

LITHOPROBE

*Canada's National Geoscience Project
Le projet pancanadien en sciences de la Terre*

PHASE V

THE EVOLUTION OF A CONTINENT REVEALED

2002-03 to 2004-05

FINAL REPORT

FOR NSERC

*Prepared by the Project Director on behalf of
LITHOPROBE Scientists
July 2005*



are built around a series of ten transects, or study areas, each of which is focused on carefully selected and representative geological features of Canada that represent globally significant tectonic processes.

First established in 1984 with Phase I, LITHOPROBE developed through Phases II to IV (1987-88 to 1997-98) and is now recognized internationally as the best project of its kind in the world. Through its inception and first four phases, LITHOPROBE was funded by NSERC under the Collaborative Special Projects program, primarily as a basic science project with one primary partner, the Geological Survey of Canada (GSC). With reorganization of programs at NSERC in the mid-1990s, LITHOPROBE was moved into the Research Networks program, and competed in that program for Phase V. LITHOPROBE Phase IV brought data acquisition to completion in 8 of the 10 transects and initiated activities in the final two transects. LITHOPROBE Phase V (1998-99 to 2002-03) completes one of the most visionary Earth science projects ever undertaken worldwide. It is a project that has developed, and is developing, fundamental new scientific understanding, contributing significantly to Canada's economic and social benefit, and bringing further international renown to Canadian Earth science.

Bearing in mind that Phase V represents the concluding phase of an extensive, Canada-wide project, the principal objectives associated with Phase V are noted below.

- Completion of data analyses and interpretations, preparation of syntheses and compilation of a digital data base and archive for each of the four transects that were active primarily during Phase IV – Abitibi-Grenville, Trans-Hudson Orogen, Alberta Basement and Eastern Canadian Shield Onshore-Offshore.
- Completion of data acquisition, analysis and interpretation, preparation of the transect synthesis and compilation of a digital data base and archive for the two transects for which activities were initiated during Phase IV – Western Superior and Slave-Northern Cordillera Lithospheric Evolution.
- Development of a pan-LITHOPROBE synthesis, an integration and synthesis of the comprehensive, multidisciplinary results from all ten LITHOPROBE transects to elucidate tectonic evolution of the Canadian landmass, the tectonic processes associated with that evolution, and the development of fundamental understanding of these processes that have worldwide significance.
- Completion of the LITHOPROBE data archives in the LITHOPROBE Seismic Processing Facility at the University of Calgary, and eventual transfer of these archives and the digital data bases established at the six transects noted above to the Geological Survey of Canada, Ottawa following establishment of procedures to achieve this result.
- Continuation and enhancement of the successful LITHOPROBE communications/public outreach activities through further media interactions, development of an updated educational brochure and slide set, preparation of an educational CD ROM, use of the internet, and development of video material based on footage acquired during a number of field experiments.

Extent of achievements of objectives

NOTE: New funding for LITHOPROBE Phase V ended in fiscal 2002-03. However, we were allowed to carry forward the funds remaining after 2002-03 for two years to 2004-05 to enable planned activities to continue. Many of these activities are now complete, but others continue with funds remaining from our industry support. See the section below labelled "Financial Information" [Final Report Item 17] for further information on LITHOPROBE funds.

This section focuses on achievements and progress toward the objectives from the submission in January 2002 of the *2000-2001 to 2001-2002 Progress Report for NSERC* to the present [July 2005]. However, some replication from that Progress Report is necessary. Note that much archival information about all transects is included in the LITHOPROBE web site [www.lithoprobe.ca]. Individual transect information is provided. As well, the entire list of LITHOPROBE publications is included. It can be searched by author or title and results displayed in a number of combinations. All publications for one transect are readily displayed.

The primary geophysical data acquired by LITHOPROBE in all transects [seismic reflection, seismic refraction and magnetotelluric] are archived with the Geological Survey of Canada (GSC) and available from them for nominal costs of reproduction. This procedure is consistent with the manner in which the national potential field data [gravity and magnetic] are made available in the public domain. For individual transects, much of the basic geological, geochemical and geophysical data are included in the extensive publications arising from the research program in each transect. Most of the transects active during Phases IV and V also compiled scientific information through a web site and digital data management program. This information is being placed on CDs or equivalent media for archival purposes. Further information is provided in the sections below and under Final Report Item 9, which describes the mechanism for accessing the network's data base.

Achievements for four transects active primarily during Phase IV

1) Abitibi-Grenville Transect (A-G): A double issue of the *Canadian Journal of Earth Sciences* [*CJES*; February/March 2000], comprising 22 papers, incorporated synthesis and new results for the transect. Since the last report, seven new publications relating to the transect have been added to the publication list.

The LITHOPROBE Abitibi-Grenville CD ROM was completed in January 2002 and distributed to transect scientists. Copies are available upon request from the LITHOPROBE Secretariat; a nominal charge applies to non-LITHOPROBE scientists. The CD includes maps of the locations of the seismic reflection and refraction surveys, migrated sections of the reflection lines and interpretations of them, and the interpreted velocity structure for the refraction surveys. It includes lists of publications that arose from the transect with abstracts for most of them. The actual scientific data collected in association with the scientific work of the transect are not provided in the CD, both because of the very large variety of formats in which such data occur, the difficulty of accessing such data from more than a hundred scientists involved and the limitations of space and time. However, many of the publications contain the essential data upon which the science is based and thus provide a long-term archive for these data. To facilitate communication with authors, the CD provides e-mail addresses for at least one author of each publication associated with the transect.

2) Trans-Hudson Orogen Transect (THOT): Interpretations of all major data sets are complete. Two special issues of *CJES* in 1999 provided summaries of results from a sub-region of the transect that was of particular significance scientifically and from an industry perspective. The April 2005 issue of *CJES* provides a synthesis of results from THOT as well as new research results. The issue includes 19 separate articles representing the multidisciplinary research program and the combined efforts of more than 50 individual authors and co-authors. In addition to these publications, five other papers have been published.

During the decade of activity of THOT, more than 2 Terrabytes of digital data were generated. Documentation of the data and the final interpretations, as well as the synthesis of the results, are compiled on a set of CDs that should be available by autumn 2005. Data sets to be included are: (i) important geophysical data, particularly those resulting from reprocessing or additional analyses, and their interpretations; (ii) geochemical and geochronological data derived from LITHOPROBE plus all available data from the Saskatchewan and Manitoba geological surveys; and (iii) some data, and appropriate referencing of all relevant information, from the GSC-led Shield Margin NATMAP project that was carried out separately but in conjunction with THOT. Several poster-type displays that summarize the fundamental discoveries within the major regions of the transect are presented. These will include the eastern margin, internides of the THO, interpreted refraction profiles, gravity and magnetic trend maps outlining the major lithotectonic domains, electrical signatures of the crust, the western margin and a correlation chart of the tectonic evolution of the THO. The format of these presentations is made for easy access by a standard PC system.

3) Alberta Basement Transect (ABT): Interpretations of all major data sets are complete. A special issue of the *Bulletin of Canadian Petroleum Geology* [December 1999] summarized results that had particular relevance to the oil and gas exploration industry. Two special issues of *CJES* provided syntheses and new results for the sub-sedimentary region of the transect. The November 2000 issue included 11 papers representing the efforts of 28 individual authors. The March 2002 issue, published after submission of the previous report to NSERC, includes an additional 8 papers involving 22 separate authors.

A web site with extensive information was developed by the ABT digital data manager and the transect leader, a research scientist with the GSC in Calgary. However, the data manager became ill and went on long-term medical leave and the transect leader left his position at the GSC. Prior to the latter development, all the web site information was transferred to the Secretariat so that it would not be lost. We plan to employ an appropriate person to extract the main archival information from the web site and prepare it in a format that can be placed on a CD(s) and thus be readily accessed by other scientists.

4) Eastern Canadian Shield Onshore-Offshore Transect (ECSOOT): Interpretations of all major data sets are complete. The May 2002 issue of *CJES*, also published after submission of the previous report to NSERC, provides some new results and a synthesis of transect studies. This thick issue includes 18 separate articles showcasing the multidisciplinary aspects of studies over a large area of northeastern Canada; 40 individual authors contributed to this compilation.

The ECSOOT compilation CD was prepared in late 2002 and was made available to transect scientists and others in early 2003. It includes data, reports and images as well as free software that is useful for viewing and accessing different components of the results. Transect maps with different types of information [e.g., geology, topography, gravity, magnetic, seismic survey lines], final seismic reflection sections with interpretations, P-wave

seismic velocity structural models, ECSOOT synthesis data, transect reports and other information are available on the CD.

Achievements for two transects active primarily during Phase V

1) Slave – Northern Cordillera Lithospheric Evolution Transect (SNORCLE): Interpretations of all major data sets are complete. The June 2005 issue of *CJES* provides a synthesis of transect results and new research results. The issue includes 22 separate articles representing the multidisciplinary research program and the combined efforts of 74 individual authors and co-authors.

The SNORCLE compilation CD is partially complete, but has been in a hiatus since the person responsible for it accepted a position with an industrial firm in Calgary about a year ago. During the last one to two years, the Transect Leaders focused their efforts on ensuring a timely completion of the *CJES* synthesis issue with a range of quality papers. However, they intend to complete the compilation as soon as possible, the timing dependent upon their continuing other responsibilities and the availability of a key Research Associate at The University of Calgary who is familiar with the SNORCLE Transect compilation activities.

2) Western Superior Transect (WSUP): Interpretations of all major data sets except one are complete. Interpretation and publication of results for the multichannel seismic (MCS) reflection profile in Transect Corridor 3 [Geraldton-Beardmore region] has not been completed. Due to other responsibilities now in place, the scientists involved are only able to work intermittently to bring the study to completion, but expect to do so as soon as possible. Seventeen articles, representing the efforts of 41 individual authors and co-authors, were submitted in late April 2005 for the WSUP synthesis issue of *CJES*; the peer review process is in progress. Publication of the issue is not expected until the summer of 2006.

The WSUP web site and digital data compilation process has been inactive since early 2004, pending the completion of papers and publication of supporting materials for the Transect synthesis volumes. Some development work on the transect archive specifically focused on making all of the Transect workshop volumes available in electronic form. A final compilation CD will be prepared in the fall of 2005. This disk will include the PDF's from the Transect workshop volumes, a large number of digital figures from publications and presentations made over the life of the project, a number of digital data sets collected by transect researchers and any materials submitted as part of the final synthesis process. A memo will be sent to all known transect researchers in the early fall of 2005 requesting new materials for this final CD.

Development of pan-LITHOPROBE syntheses

Having completed the syntheses of individual transects, current efforts and those in the recent past continue toward the development of pan-LITHOPROBE syntheses. Five primary areas of activities form the syntheses; these are summarized below. Funds retained from previous industry contributions to LITHOPROBE provide the resources to maintain these activities after March 2005; see Final Report Item 17, "Financial Information".

1) Pan-LITHOPROBE workshops: To foster the pan-LITHOPROBE synthesis process, the pan-LITHOPROBE Subcommittee organized a series of workshops to address thematic issues of global relevance and current interest to which LITHOPROBE studies have contributed. Three such workshops were held by January 2002, the time of submission of the last LITHOPROBE report. Since then, two additional workshops have been held.

Pan-LITHOPROBE Workshop IV: Intra-orogen correlations and comparative orogenic anatomy was held in Merrickville, ON from February 20-23, 2003. The first part of the workshop dealt with integration of multiple data sets from single orogens, with the goal of reconciling along-strike observations into an integrated perspective of the orogen. This synthesis of data and interpretations forms the basis of 4-D (space and time) overviews of many of the major geological provinces of Canada, representing over 3 billion years of geological time. The second part of the workshop used the templates established in Part 1 to focus on the evolution of tectonic forces through a large portion of Earth's recorded history, as represented in the Canadian lithosphere. The workshop was deemed a tremendous success by all those who attended. Percival and others published a report of it in *Geoscience Canada* in March 2004; for reference see LITHOPROBE publication no. 1343 in Section B.8, Appendix B. The workshop and the subsequent report form the basis for the first synthesis volume, item 4 described below.

Pan-LITHOPROBE Workshop V: From orogenic parameters to processes, held in Merrickville from October 16-19, 2003, focused on tectonic processes that have shaped Canadian orogens. Orogen syntheses, developed at Workshop IV, served as a departure point in defining similarities, differences, controls and processes associated with different orogens. Breakout and plenary sessions that included much discussion addressed themes such as orogenic structures and their geophysical expressions, metamorphism and tectonics, lithospheric characteristics

and the factors that make crust and mantle lithosphere weak or strong, orogenic effects of plumes, mantle lithosphere and its role in orogeny, late orogenic granite blooms, their heat source and emplacement as a crustal probe, and secular change associated with orogenic development. The workshop served as a prelude for some items included in the LITHOPROBE Celebratory Conference (see item 3 below) and provided content that will be included in the second synthesis volume, item 5 below.

2) The LITHOPROBE trans-Canada lithospheric cross-section: By merging results from transects across the country, a trans-Canada lithospheric cross-section, extending from the Juan de Fuca Ridge off the west coast of B.C. to the deep waters of the Atlantic Ocean off Nova Scotia, has been compiled, as planned per the Phase V Proposal. This is the first-ever trans-continental transect based on modern seismic reflection, refraction and related datasets. The main transect follows a corridor that represents a 6000-km-long swath across the southern part of Canada. However, two LITHOPROBE transects, SNORCLE and ECSOOT, focused their scientific program on areas in northwestern and northeastern Canada, respectively. Results from these transects were compiled with the same information and in the same format as the cross-Canada transect to ensure that all LITHOPROBE transects and as much of the Canadian land mass as possible were appropriately represented. As part of this effort, we also compiled the first digital tectonic element map of Canada. Somewhat to our surprise, such an item was not available through the GSC. Hence, we digitized existing regional tectonic element maps that had been developed for each LITHOPROBE transect and other maps from the literature, then combined them into a tectonic element map for all of Canada. Considerable effort was involved because the maps were at different scales and with different projections. The map is now available for other users. The primary information in the lithospheric cross-sections comprises (1) profile locations on the tectonic element map, (2) one panel showing the reflection fabric that provides the sub-surface geometry, (3) one panel showing the velocity models from refraction data that provide information related to sub-surface composition and temperature effects, and (4) an interpretation of the tectonic elements, with reference to the map, that is based on the seismic results integrated with surface geology and related geological information. The map and cross-sections have been compiled into scientific poster format. Some enlargements of data and the detailed interpretation are included to illustrate the quality of data on which the complete cross-section is based. The tectonic element map and lithospheric cross-section will form the basis of one contribution to the pan-LITHOPROBE syntheses; see below.

3) LITHOPROBE Celebratory Conference, October 12-15, 2004: In recognition of this highly successful project, the LITHOPROBE Celebratory Conference was held at the Ontario Science Centre in Toronto from October 12-15. This was the final meeting of LITHOPROBE scientists; about 130 individuals participated. The objectives of the meeting were to:

- Highlight the scientific achievements of LITHOPROBE during the past 20 years, focusing on the parameters, structures and processes associated with continental evolution;
- Provide a forum for comparisons of results from studies in geologically similar environments;
- Provide an opportunity for LITHOPROBE and other scientists to demonstrate how their research addresses the themes below; and
- Bring the results of LITHOPROBE and the importance of the Earth sciences to the attention of the public through a Media Morning.

