the absence of any concrete action on this proposal, it was suggested that the 1974 Joint Annual Meeting of the Geological and Mineralogical Associations (GAC-MAC) of Canada in St. John's, Newfoundland, would be an appropriate occasion to recapture the enthusiasm of the Montreal Symposium and to make a serious attempt at devising some kind of on-going mechanism for continuing discussions. Sponsorship for a two day International Workshop on Earth Science Aid to Developing Countries was readily obtained from the Canadian Geoscience Council, the co-ordinating body for the major earth science societies in Canada. Financial backing came from UNESCO, the Commonwealth Foundation (London), the Canadian International Development Agency (CIDA), the Geological Survey of Canada and Memorial University of Newfoundland.

### Organization and Participation

The Workshop was held at Queen's College, Memorial University of Newfoundland on May 18th and 19th, 1974, immediately preceding the GAC-MAC meeting. Its aims were:

1. to provide a forum for continuing the discussions begun at Montreal,
2. to identify where possible and record views on earth science aid programs in order to suggest guidelines for improving their scope and efficiency, and
3. to discuss ways of continuing this dialogue and of carrying some of the recommendations into action.

Notices of the Workshop were placed in a variety of Canadian and international geoscience journals and newsletters, and special invitations were extended to some thirty five individual earth scien-

tists in other parts of the world, many of whom had been notable contributors to the Montreal Symposium. Of this group, about twenty five were able to attend the Workshop, including senior government officials, mining and petroleum company personnel, academics, and even post-graduate students. An additional fifteen participants came from bilateral and multilateral aid agencies and from government departments and the balance consisted of those with considerable experience in aid programs as mineral exploration advisers, hydrogeologists, soil scientists, lecturers, etc., and those with little direct experience but with an interest in learning more. In all they formed a diverse group of some seventy five geoscientists of varying age and seniority, from many countries and backgrounds and with outlooks ranging from traditional to relatively radical.\*

Since all participants came as individuals and not as representatives of industry, government or agencies, the discussions were not unduly hampered by rigid adherence to official viewpoints and policies. It is also of interest to note that the attempt to enlist participation from the "grass roots" of our profession resulted in the attendance of a number of students and young professionals many of whom made significant contributions to the proceedings.

### Format and Recording

The Montreal Symposium was held entirely in plenary session, with brief introductory talks on set topics by invited speakers followed by a general discussion from the floor. Formal papers were solicited in advance and published as a regular Congress volume (Neale and Tremblay, 1972), but were not delivered at the symposium. A written transcript of the actual discussions was prepared and issued as a mimeographed report just prior to the St. John's Workshop (Tait, 1974).

Participants at the Workshop were invited to submit in advance, statements, formal or informal, of their viewpoints and suggestions. Some twenty five such "Background Documents" were received, and most were duplicated and circulated to all participants prior to the meeting, thereby helping to establish a common frame of reference. Summaries of most of these background documents, together with a few post-Workshop contributions, are included here as Appendix II.

The informality of the Montreal Symposium was further enhanced at St. John's by the use of workshop sessions. On the first day of the meeting, groups of ten to fifteen people engaged in round-table discussions of a set of topics decided in advance (see

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\* Appendix I lists names and addresses of all participants.



Appendix IV for a list). From these small workshops came several summary reports which were presented on the second day to plenary sessions for general comment. Thus, each participant had an opportunity to learn something of the discussions in all the workshop sessions.

This volume records some of the major points that emerged from the St. John's meeting.\* It is based upon the summary reports from the workshop sessions and upon the transcripts of the plenary discussions, statements from which are quoted anonymously, partly because of the difficulty of identifying their source from the taped recordings. The background and follow-up documents also figured largely in the compilation of this report, and quotations from these documents are fully acknowledged.\*\* An attempt has also been made to pull together some of the threads from the Montreal Symposium and from the rather sparse recently published literature on the subject of earth science aid.

In addition to the inevitable editorial license, for which I accept full responsibility, there are some unavoidable biases in this volume of which the reader will become aware. One is a natural consequence of the Canadian meeting place and the relatively large Canadian participation in these meetings: Canadian viewpoints are emphasized. Other biases stem from the absence at Montreal and St. John's of adequate participation from the socialist countries and, at St. John's especially, from linguistic groups other than English. Moreover, despite the open invitation to attend which was extended through the geoscience "press", participation by senior UN geoscientists and by representatives from the mining industry was minimal. Nevertheless, it seems worthwhile to make this attempt to compile some of the current viewpoints and experiences in this most important area of concern.

Many, if not most, of these views and comments could equally well apply to aid programs in other fields, and much of this discussion could easily be rewritten from the point of view of the town planner, biologist, or engineer (see e.g. King, 1967). To those with long experience of international co-operation, many of the views expressed here will seem naive, "old-hat" or trite, and those who wish to see for themselves something of the advanced ideas current among specialists in international development would do well to browse through recent editions of journals such as CERES, International Development Review, or Development Forum (see Appendix V). However, despite these considerations there was a clear consensus at Montreal and St. John's that these discussions were very useful if for no other purpose than to further the education of those present.

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\* A preliminary account of the Workshop has already been published in Geoscience Canada (Berger, 1974).

\*\* Copies of the complete background documents and reports of the workshop sessions can be obtained at cost from the editor.

## The Association of Geoscientists for International Development

Throughout the Workshop a small volunteer group met to formulate a proposal for a permanent association, and this received overwhelming support at a final plenary session. It stated that a non-political association on the earth sciences in international development should be formed with membership open to individuals and corporate bodies. The Organizing Committee of twelve which was elected to work out the detailed structure and activities of the new organization has suggested that it be known as the Association of Geoscientists for International Development, a title which emphasizes both the main concern and the individual membership. Appendix III describes the objectives and current activities of this association.

### St. John's: A Relevant Venue

St. John's, a small city in easternmost Canada, may seem at first an unlikely venue for a meeting on earth science aid to developing countries. But a brief look at the history and economic situation of Newfoundland shows that it has something in common with other less developed areas, a situation which brings home the reality of the "global village" concept.

Newfoundland ended nearly four hundred years of isolation as one of the oldest British colonies twenty five years ago, when it became the tenth province of Canada. At that time communication, transport, public services, and the general standard of living were far below the standard for North America, and there were distinctive cultural and social traditions. Since then Newfoundland has undergone great changes, many of them undoubtedly beneficial, but some arguably less so. It is still regarded by the rest of Canada as a "have-not" province, unemployment rates are currently around 15%, the cost of living is higher than in most other parts of Canada whence most food and other commodities are imported, and cultural changes are marked as the old way of life dies out and a large number of the young people migrate to the larger and more affluent urban areas of Canada.

There are even closer parallels in the mineral resource situation. Faced with large areas of unexplored country, the Newfoundland government in the 1950's and 1960's parcelled out much of the province in very generous concessions to a handful of mining companies whose financial and managerial bases were, of course, elsewhere. On some of these concessions, mines are now or have been producing, and the gross value of mineral production is now approaching \$400,000,000 per year. Of this total only about 1% is returned to the province in the form of direct taxes, royalties, and so on.

The question many Newfoundlanders are now beginning to ask is whether we should so readily have given away control of what we now know to be our great mineral wealth, or whether we should have done it differently. Were we right in excluding the free lance prospector from the best ground? Should we

have insisted upon more local processing of ores? And what policy should we adopt with regard to the current vigorous exploration for oil and gas on the continental shelf off our coasts? Whatever the answers there can be little doubt that this situation is one familiar to many Third World nations, and surely there are lessons to be learned on both sides.

#### Acknowledgments

On behalf of all those who participated in the St. John's Workshop I would like to offer sincere thanks to the several sponsoring organizations: to the Canadian Geoscience Council in its first venture as a host for an open meeting, to the Commonwealth Foundation and UNESCO for their support for overseas participants, to the Geological Survey of Canada and its editor-in-chief Dr. Peter Harker for publishing these proceedings, to the Canadian International Development Agency, the major financial contributor to both the Montreal and St. John's meetings, for recognizing the value of this continuing dialogue, and finally to the Memorial University of Newfoundland and to Queen's College for their invaluable administrative and financial assistance.

The sterling efforts of Frank Blackwood and Cyril O'Driscoll in handling the administrative arrangements of the Workshop were appreciated by all, as was the assistance of other students of the Memorial University Geology Department. The unflagging enthusiasm of Dr. W. W. Hutchison was a major factor in organizing the Workshop, and a special acknowledgment must be made to Prof. H. R. Wynne-Edwards for his skill and tenacity in chairing the working group which produced the proposal to establish the new association. Thanks are also due to all those who at short notice agreed to chair or report on individual workshop and plenary sessions, and especially to Prof. O. S. Adegoke, Dr. D. J. McLaren, Prof. R. A. Price and Mr. M. Zentilli for their summary reports, which form the basis of much of what follows. The contribution of Prof. E. R. Ward Neale to this dialogue must also be acknowledged. The Montreal Symposium of which he was co-chairman, was largely due to his vision and perseverance, as was the idea of the St. John's Workshop.

Finally my sincere thanks to Michael Barkley, Michael Belliveau, and Nigel Martin, actors in search of a role, and to Wilf Allan who found one and played it magnificently.

A. R. Berger, Convenor,  
St. John's, August, 1974.

#### PROCEEDINGS

##### Preamble: Some General Considerations

Throughout the Workshop the theme of the social responsibility of the earth scientist was stressed, and there was general agreement that the earth sciences should be used to improve the well-being of the people

of the Third World both in immediate economic benefit and in terms of the quality of life. Contacts between geoscientists from different nations can, of course, help to increase international understanding, and nowhere is this better seen than in aid programs where personnel from one country live and work for extended periods in another. A common interest in and concern for the natural environment and natural process should make the international geoscience community especially coherent. Furthermore, as one participant remarked "if nothing is ever achieved in the earth science aid projects, at least the communication between the geoscientists who are trying to get it all together will broaden our understanding of the problems of the Third World."

A sense of urgency was also apparent at the Workshop. In the words of one of the workshop reports, "If at Montreal the need was expressed for a serious consideration of how the earth sciences can best be deployed for international development, our new situation today emphasizes more strongly the plight of the developing countries at a time of energy crisis and world-wide inflation. Now there is a desperate need for massive technical help and the means to ensure that world resources are not squandered but used widely and wisely to allow full development in a framework suited to a particular region or people."

The view was stressed that our greatest task as earth scientists – and one for which we seldom accept responsibility – is to educate government and the public on the role of the earth sciences in the orderly development of natural resources. Local planners the world over often do not understand the results from aid programs aimed at basic geoscientific work, such as mapping. As one overseas participant pointed out, "They say 'Well you come back and bring voluminous reports with coloured sheets, but so what? What has the aid project given us?' I'm sorry to have to say this but the developing countries are becoming quite sceptical of the aid projects, because they have not felt any economic benefit from them." As others pointed out, this natural desire for immediate economic benefits (see also Heindl, 1972) could best be answered by detailed case histories which show the social and economic benefits of applied earth science programs, but unfortunately there are few such studies available (see Appendix V).

Commenting upon the Montreal Symposium, one participant asked "Are we geologists too low on the bureaucratic scale to really affect any significant change? Are programs effectively controlled by political and fiscal factors too far out of reach of the geologists who participate in these programs? Knowing that a good percentage of the geologists participating in those international projects dedicate their very souls to their projects, I dread to think that we are but small cogs in international politics. Yet my feeling at the end of the Montreal meeting was that indeed we were almost 'pawns' and that it would be most difficult to affect many changes in international programs. Many of the participants gave me the impression that they thought the situation was almost hopeless."

Despite this feeling, the discussions at St. John's demonstrated the "increasing concern of the geoscientist who realises that he can no longer avoid the responsibility for the discoveries he makes, for if he does not take some responsibility for earth resource development, then the planners, economists-sociologists, and semi-scientists will do it for him!" (HEPWORTH)\* One workshop report suggested that efforts be made to "strengthen the capabilities of local technical and scientific managers by helping them master the arguments needed to influence decision makers. Furthermore, an adequate scientific community must be built up in order to influence the political power into taking appropriate action." There is clearly a need to educate or sensitize planners and politicians in terms understandable to them, even if this means learning the language of the economist and the policy maker.

While the natural tendency may be to think of earth science aid primarily in terms of mineral resource development (e.g. Tremblay, 1972), the essential contribution of the other earth sciences should not be neglected. A number of participants stressed the importance of engineering and environmental geology in resource management (e.g. DAVOUDZADEH), and many examples of aid programs in hydrogeology were quoted (e.g. OZORAY; see also Burdon and Thomas, 1972; Dijon, 1972; Heindl, 1972). It should be borne in mind that programs dealing with groundwater and with the soil sciences are of more fundamental importance to human existence than traditional geological projects such as regional mapping and mineral exploration (e.g. BURDON, IGNATIEFF).

A vigorous discussion of aid projects underlined, as always, the difficulties and dangers of generalizing (e.g. Carman, 1972; Reinemund in Tait, 1974, p. 3-5). The diverse nature, scope, and objectives of geoscience programs and the greatly varying needs of the developing countries make it difficult to draw widely applicable conclusions. Not only is the gap between the West and the richer of the Third World nations (e.g. Nigeria, Mexico, Iran) often smaller than that between these countries and those designated "least developed" by the UN (e.g. Chad, Botswana, Afghanistan), but there are also the vast differences in geological setting between countries like Saudi Arabia, Burma, and Fiji that must be taken into account. Obviously, "a country like Zambia with a huge prosperous mineral industry and potential for even more has totally different problems to Tanzania with little mineral production and not any great prospects."

Some developing countries have completed basic mapping and reconnaissance prospecting and can now focus on advanced mapping or on detailed mineral assessment, while others still lack basic reconnaissance coverage. Certain countries such as Zambia, Mongolia, and Lesotho are still badly in need of their

own trained earth science personnel, while others such as India, Nigeria, and Brazil appear to be adequately or even over-supplied. For these latter nations particularly, the traditional relationship between donor and recipient countries is fast breaking down. As one participant put it, these nations have "already developed a certain amount of indigenous capability, and with it pride and confidence. This group still wants and needs foreign assistance, but on its own terms. They do not wish to be told how to run or do things. They know what they want and feel that outsiders should not impose their views and methods as part of the assistance program."

This situation was highlighted at St. John's by a debate on the relative merits of short-term versus long-term (and/or large scale) projects. As many developing countries now have basic earth science institutions and at least some well-trained personnel, both the U.K. and the U.S. are going more and more to short-term requests for specific projects such as age determinations, chemical analyses, mineral assessment and groundwater projects (see also Pallister, 1972). One advantage of these is that requests can be handled without going through the normal bureaucratic channels involved for larger projects. In contrast, other participants stressed the need still for long-term assistance in building up permanent local organizations which can advise governments and act as training institutes, as for example in the case of Botswana (HEPWORTH, see also COORAY, FOURNIER D'ALBE and van der SLUIJS, Reinemund *et al.*, 1972). PATERSON argued strongly in favour of large-scale mineral exploration, stating the great need for developing countries to "develop a satisfactory economic base. I am sure that we can meet this challenge if we are imaginative and if we approach the problems from the viewpoint of explorationists rather than researchers and academics... What is needed most now, and I doubt if it will wait another five years, is exploration and plenty of it!" (cf. Tremblay, 1972; but see DAVOUDZADEH, GIBBS, Adegoke, 1972; Reinemund in Tait, 1974, p. 5, for different viewpoints).

At Montreal a similar discussion centred around the pros and cons of multilateral versus bilateral geoscience aid programs (Tremblay, 1972; Tait, 1974, p. 14-20). Bilateral projects, it was pointed out, often give more control over projects to the recipient country and are thus especially useful in aiding institutions (cf. HEPWORTH, Pallister, 1972, 1973; Tamale-Ssali, 1972; Reinemund *et al.*, 1972). On the other hand bilateral programs are more subject to the political views of the donor's country, are too often "tied" to the donor's products, equipment or personnel and are too little concerned with the follow-up stage. Multilateral programs are bound to be relatively apolitical and thus perhaps best suited to large mineral exploration projects (e.g. Brand, 1972), but a common criticism was that they are often less precise and well-planned than bilateral projects and that they suffered from differences in background among the team members (e.g. Tamale-Ssali, 1972). Obviously "there can be no single blueprint for aid to developing countries" (SINGH).

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\* Names in capitals refer to Background or Follow-Up Documents summarized in Appendix II. Not all the authors of these were able to be present at the Workshop.

Finally it should be pointed out that several participants objected to the term "aid" as applied to international development programs. As one person pointed out, the term has "developed bad connotations, and what we should be considering is a co-operation because all forms of so-called "aid", if they are to be successful, are co-operative efforts involving "host" and "visitor" countries. "Aid" has a ring of colonialism which will become increasingly unacceptable." It should be noted in this connection that relevant programs of the U. S. Geological Survey are labelled as "technical assistance", "international co-operation", "co-operative assistance" and the like (see also Dunham, 1973). However, since the word "aid" appeared in the title to the St. John's Workshop, it will be retained throughout this volume.

### Role of the Private Sector

Some attention, though perhaps less than might have been expected, was focussed upon the role of the foreign private sector in mineral exploration and development in the Third World. One Canadian participant asked "why free enterprise is not given much more incentive to come into these countries? A lot of companies I've dealt with on an international basis are very reluctant to consider foreign exploration" and "are just waiting for a fair incentive to get with it and help you develop your resources."\*

Support for the traditional role of the foreign private sector also came from another Canadian participant who felt that "foreign investment cannot 'hinder' Third World development. The resulting influence or perhaps domination by foreign companies may be objected to as a policy or philosophy and this could be discussed, but I don't think that the physical value of financing and management of mining projects by foreign corporations should even be questioned." (cf. Blais *et al.*, 1971; Crabb, 1974; Lespine, 1972)\*\*

On the other hand many opinions critical of these viewpoints were also expressed. As one overseas participant said "All of us seem to focus primarily on earth science co-operation as a means of developing resources that when exploited can be exported in a relatively

crude form to produce a large inflow of foreign exchange. Copper, gold, diamonds, lead, zinc, iron ore and bauxite are typical examples. There is an alternative theory of development which we should consider, that would stress water resource and soil investigations to promote agricultural growth as being of greater importance, together with such high bulk-low price minerals as would make a country self-sustaining in a wide range of the so-called 'industrial' minerals." (see also BILGRAMI, BURDON, SINGH)

An even wider outlook came from GIBBS who pointed out that Third World nations are on the whole large exporters of "earth resources" to the West. This "unequal trade" serves the "high material demands" of the industrialized nations which control the "financial institutions, the mining and processing corporations, the balance of market power, and the expertise and information necessary for raw material production and utilization. Redress of the terms of trade and a reduction of the export sectors of developing countries would transfer far more financial power and free more development resources than any aid program could, and would have the great advantage of leaving the decision on the disposition of the assets in the hands of those aided."

Similar criticisms are becoming increasingly more common and find expression in rapidly changing governmental policies toward mining the world over. \* Those familiar with the contemporary Canadian scene will be aware of a vociferous battle between the mining industry which naturally wishes to see a continuation of the traditional "free-wheeling" private enterprise that has characterized Canadian mining for so long, and several provincial governments (e.g. British Columbia, Manitoba, and even Newfoundland) which are moving towards greater governmental control over mineral resource development (see especially Kierans, 1973). And there is a long-standing debate in Canada too over the question of foreign ownership and control of natural resources (e.g. Levitt, 1970; Mohr, 1972; Bennett *et al.*, 1973).

Similar moves by Third World nations are of course a familiar feature of international mining now (e.g. Prain, 1973; Ridge, 1973; Weiss, 1974), and many mining companies have learned to live with government participation, which as one workshop report pointed out "may vary from majority private capital in a venture to government majority or even to government ownership with contracted management." It is perhaps surprising and certainly of significance that the consensus that emerged from workshop discussions on the role of the private sector was, to quote the same report, "Where private capital controls management,

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\* For a recent review of Canadian policy and of the involvement of Canadian mining companies in the Third World see Malhotra (1974).

\*\* In connection with this apparent reluctance of mining companies to engage in international work, reference should be made to a seminal study by Michener (1973; see also Blais *et al.*, 1971), who worked out a complex method of ranking countries in order of their desirability (to Western companies) for foreign mining investment. Not surprisingly this list was headed by the United States, Canada and South Africa with Rhodesia not far behind, while countries such as Tanzania, Peru, Philippines and Argentina were labelled least deserving of attention!

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\* For a detailed study of mining policies viz-a-viz foreign investment in Latin America see Mikesell (1971) and Bennet (1973). Sutulov (1973) comments upon mineral development policies on a global scale from what may fairly be termed the traditional "cold war" viewpoint.

this should be limited to a specified number of years necessary to train local management and technologists for assuming control. Majority control will give way to minority equity, and no large resource should remain indefinitely in the hands of the (foreign) private sector. "\*

### Technology Transfer

Technology must obviously be adapted to the needs and priorities of the developing countries, and the assumption that the approaches to natural resource development which have worked well for the West are necessarily appropriate elsewhere, is being increasingly challenged. For example, much of the past Canadian aid in mineral resource development seems to have been based upon the experience in Canada. This has involved a "little bit of government help", such as the regional mapping programs of the provincial and federal surveys and mines branches, with the rest left to private enterprise (cf. Lord in Tait, 1974, p. 23-24). We in Canada cannot continue to assume that this approach is valid in Third World situations. This criticism applies with equal force to large scale programs involving airborne geophysics or geochemical sampling. (cf. Brand, 1972)

Obviously every effort should be made to design adaptive technologies which are relevant to Third World conditions, whether these are applied to field methods or to earth science education. As PALLISTER stated "It may be that more sophisticated use of remote sensing techniques, automated laboratory methods, and cartography are not the best ways to assist a less developed country with a large population which is unemployed or employed only on subsistence level. Tactical methods in large scale civil engineering projects are beginning to consider a partial return to more labour-intensive methods, and the same may well be needed in prospecting and mining activities in aid programs." (see also SINGH; United Nations, 1972a; Arogyaswamy, 1972; Carman, 1972; Wairegi in Tait, 1974, p. 36)\*\*

One danger of technology transfer concerns the effect that new forms of technology (e. g. a mine or oil field) may have on local cultural and social traditions. Participants at St. John's emphasized that donor countries must assess the social implications of aid programs and ensure that they do not lead to conflict or to disruption of the way of life of the recipient peoples. As several participants pointed out, the development of a mine or of a functioning groundwater system is bound to have a major effect on the way of life of local people, and there are too few examples of sufficient planning for the consequences of these kinds of resource development.

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\* This is especially important for Canadians in view of the rather different contrasting positions taken by Blais *et al.* (1971).

\*\* For an excellent account of current ideas on "alternative" or "appropriate" technology see Clarke, 1973.

It is of course easy to make such statements but very hard to put them into practice, as exemplified by the concern in Canada over the future effects of the possible discovery and exploitation of petroleum deposits off our eastern coast (e. g. Gibbons and Voyer, 1974). The current debate in the United Kingdom about the social, economic and cultural implications of the North Sea oil and gas development is another case in point. However, even though solutions to these problems are not easily found, we can make a start by being sensitive to possible clashes between modern technologies and Third World societies.

The developing countries also have a great responsibility, although not always exercised, to ensure that the benefits of natural resource development should be used to build up their own economies. They must see that resource development is controlled in a framework of overall development so that the benefits are used to attain self-sufficiency, for example to build up permanent infrastructures (cf. Govett and Govett, 1972). As one Third World participant stated "Many co-operative programs would be more successful if the participants defined their long-term goals more clearly. Does the host country government want to undertake the development itself or to create a political-fiscal-legal environment that will induce others to undertake the development? Is the host country government prepared for the political and social changes brought about by industrialization along the Western pattern? Many countries have conflicting policies in this area without being aware of it and often the inevitable results are deplored most by those who did most to bring them about."

### The Aid Project

Most of the discussions at St. John's, as at Montreal, centred around the planning, execution and follow-up stages to aid programs (e. g. Reinemund *et al.*, 1972; Tremblay, 1972), and there was little direct attention paid to the actual content of aid projects. The consensus perhaps was that generalizations were of little use here, especially in view of the many previous statements on the priorities for geoscience activities in the Third World (see Appendix V for a brief review of some of this literature). At St. John's, several workshop sessions concentrated on the factors necessary for successful aid programs, that is, programs which produce permanent beneficial results.

Concerning the planning of aid projects, one participant voiced a common concern when he asked "How do you ensure the most effective and pertinent aid when the recipient country does not have the expertise to know what type of aid to request or accept?" However, HEINDL pointed out that developing countries can hardly be expected to define their own objectives, capabilities and requirements any more readily than the developed countries "which have shown their own inability to evaluate their own situations. I question whether any country is so underdeveloped that it cannot come up with its own scheme of priorities, subject to periodic frequent review and reassessment."

Nevertheless it is clear that too often the developing countries request aid programs that are not appropriate to this end, the tendency being to follow a formula set by other programs (e.g. Adegoke, 1972; Carman, 1972). As one workshop report stated "Very often, the most urgent needs are not very glamorous (e.g. the need to train a local technician for the preparation of thin sections of polished specimens, rather than for an elaborate course on plate tectonics) yet they are very real."

Much more co-operation is needed in the planning stages of aid projects between donor and recipient country personnel (e.g. Tapsoba in Tait, 1974, p. 35), and the local counterparts who will be working in the project should be involved in these preliminary stages (e.g. Bonis, 1972). As one participant said "What is vital to any progress is that the planning and implementation of geological aid be done by those who have experience and not by political appointees!"

Many people pointed out that response to requests for assistance is generally not as rapid as it should be, due to "red tape" in both donor and recipient organizations (e.g. AJAKAIYE). Delays of several years between initial requests and inception of programs are far too common. PATERSON, for example, stated that "I have seen wonderful proposals of great value, carrying the full support at the technical level of both donor and recipient countries, become distorted, delayed, and eventually either shelved or carried out in such a diluted fashion that they are of questionable value. In particular, I have observed the plea for on-the-job professional training in exploration distorted into so many line-miles of geophysical survey simply because of bureaucratic machinery." There are general agreements that many of the aid programs are being handled by agencies "locked into the format of their own paperwork." The earth scientists who work with them should be constantly trying to get these organizations to adapt to new changes in Third World conditions "otherwise we are trying to solve what are really tomorrow's problems with yesterday's tools, and worse yet with yesterday's paperwork!"

The follow-up stage of an aid program is in many ways the most essential. There is little use in preparing a geological map or doing an aeromagnetic or soil survey if there is no practical use of the results after the work is completed (cf. PATERSON). Again the data collected during aid programs should be promptly published, or at least notice of its existence widely circulated (e.g. Blais *et al.*, 1971, p. 308). That this is not generally the case illustrates another major flaw in the whole aid system, and one that leads to much waste and duplication of effort.

Examples of such a lack of follow-up are legion but not well documented. One account, as yet unverified, concerns an aerial and natural resources survey of an Asian country under the Colombo Plan. An immense amount of data on soil, forest, and water resources, geology and airborne geophysics was gathered over a six-year period and submitted to the recipient government in a series of reports and maps. Eight years later not a copy of the reports could be found in the

libraries of the main university, the Geological Survey or the donor's local High Commission. Government planners concerned with new hydroelectric schemes were unaware of the existence of this work with its surveys of the same river basins, and a foreign geophysicist, requested subsequently as a technical adviser, uncovered many of the original maps still in their original crates in the Geological Survey offices (for another example see Carman, 1972).

As PATERSON said "Unless the initial project contains definite plans for interpretation and follow-up, very little is likely to be done. Professionals should be assigned to actively liaise with the government of the recipient country for several years after the completion of the project to ensure that the information is not lost and that appropriate action is taken." Indeed, there was some agreement that aid programs in mineral development should continue well past the reconnaissance stage and should involve even assessment and development of resources, a suggestion which deserves close examination (cf. Govett and Govett, 1972).

There were several other points concerning aid programs that evoked comment. Forceful statements by HEINDL and SINGH on the question of "who is really aiding who" indicates that there is some appreciation among earth scientists of the difficulties and resentments caused by aid programs "tied" to purchases of supplies, equipment and "expertise" from the donor country (e.g. Carman, 1972; Malhotra, 1974, lists the "benefits" to the donor of such tied aid). SINGH also gave several examples of earth science aid projects in which Guyana was the donor country to several of its Caribbean and South American neighbours. Accounts of such co-operative efforts between Third World countries would clearly be of great interest, demonstrating as they do the tremendous capability of many Third World earth science institutions and personnel (see also GIBBS).

Many participants spoke of the urgent need for improved communication and liaison among agencies and individuals involved in earth science aid work (especially GROSS), and particularly for easier access to information on past and present projects. \* Examples were given of unnecessary duplication of effort due to poor co-ordination between aid groups, even those belonging to one country. In Canada, for example, aid programs in the earth sciences are undertaken, *inter alia*, by CIDA, the GSC, the Mineral Resource Branch, and by a variety of private consultants, and communications between them appear to need improvement. As SINGH pointed out, "The distinct impression is conveyed that each aid agency wants to 'do its own

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\* In this context reference should be made to the Commonwealth Geological Liaison Office in London, with which its monthly newsletter performs a valuable, if limited, service to institutions in Commonwealth nations (see F.D. 5, Appendix II) and the UN-ECAFE office in Bangkok with its CCOP newsletter.

thing' and secure its unshared credit. If such considerations do come into the granting of aid, is it possible to have effective liaison?"

As a further example of poor communication, the case was mentioned of a recent scheme for short-term volunteer advisory services initiated by the UN Natural Resources Committee. In the two years since its adoption, Canada, one of the prime movers behind the scheme, has had only two requests, both of which were answered. The apparent reason for this lack of interest was that the UN meetings were attended primarily by diplomats who did not get the information out to their own technical personnel!

The need for a "field guide through the jungle of international aid" was stressed by many participants. In answer, one proffered a machete, but more serious proposals were made for an annual international catalogue of current and proposed aid programs, for an inventory of present and past projects on a country-by-country basis, and for data banks on aid programs in the whole field of resource development and management. In this connection, it is worth pointing out that the new information system for geological reports described by Russell (1972) has been virtually abandoned and that UNISIST, a larger information system for science and technology proposed by UNESCO and ICSU is still in the planning stages.

Examples were given of earth science aid projects which failed, and many people expressed puzzlement at the lack of efforts on the part of the aid agencies to learn from these mistakes and to improve their own programs accordingly. The establishment of a comprehensive inventory or data bank on aid programs could be a first step in this direction.

### Personnel

Perhaps the most repeated criticisms at the Workshop concerned the quality of aid personnel. There appears to be general agreement that the aid agencies could and should do a far better job of recruiting than they do at present. The selection of foreign personnel is a critical factor and one too often neglected. As de VLETTER said "I believe that people should be selected in earth science aid programs as carefully as those recruited for the diplomatic service, . . . ." (cf. Cameron in Tait, 1974, p. 75).

Time and again the importance of the personality of the "expert" was raised, even to the extent of stressing that personal qualities are as important, or even more so, than technical training (AJAKAIYE, de VLETTER, SINGH, IGNATIEFF, OZORAY). For example, according to one participant "One of the many aspects of aid programs that hinders improved relations between host nationals and the aid-given country lies in the inability of many foreign experts to appreciate the culture of the host country. There are a variety of reasons for this; most important are the disparity in the life styles of the expert and his counterparts, and secondly, ignorance of the spoken language." (cf. Bonis, 1972; Tamale-Ssali, 1972). Many criticisms were directed too at the work ethics and technical abilities of "experts".

In some cases "inexperienced experts" were clearly less capable than their local counterparts. As one African participant said "Just two months ago I had some experts from " . . . . . " and they could jolly well have been my first year students. I had to take them in the field and show them what they were supposed to be advising on." Other "experts" were considered too old or too young to be effective. As TAN (in Background Document 18) said "In many cases local counterparts possess as much expertise if not more than the aid experts assigned to guide them. . . . . Such cases do not generate much goodwill between the local population and the donor country, especially as these aid experts are often highly paid by local standards and the money spent on them is added to the high cost of foreign aid for which the local population is supposed to be grateful. "

Several participants stressed the continuing need for highly-experienced senior aid personnel. GROSS, for example, referred to several African geological surveys which were badly in need of experienced geologists to carry out editorial work on an accumulated pile of reports and maps (see also HEPWORTH).

"The local counterparts must also share the blame for the ineffective utilization of foreign aid in the earth sciences. Lack of experience, insufficient insight into the geological and economic problems of their country and even lack of dedication in some cases may have been responsible for this state of affairs" (BILGRAMI). According to a hard-hitting criticism by MORRISON, "Third World geologists and mining engineers tend to be theorizers and paper pushers rather than "doers". Often enough they hold advanced degrees from prestigious universities, but nothing in their professional backgrounds has equipped them to function effectively within the primitive economies of their own countries. Their training has convinced them that it is the function of a professional to sit in a well-appointed office issuing directives and to make only occasional brief visits to the scene of operations where they scarcely know what is going on around them" (see Carman, 1972, for a different opinion).