The scientific themes around which the conference was based are:

- The Early Earth - Establishing the Cratons;
- The Middle Earth - Stitching the Cratons and Other Events;
- The Late Earth - Young Orogenic Belts;
- Processes in the Earth - How the Planet Works;
- The Resourceful Earth - Sustaining & Endangering Life on the Planet.

The conference consisted of 30-minute invited oral presentations from key LITHOPROBE contributors and international keynote speakers for each theme and contributed poster presentations from LITHOPROBE scientists and other participants. Appendix A gives the complete program for the conference. All who attended deemed the meeting a great success. Much of the material included in the presentations will be incorporated in the two synthesis volumes described in items 4 and 5. A CD that included most of the powerpoint presentations prepared for the conference was compiled with the cooperation of the presenters; it can be referenced as LITHOPROBE E-publication no. 5. The CD was distributed to all conference participants; copies are available from the Secretariat upon request.

4) Synthesis Volume I – *Tectonic styles in Canada, revisited: Intra-orogen correlations and comparative orogenic anatomy.* Synthesis Volume I will be published as a Geological Association of Canada (GAC) Special Paper based on the themes outlined in the summary of Pan-LITHOPROBE Workshop IV [see preceding sub-section (1) and LITHOPROBE publication no. 1343]. The editors are John Percival (GSC, Ottawa) and Fred Cook

(U. of Calgary, Calgary). The venue for the publication, a GAC Special Paper, and the title of the volume are based to some extent on an historical precedent. Following the plate tectonic revolution in the Earth sciences during the 1960s, Ray Price and Bob Douglas, as editors, published a new view of the Canadian landmass entitled "Variations in tectonic styles in Canada"; it was GAC Special Paper 11 (1972). During its 20-year history, LITHOPROBE has provided much new information on this subject. Thus, a pan-LITHOPROBE synthesis that provides a "revisited" view of tectonic styles through correlations and comparisons of the different orogens studied by the project and is published as a GAC Special Paper seemed eminently appropriate.

The volume contains papers co-authored by working groups formed during the last two pan-LITHOPROBE workshops to synthesize geological, geophysical and geochemical information on the major orogenic provinces of Canada that were investigated by LITHOPROBE or related studies. Material prepared for the Celebratory Conference will undoubtedly be useful as the working groups prepare their papers. The chapters within the volume include (1) the Mesozoic Canadian Cordillera; (2) the Paleozoic northern Appalachians; (3) the Mesoproterozoic Grenville province; (4) Paleoproterozoic orogens [with sections on results from the Trans-Hudson Orogen and Alberta Basement transects; the Torngat, New Quebec, Makkovik and related orogens from ECSOOT; the Wopmay orogen from SNORCLE transect; Ungava and Baffin Island studies; reworked margins of the Archean Superior province; and a Paleoproterozoic synthesis comparing parameter features and the processes represented]; and Archean orogens [with sections on (5) the Superior province, including the Abitibi sub-province and NE Quebec; (6) the Slave province; and an Archean synthesis comparing parameter features and the processes represented]. The chapters are being prepared within a framework of orogen parameters: crustal thickness, structure, composition, seismic velocity and reflectivity, mantle lithospheric structure and composition, nature of orogen margins, age and style of rifting, nature and age of accreted terranes, nature and age of continental magmatic arcs, location and nature of paleo-suture zones, age and style of accretion, collisional geometry, current or paleotopography, evolution of pressure-temperature conditions through time, and age and style of post-collisional processes. A final chapter (7) compares orogenic anatomy and evolution over large tracts of land and a wide swath of geological time, as represented by the LITHOPROBE studies.

The first six chapters and sections identified above have lead authors assigned and are being prepared at the time of writing of this report. The lead authors for the seventh chapter will be the Editors. They anticipate that about 30 individual authors and co-authors will contribute to the volume. The Editors have requested complete draft manuscripts by September 30/05. They will review the manuscripts for completeness and consistency, requesting changes as necessary, before sending the papers out for formal review. We would anticipate publication by GAC between the end of 2006 and mid-2007.

5) Synthesis Volume II: [Title to be determined]: At the time of writing, Synthesis Volume II is not as well developed as is Volume I. The two main editors are Ron Clowes (Project Director, UBC, Vancouver) and Thomas Skulski (GSC, Ottawa). No venue for publication has been formally determined. However, the Monograph Editorial Board of the National Research Council (NRC) Research Press has submitted a formal proposal to publish one or more of the pan-LITHOPROBE syntheses within its Earth Science Series of monographs. We are seriously considering this offer and will provide our outline for the volume to the NRC Monograph Editorial Board when it is sufficiently developed. The Board would then have to determine whether our planned volume is appropriate for the Earth Science Series and to formally accept it. We plan on reaching this stage by September of this year.

The content of Synthesis Volume II will be complementary to that of Volume I and focus on: (1) processes associated with orogenic development from the early Earth to the late Earth; (2) the crust-mantle boundary and sub-crustal lithosphere; (3) contributions of this fundamental scientific research project to economic and social benefits for the country; and (4) the tectonic evolution of the Canadian land mass from 4 billion years ago to the present. For this second volume, I also plan to prepare an introductory chapter on the initiation and development of the project and how it helped shape the direction of solid Earth science research in Canada. Material related to this topic was prepared for some of my contributions at recent conferences, particularly the Celebratory Conference and Geoscience Summit 2004 [see section below on Communications and Outreach].

Focus (1) relates to material that is best described under the heading, *Processes in Earth – How the Planet Works*, from the Celebratory Conference (Appendix A). Some of this material was discussed in Pan-LITHOPROBE Workshop I, "Tectonic and magmatic processes in crustal growth" (see Percival et al. 2002; LITHOPROBE publication 1314 under "General Lithospheric Studies" in Appendix B) and in Workshop V, "From Orogenic Parameters to Processes", which discussed a range of diverse process-oriented themes, including secular change and metamorphism and tectonics. Presentations at the Celebratory Conference under the theme of *Processes in Earth* provide considerable content that is relevant to this focus. In particular, one major chapter on the advances in quantitative geodynamic modeling and applications to LITHOPROBE transect results will form an essential part of this volume. Dr. Chris Beaumont of Dalhousie University has agreed to lead this chapter.

Focus (2), the crust-mantle boundary and sub-crustal lithosphere, represents a theme within which LITHOPROBE has carried out considerable research in a number of transects. Studies associated with this focus formed the basis of Pan-LITHOPROBE Workshop II, "Where crust meets mantle: LITHOPROBE perspectives on the crust-mantle boundary", and Workshop III, "Mantle lithosphere and LITHOPROBE: Views of continental evolution from the bottom up". Each emphasized multidisciplinary aspects of the topic. Thus, inclusion of such material is important and relevant, particularly with consideration that the first volume will focus primarily on crustal characteristics of orogens and the term LITHOPROBE was selected because we planned to "probe the lithosphere". This is also a theme that relates directly to my personal research and with which I am very familiar.

Focus (3) relates to material described under the heading, *The Resourceful Earth – Sustaining and Endangering Life on the Planet*, from the Celebratory Conference (Appendix A). Presentations under this theme represent some of the material that needs to be included. One highly significant contribution made by LITHOPROBE to the base metal mining exploration industry is the demonstration of the applicability of the seismic reflection technique to provide important structural information in a hard-rock environment that can be tied to drill hole information in mature mining camps, and even, in exceptional cases, to image an ore deposit. However, additional topics, such as uranium exploration in Saskatchewan, characteristic features of the mantle lithosphere of the Slave craton where Canada's major diamonds were formed before being brought to the surface in kimberlite eruptions, imaging of a shallow but thin diamondiferous kimberlite dyke in the Northwest Territories and contributions to the discovery of petroleum deposits on the west coast of Newfoundland, need to be brought into the summary. This is a chapter that I see myself preparing, with contributions from and acknowledgements to those directly involved in the individual studies.

Focus (4) provides the summary chapter. The LITHOPROBE era has heralded a new understanding of the four-dimensional (space and time) make-up and tectonic evolution of the Canadian landmass. A clear and succinct summary of how Canada became the geological collage that it currently represents will provide important information for scientists and the public alike. Within this chapter, I envisage a series of illustrations and accompanying text that would document the tectonic evolution of the Canadian land mass from 4 billion years ago to the present. The evolution would be depicted in both plan and cross-sectional views [ideally with some 3-D perspectives] leading to the current distribution of tectonic elements as shown by the new tectonic element map and the present Trans-Canada cross-section, a discussion of which will form one section within the chapter. The summary chapter will provide an overview of the major tectonic domains of the Canadian landmass, exploring in more detail those areas in which LITHOPROBE has been active. The emphasis will be on new perspectives on Canada's tectonic evolution, including crustal-scale cross-sections, lithospheric structure and timing and nature of crustal growth. The chapter will conclude with directions for future research in the tectonic evolution of the Canadian landmass.

I think that it is worth pointing out that completion of LITHOPROBE synthesis activities was the primary activity proposed in my application for a Canada Council for the Arts Killam Research Fellowship in May 2003. I was successful in this application, receiving one of only nine such fellowships awarded in February 2004. The 2-year fellowship (July 2004 to June 2006) relieves me of all teaching and administrative duties in order that I can concentrate on the research activities documented in the application.

Completion of the LITHOPROBE data archives

Within the context of archiving, LITHOPROBE digital and related data are divided into two components: (1) digital data including field and processed seismic reflection (MCS), seismic refraction/wide-angle reflection (R/WAR), and magnetotelluric (MT) data; and (2) individual transect digital and non-digital data archives including a variety of different data sets in a range of formats and media that are appropriate for the specific transect. Throughout the 20-year history of LITHOPROBE's MCS, R/WAR and MT data acquisition, the LITHOPROBE Seismic Processing Facility (LSPF) at the University of Calgary acquired and archived both LITHOPROBE and LITHOPROBE-related data. The latter include major data donations from industry and some additional data acquired by the Geological Survey of Canada (GSC). During the final phase of LITHOPROBE, arrangements were made with the GSC for transfer of all data, the database, auxiliary information such as observers' notes, survey files, etc., associated software and some relevant equipment to the Seismology and Electromagnetic Section in Ottawa for permanent archiving and distribution upon request. Prior to the transfer of data and related information, LITHOPROBE and the GSC hired a student for a year to create metadata for all LITHOPROBE MCS, R/WAR and MT data. This metadata database is now part of the online data catalogue maintained by the Canadian Geoscience Knowledge Network (www.cgkn.net), which helps Canadians and non-Canadians interested in geoscience data discover what is available in their area of interest. The

database is a legacy that will become increasingly valuable to Canadian geoscientists as those scientists and support personnel who were involved in the original LITHOPROBE data acquisition reach retirement age.

The transfer of all data from the LSPF to the GSC was completed in 2003. One major component of this data transfer, made possible through support from the GSC, was the move of all (old) 9-track media, comprising 11,000 tapes or 510 boxes, from the University of Calgary to a National Archives facility in Edmonton. As part of this process, the GSC has committed to pay for the eventual disposal of these tapes. As part of the data transfer arrangement, the GSC also hired a Seismic Archivist who is responsible for the extensive archive and distribution of data upon request. Presently, the data are publicly available through internet requests made via the LITHOPROBE Seismic and MT Data Archive web site: www.cg.nrcan.gc.ca/lith_arch/LSDA_homepage_e.html [for English] and www.cg.nrcan.gc.ca/lith_arch/LSDA_homepage_f.html [for French]. The nominal charges to cover the costs of data reproduction (archivist's time, the medium to which the data are transferred and computer expenses) are specified on the web site.

During the transfer of data from LSPF and subsequent archiving, GSC scientists noted that high-density media copies of some LITHOPROBE-related field data, primarily from GSC offshore studies in the 1980s, were found to be missing or the tapes were unreadable. Since the original low-density 9-track field tapes were still available at the National Archives, although some were in poor condition, recovery was possible. But tape decks to replay such tapes are generally no longer available at most organizations, including LITHOPROBE and the GSC. However, with funding from a combination of petroleum exploration companies and the GSC, data from these tapes were recovered through a contract with a company in Calgary that specialize in such capabilities. The data were transferred to modern media and now are available within the archive.

Individual transect archives take a number of forms. In many cases, the important data on which scientific interpretations are made is included in the journal publication(s) associated with those data. Some of these data and much other data relevant to an individual transect's scientific program were compiled in formats appropriate to the data by the transect digital data coordinator, who performed a variety of tasks under the supervision of the transect leader(s). Most transects that became active after the "digital revolution" have compiled, or are compiling, a summary of such transect information in CD format. Details are provided under the individual transect listings described earlier in this report. Each CD is assigned a LITHOPROBE E-publication number so that it can be referenced accordingly and is available upon request from the LITHOPROBE Secretariat, now consisting of a part-time Administrator and myself. I will keep this arrangement extant for the next few years. However, for many studies, the individual scientists retain their personal data archives and need to be contacted for the relevant information. Two copies of each transect CD are archived with the GSC LITHOPROBE Seismic Data Archive in Ottawa as backup and for eventual distribution upon request at a nominal cost.

Communications and outreach activities

To achieve the necessary communication of LITHOPROBE's exciting results beyond the interested Earth science community, LITHOPROBE established a public outreach strategy coordinated by the Secretariat with the assistance of a part-time Communications Adviser. In the LITHOPROBE Phase V Proposal, public outreach activities were planned to wind down after Year 3 (2000-01) and no budget was assigned for this component of the project beyond Year 3. However, as part of the award notification, the NSERC Research Networks Selection Committee (RNSC) recommended, "this budgetary item be maintained throughout Phase V" and the "maintenance of the part-time communication advisor until the end of the project." Using uncommitted funds in the budget, arising partly from decreases in the Director's NSERC salary component, the Board of Directors at its meeting in February 2000 approved a communications budget of about \$100,000 for the final three years of the project. The 2000-01 to 2001-02 progress report to NSERC documented the status of the Communications Adviser. In it, I noted that as of January 2002, our original incumbent, who had resigned for almost two years for health reasons and was replaced with another person (who was not nearly so dedicated), returned to the position. We were able to maintain his part-time position until December 2004. During the past three years, a number of developments and results can be highlighted.

- The media: The 4th World Conference of Science Journalists was held in Montreal from Oct. 4-8, 2004. One of the conference features was a series of "Breaking science news press conferences" held during the noon-hour for the three days of the meetings. I was invited to present the first of these based on our recently completed lithospheric transect across Canada. The title of my 20-minute presentation was "*A new view of the continent beneath our feet – LITHOPROBE's scientific, economic and social contributions*". This was followed by an extensive period of questions and interviews by both print and electronic media. In particular, these included interviews with CBC National TV network, CBC national radio network and a live morning interview with the

local Montreal CBC radio station. In addition to this singular effort, we maintained our efforts at bringing LITHOPROBE to the attention of the media. At least 8 stories in the Canadian print media were carried. The most prominent of these was a 4-page article in the Ottawa Citizen's broadsheet "The Citizen's Weekly", entitled *Earth's Last Great Puzzle*. A brief segment on LITHOPROBE results was included in a BBC (England) Science Radio Unit, Discovery (Week 06/2002), that was entitled "Lost continents – 3: Oldest continent". The first half day of the LITHOPROBE Celebratory Conference included a "Media Morning"; see program in Appendix A. An excellent series of general talks was prepared. Unfortunately, we were unable to entice attendance of the media so the scientific participants enjoyed the overview presentations.