Other criticisms directed at recipient countries include the claims that (1) counterparts are unavailable when needed, despite official approval for their participation, (2) counterparts are available and willing to work but are so untrained that they are of little use to the project, and (3) some counterparts are trained but unwilling to work. On the other hand counterparts complain that (1) they are often used as mere data collectors, (2) they are not given status or responsibility in the execution of the project, and (3) they are often unnecessarily diverted from their long-term or current programs to work with aid projects (cf. Brock in Tait, 1974, p. 43-44). Other important handicaps endemic to counterparts were discussed by Adegoke (1972), Bonis (1972), and Tamale-Ssali (1972).

There were many suggestions that some of these problems might be overcome by the early selection and participation of the counterparts in the planning stages of the project, by specialized training in similar projects in similar regions or in special field institutions,

or by higher field allowances perhaps paid for by aid funds.

The problems faced by "experts" also attracted much attention, especially since many of the Workshop participants had been in that position at one time or another. Considerable emphasis was laid on the difficulties of careers in international development, chiefly stemming from the lack of job security and career continuity (see especially OZORAY, de VLETTER). Earth scientists who wish to devote themselves to work in the developing countries run more than the normal risk that their active working life will be shorter than those of their less mobile colleagues, because of the health and physical hazards involved. At the same time they are liable to have considerable periods between jobs and with no compensation. Keeping up with the literature and with modern advances is particularly difficult for such people. As one participant put it "To sum up, the average young man considering a career in earth sciences in Canada, if he is 'sensible', is not likely to devote himself to work in the developing countries. How can better career opportunities be provided, how can people be induced to devote part of their time to this work, and how can security and advancement be provided?"

The need was repeatedly stressed for a pool of earth scientists for work in aid programs. As de VLETTER said, "For a sustained effort in earth science aid, the needs of all parties are best served if at least a core of technical staff is established in each major donor country. The people chosen should be able and willing to make technical aid their main occupations for a considerable part of their professional careers. Selection could be made through stages such as volunteers, associate-experts, and the like." The staff of such a pool would know that "if overseas work is not available or is inconvenient they can temporarily be given shorter assignments or they can return to the home service. Such a case may arise because of the education requirements of their children. Between assignments staff members are available at headquarters for advice about overseas projects, consultancy services to developing countries or for work on special projects. The staff is also assured of being able to stay technically up to date, and also to enjoy such benefits as continuity of employment and pension rights. The organization is assured of a supply of properly trained and experienced staff. In this way everybody wins; the donor country, the individual staff member, and the host country by getting better service. For the latter it is particularly important that technical staff with job security will be much less inclined to go slow on training of counterpart personnel. It is expecting a great deal of a family man to work himself out of a job as soon as he can unless he is assured of job security." In contrast, one participant found this situation "dreamily optimistic and a little too 'comfortable' to motivate the most output from the individual. Observations here in Zambia suggest to me that when the host country employs the individual there is no question of divided loyalties but a greater development of mutual interests and shared goals between the employer and employee."

Nevertheless the absence of any such pool in Canada\* was contrasted with apparently well-functioning rosters in the U.S., the U.K. and the Netherlands, for example. Methods of recruitment of aid personnel in Canada also came in for criticism, there being few ways in which earth scientists outside the international consulting firms or the federal government could participate in aid programs.

The possibility of using suitable earth scientists from developing countries as "experts" was mentioned time and again (e.g. AJAKAIYE, BILGRAMI, COORAY, OZORAY, ROY CHOWDHURY). There was general agreement that there is now a significant number of well-trained geoscientists in many Third World areas who could be more useful in aid programs than "experts" from the West by virtue of their cultural and linguistic qualities and, their professional experience under similar conditions. If one of the aims of aid programs is to build up local expertise, use of local or other Third World personnel as "aid experts" instead of Western foreigners should be encouraged. Indeed, it was argued that the frustration and lack of success in some aid projects is simply due to the planners' complete neglect of such local earth scientists.

Despite these arguments, an example was quoted of aid programs in one African country where the level of education was such that local counterpart staff simply did not exist. The aid agencies involved apparently preferred to advertise for foreign counterparts in Canada rather than to look in other African countries such as Nigeria where aid programs are also functioning and where there is a surplus of trained earth science personnel (cf. Hepworth in Tait, p. 28). Indeed there was some suggestion among Third World participants, naturally enough debated by some from the West, that suitable personnel from developing countries should get preferential treatment in recruitment for aid projects.

New directions in this regard are exemplified by the aid projects between Guyana and neighbouring countries described by SINGH, and by the policies of the International Development Research Centre in Canada which, though it has yet to involve itself much in the earth sciences, in other fields may supply funds for projects to be carried out entirely by recipient country personnel (see Spurgeon, 1974, for a brief account of IDRC philosophy).

### Training

The training of earth science personnel from the Third World received much attention, especially by the GOVETTS who emphasized the need for careful planning to avoid the problem of the educated unemployed (see also Berger, 1972). It was pointed out that although most developing countries do not have sufficient geoscience personnel, a few like Nigeria and India now

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\* Despite the strong recommendations for the establishment of one by Blais *et al.* (1971).



produce more graduates than they can employ in the earth sciences. A greater interchange of personnel between Third World countries could offer an interim solution to this problem (e. g. COORAY), and in this connection it was hoped that the new Association would prove effective as a means of communication.

A more general problem is the generally low quality of graduates in the earth sciences in developing countries. As AL-SHANTI put it "One easily established fact is the negative correlation between good geological work done and the fairly large number of geology departments and students in the Third World." Reasons for this situation include (1) the attraction to geoscience of large numbers of drop-outs from the more favoured physical sciences, (2) poor instruction and academic stagnation, and (3) the common reluctance of graduates to do field work and a distinct preference for administrative posts (cf. de VLETTER, MORRISON, Carman, 1972). As BROCK pointed out, earth science trainees commonly "had spent the last two thirds of their lives in schools in towns, and had imbibed the prevalent idea that, if they completed high school, they would go on to college or get a comfortable white-collar job in a town. Hard physical work and living in the bush were thought of as being suitable only for the uneducated."

Other barriers to proper scientific education include: (1) "students from the largely rural environment in developing countries usually find it more difficult to think 'mathematically' than their opposite numbers in developed societies, and (2) traditional beliefs can be so strongly entrenched that students may resist scientific explanations. This can cause considerable stress amongst such students who are torn between two worlds." De VLETTER went on to describe a fascinating Zambian scheme to popularize science and technology at the primary and secondary school levels.

Some of these problems could be resolved at least in part by on-the-job and in-service training, with special emphasis on field work. Such programs appear to have been more successfully applied in South America and the Middle East than in Africa. As DAVOUDZADEH put it "What mattered to us (in Iran) was not the few mineral discoveries that were made in the course of this project, but the intensive on-the-job training and the wide experience which our geologists gained in all facets of geological and mineral exploration." MORRISON, in particular, advocated an apprentice system whereby mining and petroleum companies in donor countries would provide practical training for Third World geologists and engineers (cf. Carman, 1972).

Several participants referred to the continuing need for special emphasis on field work, and mention was made of a successful field training course for Turkey, Iran, and Pakistan, supported by the U. S. and the U. K. (Bailey *et al.*, 1974; see also KEPPIE). BROCK's description of a special prospectors' training course in Uganda provides an excellent case history of relevance here.

Twinning or linking schemes between university departments and other institutions in donor countries and their counterparts in the Third World received special attention. Examples were given of apparently well-functioning programs twinning the Haileybury School of Mines in Ontario with the Tarkwa School of Mines in Ghana and with several mining companies in Africa, and the Geological Survey of India with the Smithsonian Institution and the University of Uppsala. On the other hand one scheme was quoted from Thailand that had not worked well even to the extent of being harmful. Nevertheless the balance of opinion clearly favoured such links (e. g. COORAY, HEPWORTH, PAL-LISTER, Blais *et al.*, 1971).

The perennial problem of training abroad versus training at home also received much attention (see especially the debate recorded in Tait, 1974, p. 49-62). As usual the consensus was that training in the earth sciences, at least to the B. Sc. level was better done at home (cf. Blais *et al.*, 1971; Li, 1972; Tamale-Ssali, 1972). Indeed, the continuing emphasis in several aid agencies was on the building-up of training establishments in the Third World (e. g. FOURNIER D'ABLE and van der SLUJIS). In the case of nations where this was not practicable, regional training institutes in neighbouring countries offer a possible solution, as exemplified by the Centre for Applied Geology in Jeddah (see Walter, 1972). To others, however, such regional institutes were often impractical and unsatisfactory due to local political situations (e. g. Ronner in Tait, 1974, p. 59).

Several arguments in favour of training at home were presented (e. g. SINGH, AL-SHANTI). (1) The students are exposed to local problems and do not require the post-training adjustments that foreign-trained personnel often need. (2) There is no culture shock to overcome. (3) The research and field work is a contribution to the local earth sciences. (4) There is no "brain drain", temporary or permanent. In favour of training abroad are (1) better facilities, (2) more experienced staff, not hampered by the frequently unstable conditions in Third World areas, (3) an academic milieu more conducive to productive academic attainment, and (4) the broadening of personal outlook.

Regardless of where the training is done, there is still a real need for greater relevance to Third World conditions in studies and research (COORAY; Katz, 1972). In the case of graduate training abroad, this can be done by basing the research projects in the home country and by making provisions for the supervisor to travel to the home field area. The success of one such scheme involving the University of New Brunswick in Canada and students from Greece, the Philippines and Guyana indicates clearly a direction for future action (the GOVETTS, SINGH).

Consideration was also given to the appropriateness of the classical earth science education for the Third World where many graduates are rapidly promoted to positions of responsibility in which they become decision and policy makers. Such people could act as effective "agents of change" given a wider background and training (for example in economics and develop-

mental models) than normally provided by western-style scientific education. The danger that such studies lead to "underdeveloped degrees" might perhaps be overcome by appropriate in-service training involving, for example, close field work with foreign experts. This approach has proved quite successful in South America.

#### Final Comments

The St. John's meeting of course did not conclude with any resounding declarations offering solutions to the problems of international development. Indeed, some of the statements presented as consensus views in this volume may have been somewhat forced, and it would not perhaps have taken a very cynical observer at the meeting to conclude that the differences in attitudes and opinions among the participants were almost irreconcilable. A reading of the Background and Follow-Up Documents, especially, will illustrate such differences.

Nevertheless there does seem to be, to the editor at least, a pattern of some kind emerging from the Montreal and St. John's meetings, a pattern which reflects our perception of a changing world. The most obvious aspect of this is the growing realization that earth scientists must attempt to understand the basic issues of underdevelopment, issues that extend well beyond the borders of our own particular view of global geoscience. We cannot continue to regard ourselves as technicians, apolitical scientists, concerned only with the exciting search for earth resources and the fascinating study of natural processes.

Equally important is the increasing awareness of the importance of "self-reliance" to international development. This has two special implications to the earth sciences. The first involves the recognition of the growing numbers of capable and well-trained earth scientists in many Third World countries, who should be drawn into the development process on at least an equal status to "experts" from donor countries. Whatever we can do towards this end will be a step forward.

The second implication finds expression in the accelerating tendency for Third World governments to exercise more control over the exploration and exploitation of their mineral (and water) resources. This move is, of course, antagonizing to many but it found support in the Workshop statement that the private sector should not control mineral development indefinitely but should move rapidly to increase indigenous capability to the point where outside capital and expertise is not needed. Though much of this situation may well be out of our hands as earth scientists, the feeling at St. John's was that we can help in the orderly development of earth resources - minerals, water, petroleum, or deep sea nodules - by accepting some responsibility for our work and learning as much as we can about resource development and management.

Perhaps the most important aspect of the Workshop was the fact that it, like the IGC Symposium earlier, brought together a wide range of earth scientists in an open, informal and non-governmental discussion.

Many participants felt that the most useful aspect of the meeting was the opportunity it provided to talk with other geoscientists concerned with international development. The wide diversity in background and outlook among those present seems to have been balanced by a mutual understanding of geological process, the field experience and so on. The sense of intellectual isolation faced by many Third World geoscientists is something their counterparts in donor countries hardly notice, being accustomed to "frequent meetings and ease of attendance." The need for communication with professional colleagues is certainly not satisfied by the formal international scientific meetings and conferences, for these too seldom involve "grass-roots" participation from the Third World, despite the lip-service paid by aid agencies and the international scientific bureaucracy to the value of such meetings (e.g. GROSS, COORAY, Von ENGELHARDT, ROY CHOWDHURY).

The relative ease with which financial assistance for the Workshop was obtained is a clear indication of the support for non-governmental meetings of professional scientists to discuss matters of development policy. There is a general recognition especially among aid agencies and other organizations concerned with international development that among the international scientific community there is according to the Secretary-General of the United Nations (see Ritchie-Calder, 1973) a "store of good will, ability and inventiveness which, if mobilized, could greatly assist in the international co-operative effort to redress the harmful imbalance between the products of science and the needs of mankind."

Although it did not provide the answers to problems of international development or the specific guidelines for future aid programs that some may have hoped for, the St. John's Workshop did create an on-going forum for concerned earth scientists which should be able to provide a focus for such a co-operative effort. The Association of Geoscientists for International Development may well prove to be its lasting achievement.

#### REFERENCES

- Adams, J. K.  
1972: Peace corps geological program in Ghana; Earth Science Aid to Developing Countries, Symposium 2, 24th Int. Geol. Cong., Montreal, p. 151-55.
- Adegoke, O. S.  
1972: Need for training and research-oriented geoscience aid to developing countries; *ibid.* p. 79-84.
- Arogyaswamy, R. N. P.  
1972: The utility of foreign aid to underdeveloped or developing countries with special reference to mineral development; *ibid.* p. 72-78.
- Bailey, E. H., Barnes, J. W., and Nackowski, M. P.,  
1974: Report of the seventh CENTO field training program in geological mapping techniques; U. S. G. S. Project Rept. CENTO Investigations, (IR)CEN-7, 26 p.

- Bennett, H. J.  
1973: The mineral policy of selected foreign nations on direct foreign investment in the mineral industry; *Quart. Col. Sch. Mines*, v. 68, No. 4.
- Bennett, W.D. Chambers, A.D., Thompson, A.R., Eddy, H.R. and Cordell, A.J.  
1973: Essays on aspects of resource policy; Science Council of Canada Background Study No. 27, 113 p.
- Berger, A.R.  
1972: Training geologists in Ceylon: An interim case history of development aid; Earth Science Aid to Developing Countries, Symposium 2, 24th Int. Geol. Cong., Montreal, p. 169-76.  
1974: Earth science aid to developing countries: a collective critique; *Geoscience Canada*, v. 1, No. 3, p. 73-76.
- Bergquist, W.E., Lynch, L.E. and Brister, M.M.  
1972: Office of international geology reports resulting from the U.S. Geological Survey participation in the United States technical assistance program; U.S.G.S. Open File Rept. (IR) DC18-1, 47 p.
- Berthoumieux, G.L.  
1972: L'aide extérieure pour la recherche géologique et minière en République de Côte d'Ivoire; Earth Science Aid to Developing Countries, Symposium 2, 24th Int. Geol. Cong., Montreal, p. 92-99.
- Blais, R.A., Smith, C.H., Blanchard, J.E., Cawley, J.T., Derry, D.R., Fortier, Y.O., Henderson, G.G.L., Mackay, J.R., Scott, J.S., Siegel, H.O., Toombs, R.B. and Wilson, H.D.B.,  
1971: Earth sciences serving the nation; Science Council of Canada Background Study No. 13, 363 p.
- Bonis, S.  
1972: Recommendations for the refocusing of International assistance programs in natural resources; Earth Science Aid to Developing Countries, Symposium 2, 24th Int. Geol. Cong., Montreal, p. 61-66.
- Brand, H.  
1972: United Nations mineral survey programmes; *ibid.* p. 103-110.
- Burdon, D.J., and Thomas, R.G.  
1972: Importance of geology to water resources projects in developing countries; *ibid.* p. 142-50.
- Cameron, J.  
1972: Uranium exploration and development - a survey of aid to developing countries through the International Atomic Energy Agency, Vienna; *ibid.* p. 116-26.
- Carman, J.S.  
1971: United Nations mineral exploration activities - the first decade; *AIME Proc. Council of Economics*, 22 p.  
1972: Limiting factors in foreign development aid with particular reference to mineral exploration; Earth Science Aid to Developing Countries, Symposium 2, 24th Int. Geol. Cong., Montreal, p. 189-96.
- Clarke, R.  
1973: The pressing need for alternative technology; *Impact of Science on Society*, 23, p. 257-71.
- Crabb, J.L.  
1974: How EMR helps developing countries; *Geos*, Spring 1974, p. 18-20.
- Diallo, O. and Zajaczkowski, W.  
1972: Aperçu sur les formes d'aides aux pays en voie de développement dans le domaine des Sciences de la terre en s'appuyant sur l'exemple de la République du Niger; Earth Science Aid to Developing Countries, Symposium 2, 24th Int. Geol. Cong., Montreal, p. 85-91.
- Dijon, R.E.  
1972: Les activités des Nations-Unies dans le domaine de la recherche et de la mise en valeur des eaux souterraines; *ibid.* p. 127-34.
- Dixey, F.  
1957: Colonial geological surveys, 1947-56; *Geol. Min. Res. Bull. Suppl. No. 2*, 129 p.
- Dunham, K.  
1973: Geological surveys, mineral exploration and international cooperation; *Overseas Geol. Min. Res. No. 41*, p. 4-9.
- Gibbons, M. and Voyer, R.  
1974: A technology assessment system: a case study of east coast offshore petroleum exploration; Science Council of Canada Background Study No. 30, 114 p.
- Govett, G.J.S. and Govett, M.H.  
1972: New directions for development aid in the earth sciences; Earth Science Aid to Developing Countries, Symposium 2, 24th Int. Geol. Cong., Montreal, p. 203-11.
- Gorbunov, G.I.  
1972: Assistance rendered by the Ministry of Geology of the U.S.S.R. to developing countries in organization and conducting of geological exploration; *ibid.* p. 52-60.
- Gray, D.A.  
1972: Hydrological aid to developing countries from Britain; *ibid.* p. 37-40.