- A television series, the Geology of Canada: CBC Television, the Discovery Channel and other partners are planning on a multiple-part series of television specials on the Geology of Canada. It will probably be prepared along lines similar to *A People's History*, the highly successful mini-series that highlighted the history and development of Canada. Personnel from the Geological Survey of Canada will probably be involved in some way. I have had discussions with two of the researchers preparing material for the series and I am hopeful that some LITHOPROBE results will be incorporated into the series. To this end, I also have provided the LITHOPROBE video demonstration, which highlights some of the seismic field activities for which LITHOPROBE contracted professional videos using the types of tapes suitable for quality television reproduction. We will continue to follow the progress of development of this series and try to ensure that results from our project are incorporated into the stories.
- Geoscience Summit 2004: On October 15-17, 2004 the Canadian Geoscience Council, an umbrella organization of Earth Science societies in Canada, convened a meeting in Ottawa to review the status of Canadian geoscience and take steps necessary to ensure the continuing relevance and viability of our science. Approximately 100 individuals participated. These included the Assistant Deputy Minister for Natural Resources Canada; representatives from the energy industry, the mining industry and environmental & geotechnical industry; executive representatives from Earth science societies; and scientists from all sectors. I was invited to present a review of LITHOPROBE in terms of its contributions to Canadian Earth Science. The title of my talk was "*LITHOPROBE – Lessons and benefits from a successful megaproject*".
- A children's book on LITHOPROBE results: With significant assistance and input from LITHOPROBE, Key Porter Books of Toronto published *Dancing Elephants and Floating Continents – The Story of Canada beneath Your Feet* by John Wilson in September 2003. The book is aimed at children from 8 to 14 years and has been well received; it has been nominated for three awards for children's books, although it has not won any. The book represents a significant outreach milestone as I am not aware of any other major scientific project about which a children's book has been written. The success of the book and its level of content encouraged LITHOPROBE to promote it as source content for Earth science material in the middle school grades. To this end, an Earth scientist with an M.Sc. in Geophysics, who is also an accredited teacher in Ontario, prepared the Teachers' Companion Material to accompany the book. This material includes: (1) 15 complete activities involving a variety of tasks for the students; (2) reproducible student worksheets and resources; (3) specific curricula links to middle school science in all Canadian provinces and territories; and (4) a set of Teachers' pages. The complete, 113-page guide is available at no charge on the LITHOPROBE web site; print copies are provided upon request at no charge. Recent discussions with Key Porter Books indicates that they are planning on a soft-cover edition of the book, which will cost about half the current hard-cover price, and be much more appropriate for use in the classroom. LITHOPROBE is being proactive in furthering the use of *Dancing Elephants and Floating Continents* as Earth science curriculum material.
- A book on LITHOPROBE for the general public: Following the success of the children's book and further interest by Key Porter Books, John Wilson and I considered that a more adult-oriented book based on LITHOPROBE results would be another valuable outreach activity. We prepared a general proposal about such a book. Key Porter has indicated their interest in publishing the book and at the time of preparation of this report, we are finalizing a contract for preparation of the content of the book by May 2006. The book's tentative title is *Ghost Mountains and Lost Continents: North America from Birth to Middle Age*. It will be co-authored by John Wilson and myself. *Ghost Mountains and Lost Continents* will bring the story of LITHOPROBE, its scientists and its results to the general public in an informative, interesting and visual manner. The book will inform the general public about this uniquely Canadian and immensely successful project while it informs them about the geological development of northern North America. It will generate interest in, and understanding about, the Earth sciences in Canada and demonstrate the excitement and high technologies associated with our science. The book provides the opportunity to expand the reach of Earth sciences beyond its (too-often-seen) narrow bounds to a much broader segment of society. In doing so, *Ghost Mountains and Lost Continents* will advance much more general understanding and appreciation of the Earth sciences in Canada. Preparation of this book

is the second of the two primary activities proposed during the tenure of my national Killam Research Fellowship from July 2004 to June 2006.

- The LITHOPROBE web site, www.lithoprobe.ca: As more and more people turned to the internet for information, the LITHOPROBE web site took on greater significance. As a result, the web site was completely redone by a professional web developer. The key components of the web site are sections about the transects and publications and one for the classroom/media. One of the most substantial changes involved the list of publications and its utility for researchers. The 1400+ LITHOPROBE publications are listed and are searchable by transect, author, title or journal; a further selection by discipline is being set up. All relevant information about LITHOPROBE and material available from the project are indicated within the web site. I plan on keeping the web site extant for at least the next few years using some of the remaining funds from industry contributions to LITHOPROBE.
 - Brochures, posters and other outreach material: The colourful and informative poster, "Geological Cross-section of Southern British Columbia", which was completed in 2000, continues to be a source of requests. Our initial print run of 2000 was used up by 2003 so we had another 500 copies printed and almost all of them have now been distributed. The LITHOPROBE cross-Canada lithospheric cross-section has been prepared in poster format and is available on the LITHOPROBE web site. However, we have not made an equivalent effort in marketing this poster because we consider it a preliminary version and would like to prepare one that is more informative and visual. The original LITHOPROBE brochure was prepared in 1992. The GSC used this in its 150-year anniversary celebration of 1992; they provided us with the many remaining copies after the anniversary displays were completed. As a result, we have prepared some regional specific inserts for these brochures, based on individual transect results, and expect to make them available as hard copies and on the internet. However, this activity has not developed to the extent planned and is not complete, as other activities took higher priority.
- ❑ **an explanation of how the network's science committee or equivalent synthesized all the research results generated over the 5 years.**

The LITHOPROBE Scientific Committee is the senior scientific advisory committee within the LITHOPROBE management structure [see Final Report Item 6 for an overview of the LITHOPROBE organizational structure]. However, individual transect leaders participate in all meetings of the Scientific Committee, providing information and receiving advice from the Committee. The transect leaders are responsible for the synthesis of results from their individual transects. Such results are synthesized through a series of articles in a special issue of the *Canadian Journal of Earth Sciences*, an arrangement that LITHOPROBE made with the journal early in its history. For the Alberta Basement Transect, the synthesis of results relating to the sedimentary section was published in a special issue of the *Bulletin of Canadian Petroleum Geology*. Since the last report, *CJES* issues on the sub-sedimentary region of the Alberta Basement Transect (part 2) and ECSOOT have been published. Syntheses for THOT and SNORCLE transects are published in the April 2005 and June 2005 issues of *CJES*, respectively. Manuscripts submitted for a special issue of *CJES* relating to the Western Superior Transect are currently in review.

In recognition of the need to be proactive and ensure that a broad synthesis of LITHOPROBE results is achieved, the Scientific Committee established the Pan-LITHOPROBE Subcommittee in 1996. The primary purpose of the subcommittee is to provide advice, direction and comments on LITHOPROBE scientific activities as they pertain to the global synthesis being developed for the project to ensure that results and syntheses from individual transects are considered as a coherent whole, and with a view to what has been learned about the overall structure and evolution of the northern North American continent and the processes involved in that evolution. To address this responsibility, the Pan-LITHOPROBE Subcommittee has convened five Pan-LITHOPROBE workshops. The last two of these are discussed under the heading "Development of pan-LITHOPROBE syntheses" that was presented previously within Final Report Item 2. The Subcommittee also has been proactive in developing themes for the LITHOPROBE Celebratory Conference and in ideas for the synthesis volumes, all of which are discussed earlier within Final Report Item 2.

3. Please briefly describe, in one page, the benefits of conducting this research in a network rather than as separate projects.

In essence, LITHOPROBE comprises a network of networks. The operational component of the network is separated into (1) the Project Director and Secretariat, which together are the central node of the network that provides overall scientific leadership, direction, coordination and communication; and (2) the transect networks, which are the decentralized scientific teams, led by a transect leader(s), who are actively participating in the scientific programs. In essence, LITHOPROBE and the science that it has carried out, could not have been achieved in any other way than through a network approach. Some of the benefits derived from the network are noted below. Other benefits are outlined under Final Report Item 10, "Tangible results".

- The project demonstrated the value of collaborative and multidisciplinary research in addressing key geological problems. It spawned a new and healthy atmosphere of scientific cooperation among geologists, geophysicists and geochemists who are working and learning together, thereby enhancing results beyond those that could be achieved through one subdiscipline.
- The network fostered an unprecedented degree of cooperation among earth scientists in universities, the GSC, provincial/territorial geological surveys, and the mining and petroleum industries. This engendered a new spirit of cooperation among the different sectors, the results of which have been long lasting. For example, many of the federal/provincial/industry accords in terms of Earth science research derive partly from the leadership role of LITHOPROBE in this endeavour.
- The transect workshops presented a focus for multidisciplinary science wherein scientists and students were required to present their specialty results in terms that could be understood by those outside their field. Many scientists remarked that the transect workshops were one of the best features of the program and among the best scientific meetings they attended. Some of the larger individual transect workshops attracted up to 150 participants.
- Graduate students and postdoctoral fellows carried out their specialty studies within an environment of multidisciplinary studies, an experience that they will carry with them as they progress in their individual careers.
- The project was entirely inclusive and open. Any scientist who wished to participate in studies relating to the objectives of any transect or transects could do so [although LITHOPROBE funding was not necessarily forthcoming for such participation].
- The network attracted the very best university scientists to participate in the project, partly through the University Supporting Geoscience Projects [USGP] granting program [see discussion under Final Report Item 6].
- The USGP grants program provided a stimulus to many university scientists such that they enhanced their research activities and student training by a considerable measure. A number of them remarked that they were able to carry out research, of a type and in regions where previously they would never have been able to go, and also have good students involved in that research.
- Transects initiated later in the planned scientific program benefited and learned from the experiences of transects that already had been through their main phase of scientific activities.
- The network provided a focus for solid Earth science studies in Canada for almost two decades.
- The success of LITHOPROBE's unique combination of collaborative research and multidisciplinary studies within a network established the high international regard that it has achieved – considered by many to be the best such Earth science program in the world. Indeed, Europrobe, a multidisciplinary, collaborative Earth science program in Europe, selected both its name and procedures based on the LITHOPROBE example.

NETWORK MANAGEMENT

4. Identify the overall problems encountered in the network:

- Technical or scientific problems
- Management problems
- Personnel problems
- Problems with partners
- Other (specify): Timeliness in completion of some scientific studies
- No problems occurred in the network

5. Describe the problems identified above and the steps taken to resolve each one. What additional resources would have been useful in resolving these problems?

For a project of the scope and magnitude of LITHOPROBE, problems of any kind were amazingly limited. This follows from the exceptional cooperation that I received as Director, that the Transect Leaders received in fostering the science within their transects, and that the advisory committees received from the many volunteers involved. The lack of problems throughout the project is also attributed to the continuing support of scientists and administrators within the GSC. Nevertheless, a few problems did occur, as discussed briefly below.

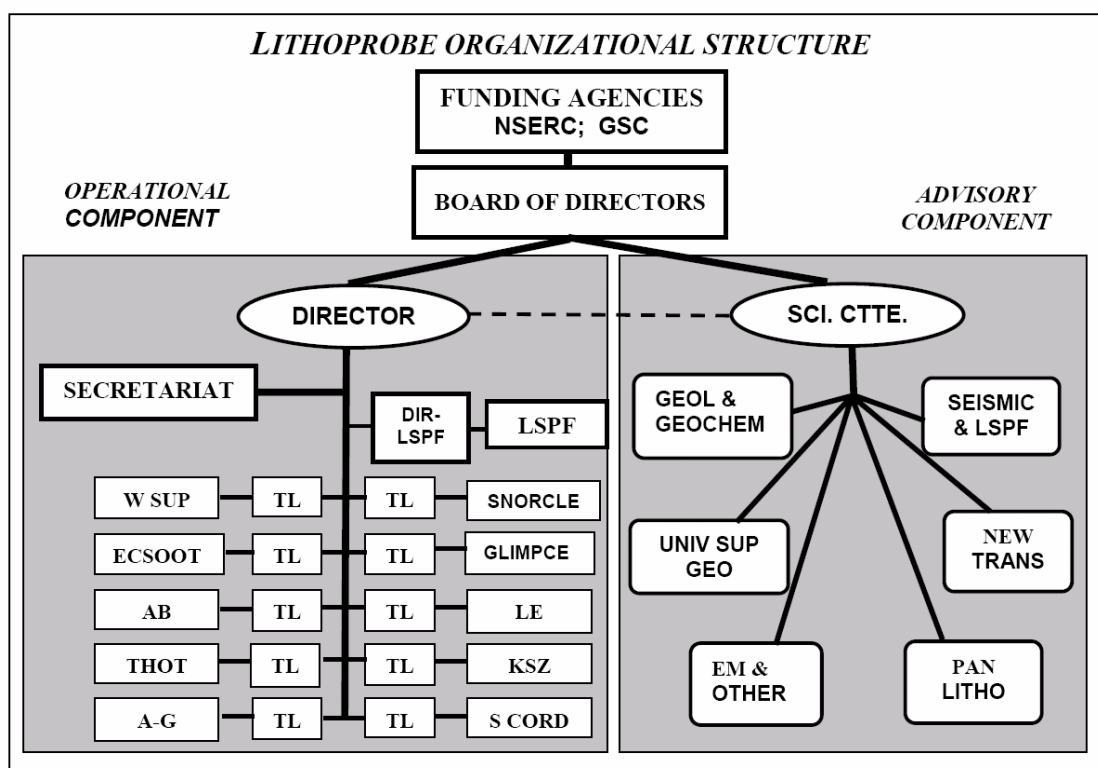
For a project that extended over a 20-year period, personnel problems related to changes in positions and circumstances of some of the key participants. No "personnel problems" in terms of individuals were encountered. Bringing the scientific results of the Trans-Hudson Orogen Transect to completion and to a final synthesis was delayed a number of years beyond the planned timing. First, the principal GSC scientific leader involved in the transect accepted a prestigious position in Europe. He was replaced by another outstanding scientist at the GSC. However, this scientist was attracted into a high-level management position, first at the GSC and then within another federal organization. About the same time, the co-Transect Leader passed away. These unfortunate developments left substantial holes in the scientific leadership. Other scientists stepped in to complete the scientific studies but the latter were delayed significantly as a result. In the Alberta Basement Transect (ABT), the transect's Seismic Coordinator, and one of Canada's most notable geophysicists, passed away suddenly. His responsibilities were assumed by other seismologists active in the transect. Before the digital data management effort and preparation of an archival CD for the ABT could be completed, the digital data manager became ill and went on medical leave and the Transect Leader left the employ of the GSC. LITHOPROBE's plans to recover from these developments are mentioned in the section on transect activities for ABT [see p. 3].

LITHOPROBE's formal partner from initiation of the project as a Collaborative Special Project has been the Geological Survey of Canada. In all respects, the GSC has been an effective and cooperative partner. Its scientists have participated in all aspects of LITHOPROBE studies, as indicated partly by their authorships on LITHOPROBE publications [e.g., see Report Item 7 below]. One problem has arisen since the formal ending of financial support from NSERC and the GSC in 2003. The GSC has moved into a more "project-oriented" style of research activities focused on the priorities and needs of the federal government. While this is readily justifiable and sensible, the net result has caused some modest problems for the network. To a certain extent, this development has limited participation of GSC scientists in the pan-LITHOPROBE synthesis process because no GSC project is directed to such an undertaking. However, some GSC scientists have been able to carry out such LITHOPROBE activities within the programs of other funded projects. As well, key GSC scientists have indicated they will use time outside of normal work hours to complete their scientific activities, if this proves necessary. In this way, the planned end results will be achieved.

Overall, LITHOPROBE scientists have done an excellent job of bringing results to the publication stage in a timely and effective manner. In a few cases, some key results have been delayed beyond what we would like. To address the issues, Transect Leaders have reminded and encouraged the scientists involved to complete their studies. As Director of LITHOPROBE, I convened a couple of meetings to address the issues and focus on plans to bring the results to fruition. As a consequence of this "pressure" and the cooperation of the scientists involved, all key LITHOPROBE results have reached the publication stage.

6. Assess the network's decision-making process, including research decisions and financial decisions. Provide details on how the decision-making process functioned.

The LITHOPROBE organizational structure has provided a highly effective format for the network's decision-making processes. The figure below summarizes that structure. As noted previously, LITHOPROBE is an integrated, decentralized network of scientific investigations, multidisciplinary studies and collaborating scientists. Under the "Operational Component" shown below, this is represented by the 10 transects and their leaders. At the same time, central coordination is vital to ensure LITHOPROBE's role as a national scientific program, to be responsible to the funding agencies, to maintain close links among the community of geoscientists in universities, government and industry and to communicate the significance and excitement of our scientific findings beyond the Earth Science community. This is represented by the "Director", "Secretariat" and "LSPF" with its director. The operational component is ably advised by a Scientific Committee and a series of Subcommittees. Both operational and advisory components are overseen by a Board of Directors which is responsible to the funding agencies, NSERC and the GSC. A testament to the success of this organizational structure is the fact that other groups, nationally and internationally, who were establishing other centres of excellence, used it as a model for organizing effective, collaborative research. Indeed, earlier on in LITHOPROBE's history, NSERC directed a number of principal investigators for a variety of projects to the LITHOPROBE Project Director for information on organizational and management aspects of a large project.



LITHOPROBE organizational structure diagram. TL - Transect Leader; LSPF - LITHOPROBE Seismic Processing Facility. Subcommittees of the Scientific Committee are Geology and Geochemistry, Electromagnetic (EM) and Other Geophysics, Seismic and LSPF, University Supporting Geoscience Projects, Pan-LITHOPROBE and New Transects. Transect abbreviations as identified previously.

The network's decision-making process was excellent and responded well to the needs of the project. Following NSERC's and the GSC's acceptance of the Phase II Proposal in 1987, new individual transect scientific programs were developed by "grassroots" scientists in response to a nationwide call from the Secretariat for new transect proposals. These were evaluated by the New Transects Subcommittee, who sent the proposals out for national and international peer review, and by the Scientific Committee. Once new transects were established,

advice for their scientific programs derived from the three disciplinary subcommittees, Geology and Geochemistry, EM and Other Geophysics (EMOG), and Seismic and LSPF (Seismic). In particular, EMOG carefully evaluated the planned magnetotelluric surveys, which were included in the budget as a separate line item. Similarly, the Seismic Subcommittee evaluated the proposed seismic reflection and refraction/wide-angle reflection surveys, which also were funded through line items in the budget. As discussed earlier in this report, the Pan-LITHOPROBE Subcommittee has been very active in promoting and developing syntheses of overall network results based on scientific results derived from the individual transects.

Transect Leaders were responsible for the scientific programs within their individual transects and recruited, if necessary, the best scientists to achieve the scientific objectives. Progress in transect activities were communicated to the Project Director and to the Scientific Committee during the semi-annual meetings of this committee. Transect leaders participated in all the Scientific Committee meetings, but did not have a vote on any matters for which one was required. The Board of Directors were kept informed of progress in the scientific programs but did not intervene. They set policy and general guidelines and encouraged industry participation but left scientific activities to the transects and oversight of the science to the Scientific Committee. However, the Board did provide guidance and support for non-scientific activities undertaken centrally by the Secretariat and Director.

Budgets for each proposal were prepared by the Project Director with input from Transect Leaders and key member of the transect teams, based on the required scientific activities. The Scientific Committee and Board of Directors provided sage advice. Following funding awards from NSERC, the proposed budgets were modified by the Director as necessary to equate with the funds awarded. This was done in consultation with the Transect Leaders and eventually approved by the Board of Directors. Thereafter, budgeted activities closely followed those that were approved. Necessary changes from the approved budget for scientific activities were discussed by Transect Leaders and the Scientific Committee at their joint meetings, prepared and modified as necessary by the Director, and presented to the Board for approval. Changes in the budget for non-scientific activities (e.g. outreach and education) were instigated by the Director and/or the Board and approved by the latter.

A unique component of LITHOPROBE was an internal grants competition called the University Supporting Geoscience Projects (USGP) grants program. This was run by the Secretariat and followed procedures similar to those for NSERC Strategic Grants competitions. For any fiscal year, the series of transects active at that time were assigned a nominal level of funding for research that supported the transect objectives; the amount of funds involved was about 25% of the annual NSERC award to LITHOPROBE. A national call for applications was issued. These were evaluated by national and international peer review. Final recommendations on funding were made by the USGP Subcommittee and approved by the Scientific Committee and Board of Directors. This was a very important part of the LITHOPROBE budget because it enabled all university scientists to participate equally on a competitive basis and actually brought into the program some of the best academic scientists who had not necessarily participated in the early stages of LITHOPROBE. In the case of the line item magnetotelluric, seismic reflection and seismic refraction experiments for each transect, some funds were set aside for "post-contract" studies; i.e. studies by academics following the acquisition and/or initial processing of the data. In each case, a national call for proposals to access funds for the post-contract studies was made to institutions with the personnel and capabilities of carrying out such studies. In these cases, the scientists involved were encouraged to put together a coordinated proposal such that little competition was involved in the evaluation. The EMOG and Seismic subcommittees vetted the proposals and made recommendations to the Scientific Committee which passed these on to the Board for approval.

DISSEMINATION AND USE OF NETWORK RESULTS

7. Describe the dissemination and transfer of the network's results to the scientific and industrial communities, listing publications, presentations, and any other means. Please use one text box for each dissemination item.

LITHOPROBE is a project that has involved faculty and students from most Canadian universities with an Earth Science program, scientists from the Geological Survey of Canada and from ten provincial/territorial geological surveys, and individual scientists from industry. During the 20-year history of the project, more than 1420 refereed publications have been catalogued in our publication list available on the LITHOPROBE web site. Since the last report, dated January 2002, 193 refereed and 2 non-refereed articles have been completed and published; Appendix B includes a list of these publications. LITHOPROBE generally only adds papers to the publication list when they have

reached the stage of resubmission after revision or are accepted; hence, we don't have information related to the total number of submitted papers. However, I do know that 17 manuscripts have been submitted for the special issue of *CJES* focused on the Western Superior Transect. Because of the large number of scientists involved in LITHOPROBE and the large number of different conferences at which presentations are made, we have not attempted to catalogue this form of scientific dissemination. The LITHOPROBE report series now totals 87 reports; six such reports have been added since January 2002 and are included in Appendix B. A new series of E-publications has been initiated. To date, we have five entries, also noted in Appendix B. We have not attempted to catalogue other types of reports by individual scientists.

Title/Source	Refereed Journal Articles	Non-refereed Journal articles	Conf. pres. (invited)	Conf. pres. (not invited)	Technical report	Other
Accepted/Published Since January 2002	193	2	N/A	N/A	10	N/A
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Submitted	N/A	N/A	N/A	N/A	N/A	N/A
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

8. How many of the papers and presentations above were co-authored by the network's industry and government partners?

Geological Survey of Canada authors or co-authors: 71 of 195 articles

Provincial/territorial geological survey authors or co-authors: 24 of 195 articles

Industry authors or co-authors: 1 of 195 articles

9. Describe the mechanism for accessing the networks data base by researchers in Canada in the future, if applicable.

Details of LITHOPROBE's achievements relating to "Completion of the LITHOPROBE data archives" are provided under the heading just quoted within Item 2 of this report. Here, we present only a brief summary.

The primary LITHOPROBE database comprises digital data from field and processed seismic reflection (MCS) surveys, seismic refraction/wide-angle reflection (R/WAR) experiments and magnetotelluric (MT) field campaigns. Throughout the 20-year history of LITHOPROBE's MCS, R/WAR and MT data acquisition, the LITHOPROBE Seismic Processing Facility (LSPF) at the University of Calgary acquired and archived both LITHOPROBE and LITHOPROBE-related data. The latter include major data donations from industry and some additional data acquired by the Geological Survey of Canada (GSC). During the final phase of LITHOPROBE, all data and related material were transferred to the GSC's Seismology and Electromagnetic Section in Ottawa for permanent archiving and distribution upon request. As part of the procedure, metadata for all LITHOPROBE MCS, R/WAR and MT data were created. This metadata database is now part of the online data catalogue maintained by the Canadian Geoscience Knowledge Network (www.cgkn.net), which helps Canadians and non-Canadians interested in geoscience data discover what is available in their area of interest.

The GSC has hired a Seismic Archivist who is responsible for the extensive archive and distribution of data upon request. All data are publicly available through internet requests made via the LITHOPROBE Seismic and MT Data Archive web site:

www.cg.nrcan.gc.ca/lith_arch/LSDA_homepage_e.html (for English)

www.cg.nrcan.gc.ca/lith_arch/LSDA_homepage_f.html (for French).

The nominal charges to cover the costs of data reproduction (archivist's time, the medium to which the data are transferred and computer expenses) are specified on the web site.

Individual transect archives take a number of forms. In many cases, the important data on which scientific interpretations are made is included in the journal publication(s) associated with those data. Most transects that

became active after the “digital revolution” have compiled, or are compiling, a summary of data relevant to the individual transect’s scientific program in CD format. Details are provided under the individual transect listings described earlier in this report. Each CD is assigned a LITHOPROBE E-publication number so that it can be referenced accordingly and is available upon request from the LITHOPROBE Secretariat, which will remain extant for the next few years. Two copies of each transect CD are, or will be, archived with the GSC LITHOPROBE Seismic Data Archive in Ottawa as backup and eventually for distribution upon request. For many studies, the individual scientists retain their personal data archives and need to be contacted for the relevant information.

10. Please identify the tangible results obtained as a direct result of the Research Network using the chart below.

The results below apply to LITHOPROBE throughout its 20-year history of scientific discovery.

Tangible Result	Prototype / Pilot	New process/ product/ service	Improved process/ product/ service	Knowledge applied toward policy or regulation	New spin-off (applications)	Other (specify section to be added)
**Development of portable seismic refraction seismographs	X	X				
**Development of new magnetotelluric instrumentation	X	X				
**Multichannel seismic (MCS) reflection technology applied to base-metal exploration in established mining camps		X			X	
**MCS reflection technology applied to uranium exploration		X			X	
**MCS reflection technology applied to thin kimberlite dykes in diamond exploration		X			X	
**Contribution to a new petroleum discovery on the west coast of Newfoundland			X			
**Framework for better understanding of the mega-thrust earthquake hazard on Canada’s west coast				X		
**New understanding of the mantle lithosphere relating to diamond exploration in the NWT						Knowledge applied to diamond exploration

11. Please indicate the number of patents, licenses or options obtained in Canada, the United States or elsewhere as a direct result of the Research Network projects.