- Heath, J. A. and Tabacchi, N. B.  
1968: Bibliography of reports resulting from U. S. Geological Survey participation in the United States Technical Assistance Program, 1940-67; U. S. G. S. Bull. No. 1263, 68 p.
- Heindl, L. A.  
1972: The International Hydrological Decade - A preliminary evaluation of a cooperative effort in the earth sciences field; Earth Science Aid to Developing Countries, Symposium 2, 24th Int. Geol. Cong., Montreal, p. 135-41.
- Katz, M. B.  
1972: "Relevance" in university earth science aid to developing countries; *ibid.* p. 182-88.
- Kierans, E.  
1973: Report on Natural Resources Policy in Manitoba; Queen's Printer, Winnipeg, Manitoba, Canada, 50 p.
- King, M.  
1967: Medical care in developing countries; Oxford University Press, Nairobi.
- Lea, G., Diment, J. and Harvey, A. P.  
1973: Geological libraries and collections; Volume 9, Encyclopedia of Library and Information Science, Marcel Dekker Inc., New York.
- Lepeltier, C.  
1971: Geochemical exploration in the United Nations Development Programme; Geochemical Exploration, ed. R. W. Boyle, Can. Inst. Min. Met. Spec. Vol. 11, p. 24-27.
- Lespine, J.  
1972: Les sciences de la terre et leur action dans les pays en voie de développement - le cas de la France; Earth Science Aid to Developing Countries, Symposium 2, 24th Int. Geol. Cong., Montreal, p. 41-51.
- Levitt, K.  
1970: Silent surrender: the multinational corporation in Canada; MacMillan, Toronto, 185 p.
- Li, C. Y.  
1972: Some observations based upon experience in Asia; Earth Science Aid to Developing Countries, Symposium 2, 24th Int. Geol. Cong., Montreal, p. 197-202.
- Malhotra, S. P.  
1974: Canadian mineral aid and private investment in the developing countries; mineral Bull. MR 143, Dept. Energy, Mines and Resources, Ottawa, 78 p.
- Michener, C. E.  
1973: Foreign investment climates for non-fuel minerals; Northern Miner, Sept. 13, 1973. p. 35-36.
- Mikesell, R. F. (Ed.)  
1971: Foreign investment in petroleum and mineral industries: case studies of investor-host country relations; Johns Hopkins Press, Baltimore, 459 p.
- Mohr, P. M.  
1972: Economic development strategies and foreign ownership policies of selected countries; Mineral Bull. MR 123, Dept. Energy, Mines and Resources. Ottawa, 49 p.
- Neale, E. R. W. and Tremblay, M. (Eds.)  
1972: Earth science aid to developing countries; Symposium 2, 24th Int. Geol. Cong., Montreal, 214 p.
- OST-AID  
1972: The application of geochemical, botanical geophysical and remote sensing mineral prospecting techniques to tropical areas; Office of Science and Technology, Agency for International Development, Washington, D. C. TA/OST 72-13., 74 p.
- Pallister, J. W.  
1972: British overseas aid in the field of earth sciences; Earth Science Aid to Developing Countries, Symposium 2, 24th Int. Geol. Cong., Montreal, p. 27-36.  
1973: Integrated mineral surveys overseas; Mining Mag., March 1973, p. 166-73.
- Prain, R. L.  
1973: State control in the free world copper industry; Trans. IMM, 82A, p. 69-76.
- Reinemund, J. A., Taylor, G. C. and Schoechele, G. L.  
1972: Scope and concepts of United States Geological Survey cooperative assistance to developing countries; Earth Science Aid to Developing Countries, Symposium 2, 24th Int. Geol. Cong., Montreal, p. 13-26.
- Ridge, J. D.  
1973: Emerging nations, their politics and economics and the future of mineral supplies; J. Metals, v. 25, p. 24-29.
- Ritchie-Calder, (Lord)  
1973: New dimensions and opportunities in the application of science and technology to development and the role of the United Nations family; United Nations, New York, 74p, Pub. No. E/5238/Add 1.

- Russell, M.  
1972: An information system for geological reports from the United Nations Development Programme; Earth Science Aid to Developing Countries, Symposium 2, 24th Int. Geol. Cong., Montreal, p. 111-15.
- Ruttner, A. and Thiele, O.  
1969: Das UN-Projekt Geological Survey Institut Iran - Organisation und Arbeitsergebnisse 1962-68; Verh. Geol. Bundesanstalt, v. 2, p. 143-58.
- Spurgeon, D.  
1974: Bringing science and technology to the world's forgotten people; Nature (London), v. 247, p. 326-27.
- Sutulov, A.  
1973: Minerals in world affairs; Univ. Utah Press, Salt Lake City, 2nd edn., 200 p.
- Tait, A.H. (Ed.)  
1974: Proceedings of Symposium No. 2: Earth Science Aid to Developing Countries, 24th International Geological Congress, August 24-25, 1972, Montreal, Canada; Overseas Development Section, Mineral Development Sector, Dept. Energy, Mines and Resources, Ottawa, 109p.
- Tamale-Ssali, C.E.  
1972: Earth science aid experience in Uganda; Earth Science Aid to Developing Countries, Symposium 2, 24th Int. Geol. Cong., Montreal, p. 67-71.
- Taylor, G.C.  
Historical review of the International Water Resources Program of the U.S. Geological Survey, 1940-1970; U.S. Geological Survey, Reston, Virginia. (in press)
- Tremblay, M.  
1972: Canadian earth science aid; in Earth Science Aid to Developing Countries, Symposium 2, 24th Int. Geol. Cong., Montreal, p. 3-12.
- United Nations  
1963: Science and technology for development - report of United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas; Volume 2: Natural Resources. U.N., New York, 74 p., Sales No. 63.I.22.
- 1970a: Natural resources of developing countries: investigation, development and rational utilization; U.N. Dept. of Economic and Social Affairs, New York, 174 p. Sales No. E.70.II.B.2.
- United Nations (cont.)  
1970b: Mineral resources development with particular reference to the developing countries; U.N. Dept. of Economic and Social Affairs, New York, 74 p., Sales No. E.70.II.B.3.
- 1971: World plan of action for the application of science and technology to development; U.N., New York, 286 p., Sales No. E.71.II.A.18.
- 1972a: Small-scale mining in the developing countries; U.N., New York, 171 p., Sales No. E.72.II.A.4.
- 1972b: Non-ferrous metals: a survey of their production and potential in the developing countries; UNIDO, New York, 188 p., Sales No. E.72.II.B.18.
- 1973a: An Asian plan of action for the application of science and technology to development; U.N. ECAFE, Bangkok, 111 p., Doc. No. E/CN.11/1071.
- 1973b: A Latin American Plan of action for the application of science and technology to development; U.N. Economic Commission for Latin America, Santiago, 245 p., Doc. No. E/CN.12/966.
- 1973c: African regional plan of action for the application of science and technology to development; U.N. Economic Commission for Africa, Addis Ababa, 135 p., Sales No. E.73.II.K.3.
- Walter, E.  
1972: Integrated training and research in applied geology in Saudi Arabia; Nature and Resources (UNESCO), v. 8, p. 13-18.
- Weiss, R.  
1974: Mining in developing countries; Progress International, v. 1, p. 34-37.

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## APPENDIX II

### SUMMARIES OF BACKGROUND AND FOLLOW-UP DOCUMENTS\*

#### Background Documents

##### B. D. 1: Proposal to Establish a Committee on International Aid in the Earth Sciences.

A. R. Berger, Memorial University, former Colombo Plan Lecturer at University of Sri Lanka.

D. R. Derry, International Mining and Geological Consultant.

This document was drafted at the request of the Organizing Committee of the Montreal Symposium as a follow-up to a proposal presented by Dr. Derry in the closing minutes of that meeting and supported by the majority of those present. In this document five basic aims for the Committee are suggested: (1) to encourage discussion, (2) to co-ordinate activities and encourage communication among aid agencies, (3) to encourage the training of Third World personnel, (4) to emphasize the critical role of the mineral industry as a basis for general economic and social development, and (5) to establish lines of communication among interested geoscientists. A committee or working commission of the IUGS is envisaged, with twelve members appointed as individuals and not as government or agency representatives. Funding from UNESCO would be sought for annual meetings of the Committee, and a secretariat would be supplied by donor countries. Appended to the Proposal is a suggested procedure for selecting committee members and for establishing the Secretariat, and a list of thirty nine "possible future activities for the Committee." This Proposal was submitted in 1973 to the IUGS but elicited no action. It formed a starting point for the discussions which lead at St. John's to the establishment of the Association of Geoscientists for International Development.

##### B. D. 2: Responses to Workshop Proposal.

This document contains a series of comments, suggestions, and criticisms responding to the first circular for the St. John's Workshop. Many of these have been incorporated into the main body of this report.

##### B. D. 3: Co-ordination and Communication in the Earth Sciences.

G. A. Gross, Commonwealth Geological Liaison Officer, London.

Earth science work in most countries is highly diversified among many different organizations and interests. The obvious need for co-ordinating this work for optimum national benefit cannot be overemphasized. Co-ordination of it is the task and the prerogative of the country concerned but it requires the co-operation and consideration of all agencies involved.

The geological survey organizations are very concerned about co-ordination of the earth science work and are the principal contributors in this field. They have a major responsibility for continuity and interpretation of earth science work for national development. Their essential contributions and their role as co-ordinating agencies needs further recognition by donors and by those formulating technical and professional assistance programs.

Many geological survey staff feel a sense of isolation because of limited communication with neighbouring countries and their counterpart professional working group in adjacent territories. The current formal international scientific meetings and conferences are not satisfying the needs of the local working groups because they have too little opportunity for communication on scientific matters in their own region.

More consideration should be given to co-operative project work between the larger and smaller geological surveys. The costs for special discipline or professional service and the laboratory facilities they require can be shared or supported through bilateral or international aid funds. A vital point to be recognized in promoting co-operation in specialized

fields in geology is that support should be provided on a continuing basis over a period of years to enable development of specialist working teams and to give time for conclusive results to be achieved.

The development of separate specialized international institutes or organizations to provide special service does not seem to be as practical an approach as the proposal to develop special scientific discipline groups and laboratory facilities on a co-operative basis within the framework of existing government geological organizations. Some of the specific areas of work and discipline being considered here for co-operative development and for providing services include: mineral deposit geology and research, mineral resource evaluation and appraisal (especially for commodities with complex industrial standards and requirements), the study of marine geology and ocean mineral resources, development and evaluation of geophysical and geochemical survey methods, isotopic age determination of rocks, and analytical services.

Two aspects of concern in the hydrogeology field are the need for closer co-ordination of the hydrogeological work with the regional geological investigations being carried out in the geological survey, and the need for improved training facilities to equip professional staff in the use of modern engineering methods and technology in hydrogeology.

Co-ordination of earth science activities could be promoted in the following ways:

1. By improving communication among working groups in the earth sciences in local areas, (a) by sponsoring field conferences to deal with regional geological and mineral development problems, (b) by providing travel funds and facilities for field seminars and exchange visits, (c) by providing funds for preparation and publication of reports, maps, and conference proceedings dealing with geological subjects of regional and multinational interest, and (d) by sponsoring special lecture tours for specialists and advisers in mineral exploration and development technology. This would help to update isolated working groups on new scientific concepts, technology, and methods. Some of this support could be channeled through local Geological Societies and Mining and Metallurgy Institutes as well as through the Geological Survey organizations or universities.
2. By subsidizing the professional societies such as the geological societies, engineering and mining societies, regional geological associations, in the development areas where a high proportion of the professional working group are transients, or where newly established societies require working funds.
3. By sponsoring seminars on mineral resource management and development policies for high-level scientific and executive personnel from government and the mineral industry.

Probably the biggest problem being faced in most geological organizations of small countries is that of providing experienced geological staff who can bridge the generation, nationalization and scientific-technological gaps that have been created by rapid change in all aspects of their geological work and organizations. The problem of finding capable experienced professionals to bridge these gaps and give continuity in the supervision, leadership and development of scientific programs is one of the most difficult challenges confronting the management of the Geological Surveys. The problem must be given serious consideration in both the large and small Geological Surveys to see what more can be done through exchange, loan and training of senior geological staff.

##### B. D. 4: Comments on Workshop on Earth Sciences: A View from the Soil Sciences.

V. Ignatieff, Quebec,  
A former Deputy Director of FAO.

The soil scientists have a great social responsibility in the development of the developing countries, because with the ever-increasing pop-

\* Copies of the complete texts of Background and Follow-Up Documents can be obtained at cost from the Editor.

ulations of these countries, greater farm and forest production is required to feed, clothe and house mankind. This has to be done without soil deterioration, for soil is a renewable resource only as long as it is correctly handled, and various soils have to be managed differently.

The initiation, planning and execution of aid projects and their follow-up can be improved, but at present their greatest weakness can be ascribed to the difficulty in recruiting experienced personnel in the developing and the developed countries. As far as the UN system is concerned, except for countries like Denmark, the Netherlands, Belgium and the United Kingdom, little thought has been given by the wealthy nations on how to ensure that their well-trained and experienced nationals go out on assignments to the developing countries.

The best way of training people of the developing countries is to keep them in their home environment and to send well-experienced persons from the developed nations to give on-the-job training on actual projects. The disadvantage of such a procedure is that the personnel of the developing countries may not gain knowledge of the most advanced ideas and methods used in soil science. To overcome this handicap carefully selected scientists in the developing countries could be sent to the advanced countries for special training, on the clear understanding that they would return on completion of their training to their home countries. There are special cases when for personal reasons soil scientists from the developing countries may wish to have employment in the developed countries. Each case should be decided on its merits, but a candidate from the Third World should not be discriminated against.

There is an International Society of Soil Science, and the FAO has worked closely with this Society, which holds Congresses every four years. FAO has always felt that attendance of soil scientists from the developing countries at these Congresses should be encouraged and has taken steps in the past to help to defray at least some of their expenses, which these scientists or their governments cannot afford, being particularly short of foreign exchange. Nevertheless the representation at such meetings has been limited to scientists from wealthy and some centrally-planned nations, and attendance from the developing countries has been minimal.

**B.D. 5: A Critical Look at Earth Science Aid to Developing Countries.**

L. A. Heindl, Executive Secretary, U.S. National Committee for IHD, Washington.

Aid programs are overwhelmingly governmental, political, and institutional. As such they are self-serving. Unfortunately, self-service is not considered to be socially acceptable, and aid programs are bannered under the name of social responsibility, assistance to development, and similar slogans.

The acceptance of aid programs is also self-serving. The recipient countries can be less hypocritical about their needs than the donor nations, but they do flash the social responsibility slogans while in all too many instances the aid projects do more for the politically "in" than the economically needy. I do not say this is right or wrong. I merely point it out.

The individuals who are altruistic in their objectives have done amazing things as individuals. However, their efforts are scattered and uncoordinated, and without continuity. They are noble and frustrated. I sympathize with their indignation; I deplore their continued faith in altruism. It shows a lack of realism. Most professionals are self-serving in their participation in aid programs.