NOT APPLICABLE

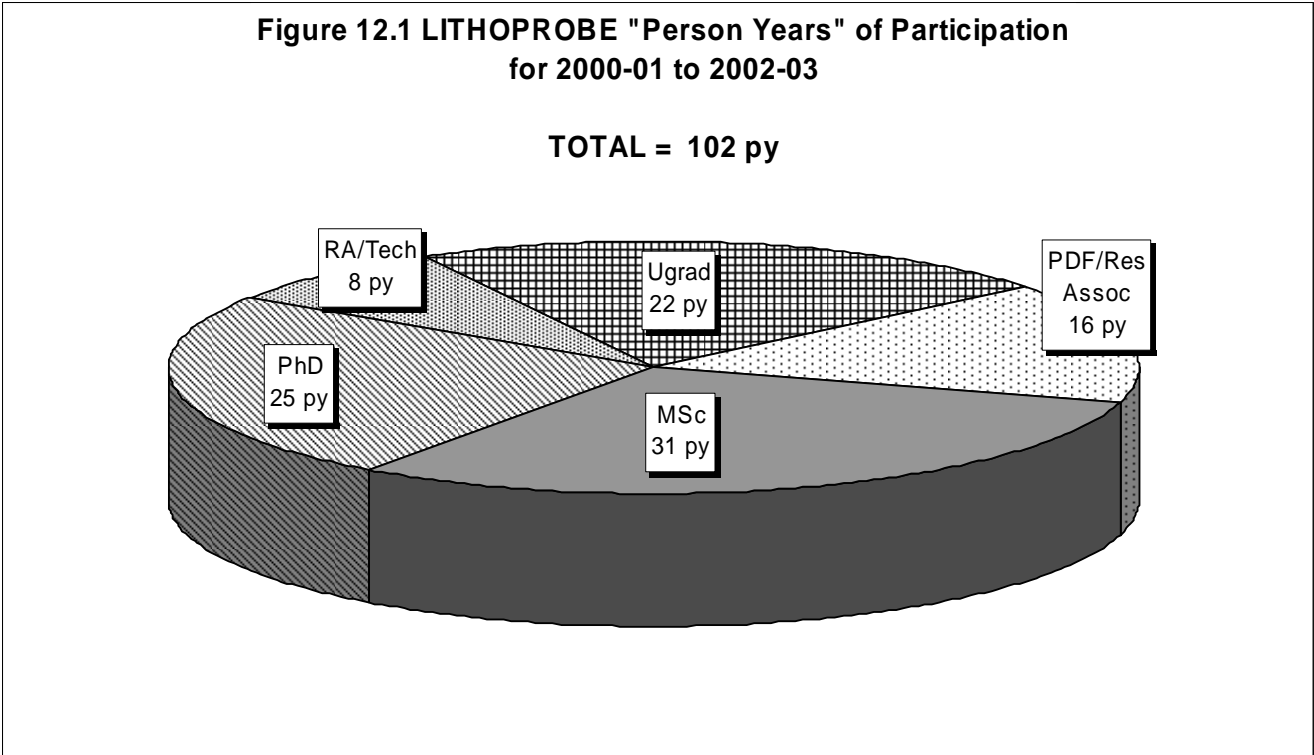
TRAINING OF HIGHLY QUALIFIED PERSONNEL

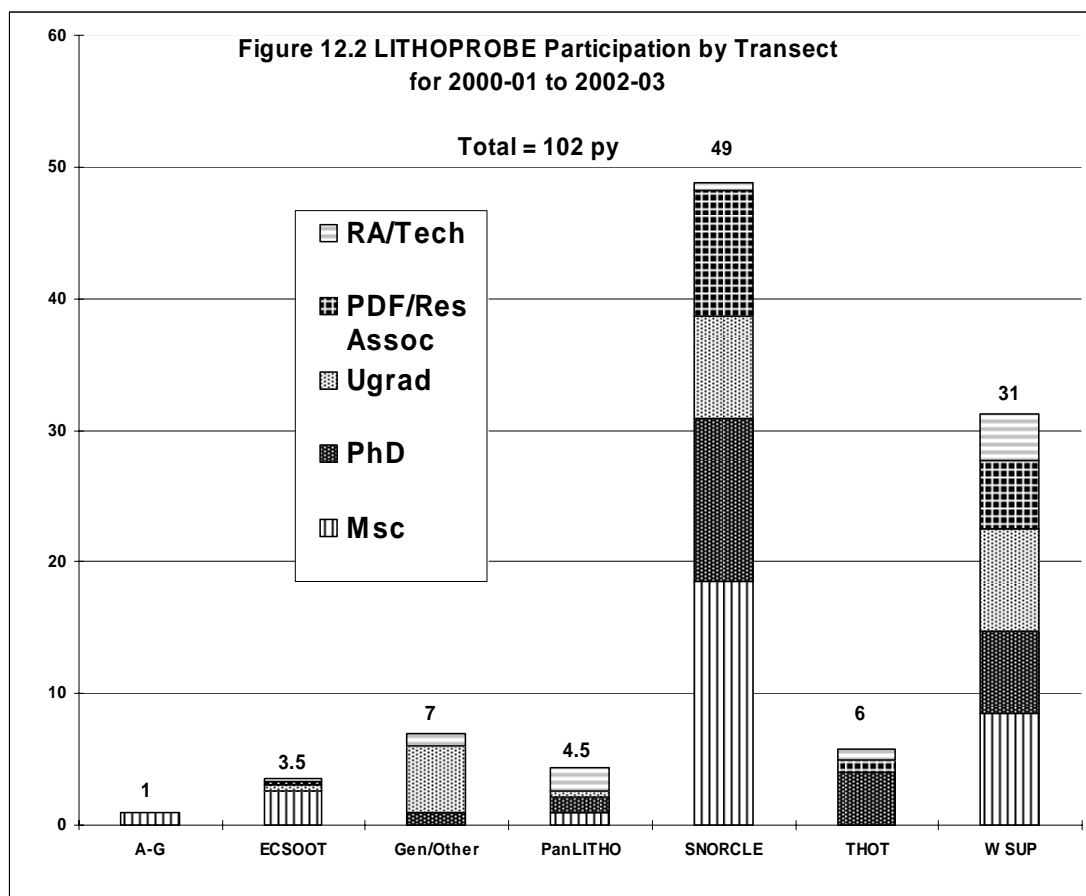
12. Please complete the table below on the number of HQP involved in the network:

Cumulatively, LITHOPROBE, during its 20-year history of activities, has involved at least 450 individuals within the types of HQP listed in the table of the template report. These individuals represent HQP being trained at almost every university in Canada with an Earth Sciences department. Some were financially supported partially or fully by funds from the LITHOPROBE University Supporting Geoscience grants competition that was held annually for transects active at the time. Some were supported by funds awarded for post-contract studies of seismic reflection, R/WAR and MT data. In most cases, additional support for students derived from NSERC Discovery grants, university teaching assistantships and other sources. Some graduate students and PDFs were on full scholarships.

Statistics related to the training of HQP have been provided in all LITHOPROBE proposals and in most reports prepared for NSERC. These statistics are compiled from information provided by participants in response to a request from the Secretariat to complete a "Scientific Summary Sheet". Return rates for the Summary Sheets typically were between 80-90 %, so the results are fairly representative. At the time of the last report (January 2002), statistics for the period since the previous report had not been compiled as we wished to wait and include summaries for the final official year of the project, 2002-03. In this report, we provide a summary for the three-year period 2000-01 to 2002-03. Our information is compiled in terms of "person-years" in a particular category of HQP. The numbers of individuals are considerably less since most M.Sc. students average about 3 years and most Ph.D. students average about 5 years for their degrees; PDFs typically spend 2 years in their appointment. The information compiled by LITHOPROBE does not fit into the format of the table provided in this section. Thus, we are providing the data in a different format.

Figure 12.1 shows HQP participation in terms of person years for the differing types of HQP. For the 3-year period under consideration, during a time when LITHOPROBE was winding down its scientific activities, the numbers imply about 10 M.Sc. students, 8 Ph.D. students and 6 PDFs/Research Associates. Figure 12.2 shows the distribution of HQP active in different transects during the period of the summary, 2000-01 to 2002-03.





13. Overall, what type of interactions did HQP have with the partners during the grant?

- Many Undergrad, M.Sc., Ph.D. and PDF students carried out summer field work with scientists from the Geological Survey of Canada and/or provincial/territorial geological surveys. This provided them with invaluable field mapping experience.
- Some HQP students worked in laboratories at the GSC, where they learned sophisticated analysis procedures on state-of-the-art equipment.
- Most HQP in training participated in one or more individual transect workshops where they were able to meet and discuss their research with scientists from the GSC, provincial/territorial geological surveys, and, in some cases, industry.
- Some HQP individuals were co-supervised by scientists from the GSC.

14. Please indicate the extent to which HQP interacted with partners for each of the following types of interaction. Rate your answer on a 7-point scale where 1 means that HQP did not interact with the partners in the way described, the mid-point 4 means there was some interaction in the way described, and 7 means that HQP interacted frequently with the partners in the way described.

	No INTERACTION		SOME INTERACTION			A LOT OF INTERACTION	
	1	2	3	4	5	6	7
a) HQP WORKED IN PARTNER'S FACILITIES	1	2	<u>3</u>	4	5	6	7
b) HQP ATTENDED MEETINGS WITH PARTNER	1	2	3	4	5	<u>6</u>	7
c) PARTNER SUPERVISED THESIS PROJECTS OF HQP	1	2	<u>3</u>	4	5	6	7
d) OTHER _____	1	2	3	4	5	6	7

15. Please complete the following table on the hiring of HQP involved in the network by partner companies and the user sector.

Unfortunately, LITHOPROBE made no attempt at trying to determine the subsequent positions of the >450 individuals involved as HQP after they left the universities. Doing so would have been a massive undertaking for which human and financial resources did not exist. As a result, no systematic response to completion of the table below can be made. Anecdotally, we know that many tens of individuals who received HQP training through LITHOPROBE activities are employed in academia (both in Canada and the U.S.A.), by the GSC and provincial/territorial geological surveys, and in industry. Unequivocally, we can state that LITHOPROBE has made a significant contribution to the state of HQP in the Earth sciences in Canada.

Type of HQP	# hired by a partner	# hired by other organization in user sector	# hired by government	# employed in academia (faculty)	# hired by other (specify)	# in further academic training	# continuing on present career/ study course
Undergraduates							
M.Sc.							
Ph.D.							
PDF							
Research Associates							
Technicians							
Others							

NETWORKING AND COLLABORATIONS

16. Describe the success and/or challenges of the collaboration with industry, government and NGO partners. Specify what additional resources would have been useful in resolving problems.

The formal partner for LITHOPROBE was the Geological Survey of Canada (GSC). Scientists from the GSC participated in all aspects of the scientific activities and formed a critical component of knowledgeable scientists for both individual transects and the synthesis process. From its A-base budget, the GSC contributed annually to the costs of the seismic reflection survey contracts and provided funds to support all activities of GSC scientists involved in LITHOPROBE studies. During the earlier phases of the project, the GSC contracted and acquired additional data, primarily seismic reflection and some magnetotelluric data, through special federal initiatives such as the Frontier Geoscience Program. Other initiatives, such as the National Mapping Program (NATMAP), provided additional resources for geological, geochemical and related studies. Although not considered a direct contribution in terms of LITHOPROBE's accounting procedures, the salary and benefit costs of the many GSC scientists involved in LITHOPROBE were paid by the GSC. The main challenge involved was maintenance of the financial, personnel and related commitments to LITHOPROBE over a 20-year period [1984-2003] amidst ever-changing governments and/or priorities. To the credit of the GSC, this challenge was managed very well and contributed directly to the unqualified success of the project.

Provincial and territorial government geological surveys generously contributed scientific personnel, data and in-kind resources toward LITHOPROBE activities when these activities were within their jurisdiction. Since the provinces and territories recognized the value and contributions of LITHOPROBE studies in their jurisdictions, no serious challenges were evident. Difficulties sometime arose in funding travel of key provincial/territorial geoscientists to LITHOPROBE meetings outside of their areas. This difficulty was readily solved by using LITHOPROBE travel funds.

Industry was not a formal partner within the LITHOPROBE project. However, industry representatives were involved in all aspects of the project, from its early formative days as members of the LITHOPROBE Steering Committee to continuing membership on the Board of Directors, Scientific Committee, Seismic and LSPF Subcommittee and Electromagnetic and Other Geophysics subcommittee. The Chair of LITHOPROBE's Board of

Directors has always been a representative from industry. Industry participated financially in LITHOPROBE activities when it was in their sphere of interest. Industry contributed financially by providing additional funds to carry out add-on high resolution reflection surveys when the seismic crews were in their region as a result of LITHOPROBE contracts for lithospheric studies. Two major lithospheric seismic reflection surveys, one in Alberta and one in Ontario, were run entirely on the basis of funds from industry. Industry contributed extensive data sets to assist LITHOPROBE scientific activities and made rock samples, drill hole information and logs available in special cases where this information would be useful. They also provided in-kind logistical support for field work in a number of transects. In the initial stages of LITHOPROBE, industry contributed funds [approximately \$3.6 million] toward a computer system and software that enabled establishment of the LITHOPROBE Seismic Processing Facility. Subsequently, as the needs and direction of seismic processing changed, industry provided substantial discounts for the purchase of both new hardware and software. Throughout LITHOPROBE's 20-year history, industry has been very supportive of the project. The main challenge associated with industry participation was securing direct cash contributions. These were generally only provided when the company or companies involved considered a particular study was of direct relevance to their exploration efforts. Providing funds to support research that had general relevance was not an argument supported by those who made the budgetary decisions in industry. This is a challenge that is not easily overcome, now or in the future. Nevertheless, LITHOPROBE has benefited from a healthy informal partnership with industry and industry has benefited from their association with LITHOPROBE.

FINANCIAL INFORMATION

17. Using the forms provided below, please indicate your budget for the last 2.5 years of the network as well as your actual expenditures for Research and Administration.

LITHOPROBE has not maintained budgets or accounting practices that enable provision of information within the restrictions of the tables provided in the NSERC Final Report template. This derives somewhat from the procedures that have been followed over the years and in the various proposals made by LITHOPROBE. Part of our variances result from the fact that about 25% of the annual NSERC budget was devoted to the University Supporting Geoscience grants competition wherein grants awarded were transferred from UBC to faculty at their home universities so we do not have access to the details of expenditures from those funds. Also, from fiscal 2003-04 and later, there were only carry-forward NSERC budget funds (no NSERC budget). Residual LITHOPROBE funds from industry have been used to meet some expenses and now provide all of the funds to meet expenses needed for present synthesis and related activities.

Nevertheless, we have prepared financial information in a format that replicates as closely as possible the information requested in the template. This information is based on accounting information provided to us by UBC Financial Services and is consistent with the accounting carried out at the Secretariat. The financial information for fiscal years 2002-03 to 2004-05 is presented in table format on the following page. Please note that NSERC Form 300s from UBC have been sent to NSERC to provide full accounting for all of the NSERC funds through to June 30, 2005.

Following the NSERC LITHOPROBE financial information tabulated in the single page noted above, we present the final budget reports for 2002-03 to 2004-05 as prepared for the LITHOPROBE Board of Directors and approved by them at their last meeting. These reports follow the format of presentation used for many years in meetings of the Board of Directors. They have been reconciled with accounting information sent to the Secretariat by UBC Financial Services. As such, they provide complete information on budgets and expenditures without all the details.

Financial Information - LITHOPROBE Project 2002-2003 to 2004-2005																
FY 2002 - 2003																
Research	Bal. 01/02	02/03 Grant from LITHOPROBE	Total funds available	Bachelor's & Master's (Cdn. & Perm. Res.)	Postdoctoral (Cdn & Perm Res)	Postdoctoral (Foreign)	Non-Students (Other)	Prof. & Tech. Services/ Contracts	Equipment	Materials/ Supplies	Travel	Total Expenses	Return of funds to UBC	Deficits not borne by UBC	Bal. 02/03	Note
Other Institutions	262,236	256,000	518,236	25,949	18,006	4,038	185,522	688	3,949	50,242	17,991	306,385		1,503	213,354	
UBC (Bostock, M.)	799	60,440	61,239							544	730	1,274			59,965	
Total	263,035	316,440	579,475	25,949	18,006	4,038	185,522	688	3,949	50,786	18,721	307,659	-	1,503	273,319	
Administration	Bal. 01/02	02/03 Grant from NSERC	Total funds available	Bachelor's & Master's (Cdn. & Perm. Res.)	Postdoctoral (Cdn & Perm Res)	Postdoctoral (Foreign)	Non-Students (Other)	Prof. & Tech. Services/ Contracts	Equipment	Materials/ Supplies	Travel	Total Expenses	Return of funds to UBC	Advances to Other Institutions	Bal. 02/03	Note
The Secretariat at UBC	474,604	585,000	1,059,604				208,775	29,459	1,757	22,014	35,243	297,248		(316,440)	445,916	
Total	474,604	585,000	1,059,604	-	-	-	208,775	29,459	1,757	22,014	35,243	297,248	-	(316,440)	445,916	
FY 2003 - 2004																
Research	Bal. 02/03	03/04 Grant from LITHOPROBE	Total funds available	Master's (Cdn. & Perm. Res.)	Postdoctoral (Cdn & Perm Res)	Doctorate (Foreign)	Non-Students (Other)	Prof. & Tech. Services/ Contracts	Equipment	Materials/ Supplies	Travel	Total Expenses	Return of funds to UBC	Deficits not borne by UBC	Bal. 03/04	Note
Other Institutions	213,354	125,400	338,754	33,771		1,525	142,070	230	13,257	28,916	22,711	242,480	(5,448)	11,252	102,078	
UBC (Bostock, M.)	59,965		59,965					3,767	404	28,715	6,993	39,879			20,086	
Total	273,319	125,400	398,719	33,771	-	1,525	142,070	3,997	13,661	57,631	29,704	282,359	(5,448)	11,252	122,164	
Administration	Bal. 02/03	03/04 Grant from NSERC	Total funds available	Master's (Cdn. & Perm. Res.)	Postdoctoral (Cdn & Perm Res)	Doctorate (Foreign)	Non-Students (Other)	Prof. & Tech. Services/ Contracts	Equipment	Materials/ Supplies	Travel	Total Expenses	Return of funds to UBC	Advances to Other Institutions	Bal. 03/04	Note
The Secretariat at UBC	445,916		445,916				78,237	3,037	1,281	97,909	38,433	218,897	(5,448)	(125,400)	107,067	
Total	445,916	-	445,916	-	-	-	78,237	3,037	1,281	97,909	38,433	218,897	(5,448)	(125,400)	107,067	
FY 2004 - 2005																
Research	Bal. 03/04	04/05 Grant from LITHOPROBE	Total funds available	Master's (Cdn. & Perm. Res.)	Postdoctoral (Cdn & Perm Res)	Doctorate (Foreign)	Non-Students (Other)	Prof. & Tech. Services/ Contracts	Equipment	Materials/ Supplies	Travel	Total Expenses	Return of funds to UBC	Deficits not borne by UBC	Bal. 03/04	Note
Other Institutions	102,078	8,000	110,078	13,125			16,601	15,430	10,177	27,545	10,843	93,721	(8,413)	3,308	11,252	
UBC (Bostock, M.)	20,086		20,086				3,885	13,477		438	2,286	20,086			-	
Adjustment for 2003/04 expenditures from U. of Calgary												11,252			(11,252)	
Total	122,164	8,000	130,164	13,125	-	-	20,486	28,907	10,177	27,983	13,129	125,059	(8,413)	3,308	-	
Administration	Bal. 03/04	04/05 Grant from NSERC	Total funds available	Master's (Cdn. & Perm. Res.)	Postdoctoral (Cdn & Perm Res)	Doctorate (Foreign)	Non-Students (Other)	Prof. & Tech. Services/ Contracts	Equipment	Materials/ Supplies	Travel	Total Expenses	Return of funds to UBC	Advances to Other Institutions	Bal. 03/04	Note
The Secretariat at UBC	107,067		107,067				66,168	4,092	3,312	22,484	11,424	107,480	(8,413)	(8,000)	-	
Total	107,067	-	107,067	-	-	-	66,168	4,092	3,312	22,484	11,424	107,480	(8,413)	(8,000)	-	

	NSERC 2002-2003	NSERC c/fwd	GSC funds	Other sources	NSERC transfer	Actual Expenditures	Commitment	Balance	Global funding \$\$ & indirect
1. REFLECTION SURVEYS									
BALANCE CARRY FWD FROM 2001-2002 to 2002-2003		107,590							
SNORCLE post-contract studies (1996 data)		40,000							
SNORCLE post-contract studies		80,000							
SNORCLE post-contract studies awards - F. Cook & R. Clowes						67,000	53,000		
Donations for Douglas Nelson Memorial Funds						1,000			
Board of Directors - final meeting dinner						926			
TOTALS	0	227,590	0	0	0	68,926	53,000	105,664	227,590
2. SUPPORTING GEOSCIENCE									
BALANCE CARRY FWD FROM 2001-2002 to 2002-2003		(3,466)							
SNORCLE award 2000-01 - Bostock (UBC)		60,440							
SNORCLE award 2000-01 - Bostock (UBC)						56,974			
TOTAL	0	56,974	0	0	0	56,974	0	0	56,974
3. LITHOPROBE SEISMIC PROCESSING FACILITY									
BALANCE CARRY FWD FROM 2001-2002 to 2002-2003									
Salaries & benefits	140,000					140,000			
Hardware/software maintenance, minor upgrades & repairs	50,000					50,000			
Supplies, expendables, courier, travel	20,000					20,000			
TOTAL	210,000	0	0	0	0	210,000	0	0	210,000
4. SEISMIC REFRACTION SURVEYS									
BALANCE CARRY FWD FROM 2001-2002 to 2002-2003									
TOTAL	0	0	0	0	0	0	0	0	0
5. ELECTROMAGNETIC SURVEYS									
BALANCE CARRY FWD FROM 2001-2002 to 2002-2003		61,180							
RESERVE FOR SNORCLE EM surveys/or analyses		24,710					5,000		
RESERVE FOR WSUP EM surveys/or analyses							48,344		
TOTAL	0	85,890	0	0	0	0	53,344	32,546	85,890

	NSERC 2002-2003	NSERC c/fwd	GSC funds	Other Sources	NSERC transfer	Actual Expenditures	Commitment	Balance	Global funding \$\$ & indirect
6. TRANSECT COORDINATION & SYNTHESIS									
BALANCE CARRY FWD FROM 2001-2002 to 2002-2003		15,416							
ECSOOT digital data management 1999-2000		20,000					10,000		
DDM/GIS @ GSC - Travel of DDC to Transect DDMs		4,826				1,727			
Western Superior digital data management for future		30,000					30,000		
Western Superior digital data management 2001-2002		30,000				30,000			
Digital data management/GIS @ GSC		35,000							
SNORCLE coordination	20,000					20,000			
SNORCLE digital data management	20,000					20,000			
Digital data management/GIS @ GSC	35,000								
Funds for Seismic Archivist with GSC - approved at 2002 BOD mtg							20,000		
TOTAL	75,000	135,242	0	0	0	71,727	60,000	78,515	210,242
7. REFRACTION INSTRUMENTS MAINTENANCE									
BALANCE CARRY FWD FROM 2001-2002 to 2002-2003									
TOTAL	0	0	0	0	0	0	0	0	0
8. SECRETARIAT									
BALANCE CARRY FWD FROM 2001-2002 to 2002-2003		20,675							
Publication of synthesis (Alberta Basement)		18,735					5,000		
Publication of synthesis (THOT)		40,000					40,000		
Publication of synthesis (ECSOOT & WSUP)		80,000				2,762	77,238		
Communications funds: \$10K - J. Wilson; \$15K - Key Porter + gst		17,838					25,330		
Salaries & benefits (Director, Admin. Asst., & Secretary)	170,000					205,775			
UBC contribution of 50% to Director's salary/benefit 2002-2003						(61,504)			
Travel (Director & Committees)	30,000					33,657			
Equipment & Supplies	20,000					24,400			
Publication of synthesis (SNORCLE & PanLITHO)	80,000						70,000		
Communications for 2002-2004 - approved at 2002 BOD mtg		3,000				32,459	20,541		
TOTAL	300,000	180,248	0	0	0	237,549	238,109	4,590	480,248
9. DIRECTOR'S CONTINGENCY									
BALANCE CARRY FWD FROM 2001-2002 to 2002-2003		32,527							
Additional Award to S. Ji (Ecole Poly.)						6,000			
Balance of USGP Award to M. Bostock						3,467			
(refer to above Supporting Geoscience Budget: \$60,440 - \$56,973)									
TOTAL	0	32,527	0	0	0	9,467	0	23,060	32,527
10. RESERVE FUNDS									
BALANCE CARRY FWD FROM 2001-2002 to 2002-2003									
TOTAL	0	0	0	0	0	0	0	0	0
TOTAL BUDGET	\$585,000	718,471	\$0	\$0	\$0	\$654,643	\$404,453	244,375	\$1,303,471
ANNUAL COMMITMENT FROM GSC			500,000						

	NSERC 2003-2004	NSERC c/fwd	GSC funds	Other sources	NSERC transfer	Actual Expenditures	Commitment	Balance	Global funding \$\$ & indirect
1. REFLECTION SURVEYS									
BALANCE CARRY FWD FROM 2002-2003 to 2003-2004		105,664							
SNORCLE post-contract studies Yr. 2 awards - F. Cook & R. Clowes		53,000					10,500		
SNORCLE post-contract studies Yr. 2 awards - F. Cook						23,000			
Contribution - Tremblant Seismic Conference 2004						5,000			
Credit back - S. Ontario Seismic Reflection Survey (Overhead charges)				761					
Funds received from IEXCO				79,206					
Internal Transfer (Project related charges from Industry Funds)					37,000				
TOTALS	0	158,664	0	79,967	37,000	28,000	10,500	237,131	275,631
2. SUPPORTING GEOSCIENCE									
BALANCE CARRY FWD FROM 2002-2003 to 2003-2004									
TOTAL	0	0	0	0	0	0	0	0	0
3. LITHOPROBE SEISMIC PROCESSING FACILITY									
BALANCE CARRY FWD FROM 2002-2003 to 2003-2004									
TOTAL	0	0	0	0	0	0	0	0	0
4. SEISMIC REFRACTION SURVEYS									
BALANCE CARRY FWD FROM 2002-2003 to 2003-2004									
TOTAL	0	0	0	0	0	0	0	0	0
5. ELECTROMAGNETIC SURVEYS									
BALANCE CARRY FWD FROM 2002-2003 to 2003-2004		32,546							
RESERVE FOR SNORCLE EM surveys/or analyses		5,000					5,000		
RESERVE FOR WSUP EM surveys/or analyses		48,344					48,344		
Support for new Magnetotellurics (MT) analyses licenses x 3						15,400			
Internal Transfer (Project related charges from Industry Funds)					28,908				
TOTAL	0	85,890	0	0	28,908	15,400	53,344	46,054	114,798
6. TRANSECT COORDINATION & SYNTHESIS									
BALANCE CARRY FWD FROM 2002-2003 to 2003-2004		78,515							
ECSOOT digital data management 1999-2000		10,000							
Western Superior digital data management for future		30,000				30,000			
Funds for Seismic Archivist with GSC - approved at 2002 BOD mtg		20,000				20,000			
Internal Transfer (Project related charges from Industry Funds)						37,000			
TOTAL	0	138,515	0	0	0	87,000	0	51,515	138,515

	NSERC 2003-2004	NSERC c/fwd	GSC funds	Other Sources	NSERC transfer	Actual Expenditures	Commitment	Balance	Global funding \$\$ & indirect
7. REFRACTION INSTRUMENTS MAINTENANCE									
BALANCE CARRY FWD FROM 2002-2003 to 2003-2004									
TOTAL	0	0	0	0	0	0	0	0	0
8. SECRETARIAT									
BALANCE CARRY FWD FROM 2002-2003 to 2003-2004		4,590							
Publication of synthesis (Alberta Basement)		5,000							
Publication of synthesis (THOT)		40,000					40,000		
Publication of synthesis (EC SOOT)		37,238				23,020			
Publication of synthesis (WSUP)		40,000					40,000		
Communications funds: \$10K - J. Wilson; \$15K - Key Porter + gst		25,330				23,060			
Publication of synthesis (SNORCLE)		40,000					40,000		
PanLITHO Publication of synthesis + Workshop V expenses		30,000				6,852			
Salaries & benefits for Secretariat staff									
Director: Contrib. Admin Leave & Bonus						50,000			
Director: 50% Salaries for April - June 2003						15,468			
Administrator						43,533			
Student for in the Summer 2003						2,700			
Benefits for above staff						12,368			
Travel (Director & Committees)						31,540			
Equipment & Supplies						16,743			
Communications for 2002-2004 - approved at 2002 BOD mtg		20,541				12,690			
Services for LITHOPROBE new web site						3,646			
Purchase of "Dancing Elephants" for distributions						2,221			
Services for preparing "Dancing Elephants" Teachers' Guide						2,046	4,092		
Internal Transfer (Project related charges from Industry Funds)						28,908			
Refunds: USPG-Eaton/Miller; EC SOOT Transect						(5,448)			
TOTAL	0	242,699	0	0	0	269,347	120,000	(146,648)	242,699
9. DIRECTOR'S CONTINGENCY									
BALANCE CARRY FWD FROM 2002-2003 to 2003-2004		23,060							
*** A total of actual expenses of \$19,161 were reported under Secretariat.									
TOTAL	0	23,060	0	0	0	0	0	23,060	23,060
10. RESERVE FUNDS									
BALANCE CARRY FWD FROM 2002-2003 to 2003-2004									
TOTAL	0	0	0	0	0	0	0	0	0
TOTAL BUDGET	\$0	648,828	\$0	\$79,967	\$65,908	\$399,747	\$183,844	211,112	\$794,703

	NSERC 2004-2005	NSERC c/fwd	GSC funds	Other sources	NSERC transfer	Actual Expenditures	Commitment	Balance	Global funding \$\$ & indirect
REFLECTION SURVEYS									
BALANCE CARRY FWD FROM 2003-2004 to 2004-2005 SNORCLE post-contract studies Yr. 2 awards - R. Clowes		34,058		212,719		10,500			
TOTALS	0	34,058	0	212,719	0	10,500	0	236,277	246,777
ELECTROMAGNETIC SURVEYS									
BALANCE CARRY FWD FROM 2003-2004 to 2004-2005		18,181		81,216					
RESERVE FOR SNORCLE EM surveys/or analyses							5,000		
RESERVE FOR WSUP EM surveys/or analyses						8,000	40,344		
TOTAL	0	18,181	0	81,216	0	8,000	45,344	46,053	99,397
TRANSECT COORDINATION & SYNTHESIS									
BALANCE CARRY FWD FROM 2003-2004 to 2004-2005		42,741							
TOTAL	0	42,741	0	0	0	0	0	42,741	42,741
8. SECRETARIAT									
BALANCE CARRY FWD FROM 2003-2004 to 2004-2005		1,050							
Publication of synthesis (THOT)							40,000		
Publication of synthesis (ECSOOT)									
Publication of synthesis (WSUP)							40,000		
Publication of synthesis (SNORCLE)							40,000		
PanLITHO Publication of synthesis Celebratory Conference						8,886	20,000		
Salaries & benefits for Secretariat staff						45,569			
Administrator						40,179			
J. Amor (Computing work)						4,000			
Student Salaries/Benefits						5,614			
Travel (Director & Committees)						10,000			
Equipment & Supplies						17,270			
Scientific summary volume: publications & associated costs								30,000	
Communications for 2002-2004 - approved at 2002 BOD mtg						17,368			
Adult book on the assembly of a continent							25,000		
Svces for preparing "Dancing Elephants" Teachers' Guide						4,092			
Services for LITHOPROBE new web site (\$110x12mths)						1,760			
Refunds: U. of Manitoba						(8,395)			
TOTAL	0	1,050	0	0	0	146,343	195,000	(340,293)	1,050
DIRECTOR'S CONTINGENCY									
BALANCE CARRY FWD FROM 2003-2004 to 2004-2005		3,899		1,179					
*** A total of actual expenses of \$3,900 were reported under Secretariat.									
TOTAL	0	3,899	0	1,179	0	0	0	5,078	5,078
TOTAL BUDGET	\$0	\$99,929	\$0	\$295,114	\$0	\$164,843	\$240,344	(\$10,144)	\$395,043

APPENDIX A

THE *LITHOPROBE* CELEBRATORY CONFERENCE:

“From Parameters to Processes – Revealing the Evolution of a Continent”
October 12 - 15, 2004 Toronto, Ontario, Canada

Final Program and Associated Social Events [Includes Session Chairs]

Tuesday, October 12, 2004

19:00 – 22:00	Welcoming Reception – Centennial Ballroom, Inn on the Park, 1100 Eglinton Avenue East, Toronto
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Wednesday, October 13, 2004