The history of foreign aid is that it has been of more use to the donors than the recipients - however unpalatable this fact is to the donors themselves. Nonetheless, recipient nations can benefit from foreign aid provided they are able to define their own objectives realistically and set up their own institutional structures to implement the attainment of those objectives.

The position of a profession, or a group of professions such as those involved in the earth sciences, may take on any coloration from ulterior to altruistic, or perhaps even a selection of spectra. But, except in the case of a few individuals, the professional interest is as self-serving toward the profession as the national aid program is to the national interests. Nonetheless, there are areas where the self-service of donor, profession, and recipient overlap, and where perhaps some benefit to the recipient may accrue. These areas must be identified, projects within them initiated, and others disregarded and abandoned.

Because of variables such as manpower, time and know-how foreign aid must remain reversible and revocable as long as possible. A recipient country should not accept an irreversible change in its natural resource regimes until it is as certain as it can be that it will be able to accept and cope with its long-term consequences. Because the variables

not only vary in time and space, and in earth science will be at different stages in different fields in the same country or in different parts of the same country, what is acceptable in the Four-Corners area of the United States might be anathema in New England.

The first objective of an aid program in earth science is to make certain that the recipient country understands thoroughly the desirable and undesirable consequences of proposed programs and their alternatives. The consequences to be considered are physical, economical, political, and social - short-range and long-term.

Thus it appears to me that the first need of a recipient country is to assess its own objectives, capabilities, and requirements. How an LDC is going to do this when the MDC's have shown their inability to evaluate their own situations, I don't know. But like the MDC's they have to make a stab at it, and that stab should be in their own hands. I question whether any country is so underdeveloped that it cannot come up with its own scheme of priorities, subject to periodic frequent review and reassessment, regardless of government continuity.

**B.D. 6: Co-operation in Groundwater Technology.**

D. J. Burdon, Hydrogeologist with FAO, Rome.

Some arguments in favour of co-operation in groundwater technology: many of the countries now undergoing development are in arid and semi-arid regions of the world, where groundwater is generally the major hope for necessary supplies. Water consumption is low in many of the countries now undergoing development, and indeed low water consumption per capita is an index of low incomes and need for development. The benefits arising from water development remain wholly or mainly within the country, and flow directly to the poorer and more backward sections of the population. They do not tend to benefit corporations, export business, shipping, etc. as do other forms of earth science aid. Unlike minerals and oil, the development of water resources can clearly be seen to benefit the country, since it is not exported to one advanced country or another. There is no taint of "exploitation" associated with water.

Hydrogeology offers wide scope for earth scientists and others working in water related earth sciences and especially for volunteers and young idealistic people who want to benefit their fellow man. "I was thirsty and you gave me to drink" has meaning now as it did long ago. There are of course, many other positive aspects of co-operation in groundwater technology as well. It is however necessary to stress that emphasis should be on equality between those who know and those who learn - on sharing rather than on giving or aiding.

**B.D. 7: Some Aspects of Earth Science Aid to Developing Countries.**

G. Ozoray, Alberta Research Council, former hydrogeologist with Hungarian aid team in Mongolia and CIDA project in India.

**The Brain Drain Concept:** The earth science professionals who work in the developing countries are really involved in a big scale "brain drain". Just the same way as the U.S. has always done it, the Third World buys highly trained manpower in the international market. A part of the costs are financed from international funds (such as aid money) but the essence of the brain drain remains; the service of professionals sold where there is a surplus and bought where there is a need for it. What the so called "foreign expert" or "aid personnel" is expected to do in North America (e.g. myself, a born Hungarian, in Canada) is to work effectively, get along with local colleagues and avoid conflict with local customs and culture.

**Realistic Approach:** Co-operation is successful if the interests of all involved parties (e.g. in case of aid donor country, recipient country and aid personnel) are satisfied. Moral motivation and personal character are important things but on world-wide scale no voluntary unpaid work can replace the reward system; both foreign specialists and their local counterparts must be well paid.

There are obvious benefits on the side of the donor countries and the personnel from them. A number of specialists (in our case geologists, geophysicists and the like) receive well-paid and interesting jobs. They enrich themselves with new experiences and become more valuable persons both professionally and as human beings. They bring back to their home countries their acquired skills both in the profession and in making contact with other cultures. The earth sciences themselves gain tremendously by their study of sketchily-known parts of the planet.

Proposals:

1. Such basic projects as geological-hydrogeological mapping should also be launched. We should not only concentrate on the short-term projects.
2. Labour intensive and high wages-cost ratio projects should be preferred when applicable.
3. Diverse ways of aid should be considered including financing self-conducted programs, use of experts from one developing country in another one, sending hired-expert type professionals, volunteers and young men to obtain field experience.
4. The fair recruitment practices must be used: available information on openings, and open application system, and immediate notification if the application is turned down.
5. Job security and home advancement must be guaranteed to the expert at least equivalent to those enjoyed by the home personnel.
6. Both foreign experts and counterparts should be well paid according to the best categories of their respective countries; counterpart wages should be upgraded.
7. The written contract of the expert must state his working time. If more working days are expected than at home this must be stated and also how the expert is compensated for this overtime as distinct from other compensations for difficult working conditions. If extra working days are required after the contract is signed (e.g. Saturday work), his paid holidays must be extended accordingly.

D.D. 8: The Private Sector in the Third World - An Example of "Self-Help".

R. A. Thomas, Petroleum Consultant, Trinidad.

Most aid projects are more effectively carried out by private enterprise rather than governmental agencies and it is for this reason that governments of receiving countries should be encouraged to contract local firms in most of these projects rather than carry out the job themselves. The local private firm can then obtain the outside expertise required, and have the job executed under its own supervision. The effect of this procedure is to leave behind the knowledge and expertise gained in the project in the receiving country, so that if similar jobs are required in the future, they can be accomplished solely from within the country concerned.

In my country there are many able and experienced people in the oil industry, but because of the low wages and the shortage of funds and organizational ability, there is a big exodus of these people to other oil producing countries where the opportunities are better. I was therefore of the opinion that if attractive enough opportunities and incentives were provided in their own country, this skilled group would choose to stay at home. With this in mind, I formed a local service company which in the main, provides a service to the oil companies in the drilling and workover offshore operations. I then went about selecting the best talent available locally and offered all supervisors shares in the Company. Since there was only a minimum of top posts in the Company, some of those approached were willing to take up my offer at a lower salary than they were making at the time in order to become an active participant in the new venture.

My next obstacle was raising the money to buy equipment, especially as most of the local banks a) have no expertise in oil operations, and b) are commercial banks rather than finance houses. I realized that prior to securing finance, I would first have to negotiate a contract with an Oil Company. This I was able to do on the basis of my professional qualifications and expertise in the oil industry, and the skills of the supervisors involved. Our Company then bought an offshore workover rig and it has been in operation now for a little longer than one year.

As a result of this mini-co-operative, our Company has had no labour problems since there is a good relationship extending to personal friendship between the workers and their supervisors. Although work has not been continuous, and there has therefore been a big fluctuation in the labour force, the sense of pride in and identification with the local ownership is so predominant, that grievances have been kept to the very minimum.

The end result of this venture is that several similar small companies have evolved; there is a reversal of the brain drain in this field; the wealth is more evenly distributed, and jobs that were previously performed by expatriates are now performed by locals.

B. D. 9: Project-Orientated Training Aid for Developing Countries.

G. J. S. Govett, Geochemist, University of New Brunswick  
and M. H. Govett, Economic Consultant.

One of the most important functions of aid agencies and universities involved in aid in the earth sciences is to help a country formulate its needs for trained scientists and technicians. Aid should be granted only after estimates of a country's needs have been made.

Training within a country's own educational system should be designed to provide an adequate number of lower-level trained people - a corps of technicians to provide the draughting services, help in the laboratories, and to provide field assistance for geologists and engineers. Technical assistance programs should be designed to provide more training *in situ*. The role that mining companies can play is generally unappreciated; provided that the country has an adequate secondary education system, on-the-job training can be extremely productive. Higher-level technical training - through the establishment of technical schools or institutes in the developing countries and short courses in technical colleges abroad - may be more effective than university education in terms of a country's development. Companies should be encouraged to send promising people abroad for technical courses and even for university training (this has been successfully done at the University of New Brunswick by both private and national companies who provide thesis topics for post-graduate research).

Where university training is indicated, the logical progression from B. Sc. to Ph. D. is acceptable only if it can be shown to represent an increased ability for the developing country to find and exploit mineral resources and to provide the expertise to build a country's infrastructure. The present system of post-graduate training in the earth sciences needs radical revision. Advanced training in most industrial countries is geared to geological, climatic, and social conditions which are vastly different from the African, Latin American, and Asian environment. National and regional training institutes (such as those established by the United Nations in the Philippines and Burma) should be encouraged. In many instances if "diploma courses" of one or two years duration (and involving and "mini" thesis based on a student's own country's problems) were more readily available in the developed countries, they would provide a good alternative to more formal post-graduate programs.

Where post-graduate training abroad is necessary, the program should ideally involve a thesis project in a student's own country. His research supervisor should visit the country to identify the problem and give on-site training (in conjunction with and financed by either a geological survey, a mining company, or an aid agency which is active in the country); field work should be done during the summer months. This approach, which is successfully followed at the University of New Brunswick, has the practical advantages of a student applying his theoretical knowledge to his own country's problems and a stronger likelihood that he will return to work productively in his own country.

In implementing a program to encourage and increase the scope of project-orientated earth science education and training, the problems of triple bureaucracy - the aid agency, the recipient country, and the university - should be met through new financial arrangements and new administrative structures within both the aid agencies and the universities.

B. D. 10: Some Notes on Natural Resource Development in the Third World.

A. Gibbs, London, Former Peace Corps Geologist in Guyana.

Earth resources and the technologies connected with them play a vital role in the economic development and social transformation of nations. The goal of many developing countries is self-reliance, and the status quo for many is criticized as neo-colonial.

Developing countries are in the aggregate large net exporters of earth resources to the industrialized world. This is an unequal trade, with the latter controlling the financial institutions, the mining and processing corporations, the balance of market power, and the expertise and information necessary for raw material production and utilization. The trade is not a logical development of the economic aspirations of the populations of the Third World; rather it serves the high material demands of the industrial states. The intention on the part of the latter to continue the growth of their per-capita material consumption over the next quarter century, although their levels of materials-in-use per-capita are already many times the world averages, is a fact which has severe implications for those who would pursue self-reliant development policies. The financial scale of the

earth sciences aid programs is insignificantly small in comparison with the scale of effects of the unequal trade. Redress of the terms of trade and a reduction in the role of the export sectors of developing countries would transfer far more financial power and free more development resources than any aid program could, and would have the great advantage of leaving the decisions on the disposition of the assets in the hands of those aided. It is interesting to note that China's mineral production has grown very rapidly in the last quarter-century without the dominance of the export sector or the influx of foreign investment capital.

The industrial countries can aid the Third World most by reducing the heavy material demands of their own economies - particularly the private and military sectors. Freed of the burdens and distortions brought about by the export sector's dominance, developing countries can turn to the utilization of their resources towards ends that make sense to their own economic and cultural requirements.

It has been suggested that the Third World should look to the industrial countries more as a warning than as a pattern for emulation. Similarly those individuals from industrial countries who have the opportunity to work elsewhere can return with a fresh perspective on the development goals of their own societies.

B. D. 11: On the IUGS Committee "Geoscience and Man".\*

W. v. Engelhardt, Tubingen, Germany,  
Convenor IUGS Committee

In 1970 the IUGS Executive Committee approved the creation of a Committee on "Geoscience and Man", which was endorsed by the Montreal IGC in 1972. A preparatory committee was created in 1973, and met in Washington that year.

It was evident at this meeting that since the original proposals, a certain change in outlook had taken place. All members agreed that the primary task of the Committee should be to examine the present critical situation of mankind from the angle of the geosciences. Geoscientists should help to assess the problems which the present exponential growth of population and of per-capita consumption implies, and should also help in controlling the effects of the impending crisis. The methods by which geoscience can contribute towards the discovery of hitherto unknown ore-bodies were considered to be more necessary than an assessment of the exact proven and possible reserves. The notion of finiteness of our resources has to be brought clearly into the mind of those concerned, and also the fact that substantial under- or over-estimates make little difference to the problem. The committee felt it should give urgent attention to the resources of mineral fertilizers on which the future development of agriculture depends. Formation, conservation and destruction of soils is another important problem to the study of which geoscientists must contribute.

The group finally discussed the capacity limitations of our physical environment. Many natural processes, for example seismic activity, land-subsidence and flooding, can be to some extent predicted, but only marginally controlled. Other processes, for example, landslides, may be initiated or aggravated by human activity. It was emphasized that the depletion of groundwater reserves evident in many heavily populated areas amounted to the mining of a scarce resource. There is a need to study all aspects of this problem and particularly the effects upon it of the disposal of the waste products of civilization.

The Committee thinks that education, both inside the geological profession and among those who will have to take grave decisions in the near future, is the most urgent task. In the long run, the Committee should stimulate research on critical subjects.

A high degree of consensus was achieved among those present. This unanimity, however, may be misleading, as all these scientists came from Western Europe and North America. It will be necessary to consider very seriously the viewpoint of geologists from countries with different economic systems and especially of those from developing countries. It must be recognized that our limited future resources do not have an equitable distribution. The problem of the impending growth crisis will ultimately affect the whole of mankind. But the manner in which these problems are considered will necessarily vary among geoscientists according to their social and economic background. This implies that the Committee should establish a wide range of contacts.

B. D. 12: A Critical Look at Earth Science Aid Projects with Special Reference to Canada.

N. R. Paterson, Consultant Geophysicist,  
Toronto, Canada.

In the past 20 years Canada has carried out a number of bilateral aid programs, some quite major, in the area of the earth sciences. Until recently, however, the emphasis has been more towards basic mapping than to mineral exploration which, in my opinion, is where the assistance is really needed.

I am well aware of the arguments against direct government involvement in mineral exploration programs. I am also aware that the time left for closing the gap between the have and have-not nations is growing very short and that the "hands off" attitude of the 1950's and 1960's is a luxury that we can no longer afford. If a mine is discovered on a CIDA project, what is more natural than the recipient country requesting the assistance of a Canadian mining company to develop and exploit it? And if they do not, have we not already fulfilled our responsibility in a most satisfactory way?

I have observed too often in my visits to underdeveloped countries stacks of raw and partly assimilated data of enormous potential value but serving no useful purpose as far as the recipient country is presently concerned. It is possible that "counterpart" personnel were involved in the data gathering and that some attempt was made to hand over the program to local staff on its completion. What must be becoming clear to the planners of CIDA projects (and I sense this change is taking place now) is that unless the initial program contains definite plans for interpretation and follow-up, very little is likely to get done. By interpretation I do not mean sophisticated, mathematical data processing (though this may be a necessary integral step) but the definition of target areas and the commodities to be looked for in those areas, together with detailed recommendations for the further investigation of the areas down to and including costs and specifications. Professionals should be assigned to actively liaise with the government of the recipient country for several years after the completion of the project to ensure that the information is not lost and that appropriate action is taken (if action is not forthcoming, CIDA should provide further funds for ground surveys, prospecting and drilling; or it should underwrite the risk for a Canadian mining company to do this).

It seems strange to me that Canada which has benefitted so greatly from its storehouse of natural resources (and will be benefitting still further as other nations run out of theirs) seems so unaware of the vital importance of the development of similar resources in the underdeveloped countries of the world. (Less than five per cent of Canada's foreign aid budget is spent on the earth sciences.)

In my opinion funds directed towards welfare, health and education, though necessary, are strictly "band-aid" operations; the real need is for the countries to develop a satisfactory economic base, after which the rest will follow. It is unrealistic to expect private industry to carry out the necessary development, as it would the industrialized countries. For one thing, countries that need the assistance most are the very ones that private industry is most inclined to steer clear of. And yet, Canadian foreign aid policy has always been to direct aid towards the politically stable countries, which have the least need of it.

It is unfortunate that countries are required to deal through such formal channels in their development programs. I have seen wonderful proposals of great value, carrying the full support at the technical level of both the donor and recipient countries, become distorted, delayed, and eventually either shelved or carried out in such a diluted fashion that they are of questionable value. In particular, I have observed the plea for on-the-job professional training in exploration distorted into so many line miles of geophysical survey simply because of bureaucratic machinery. Certainly it is easier to specify and provide a geophysical survey than to round up a team of professionals to consult, plan, organize, supervise, teach and recommend; but it is still easier to ship the equivalent value in copper pipe or nickel alloy; but which, in the end, provides the most benefit to the recipient country?

B. D. 13: "Aid" Programs - Some General Comments.

Deborah E. Ajakaiye, Geophysicist, Ahmadu  
Bello University, Nigeria.

From a purely rational point of view, aid in the field of earth sciences can, if properly handled, be a major contribution to basic technological development. Unfortunately, political, prestigious and economical considerations have made donor countries the indirect benefactors of their own aid, and receiving countries are consequently becoming increasingly disillusioned about aid programs. The reasons for this include the following:

\* All reports published in Geological Newsletter (IUGS), 1974, No. 1, p. 44-46.

- (1) Time and money is wasted on cumbersome administrative machinery. Rigid procedures, standards and specifications, are laid down, such that large-scale projects especially, are doomed to be time and money consuming even before they are extended. Maybe bilateral aid or smaller projects would be less cumbersome to handle and more efficiently and effectively pursued.
- (2) Due to lack of knowledge of local conditions in the receiving countries some "aid" organizations tend to recruit the wrong man as the "expert". The technical know-how of the "expert" may be acceptable but many other aspects must be taken into consideration for an "expert" to be accepted as a suitable member of the society of the receiving country. The "expert-counterpart" relationship has especially been found to be a bottleneck with frustrations on either side. In order to reduce this friction, "experts" could in some cases be recruited from the receiving country itself. "Experts" and "counterparts" could then work together under the same circumstances, with comparable salaries and responsibilities.
- (3) A substantial part of "aid" money is ploughed back to the donor country in terms of salaries of their "experts" and in the running of the base offices. A greater emphasis should be given to the use of local people in the receiving country. The donor country can help by sending materials and equipment together with experts who come for only short periods. This makes it easier to get a good "expert" who does not need to give up his normal job and it also improves the feedback between donor and recipient country.
- (4) Another bottleneck in the execution of aid projects is the lack of spare parts and facilities to repair equipment in receiving countries. More attention should be given to this (e.g. send a competent technician along with the "expert" or use equipment familiar to local technicians).
- (5) To avoid risk of loss or duplication of valuable work, aid reports should be published as soon as feasible after the completion of the project.

Finally, one thing is very true, that is, aid programs can achieve far more results with lesser means than is presently the case.

B.D. 14: Some Suggestions Concerning Earth Science Aid to Development Countries.

M. Davoudzadeh, Geological Survey of Iran.

Emphasis in development programs should be not so much on developing a certain mine or mineral deposit or a "selected area", but on developing geologists - the professional capacity of the receiving country. The best aid is that which creates in the developing country a sound and broad geological platform from which this country can carry on its own development. Iran was lucky in receiving this kind of broadminded assistance from the United Nations in the development of a Geological Survey. What really mattered to us was not the few mineral discoveries that were made in the course of this project, but the intensive on-the-job training and the wide experience which our geologists gained in all facets of geological and mineral exploration: mapping, paleontologic and petrographic research, hammer prospecting, geophysical and geochemical surveying, drilling, laboratory work, ore dressing, and so on. Today we plan direct and execute this fundamental work ourselves. We still need and welcome assistance in certain specialized fields; in fact no country, developed or developing, will ever be entirely independent from knowledge and experience available in other countries. But having now an established basis of our own, we are in a position to obtain much more specialized knowledge and experience not as mere receivers but in the form of mutual co-operation beneficial to both sides.

There is a tendency to view aid in the field of earth sciences solely as the development of mineral resources. Although the discovery, evaluation and development of useful minerals remains the most important practical application, earth sciences provide the basis for a much broader field of industrial enterprise: foundation studies, town planning, protection against earthquakes and other natural catastrophes, water supply, search for construction material. . . . to mention only a few. In this respect, it is difficult to understand why many development planners underestimate or even totally disregard the important role of geological mapping and the need to train geologists for mapping.

In Iran we found that the geological map is the first and fundamental document required in any development project, and a document that proves its usefulness throughout the execution of the project, be it the tracing and assessment of a phosphate layer, the underground exploration of a copper deposit, the planning and execution of a geochemical survey, the search for groundwater, or the re-routing of a railway line - not to speak of the value of every map for the student or research worker. What is important is that the map be made with a particular aim in view; it must be a practical map as regards the scale, the features to be shown and the symbols to be used. It must also be stressed that photogeology and examination of space imagery can most usefully supplement but never replace the mapping work on the ground.

B.D. 15: Comments on Earth Science Aid.

S. A. Bilgrami, Pakistan Chrome Mines, Pakistan.

Pakistan has large reserves of industrial minerals - gypsum, rock salt, natural gas, vermiculite, limestone, low grade iron ore, low quality coal, fire clay - and yet she is importing the products of all these minerals. It might reasonably be asked why in the presence of all these resources artificial fertilizer is still being imported in the country? Why was cement being imported till a few years ago? Why some qualities of cement are even now being imported into the country? The answer seems to be two-fold: (1) the planners do not know the mineral potential of the country, and (2) the earth scientists failed to appraise the planners of what could be done with the known resources of the country. Actually the two statements amount to the same thing but have been stated separately to show clearly that there was failure on the part of the planners as well as the earth scientists.

In most of the developing countries there is a fascination for glamorous minerals, and large sums of money are being spent on prospecting for minerals of copper, gold, silver, precious stones and nuclear energy while large reserves of industrial minerals are not being fully utilized. This is the situation even now in Pakistan and may be prevailing in many developing countries.

Since advice given by foreign "experts" is more readily heeded to by the planners, it was expected of the foreign advisers to tell the planners which industries to establish in the country. Had we in Pakistan planned to utilize our resources properly we would have been one of the major exporters of cement and artificial fertilizers in the world.

An impression has been gained in the developing countries that the aid-giving agencies are only interested in preparing an inventory of the mineral resources of the developing countries. However, erroneous this impression may be, we cannot turn away from it and have to find ways of erasing this misunderstanding. I feel that aid in earth sciences should be given on two distinct lines:

- a) Purely Academic: The formation of an association of the aid-giving country or agency with the universities, national geological surveys and other such organizations of the recipient country. The scope of "aid" would include exchange of professors, grant of teaching aids, books, equipment, training of personnel, geological, geophysical, geochemical field work, preliminary examination of the mineral deposits and engineering problems in seismic areas etc.
- b) Utilization Studies: These will aim at a close association with the planning organizations in the governments and private mining industry of the country. Uses will be found for the known mineral resources of the country and assistance will be rendered in establishing mineral based industries. Evaluation of the known deposits will be undertaken with a view to their utilization. This program will thus have a direct impact on the economy of the country.

Yet another way of making the earth science aid programs more effective can be the recruitment in the aid-giving agencies like UNESCO, UNIDO, WHO, World Bank etc., of a greater number of people from the developing countries. A person from an underdeveloped or developing country going to a like country has little problem of communication with his counterparts since his background has been similar to that of the personnel of the aid-receiving country. He does not have to make any effort at understanding their aspirations and fears, and he does not have an 'imperialist' background. He has not colonized any country and is thus more readily accepted by his hosts.

Painful as it may seem, one must not mince words while evaluating one's own performance. The underdeveloped and developing countries are rather suspicious of the advanced nations of the world because of their past dominance of other nations. The local counterparts must also share equally the blame for the ineffective utilization of foreign aid in earth sciences. Lack of experience, insufficient insight into the geological and economic

problems of their country and maybe even lack of dedication in some cases may have been responsible for this state of affairs. The aid-receiving country thus has to make special efforts not only to select carefully the kind of experts she needs but to choose her best available men to work as the counterparts.

B. D. 16: The Need for More Practical Training of Young Professionals for The Mineral Industries of the Third World.

L. G. Morrison, Mining Geologist, Calgary, Canada.

One of the major obstacles to efficient mineral industry operations in underdeveloped countries is the lack of practical experience among local engineers and geologists. Advanced degrees from prestigious universities are too often regarded by their holders as licences to sit in well-appointed offices theorizing and issuing directives to less educated but more competent subordinates.

In the Third World, advanced education is mostly reserved for a privileged class whose members have never been in the labour force or even practiced a blue collar trade. It is extremely difficult for this professional elite to relate to practical industrial problems, especially within the primitive economic and technological environments of underdeveloped countries. It is unrealistic to offer postgraduate training in esoteric disciplines to earth scientists who intend to work in countries where the application of animal power to a task often represents technological progress.

Social and economic restrictions preclude any meaningful system of apprenticeship or on-the-job training of young professionals in their own underdeveloped countries. However, they could gain practical experience in modern industrialized countries and carry home useful knowledge of how to do things.

It is contended that practical training in industry is the most useful form of fellowship aid which developed countries can offer in the earth sciences. It is proposed that medium-ranked mining and petroleum companies be approached to provide training programs of approximately eighteen months duration for young geologists and engineers from the Third World. Ideally these programs would comprise six months as a labourer or lower rank technician, six months in field exploration and six months in production geology or engineering.

B. D. 17: The Need for a Permanent Pool of Technical Aid Staff - Requirements, and the Problem of Counterpart Training.\*

D. R. de Vletter, Director, Geological Survey and Mines Department, Swaziland.

The importance of a permanent pool of technical aid staff from the industrialized countries and the mechanism for transferring technological skills to largely agricultural societies are discussed. In this connection examples from Zambia are given of the way in which an interest in science is stimulated from primary school onwards.

In view of the greatly expanding role of technical aid to developing countries it has become highly desirable for each major donor country to build up a pool of permanently employed professional staff. That is already recognized by countries such as Britain and the Netherlands. Human qualities such as dedication, teamwork, understanding, tact, self-discipline, persistence and adaptability are quite as important as professional qualifications. Readiness and ability to transfer knowledge to local technical personnel is essential. The possibility of job security for personnel who want to make foreign aid their career will help to attract the right type of person.

During assignments, technical aid staff will generally lack both time and opportunity to keep abreast of technical developments in their fields. Suitable university courses and refresher training must therefore be provided in intervals between assignments and the advisers would then also be available for consultation at Foreign Aid Headquarters on technical and practical matters.

In Zambia, where the lack of physical scientists is desperate, an attempt is being made to raise interest in science and technology at the "grass roots" level, through the ORBIT and JETS schemes. For children in the

upper primary and lower secondary schools the magazine ORBIT is published. It aims to help children to become alert and to question. There is strong emphasis on doing things: puzzles, do-it-yourself hobbies, home experiments, observations.

JETS (Junior Engineers, Technicians and Scientists) is operative on the secondary school level. It undertakes (1) creation of science clubs in secondary schools, (2) organization of school science fairs, (3) organization of regional and national student fairs, (4) dissemination of technical information through the magazine "JETS of Zambia", (5) career guidance in science and technology, and (6) organization of Workshop courses for club advisers (usually science teachers) and laboratory assistants. At the Science Clubs the pupils are taught how to apply scientific principles, how to carry out research work, and how to prepare and present technical reports. "JETS of Zambia" is trying to harmonize its activities with those of similarly oriented groups in neighbouring countries.

Technical training programs, strongly supported by the Canadian International Development Agency, and mineral education at the University of Zambia are briefly described, and some problems associated with counterpart training are discussed.

B. D. 18: Miscellaneous Comments.

A series of informal comments responding to the Second Circular for the St. John's Workshop.

B. D. 19: Training of Earth Science Personnel in Less Developed Countries.

P. G. Cooray, Head, School of Mines, University of Zambia.

1. Personnel. Owing to the nature of "contract appointments", better continuity can best be achieved by link arrangements in which aid (a) is concentrated in one or two areas of specialization; (b) is spread over a meaningful length of time; (c) involves supply of staff and equipment to carry out well defined teaching and research programs; and (d) makes certain that counterparts are ready to take over at end of link arrangement.

Post-graduate training to M.Sc. level, at least, should be encouraged in the home country, but beyond that students should have access to contacts and equipment in the more developed countries.

Movement of personnel within LDC's should be encouraged and the relevance of the content of earth science training should be discussed regionally at frequent intervals.

2. Equipment. The increasing cost of basic teaching material like petrographic microscopes and compasses, the absence of more sophisticated equipment for post-graduate training, and the shortage of competent technical staff to maintain such equipment are major problems facing the LDC's. Solutions must be found quickly to these problems.

For material like specimens, maps, colour slides etc., an appeal is made here that those institutions with excess material donate such to newly established earth science departments handicapped by the difficulty of obtaining such material owing to cost and the time factor. Also, a small financial grant each year, held in the donating country, would make possible the purchase of minor items, the ordering of which would normally involve much red tape.

3. Books and Journals. Similarly, surplus books, back numbers of journals, reprints etc. would be very welcome to earth science departments in the LDC's. In addition, authors of new books and/or publishers might be encouraged to send copies to LDC's. This would avoid the present considerable time-lag between the publication of a new book or journal in a MDC and its use in teaching and research in the LDC.

4. Other comments. (a) There is an urgent need for more frequent contact between earth scientists in MDC's and LDC's in order to reduce the feeling of isolation. This could be achieved by the holding of conferences, seminars, colloquia, workshops etc. in the LDC's, rather than in the MDC's.

(b) Is there a need for a new "Earth Science" course at high school level in the LDC's? I, for one, think this very necessary, the present subject "Geography" being far too narrow in concept in view of our rapidly increasing knowledge of the earth and planetary system, and because of the present revolution in "earth science".

\* This paper was produced for the IGC Symposium but was too late to be included in the published volume. It carries the designation "Occasional Paper 52, Geological Survey, Zambia", but has not yet been published.

B. D. 20 The Mineral Prospectors' Training Program in Uganda: A Case Study of an Aid Project Providing In-Service Training of Geological Assistants in a Third World Country.

P. W. G. Brock, Geology Department, Queen's College, New York.

The Mineral Prospectors, Training Program is an example of a small aid project carried out in close co-operation with a Third World geological survey department.

The operations of the Uganda Geological Survey included regional geologic and geochemical surveys, detailed geologic, geophysical and geochemical follow-up work on mineral prospects, and siting, drilling and maintenance of water wells.

The Geological Survey of Uganda did not have enough geologists to meet all these obligations. One possible solution to the staff shortage was to train twenty five geological assistants i) to carry out much of the routine geochemical sampling, and ii) to record and collect samples of the rocks and any mineralization encountered during the geochemical surveys. CIDA provided the instructors and Uganda provided the facilities and equipment. The first group of ten trainees was recruited in June, 1967, and between January, 1968, and March, 1970, they spent sixteen months in the classroom and eleven months in the field.

Some of the main factors that, I think, contributed significantly to the smooth running and general effectiveness of the project, were:

1. The concept of the project originated with the Commissioner of the Uganda Geological Survey. As a result, I received his whole-hearted support throughout the project. The co-operation that I received from the rest of the Survey Staff can in part be attributed to his influence, but was also due in part, I think, to the good relationships built by the Canadians during an earlier aid project. In any event, there were few personality conflicts, and there was general agreement on the objectives of the project and the ways of attaining those objectives.
2. CIDA supported the project throughout and attached no "strings". They agreed to my extending my home leave in 1967, to visit Canadian training institutions (e. g. Haileybury School of Mines) and to compile necessary information in preparation for the training program. They also agreed to send out my replacement some months before I was due to return, so he could familiarize himself with the local geology and Survey procedures.
3. The project was practical and realistic. There was a need for trained assistants; positions or "lines" could be made available for the trainees, and suitable candidates were available for training, including some with field experience. The training was focussed to meet the Survey's special needs.
4. The project did not strain the Survey's budget. The emphasis throughout was on training, not prestige. In contrast, a nearby UN training project, aimed at turning out a similar level of staff for another department, entailed large prestigious building, grandiose equipment, and a large staff of expatriate and counterpart personnel, all of whom required housing allowances, etc.
5. The field training was directly productive in that it was carried out on projects that the Survey would otherwise have had to do itself.

B. D. 21: A Viewpoint from Within a Developing Country

S. Singh, Manitoba Dept. of Mines, Formerly  
Commissioner, Geological Survey and  
Mines Department, Guyana.

There can be no denying the fact that aid in the earth sciences has had a significant impact on the economy of many developing countries, but those who have been involved to any degree with the administration of aid will readily admit that all has not gone well. Today, the word "aid" in many developing countries is unpalatable, and invokes an image of inferiority or the suspicion of a vehicle for exploitation or espionage. Such a situation has been conditioned by the way in which aid programs have operated in the past and, in some cases, continue to operate.