09:00 – 12:15	MEDIA MORNING CHAIR: Hugh Morris, Padre Resources, Delta, BC
08:30 – 09:00	Pressroom and conference area opens. Posters can be put up throughout morning
09:00 – 09:20	INTRODUCTION: A New View of the Continent Beneath Our Feet: LITHOPROBE's Scientific, Economic and Social Benefits <i>Ron Clowes, Director, LITHOPROBE, U. of British Columbia, Vancouver, BC</i>
09:20 – 09:40	The NSERC perspective on LITHOPROBE <i>Janet Walden, VP, Research Partnerships Program, NSERC, Ottawa, ON</i> LITHOPROBE and the Geological Survey of Canada: A productive partnership <i>Murray Duke, Director-General, Minerals and Regional Geoscience Branch, GSC Ottawa, Ottawa, ON</i> A Few Words from the Original LITHOPROBE Steering Committee <i>William Fyfe, U. of Western Ontario, London, ON</i>
09:40 – 09:55	The Ancient Earth: Development of the Canadian Shield, the oldest parts of North America – building a continental foundation from 4000 to 2500 million years ago <i>John Percival, GSC Ottawa, Ottawa, ON</i>
09:55 – 10:10	The Middle Earth I: Ancient oceanic crust in the middle of the Prairies and formation of the Canadian Shield 2000 to 1800 million years ago <i>David Corrigan, GSC Ottawa, Ottawa, ON</i>
10:10 – 10:25	The Middle Earth II: A Himalayan-scale mountain range through southern Ontario and Quebec – colliding continents enlarge proto-North America from 1100 – 1000 Ma <i>Andrew Hynes, McGill U., Montreal, QC</i>
10:25 – 10:45	BREAK
10:45 – 11:00	The Late Earth I: The story of the Appalachians – Opening and closure of ocean

	basins and the arrival of south American and African pieces in Atlantic Canada <i>Cees van Staal, GSC Ottawa, Ottawa, ON</i>
11:00 – 11:15	The Late Earth II: The story of the Canadian Cordillera – British Columbia grows westward and the Rocky Mountains are formed during the period 200 – 50 Ma <i>Fred Cook, U. of Calgary, Calgary, AB</i>
11:15 – 11:30	LITHOPROBE and the Mining Industry: Diamonds, Earth's mantle and the roots of continents <i>Herman Grutter, Mineral Services Canada, North Vancouver, BC</i>
11:30 – 11:45	LITHOPROBE and the Petroleum Industry: New contributions to regional geological frameworks and exploration for oil and gas deposits <i>Gary Taylor, Past-president, Canadian Society of Exploration Geophysicists, Calgary, AB</i>
11:45 – 12:00	LITHOPROBE and the International Community – a Canadian project, considered the best of its kind in the world, influences scientific approaches in other countries <i>Maarten J. de Wit, U. of Cape Town, South Africa</i>
12:00 – 12:15	“The Big One!”: Megathrust earthquakes and LITHOPROBE on the west coast – contributions to understanding of seismic hazards <i>Roy Hyndman, GSC Pacific, Sidney, BC</i>
12:15 – 13:10	LUNCH at Ontario Science Centre; POSTER viewing
13:10 – 16:50	THE EARLY EARTH – ESTABLISHING THE CRATONS
13:10 - 14:50	CHAIR: Bill Davis, GSC Ottawa, Ottawa, ON
13:10 – 13:50	Recombining the fragmented structure and memory of cratons <i>Maarten J. de Wit, U. of Cape Town, South Africa</i>
13:50 – 14:20	The Slave craton from on top: The crustal view <i>Wouter Bleeker, GSC Ottawa, Ottawa, ON</i>
14:20 – 14:50	The Slave craton from underneath: The mantle view <i>Alan Jones, Dublin Inst. Adv. Studies & GSC Ottawa</i>
14:50 – 15:20	BREAK
15:20 - 16:50	CHAIR: Gordon West, U. of Toronto, Toronto, ON
15:20 – 15:50	The Superior craton – What have we learned from geological, geochemical and geochronological studies? Lessons on the development of the Archean Earth and processes involved <i>Herb Helmstaedt, Queen's U., Kingston, ON</i>
15:50 – 16:20	The Superior craton – What have we learned from reflection, refraction, teleseismic, magnetotelluric and heat flow studies? Lessons on development of the Archean Earth and processes involved <i>Don White, GSC Ottawa, Ottawa, ON</i>
16:20 – 16:50	Orogenic framework for the Superior Province: Dissection of the "Kenoran Orogeny" <i>John Percival, GSC Ottawa, Ottawa, ON</i>
16:50 – 18:20	POSTER SESSION [with refreshments]

Thursday, October 14, 2004

08:20 – 14:00	THE MIDDLE EARTH – STITCHING THE CRATONS AND OTHER EVENTS
08:20 - 10:00	CHAIR: David Symons, U. of Windsor, Windsor, ON
08:20 – 09:00	Progressive proterozoic growth of southern Laurentia by magmatic stabilization of lithosphere, and preservation of proterozoic suture scars in the modern-day lithosphere <i>Karl Karlstrom, U. of New Mexico, Albuquerque, NM</i>
09:00 – 09:30	Probing the Lithosphere of the Wopmay orogen <i>Fred Cook, U. of Calgary, Calgary, AB</i>
09:30 – 10:00	The Trans-Hudson and East Alberta orogens of western Canada – geophysical characteristics of complex collisional processes and delineation of the Sask craton <i>Zoli Hajnal, U. of Saskatchewan, Saskatoon, SK</i>
10:00 – 10:30	BREAK
10:30 - 12:00	CHAIR: Aphrodite Indares, Memorial U., St. John's, NL
10:30 – 11:00	Evolutionary Tectonic Development of the Trans-Hudson orogen - a tale of three cratons, a large ocean, accretionary and collisional tectonics <i>David Corrigan, GSC Ottawa, Ottawa, ON</i>
11:00 – 11:30	Evolution of the Southeastern Churchill Province and development of the Torngat orogen in northeastern Labrador – results from extensive geological and geophysical studies <i>Jeremy Hall, Memorial U., St. John's, NL</i>
11:30 – 12:00	The ascendancy of a late paleoproterozoic and mesoproterozoic tectonic dynasty: An eastern Laurentian perspective <i>Charlie Gower, Geological Survey Mines and Energy, St. John's, NL</i>
12:00 – 13:00	LUNCH at Ontario Science Centre; POSTER viewing
13:00 - 14:30	CHAIR: Sandra Barr, Acadia U., Wolfville, NS
13:00 – 13:30	Architecture and tectonic evolution of the Grenville Province: Part of a hot wide orogen that developed over 200 M.y. on the southeastern margin of Laurentia <i>Toby Rivers, Memorial U., St. John's, NL</i>
13:30 – 14:00	The Grenville orogen of Ontario and New York – A Himalayan-Scale Mountain Belt: Significance of along-strike variations <i>Sharon Carr, Carleton U., Ottawa, ON</i>
14:00 – 16:40	THE LATE EARTH – YOUNG OROGENIC BELTS (I)
14:00 – 14:30	The Northern Appalachian orogen – From rifting and ocean opening to accretion of oceanic terranes and collisional events <i>Cees van Staal, GSC Ottawa, Ottawa, ON</i>
14:30 15:00	BREAK
15:00 - 16:00	CHAIR: Paul Williams, U. of New Brunswick, Fredericton, NB
15:00 – 15:30	The northern Canadian Cordillera - a synthesis of new geological and geophysical results for the Yukon and surrounding areas <i>Jim Mortensen, U. of British Columbia, Vancouver, BC</i>
15:30 – 16:00	The evolving Cordilleran lithosphere <i>Fred Cook, U. of Calgary, Calgary, AB</i>
16:00 – 17:30	POSTER SESSION [with refreshments]
19:00 – 23:00	LITHOPROBE Banquet – Centennial Ballroom, Inn on the Park, 1100 Eglinton Avenue East, Toronto

Friday, October 15, 2004

08:30 – 09:30	THE LATE EARTH – YOUNG OROGENIC BELTS (II)
08:30 - 10:00	CHAIR: John Waldron, U. of Alberta, Edmonton, AB
08:30 – 09:00	Probing the Cordilleran lithosphere with mafic lavas and mantle xenoliths <i>Don Francis, McGill U., Montreal, QC</i>
09:00 – 09:30	Some recurring themes in Cordilleran orogenic evolution: Tectonic heredity, tectonic wedging, and retrograde mantle flow <i>Ray Price, Queen's U., Kingston, ON</i>
09:30 – 12:00	PROCESSES IN EARTH – HOW THE PLANET WORKS (I)
09:30 – 10:00	An 1800-km cross section of the lithosphere through the northwestern North American plate: Lessons from 4.0 billion years of Earth's history <i>Fred Cook, U. Calgary, Calgary, AB</i>
10:00 – 10:30	BREAK
10:30 - 12:00	CHAIR: Charlotte Keen, GSC Atlantic, Dartmouth, NS
10:30 – 11:00	Geodynamical modeling of collisional orogens: from small-cold to large-hot orogens and applications to LITHOPROBE problems <i>Chris Beaumont, Dalhousie U., Halifax, NS</i>
11:00 – 11:30	Coupled mantle-crust dynamics and its relevance for tectonic processes – Effect of mantle dynamics and properties on lithospheric structure <i>Russ Pysklywec, U. Toronto, Toronto, ON</i>
11:30 – 12:00	Metamorphic-tectonic interactions in large hot orogens: Lower crustal flow in the central Gneiss Belt, western Grenville Province <i>Becky Jamieson, Dalhousie U., Halifax, NS</i>
12:00 – 13:00	LUNCH at Ontario Science Centre; POSTER viewing
13:00 – 14:00	PROCESSES IN EARTH – HOW THE PLANET WORKS (II)
13:00 - 14:30	CHAIR: Henry Halls, U. of Toronto, Toronto, ON
13:00 – 13:30	Precambrian mafic magmatism: An overview <i>Larry Heaman, U. of Alberta, Edmonton, AB</i>
13:30 – 14:00	Secular changes in tectonic evolution and the growth of continental lithosphere <i>Tom Skulski, GSC Ottawa, Ottawa, ON</i>
14:00 – 16:00	THE RESOURCEFUL EARTH – SUSTAINING AND ENDANGERING LIFE ON THE PLANET
14:00 – 14:30	Enhancing base metal exploration through seismic reflection studies adapted for the crystalline rock environment <i>David Eaton, U. Western Ontario, London, ON</i>
14:30 – 15:00	BREAK
15:00 - 16:30	CHAIR: Walter Mooney, US Geological Survey, Menlo Park, CA
15:00 – 15:30	Diamonds and kimberlite intrusions – contributions from LITHOPROBE and related geophysical, geochemical and petrological studies <i>David Snyder, GSC Ottawa, Ottawa, ON</i>
15:30 – 16:00	Giant earthquakes beneath Canada's west coast <i>Roy Hyndman, GSC Pacific, Sidney, BC</i>
16:00 – 16:30	LITHOPROBE - A legacy of benefits to Canada <i>Ron Clowes, Director, LITHOPROBE, U. of British Columbia, Vancouver, BC</i>
16:30 – 18:00	POSTER SESSION [with refreshments]

∞ End of Conference ∞

APPENDIX B

LITHOPROBE PUBLICATIONS BY TRANSECT, AND REPORT LIST (Past 3 years)

[Only publications listed, published or in press since preparation of the 2000-01 to 2001-02 Progress Report in January 2002 are included. The total number of publications in this list is 195.]

NOTE: An "R" beside a number indicates a refereed publication.

B.1 SOUTHERN CORDILLERA

- 1236.^R Ledo, J. and A.G. Jones 2001. Regional electrical resistivity structure of the southern Canadian Cordillera and its physical interpretation. *Journal of Geophysical Research*, **106**: 30755-30769.
- 1252.^R Clowes, R.M. and R.D. Hyndman 2002. Geophysical studies of the northern Cascadia subduction zone off western Canada and their implications for great earthquake seismotectonics: A review. *In* Seismotectonics in Convergent Plate Boundary, Y. Fujinawa and A. Yoshida (editors), TERRAPUB, Tokyo, 1-23.
- 1284.^R Monger, J. and R. Price 2002. The Canadian Cordillera: Geology and tectonic evolution. *CSEG Recorder*, **27**: 17-36.

B.2 LITHOPROBE EAST

- 1283.^R Jackson, H.R. 2002. Seismic refraction profiles in the Gulf of Saint Lawrence and implications for extent of continuous Grenville lower crust. *Canadian Journal of Earth Sciences*, **39**: 1-17.
- 1285.^R Loudon, K. 2002. Tectonic evolution of the east coast of Canada. *CSEG Recorder*, **27**: 37-48.
- 1335.^R Zhang, S. and C.R. Barnes 2004. Late Cambrian and Early Ordovician conodont communities from platform, shelfbreak and slope facies, western Newfoundland: a statistic approach. *Journal of the Geological Society, London, Special Publication*, **230**: 47-72.
- 1336.^R Zhang, S. and C.R. Barnes 2004. Arenigian (Early Ordovician) sea level history and the response of shelf and slope conodont communities, western Newfoundland. *Canadian Journal of Earth Sciences, Special Publication*, **41**: 843-865.
- 1357.^R van der Velden, A.J., C.R. van Staal and F.A. Cook 2004. Attempted subduction of Ganderia beneath Laurentia: a Lithoprobe seismic reflection survey of the Newfoundland Appalachians. *Geological Society of America Bulletin*, **116**: 1485-1498.

B.3 ABITIBI-GRENVILLE

- 1246.^R Tournerie, B. and M. Chouteau 2002. Analysis of magnetotelluric data along the Lithoprobe Seismic Line 21 in the Blake River Group, Abitibi, Canada. *Earth Planet Space*, **54**: 575-589.
- 1247.^R Chown, E.H., R. Harrap and A. Moukhsil 2002. The role of granitic intrusions in the evolution of the Abitibi belt, Canada. *Precambrian Research*, **115**: 291-310.
- 1251.^R Mueller, W.U. and J.K. Mortensen 2002. Age constraints and characteristics of subaqueous volcanic construction, the Archean Hunter Mine Group. Abitibi greenstone belt. *Precambrian Research*, **115**: 119-152.
- 1258.^R Daigneault, R., W.U. Mueller and E.H. Chown 2002. Oblique Archean subduction: accretion and exhumation of an oceanic arc during dextral transpression, southern volcanic Zone, Abitibi Subprovince Canada. *Precambrian Research*, **115**: 261-290.
- 1271.^R Davis, D.W. 2002. U-Pb geochronology of Archean metasedimentary rocks in the Pontiac and Abitibi subprovinces, Québec, constraints on timing, provenance and regional tectonics. *Precambrian Research*, **115**: 97-117.

- 1276.^R Mueller, W.U., R. Marquis and P.C. Thurston 2002. Evolution of the Archean Abitibi greenstone belt and adjacent terranes: new insights from geochronology, geochemistry, structure, and facies analysis. *Precambrian Research*, **115**: 1-9.
- 1323.^R Wyman, D.A. and R. Kerrich 2002. Formation of Archean continental lithospheric roots: The role of mantle plumes. *Geology*, **30**: 543-546.
- 1325.^R Daigneault, R., W.U. Mueller and E.H. Chown 2004. Abitibi greenstone belt plate tectonics: the diachronous history of arc development, accretion and collision. Pat Eriksson, Wlady Altermann, David Nelson, Wulf U Mueller, and Octavian Catuneanu (editors). *The Precambrian Earth: tempos and events in Developments in Precambrian Geology 12*, Elsevier, 88-103 pages.
- 1349.^R Indares, A. and G. Dunning 2003. Crustal architecture above the high-P Belt of the Grenville Province in the Manicouagan area: new structural, petrologic and U/Pb age constraints. *Precambrian Research*, **136**: 199-228.
- 1380.^R O'Dowd, C.R., D. Eaton, D. Forsyth and H.W. Asmis 2004. Structural fabric of the Central Metasedimentary Belt of southern Ontario, Canada, from deep seismic profiling. *Tectonophysics*, 388: 145-159.
- 1418.^R Schwerdtner, W.M., U.P. Riller and A. Borowik 2005. Structural testing of tectonic hypotheses by field-based analysis of distributed tangential shear: examples from major high-strain zones in the Grenville Province and other parts of the southern Canadian Shield. *Canadian Journal of Earth Sciences*, accepted.