Particularly in developing countries, there is a general, if not total lack of appreciation of the implications and ramifications of the earth sciences. In a discussion of financial allocation to the Geological Survey in his country, the writer has heard a politician argue that the Geological Survey "is a hangover of the colonial regime" and that he could see no purpose to perpetuating such colonial practices at the expense of the taxpayers. Such expressions and sentiments are not uncommon among politicians and planners in developing countries who are almost exclusively

educated in the arts and who, because of the lack of earth science teaching facilities in local universities, are quite uninformed. In developing countries, too, there is fierce competition for the usually scarce dollar available for development projects. Almost invariably, the dollar spent in the agricultural sector, by virtue of providing quick results cheaply, earns more political favour than the dollar spent in the earth science sector, where positive results cannot be guaranteed during the usually short term of an elected government.

The patterns and practices of foreign investment in Third World countries have come under severe criticism in recent years and in some cases have met with the supreme penalty. Only from a peculiar, if not emotional, perspective can it be said that foreign investment in earth science has hindered Third World development. Earth resources which have been exploited in developing countries could have been of no benefit to their citizens unless they were mined and marketed at a profit. And the developing countries do not have the means and competence to do these things. No country could truly say that it has not benefitted from exploitation of its earth resources by foreign investment. What may be legitimately said is that there could have been a more equitable deployment of the returns. Specifically foreign investment will need to give serious consideration to a greater degree of processing of earth resources within the Third World countries.

In Third World countries, the use of intermediate technologies and labour-intensive schemes are very much mooted by politicians and planners, in the face of rapidly growing unemployment and absence and cost of advanced technologies. But in the earth sciences field is this not more academic than practical? Except on a limited scale and in special circumstances for local requirements, can such schemes really have any significant impact on the economy? Can the products of intermediate technologies and labour-intensive schemes be competitive with those of advanced technologies and mechanization? What about the technology lag; would this not be interpreted as a form of imperialism? Cottage industries have been very successful in Third World countries in certain fields, notably cutting and polishing of precious, semi-precious and ornamental stones. They can, however, logistically encompass only a narrow spectrum of the mining field. Again, conventional methods of prospecting are extensively in practice in many Third World countries and can sustain individuals at subsistence, or a little above subsistence level but they usually have little impact on the economy of the country.

It is common knowledge that the "expert" personnel of a most important multilateral aid organization have proved to be dismal failures over and over again. The aid expert should regard himself as an ambassador and be always careful to observe the attendant diplomacy in relationship with his counterpart personnel and agency. He often has to face an ingrained psychological inferiority complex, the delicate handling of which can make the difference between success and failure of his assignment or the generation of goodwill or ill will between donor and recipient agencies. Some areas which, in the writer's opinion, are weaknesses in the system, are:

- (a) The quality of aid experts provided to developing countries from multilateral source has in general been poor. This appears to be due to a combination in varying proportions, of bureaucracy and nepotism. The quality of experts from bilateral aid has been on the whole very good.
- (b) Experts should not be foisted on developing countries. Countries should choose from a number of candidates and not have one selected for them.
- (c) Experts should be briefed on elementary principles of diplomacy before taking up their assignments.
- (d) Experts should not demand of poor governments, logistics or facilities infinitely greater than that of their local counterparts, and indeed that the governments can afford. And aid organizations should not support such demands.

A problem is how to encourage ambitious young geoscientists to carry out research for higher degrees without having to part with them for four or five years. Naturally the way is to encourage them to develop local topics and spend the minimal of time abroad to obtain accreditation. Universities should take a hard look at this area with a view to assisting countries in the most effective way. Developing countries need all of their geoscientists for all of the time and certainly cannot afford to send them abroad for four or five years to work on a topic which mostly advances the geoscience knowledge of the country of study. Further, the writer has experienced many cases where the researcher from a developing country gets so involved and attached to the topic of his research in the developed country that he will not return to his country or will have difficulty re-orienting himself.

Guyana has traditionally assisted the Commonwealth Caribbean countries in the geoscience field. During the time of British rule facilities were built up in Guyana which catered for the geoscience needs of the



islands by one arrangement or another depending on the nature of the requirement. This arrangement has continued despite the independent status of Guyana and that of most of the other islands. Assistance has ranged from secondment of geoscientists for specific assignments; training of counterparts (mostly at the technical level) both at home and in Guyana; advice on program planning; secondment of specialists; chemical analyses and interpretation of data; and the writer even advised on terms and conditions which should be attached to concessions given to mining companies for exploration.

Severe handicaps have, however, been encountered by financial and personnel limitations. Guyana itself is short of trained geoscience personnel and cannot afford secondments for long periods. Developed countries could assist in training indigenous professional personnel who could work in collaboration with Guyana, utilizing its experience, expertise and facilities. Financial limitations have further curtailed expansion and benefits of such assistance.

The writer has found from his considerable exposure in a developing country to aid and offers of aid, that "aid with strings" and "aid with trade" characterize aid in a significant measure. As such it operates in a manner which will generate a surplus of political and financial benefit for the donor country. This has been observed to be the case with aid from both socialist and democratic countries. If aid continues to be of this nature, its effectiveness can hardly be significantly improved.

B. D. 22: Some Highlights from the Proceedings of 1972 IGC Symposium: A Personal Selection.

Brief excerpts from the Montreal IGC Proceedings issued April, 1974, compiled by A. R. Berger for the use of Workshop participants.

B. D. 23: Earth Science Aid to Developing Countries.\*

J. W. Pallister, Head, Overseas Division  
Institute of Geological Sciences,  
London.

The British Aid Program

Britain has continued to provide geologists, mining engineers and allied scientists to staff geological survey departments in Commonwealth countries and dependencies as follows: in Botswana (18), British Solomon Islands (6), Fiji (6), Kenya (2), Malawi (9), New Hebrides (3), Swaziland (3), Ugnada (3), Zambia (21). (Numbers indicate staff in post in 1973.)

Apart from these secondments, some seventeen officers of the Institute of Geological Sciences served abroad in technical assistance assignments of over a year's duration during 1973 and another thirty four officers undertook short-term advisory or instructional appointments in developing countries and these were supplemented by a few direct contact officers.

In addition to these government-to-government arrangements, British university staff carried out a variety of research activities abroad partly supported by direct government funds.

General Remarks

There has been no special policy of concentrating on one or other aspect of earth science research and there has been a fairly equal proportion of basic geological mapping and applied geology in mineral and water prospecting, engineering geology, laboratory services, photogeology etc. There is a strong desire that the developing countries should decide the type of aid they require, although it is recognized that in a list of natural resources priorities, the speculative nature of mineral prospecting places it low as compared with agricultural development or improvement in public works. Furthermore, basic geological surveys have not the attraction of possible immediate returns in economic or social improvements. In so far as the expenditure in the earth sciences is an extremely small proportion of most national aid programs, it is inevitable that the conditions under which it operates - recruitment of personnel, purchasing of equipment and general supervision, has to some extent to conform to the larger pattern of government operations. This may be a cause of some frustration and delay in both donor and recipient country.

A second major factor in retarding earth science aid is the widely prevalent attitude in developing countries in offering poor rewards to official

scientists and to the comparative unpopularity of earth science research compared to most other scientific activities. Advanced instruction and training may often result in promotion to positions where such training serves little purpose.

While the more sophisticated techniques and equipment provided by donor countries may accelerate development they do not always provide the basis on which a developing country can continue its own development; aid programs should ideally be planned to introduce means and methods which are readily assimilated by the recipient.

There is an urgent need for the developing countries to recognize the vital importance of supporting services such as adequate library and records maintenance, good laboratories, suitable and sufficient transport and funds for field operations even at the expense of professional staff.

B. D. 24: On Earth Science Aid to Developing Countries.

M. K. Roy Chowdhury, former Director-General  
Geological Survey of India.

Environmental development, involving minerals, water or evaluation of the terrain for communication and stability, lies at the basis of all development, whether national or international. Gradually, the planning authorities in many countries are taking the earth scientists into confidence and depending on their recommendation before embarking upon detailed development planning. It is rather encouraging that in most of the developed and developing nations the earth scientists are participating in a responsible manner in planning activities.

Paternalism in the earth sciences is a fast-developing problem, and is generated by the domination of scientists of certain countries in all types of aid programs. There should be a world pool of specialists from all countries, graded according to experience/competence.

In both developing and underdeveloped nations the roles of intermediate technologies and semi-professionals and labour-intensive schemes have immense potentials. Development of proper cadres may be time consuming and may fall behind the development time-schedules. As such the existing semi-professional skills and cheap labour should be properly utilized instead of over-emphasis on professionalism and mechanization. Very often a wide intellectual gap separates the expert and counterpart. Both should be associated from the stage of planning of the project, so that they are allowed to examine compatibility aspects. The adviser should be engaged from the stage of pre-investment feasibility study, and he should have a missionary spirit and zeal. The counterpart should enjoy the same status and administrative importance.

The problem of unemployed earth scientists is reaching alarming dimensions. This problem is already acute in the developed as well as developing nations. Exchange of personnel and employment of the surplus professional manpower in deficit areas provide the only immediate hope of solution. The Third World scientist should be considered for preferential employment.

There is an awareness in the declared objectives and aims of the IGCP, the Geodynamics Project and of COGEO DATA, regarding participation of the Third World geoscientists. However, the current activities under these international scientific programs do not reveal as yet any move to implement the assured participation of such scientists. Up to the present, the project under these programs are mostly concentrated in the richer nations and a scrutiny of the available reports would show that the Third World is singularly neglected. Most of these programs envision rather sophisticated studies for which in the Third World, the facilities or know-how may be inadequate. Since the projects are mainly approved on the basis of their inherent, scientific merit, a procedure which seems to be rational, it is difficult to visualize how Third World scientists can be effectively accommodated in these programs.

B. D. 25: Note on UNESCO's Aid to Developing Countries in the field of Earth Science.

E. M. Fournier d'Albe and A. van der Sluijs,  
Division of Earth Sciences, UNESCO, Paris.

General

There is virtually a universal desire among the governments of developing countries to participate actively in, or to control, research and development of earth resources in the national interest. This entails the creation of the necessary scientific and technical manpower.

\* An addendum to Pallister, 1972.

## Financial Resources

Within its own budget, UNESCO disposes of about \$50,000 a year for assistance to Member States in the earth sciences. However, as Executive Agency of the United Nations Development Program (UNDP), it can draw upon much larger resources (more than \$500,000 per year) for research and training projects in developing countries; these projects are not planned or initiated by UNESCO but by the governments of the countries concerned.

The above resources are used for providing assistance to developing countries in several different forms.

## Institution - building

The establishment of training and research institutes of national or regional vocation appears at present to correspond best to the requirements of developing countries.

## Post-Graduate Training Courses and Seminars

Financial assistance (usually only a small part of the total cost) is provided to university institutions for the organization of post-graduate training courses and seminars in various branches of the earth sciences.

## Fellowships and Study Grants

Most of the projects financed by UNDP contain a fellowship component to enable the local personnel assigned to the projects to receive advanced training abroad.

## Visits of experts

The sending of experts to developing countries for periods varying from a few weeks to several years represents the most common form of technical assistance.

## Participation in international meetings

Both through its annual subvention to the international scientific unions and through special contracts with unions and associations for particular meetings, funds are provided for aiding scientists from developing countries to attend international scientific congresses, symposia, working groups, etc.

From the above, it may be seen that UNESCO's effort is mainly directed towards the building up of scientific manpower in developing countries.

## Follow-Up Documents

(Contributions submitted in Response to the Workshop Discussions.)

### F.D. 1: The Geological Survey's Role in Development:

J. V. Hepworth, Director, Geological Survey of Botswana.

Although professionally immersed in Earth Science Aid, I find it difficult to navigate through the flood of thought issuing from the Workshop, and pick on one aspect - the role of the Geological Surveys - as my familiar landmark upon which to anchor a few opinions.

There is no doubt in my mind that the greatest merit of the Geological Survey as an element in development is its continuity - continuity of organization, continuity of service to the "customer" (government, the public and the private sector) and continuity of personnel. Insofar as aid can provide staff, both experienced leaders and newly graduated geologists, it is contributing the basic element in continuity in a Geological Survey. In Botswana, the Survey is still almost entirely dependent upon expatriate, aid-funded professional staff. The degree of continuity in this regard would be improved by encouraging double tours amounting to four year minimum contracts.

A prime reason for organizational continuity in the Geological Surveys follows from their role as the initiators of Development Projects, as their champions, as the projects fight their way past the planners, and ultimately as the complete or partial executors.

The necessity for continuity is also obvious where, as in the case of Botswana's Development Project "Mineral Exploration" (U. K.) which funds

the Survey's main mapping and survey work, the activity itself is continuous over the years. This becomes ever more a necessity as the lead-time between initiation of an order (e.g. for a drilling machine or a vehicle) and its eventual delivery at an inflated cost becomes progressively greater. Perhaps this lead time will shorten as communications, management techniques, financial and industrial relations become ever more sophisticated.

Less obvious is the need for continuity in Geological Surveys in the case of the special "on-off" Project, such as the provision of an Aid Team, or an airborne geophysical survey. By the time special projects such as these have been proposed and effected, so much water has flowed down the Zambesi that without the continuity of staff the source can be long forgotten.

It may be argued that a Project that will not stand the erosional processes of time and planning is not worthy to succeed. This raises the valid question as to how far the geologist is capable, of planning a project: to what extent are we earth scientists, with our sense of geological time and an eye on the eternities, capable and professionally equipped to deal with the complexities of socio-economic priorities, financial control, and of project planning? Whatever the answer may be, there is something to be said for the sower of the seed having the opportunity to taste the fruits - sweet or sour.

Turning to another aspect of the desirability of continuity in Geological Surveys' organization, it may be conjectured that the fragmentary nature of much aid-funded service (whether "consultants", "experts", "seconded officers", or short-term contracts), may contribute to the information hiatus; the failure to effectively publish or disseminate the written results of the field work. It is easy to disappear - with the promise of "the final manuscript to follow within a month" - at the end of a visit or contract. The "report before leaving" should be a managerial imperative, but there are cases, such as the Bulletin, or the published Map, where only the physical return of the author would completely satisfy the requirements of would-be perfect publication: this may be a partial reason for the hulks of manuscript which litter the shelves of many Surveys - they fell just short of perfection and so were never launched.

While on this question of effective dissemination of scientific results, it may be remarked that there is room for practical steps in most Geological Surveys for (a) doubling the editorial capacity and (b) adopting new methods of reproduction and publishing. The second matter requires comparatively easily obtained expertise, but the first is much more difficult as it involves obtaining more people. Is there room for the profession of "geological communicator"?

At the Workshop, several contributors mentioned the fundamental importance of the geological map in development. Others emphasized the importance of educating the planners to appreciate its importance, and another contended that hydrogeological maps - for example in the Sahel region - were vital for human survival. It is very difficult, and embarrassing, to explain to the non-scientifically educated that planning without data (perhaps requiring a whole decade to begin to be significant) is meaningless. In Botswana I have often heard my own unconvincing voice explaining what the benefits of the National Gravity Survey might be. Even now, when this is completed and the dramatic picture of the sub-Kalahari geology begins to emerge in place of a great blank space, it is difficult to demonstrate to the non-geologist that this may give us a clue to the control of emplacement of our known and undiscovered kimberlite pipes, the extension of the Limpopo mobile belt, the disposition of the Karroo coal basins, and of the Katangides with their copper mineralization.

Finally, among these thoughts regarding the importance of the Geological Surveys, and of their existence as established, solid institutions with a function of their own in the developing countries, one must mention the all-important matter of training. I believe that, for the most part, full-time study, whether professional or technical, is obligatory to attain the highest standards. Equally, a working Survey finds it extremely difficult to extend itself into another fulltime role - that of education. Should not some thought be given to deliberate over-staffing of developing country Surveys, related to formally adopted time and work levels which include the training element? Should not every Geological Survey have a classroom or lecture hall and a museum with a teacher-curator? Only in these ways, I believe, will aid-funded staff be able to effectively train their counterparts, as well as the all-important junior staff. At present, most surveys (Botswana is a case in point) desire to train, are committed to doing so, but their establishments are those of institutes fully committed to production.

To sum up, against the wider perspective of international earth science aid, the national Geological Survey stands firmly identified as the institution which provides essential continuity, in providing a steadily growing "earth resources inventory", in providing guidance and supervision of external aid projects, and as an educational base in which local people can attain full professionalism.

F.D. 2: Critical Comments on Earth Science Aid Workshop

A. H. G. Mitchell, UNDP, Rangoon, Burma.

In general the Workshop discussions were rather inconclusive. The most useful result of the meeting was the establishment of an *ad hoc* committee.

Of the three Workshop sessions I attended, two were insufficiently specific in their assigned or chosen topics and in the resulting discussions. Consideration of developing countries as though all have common requirements is of little use. The problems and needs of Burma, Fiji, and Saudi Arabia, for example, differ so greatly that simultaneous discussion of all three precludes widely applicable conclusions. These differences between countries were emphasized by the fact that one of the most useful aspects of the Workshop to me was the opportunity to talk to individuals outside the programmed meetings. Comments by people concerned with specific countries brought problems into sharper focus than did the workshop discussions.

At future meetings, topics will presumably be more specific. They could be divided "horizontally" as at the Workshop, into subjects such as training, role of private capital, etc. and "vertically" into groups of countries with similar economic problems and similar cultural backgrounds. Discussions could then proceed from specific cases to limited generalizations, which would provide a framework for consideration of specific problems in more detail.

F.D. 3: Recommendations for Training Geologists for the Developing Countries.

J. Duncan Keppie, Acadia University,  
Wolfville, Nova Scotia.

Two proposals to supplement existing educational programs are made. Firstly, it is recommended that regional Field Institutes be set up in the developing countries to serve several neighbouring countries. Education should emphasize field training in a wide variety of subjects such as geology, biology, land use development, etc. The level and length of the courses could be varied to suit local requirements. Some courses could centre around projects underway in the region. Turkey, Iran and Pakistan presently co-operate in a program of this type.

Secondly, it is recommended that certain universities in the developed countries develop research competence in some part of the developing world. Thus M. Sc. and Ph. D. candidates from the developing countries could present thesis projects relevant to their home countries, while still benefitting from the research facilities available in the developed countries. An example is the Research Institute of African Geology of the University of Leeds, England.

F.D. 4: Notes on Training Third World Geoscience Personnel.

A. M. Al-Shanti, Director, Centre for Applied  
Geology, Jeddah, Saudi Arabia.

The Relative Merits of At-Home vs. Training Abroad:

Some positive aspects of at-home training are: (1) No adjustment period for students. (2) No cultural shock. (3) No temptation to stay away from home when examinations are completed. (4) The student gets used to the work in his own environment. (5) His research for a degree is a contribution to his country. (6) Training can be more widespread; even those who are academically weak can get a good training because selection can be less rigorous when facilities are on the spot. (7) The evaluation of the student's work will not be affected by the quite usual attitude found in the developed countries of being lenient with foreign stu-

dents because they are not going to remain in the profession in the host country.

Negative aspects of at-home training include: (1) institutions are not well equipped, (2) there is a rapid turnover of teachers, and (3) the research atmosphere is not well developed. All these aspects can be overcome by means of sufficient budget.

Ways of Ensuring Relevance of Earth Science Training to Third World Conditions.

The training must be geared to attract students with combined field and academic abilities. One easily-established fact is the negative correlation between good geological work done and the fairly large number of geology departments and students in the Third World. This negative correlation must be due to insufficient field training, which can be explained by lack of facilities for field work (e.g. camp equipment, cars, etc.) and/or by the low status field work generally has.

It is essential that young students get plenty of field experience early during their studies. This way they will find out if field work appeals to them, and instructors can weed out those who do not show field capabilities before the student has reached a point of no return in his career. Frequently a student can be interested in geology during his studies because he does not know what extended field work actually involves. Therefore, efforts should be made at an early stage in their training to select students capable of being in the field.

F.D. 5: The Commonwealth Geological Liaison Office, London.

G. A. Gross, Commonwealth Geological  
Liaison Officer, London.

The Commonwealth Committee on Mineral Resources and Geology is composed of the Directors of Geological Surveys from most of the Commonwealth countries and is one of the committees affiliated with the Commonwealth Scientific Committee Secretariat. The purpose of the Commonwealth Committee on Mineral Resources and Geology is to promote the exchange and distribution of scientific information in this field and it has maintained its liaison and executive office in Africa House on the Kingsway in London since 1951. Canada accepted her turn to appoint the Commonwealth Geological Liaison Officer for a two year term at the International Geological Congress held in Montreal and Gordon Gross of the Geological Survey of Canada took up this position in October, 1972. Previously Geological Liaison officers have been appointed from United Kingdom, Australia, Canada, India, New Zealand and Pakistan.

The liaison office is staffed by a senior geologist, a geologist-information officer and a secretary and is well known through the monthly newsletter it circulates to more than 500 earth science organizations and government offices in the Commonwealth. The liaison office maintains a close relationship with government, university, and industrial organizations concerned with the earth sciences, and assists the sponsoring Commonwealth countries with scientific contacts and communications. The liaison office plays an active role in the placement of professional staff and lists of positions available are compiled and circulated regularly. The liaison office is primarily concerned with communicating the kinds of scientific work being carried out and in creating an awareness of the wealth of scientific experience and achievement within the Commonwealth association.

Visits by the CGL officer to countries abroad confirm the high level of interest and regard for the work of the liaison office. They provide an appreciation of the status of earth science work in each country, of the specific problems and challenges being faced in developing areas, and of the particular professional service and assistance that can be expedited through this liaison among Commonwealth countries.

The success of the geological liaison work is dependent on the continued response of its supporting organizations and associates in reporting their current activities for the mutual benefit of the earth science community in the Commonwealth.

THE ASSOCIATION OF GEOSCIENTISTS FOR INTERNATIONAL DEVELOPMENT

In a final plenary session, the participants at the St. John's Workshop voted overwhelmingly to establish a non-political association on the earth sciences in international development. This would be composed of individual and corporate members. The latter would consist of companies, institutions, government agencies and professional societies, but these would not have the right to vote.

The following objectives were agreed upon:

1) To emphasize to both donor and recipient countries the fundamental role of the earth sciences in international development.

2) To encourage communication among all individuals, societies, and agencies interested in international aid in the earth sciences.

3) To encourage and promote co-ordination of the activities of the various agencies relating to international aid in the earth sciences.

4) To promote regional co-operation among countries with similar earth science problems.

5) To study mechanisms and evolve guidelines for the training of earth science professional and technical personnel of less developed countries for service in their own countries.

6) To evolve criteria for the selection of personnel for international service and to encourage donor countries to second able people to recipient countries with complete retention of their status upon their return.

7) To encourage the establishment of information centres on manpower, available expertise, past activities and results, and on other aspects of earth science aid.

8) To develop the necessary criteria for the adequate evaluation of individual programs and to encourage the publication of results.

9) To provide for a regular publication and dissemination of information on the above and related matters.

In order to work out the detailed structure of the association, an *ad hoc* Organizing Committee of twelve was elected to serve until the next general meeting at

the 1976 International Geological Congress in Sydney, Australia. Heading this committee is Dr. Deborah E. Ajakaiye, a geophysicist with Ahmadu Bello University in Nigeria, with Vice-Chairman Dr. Roger Blais, perhaps best known as the Chairman of the Study Group which produced the Science Council of Canada report "Earth Sciences Serving the Nation", and the writer as Secretary-Treasurer. Committee members are Dr. A.M. Al-Shanti, Director of the Centre of Applied Geology at Jeddah, Saudi Arabia; Dr. S. Bonis of the National Geographic Institute of Guatemala; Dr. G. Constantinou of the Geological Survey of Cyprus; Prof. Dr. W. von Engelhardt of the University of Tübingen in West Germany; Dr. L.A. Heindl, Executive-Secretary of the U.S. National Committee for the International Hydrological Decade in Washington; Dr. J.V. Hepworth, Director of the Geological Survey of Botswana; Mr. C. Hudson, an economic geologist from Peru; Dr. S. Singh, former Commissioner of the Geological Survey and Mines Department of Guyana; and Dr. B.K. Tan, Senior Lecturer at the University of Malaysia in Kuala Lumpur.

The Organizing Committee is now in the process of drafting a Constitution, and has suggested that the new organization be known as the Association of Geoscientists for International Development, a title which emphasizes both the main concern and the individual membership. Other activities include planning for the 1976 meeting, exploration of the possibilities of affiliation with the International Union of Geological Sciences, a search for supporting funds, and most importantly the production of a newsletter to provide a means of communication. The first issue will be ready for distribution in the very near future.

Geoscientists from many parts of the world have already expressed great interest in the Association, which appears to be the only international association of scientists aimed specifically at international development. Enquiries are welcomed and should be directed to Dr. A.R. Berger, Secretary-Treasurer, c/o Geology Department, Memorial University, St. John's, Newfoundland.

## APPENDIX IV

### WORKSHOP TOPICS

The second circular for the St. John's Workshop listed a series of topics for possible discussion. Not all of these were actually dealt with during the meeting, but it seems worthwhile to record these items together with some additional ones suggested during the meeting so that they can provide a checklist, however incomplete and arbitrarily arranged, for future discussions.

#### The Role of the Earth Sciences in International Development

- What kinds of contributions to national and international development and understanding can the earth sciences make? What means can be used to increase awareness of these among governmental planners and the general public?
- The role of the private sector, both foreign and local (e. g. foreign investment, local and international consultants, local industry) in the development of earth resources in the Third World.
- International paternalism (? imperialism) in the earth sciences. Does it exist and if so what should be done about it?
- The role of intermediate (appropriate) technologies, nonprofessionals, and labour-intensive schemes in earth science programs (e. g. "cottage" mining industries, use of "old-fashioned" methods of prospecting and mineral development).
- Does the earth scientist have any special "social responsibility" in international development? If so, how can this be emphasized so as to involve a larger number of earth scientists in the problems of the Third World?
- Mechanisms for distributing aid funds in the earth sciences.

#### The Aid Project

- The pros and cons of "tied" earth science aid projects.
- The initiation, planning, and execution of aid projects, and their follow-up; criticisms and suggestions for improvement.

- Is there any way to ensure maximum use of data collected and people trained in aid projects?
- The role of the "expert" and his local counterpart, and ways of improving their effectiveness. What characteristics are most desirable in the adviser and the consultant? How can the role of the counterpart be facilitated?
- Recruiting and selection of the adviser. How to deal with the problem of "career continuity" (job security)?

#### Manpower, Training and Employment

- What criteria are useful in gauging a nation's need for earth scientists? Can guidelines be set with reference to the more developed nations?
- The relative merits of "at home" versus training abroad.
- Ways of ensuring the relevance of earth science training to Third World conditions.
- Means of assisting Third World institutions (e. g. "twinning" schemes).
- The unemployed Third World geoscientists. Can exchange of personnel among Third World areas be promoted?

#### The Problem of Liaison and "Big Science"

- Ways of improving liaison among aid agencies, national and international.
- The role of the international scientific unions and the professional societies.
- The use and effectiveness in promoting international development of the new ("mission-oriented") international scientific programs (e. g. IGCP, COGEOLOGICAL, Geodynamics Project). How can participation in these by Third World geoscientists be increased?
- How can the international data centres help in stimulating and planning earth science programs in the Third World?

## APPENDIX V

### A SELECT READING LIST

The following is a list of some readings on the role of the earth sciences in international development and on specific earth science aid programs. For full details on these publications see the References, page 11.

#### General statements on global and regional priorities for the development of natural earth resources

UN 1963: Volume 2 of the Geneva Conference on the Application of Science and Technology for the Benefit of Less Developed Areas.

- A "state of the art" report reviewing, *inter alia*, mineral development policy, exploration and concentration, mining and processing, conservation of minerals, and water resources. Sets out guidelines for development as seen then.

UN 1970a: Natural Resources of Developing Countries - Investigation, Development and Rational Utilization.

- A report of the UN Advisory Committee on the Application of Science and Technology to Development (ACAST) which reviews the relevant activities of the UN "family" (e.g. the Resources and Transport Division of the Dept. of Economic and Social Affairs; ECAFE, UNDP, UNIDO, FAO, UNESCO, IAEA), and which lists "areas for specific action" including national services in hydrology, geology and mining, energy, and the soil sciences.

UN 1970b: Mineral Resources Development with Particular Reference to Developing Countries.

- A detailed review by the Geology and Mining Division of the Resources and Transport section of the various stages in mineral resource development, necessary institutional framework, and mineral development policy. An attempt to present to officials of developing countries "a better appreciation of the requirements" of a viable mineral industry so as to "enable them to determine where the national effort requires attention."

N. B. UN 1970a and 1970b, offer probably the most complete global prescription of what should be done in the earth sciences.

UN 1971: World Plan of Action for the Application of Science and Technology to Development.

- A program prepared by ACAST for the general development of scientific and technological structures in the developing countries. Chapter 7 deals with scientific and technical education and Chapter 8 with natural resources (in a less detailed fashion than UN 1970b). UN 1973a, 1973b, and 1973c\* present regional plans for Asia, Latin America and Africa

respectively, each commenting in brief upon natural resources, education, industry, the environment, etc. Of these the African Plan is the most frankly critical of the present situation.

Ritchie-Calder (Lord), 1973. New Dimensions and Opportunities in the Application of Science and Technology to Development and the Role of the United Nations Family.

- A thoughtful and provocative critique of the ways in which science and technology have been "deployed", often to the detriment of Third World nations.

#### Some Specific Titles

UN 1972a: Small-Scale Mining in the Developing Countries.

- A report by the Resources and Transport Division on small-scale mining (i.e. involving an annual production of up to 50,000 metric tons). Reviews the relative importance of minerals to national economies, techniques and economics of small-scale mining, guidelines for national policies, and a country-by-country review of activities. "Small-scale mining is even more prevalent than is usually realized, and it can and often does make a significant contribution to the national economy."

OST-AID, 1972: The Application of Geochemical, Botanical, Geophysical and Remote Sensing Mineral Prospecting Techniques to Tropical Areas.

- A review of the "state of the art and research priorities" for OECD, based upon an open-file report for USAID. A brief discussion of instrumentation, survey techniques, costs, and directions for future research. Useful bibliography.

Lea et al., 1973

- Includes a comprehensive world-wide list of addresses of geological surveys and related organizations, and a brief overview of the organization of international geoscience (e.g. IUGS, ICSU, IUGG, COSTED, IUCOG, etc.).

United Nations 1972b: Non-Ferrous Metals.

- A survey by the United Nations Industrial Development Organization of production and potential for Cu, Al, Pb, Sn, and Zn in developing countries. Comments on their use as a resource base, problems in promoting investment, international cooperation in marketing (e.g. CIPEC), and gives a country-by-country review. (UNIDO also publishes monographs on the development of metal and other resources-based industries.)

\* See References

UN ECAFE: Mineral Resources Development Series.

- A series of over 40 volumes on various aspects of mining, petroleum, geology, and exploration techniques in Asia and the Far East. For example no. 34 - Proceedings of Seminar on Mining Legislation and Administration (a comprehensive review of mining policy), and no. 38 - Proceedings of the Second Seminar on Geochemical Prospecting Methods and Techniques (a lengthy compilation of case histories and reviews of techniques).

UN ECAFE: Water Resources Series.

- A series on water resources similar to the Mineral Resources Development Series. For example no. 37 - Planning Water Resources Development.

Reviews of and Comments  
upon National Programs

Canada: Blais *et al.*, 1971; Malhotra, 1974; Tremblay, 1972.

Cote d'Ivoire: Berthoumieux, 1972.

France: Lespine, 1972.

India: Arogyaswamy, 1972.

Iran: Ruttner and Thiele, 1969.

Niger: Diallo and Zajackowski, 1972.

Nigeria: Adegoke, 1972.

Uganda: Tamale-Ssali, 1972; Brock, this volume.

United Kingdom: Dixey, 1957; Dunham, 1973; Gray, 1972; Pallister, 1972, 1973, this volume.

United Nations: Brand, 1972; Carman, 1971; Dijon, 1972; Lepeltier, 1971; Burdon and Thomas, 1972 (FAO); Cameron, 1972 (IAEA); Heindl, 1972 (IHD).

United States: Adams, 1972; Heath and Tabacchi, 1968; Bergquist *et al.*, 1972; Reinemund *et al.*, 1972; Taylor, in press. See also U.S.G.S. Prof. Paper 850, 1973, International Co-operation in Earth Science.

USSR: Gorbunov, 1972.

N. B. This list is based partly on "Earth Science Aid to Developing Countries: A Selected Annotated Bibliography", prepared for the St. John's Workshop by Geosystems, P.O. Box 1024, Westminster, London SW1. This will be published in their Geoscience Documentation in the near future.

Three relevant periodicals on  
international development

1. CERES: FAO Review on Development. Published bimonthly by FAO, Via delle Terme di Caracella, 00100 Rome, Italy.
2. Development Forum. Published monthly by Centre for Economic and Social Information, United Nations, Palais des Nations, 1211 Geneva 10, Switzerland. Free of charge.
3. International Development Review. Quarterly Journal of the Society for International Development, 1346 Connecticut Ave. N.W., Washington, D.C. 20036, U.S.A. Contains "Focus: Technical Co-operation".