B.4 TRANS-HUDSON OROGEN TRANSECT (THOT)

- 1278.^R Rolandone, F., C. Jaupart, J.C. Mareschal, C. Gariépy, G. Bienfait, C. Carbone and R. Lapointe 2002. Surface heat flow, crustal temperatures, and mantle heat flow in the Proterozoic Trans-Hudson Orogen, Canadian Shield. *Journal of Geophysical Research*, 107(B12), 2341, doi:10.1029/2001JB000698.
- 1279.^R White, D.J., S.B. Lucas, W. Bleeker, Z. Hajnal, J.F. Lewry and H.V. Zwanig 2002. Suture-zone geometry along an irregular Paleoproterozoic margin: The Superior boundary zone, Manitoba, Canada. *Geology*, **30** (no. 8): 735-738.
- 1342.^R Fedorowich, J.S., M.R. Stauffer, R. Kerrich and J.F. Lewry 2003. Thermochronology of the Needle Falls Shear Zone: a post-collisional high-strain zone of the Trans-Hudson Orogen. *Canadian Journal of Earth Sciences*, **40**: 1009-1025.
- 1360.^R Ashton, K.E., J.F. Lewry, L.M. Heaman, R.P. Hartlaub and M.R. Stauffer 2005. The Pelican Thrust Zone: Basal detachment between the Archean Sask Craton and Paleoproterozoic Flin Flon-Glennie Complex, western Trans-Hudson Orogen. *Canadian Journal of Earth Sciences*, in press.
- 1371.^R Mareschal, J.C., C. Jaupart, F. Rolandone, C. Gariépy, C.M.R. Fowler, G. Bienfait, C. Carbonne, and R. Lapointe 2005. Heat flow, thermal regime, and elastic thickness of the lithosphere in the Trans-Hudson Orogen. *Canadian Journal of Earth Sciences*, in press.
- 1375.^R Bickford, M.E., T. D. Mock, W.E. Steinhart III, K. D. Collerson and J. F. Lewry 2005. Origin of the Sask craton and its extent within the Trans-Hudson Orogen: Evidence from Pb and Nd isotopic compositions of basement rocks and post-orogenic intrusions. *Canadian Journal of Earth Sciences*, in press.
- 1378.^R Ansdell, Kevin M., Larry M. Heaman, Nuno Machado, Richard A. Stern, David Corrigan, Pat Bickford, Irvine R. Annesley, Christian O. Böhm, Herman V. Zwanig, Al H. Bailes, Ric Syme, Tim Corkery, Ken E. Ashton, Ralf O. Maxeiner, Gary M. Yeo, and Gary D. Delaney 2005. Correlation Chart of the evolution of the Trans-Hudson Orogen - Manitoba-Saskatchewan segment. *Canadian Journal of Earth Sciences*, in press.
- 1379.^R Symons, D.T.A. and M.J. Harris 2005. Accretion history of the Trans-Hudson Orogen in Manitoba and Saskatchewan from paleomagnetism. *Canadian Journal of Earth Sciences*, in press.
- 1386.^R Garcia, Xavier and Alan G. Jones 2005. Electromagnetic Image of the Trans-Hudson orogen – THO94 transect. *Canadian Journal of Earth Sciences*, in press.

- 1387.^R Cholach, Pavlo Y., Joseph B. Molyneux and Douglas R. Schmitt 2005. Flin Flon Belt seismic anisotropy: elastic symmetry, heterogeneity, and shear wave. *Canadian Journal of Earth Sciences*, in press.
- 1390.^R Hajnal, Z., J. Lewry, D. White, K. Ashton, R. Clowes, M. Stauffer, I. Gyorfi and E. Takacs 2005. Outlining the Sask Craton: Seismic Reflection Studies of the Western Trans-Hudson Orogen. *Canadian Journal of Earth Sciences*, in press.
- 1392.^R White, D.J., M.D. Thomas, A.G. Jones, J. Hope, B. Nemeth and Z. Hajnal 2005. Geophysical Transect across a paleoproterozoic continent-continent collision zone: The Trans-Hudson Orogen. *Canadian Journal of Earth Sciences*, in press.
- 1396.^R Ferguson, I.J., K. Stevens and A.G. Jones 2005. Electrical-resistivity imaging of the central Trans-Hudson Orogen in eastern Saskatchewan, Canada. *Canadian Journal of Earth Sciences*, in press.
- 1399.^R Jones, A.G., J. Ledo and I.J. Ferguson 2005. Electromagnetic images of the Trans-Hudson orogen: The North American Central Plains (NACP) anomaly revealed. *Canadian Journal of Earth Sciences*, in press.
- 1401.^R Németh, B., R.M. Clowes and Z. Hajnal 2005. Crustal structure of the Trans-Hudson Orogen from seismic refraction/wide-angle reflection studies. *Canadian Journal of Earth Sciences*, in press.
- 1402.^R Corrigan, D., Z. Hajnal, B. Németh and S. Lucas 2005. Tectonic framework of a Paleoproterozoic arc-continent to continent-continent collisional zone, Trans-Hudson Orogen, from geological and seismic reflection studies. *Canadian Journal of Earth Sciences*, in press.
- 1403.^R Ansdell, K.M. 2005. Tectonic evolution of the Manitoba-Saskatchewan segment of the Paleoproterozoic Trans-Hudson Orogen, Canada. *Canadian Journal of Earth Sciences*, in press.
- 1404.^R Tran, H.T., K. Ansdell, K. Bethune, B. Watters and K. Ashton 2003. Nd isotope and geochemical constraints on the depositional setting of paleoproterozoic metasedimentary rocks along the margin of the Archean Hearne craton, Saskatchewan, Canada. *Precambrian Research* **123**: 1-28.
- 1410.^R Gorman, A.R., B. Németh, R.M. Clowes and Z. Hajnal 2005. An investigation of upper mantle heterogeneity beneath the Archean and Proterozoic crust of western Canada from Lithoprobe controlled-source seismic experiments. *Physics of the Earth and Planetary Interiors*, in press.
- 1411.^R Annesley, I.R., C. Madore and P. Portella 2005. Geology and thermotectonic evolution of the north western margin of the THO: evidence from the eastern sub-Athabasca basement, Saskatchewan. *Canadian Journal of Earth Sciences*, in press.
- 1415.^R Ansdell, K.M., Z. Hajnal and K.E. Ashton 2005. Introduction to the Trans-Hudson Orogen Transect of Lithoprobe. *Canadian Journal of Earth Sciences*, in press.
- 1419.^R White, D.J. 2005. High-temperature, low-pressure metamorphism in the Kiseynew domain, Trans-Hudson orogen: crustal anatexis due to tectonic thickening? *Canadian Journal of Earth Sciences*, in press.

B.5 ALBERTA BASEMENT

- 1229.^R Gorman, A.R., R.M. Clowes, R.M. Ellis, T.J. Henstock, G.D. Spence, G.R. Keller, A. Levander, C.M. Snelson, M.J.A. Burianyk, E.R. Kanasewich, I. Asudeh, Z. Hajnal and K.C. Miller 2002. Deep Probe: imaging the roots of western North America. *Canadian Journal of Earth Sciences*, **39**: 375-398.
- 1239.^R Clowes, R.M., M.J.A. Burianyk, A.R. Gorman and E.R. Kanasewich 2002. Crustal velocity structure from SAREX, the Southern Alberta Refraction Experiment. *Canadian Journal of Earth Sciences*, **39**: 351-373.
- 1242.^R Ross, G.M. and D.W. Eaton 2002. Proterozoic tectonic accretion and growth of western Laurentia: Results from Lithoprobe studies in northern Alberta. *Canadian Journal of Earth Sciences*, **39**: 313-329.
- 1259.^R Ross, G.M., M.E. Villeneuve and R.J. Theriault 2001. Isotopic provenance of the lower Muskwa assemblage (Mesoproterozoic, Rocky Mountains, British Columbia): new clues to correlation and source areas. *Precambrian Research* **111**: 57-77.

- 1272.^R Ross, G.M. 2002. Evolution of Precambrian continental lithosphere in Western Canada: results from Lithoprobe studies in Alberta and beyond. *Canadian Journal of Earth Sciences*, **39**: 413-437.
1273. Da Roza, R.J., W.F. Miles and G.M. Ross 2002. Virtual 3D Digital Elevation Model (DEM) - Alberta & B.C. GSC Open File, in press.
1274. Da Roza, R.J., W.F. Miles and G.M. Ross 2002. Virtual 3D Aeromagnetics with the Digital Elevation Model (DEM) – Alberta & B.C. GSC Open File, in press.
- 1277.^R Hope, J. and D.W. Eaton 2002. Crustal structure beneath the Western Canada Sedimentary Basin: constraints from gravity and magnetic modelling. *Canadian Journal of Earth Sciences*, **39**: 291-312.
- 1287.^R Bouzidi, Y., D.R. Schmitt, R.A. Burwash and E.R. Kanasewich 2002. Depth migration of deep seismic reflection profiles: crustal thickness variations in Alberta. *Canadian Journal of Earth Sciences*, **39**: 331-350.
- 1288.^R Shragge, J., M.G. Bostock, C.G. Bank and R.M. Ellis 2002. Integrated teleseismic studies of the southern Alberta upper mantle. *Canadian Journal of Earth Sciences*, **39**: 399-411.
- 1289.^R Ross, G.M. 2002. Introduction to special issue of *Canadian Journal of Earth Sciences*: the Alberta Basement Transect of Lithoprobe. *Canadian Journal of Earth Sciences*, **39**: 287-290.
- 1294.^R Ross, G.M. (Editor) 2002. The LITHOPROBE Alberta Basement Transect. *Canadian Journal of Earth Sciences*. **39**, 287-437.
- 1295.^R Ross, G.M. (Editor) 1999. The LITHOPROBE Alberta Basement Transect. *Bulletin of Canadian Petroleum Geology*, **47**: 331-594..
- 1303.^R Jones, F.W., R.A. Munro, J.A. Craven, D.E. Boerner, R.D. Kurtz and R.D. Sydora 2002. Regional geoelectrical complexity of the Western Canada Basin from magnetotelluric tensor invariants. *Earth, Planets and Space*, **54 (9)**: 899-905.

B.6 EASTERN CANADIAN SHIELD ONSHORE-OFFSHORE TRANSECT (ECSOOT)

- 1248.^R James, D.T., S. Kamo and T. Krogh 2001. Evolution of 3.1 and 3.0 Ga volcanic belts and a new thermotectonic model for the Hopedale Block, North Atlantic Craton (Canada). *Canadian Journal of Earth Sciences*, **39**: 687-710.
- 1250.^R Scott, D.J., R.A. Stern, M.R. St-Onge and S.M. McMullen 2002. U-Pb geochronology of detrital zircons in metasedimentary rocks from southern Baffin Island: implications for the Paleoproterozoic tectonic evolution of Northeastern Laurentia. *Canadian Journal of Earth Sciences*, **39**: 611-623.
- 1254.^R Culshaw, N., P. Reynolds, G. Sinclair and S. Barr 2002. Amphibole and mica ⁴⁰Ar/³⁹Ar ages from the Kaipokok and Aillik domains, Makkovik Province, Labrador: towards a characterization of back-arc processes in the Paleoproterozoic. *Canadian Journal of Earth Sciences*, **39**: 749-764.
- 1256.^R Bourlon, E., J.C. Mareschal, W.R. Roest and H. Tilmat 2002. Geophysical correlations in the Ungava Bay area. *Canadian Journal of Earth Sciences*, **39**: 625-637.
- 1263.^R Sinclair, G.S., S.M. Barr, N.G. Culshaw and J.W.F. Ketchum 2002. Geochemistry and age of the Aillik Group and associated plutonic rocks, Makkovik Bay area, Labrador: implications for tectonic development of the Makkovik Province. *Canadian Journal of Earth Sciences*, **39**: 731-748.
- 1267.^R Ketchum, J., N.G. Culshaw and S.M. Barr 2002. Anatomy and orogenic history of a Paleoproterozoic accretionary belt: the Makkovik Province, Labrador, Canada. *Canadian Journal of Earth Sciences*, **39**: 711-730.
- 1282.^R Wardle, R.J., D.T. James, D.J. Scott and J. Hall 2002. The Southeastern Churchill Province: synthesis of a Paleoproterozoic transpressional orogen. *Canadian Journal of Earth Sciences*, **36**: 639-663.

- 1286.^R van Gool, J.A.M., J.N. Connelly, M. Marker and F.C. Mengel 2002. The Nagssugtoqidian Orogen of West Greenland: tectonic evolution and regional correlations from a West Greenland perspective. *Canadian Journal of Earth Sciences*, **39**: 665-686.
- 1290.^R Rivers, T., J. Ketchum, A. Indares and A. Hynes 2002. The High Pressure belt in the Grenville Province: architecture, timing and exhumation. *Canadian Journal of Earth Sciences*, **39**: 867-893.
- 1291.^R Hall, J., K.E. Loudon, T. Funck and S. Deemer 2002. Geophysical characteristics of the continental crust along the Lithoprobe Eastern Canadian Shield Onshore-Offshore Transect (ECSOOT): a review. *Canadian Journal of Earth Sciences*, **36**: 569-587.
- 1292.^R Palmer, S. E., J.W.F. Waldron and D.M. Skilliter 2002. Post-Taconian shortening, inversion and strike slip in the Stephenville area, western Newfoundland Appalachians. *Canadian Journal of Earth Sciences*, in press.
- 1305.^R St-Onge, M.R., D.J. Scott and N. Wodicka 2002. Review of crustal architecture and evolution in the Ungava Peninsula – Baffin Island area: connection to the Lithoprobe ECSOOT transect. *Canadian Journal of Earth Sciences*, **39**: 589-610.
- 1306.^R Garde, A.A., M.A. Hamilton, B. Chadwick, J. Grocott and K.J.W. McCaffrey 2002. The Ketilidian orogen of South Greenland: geochronology, tectonics, magmatism, and fore-arc accretion during Paleoproterozoic oblique convergence. *Canadian Journal of Earth Sciences*, **39**: 765-793.
- 1307.^R Gower, C.F. and T.E. Krogh 2002. A U-Pb geochronological review of the Proterozoic history of the eastern Grenville Province. *Canadian Journal of Earth Sciences*, **39**: 795-829.
- 1308.^R Krogh, T.E., S. Samo, C.F. Gower and J.V. Owen 2002. Augmented and reassessed U-Pb geochronological data from the Labradorian-Grenvillian front in the Smokey archipelago, eastern Labrador. *Canadian Journal of Earth Sciences*, **39**: 831-843.
- 1309.^R Heaman, L.M., P. Erdmer and J.V. Owen 2002. U-Pb geochronologic constraints on the crustal evolution of the Long Range Inlier, Newfoundland. *Canadian Journal of Earth Sciences*, **39**: 845-865.
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B.11 LITHOPROBE REPORT LIST (APPENDIX to LITHOPROBE PUBLICATION LIST)

[Only reports listed since preparation of the 2000-2001 and 2001-2002 Progress Report in January 2002 are included.]

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| 82. | Feb 21-24, 2002
(Sidney, BC) | SNORCLE Transect and Cordilleran Tectonics Workshop |
| 83. | July 2002 | Slave-Northern Cordillera Refraction Experiment (SNORE'97):
Field Acquisition and Preliminary Data Processing Report |
| 84. | Sep 25-Oct 2, 2004
(Mont-Tremblant, QC) | The 11 th International Symposium on Deep Seismic Profiling of the
Continents and their Margins - programme and abstracts |
| 85. | Sep 25-Oct 2, 2004
(Mont-Tremblant, QC) | The 11 th International Symposium on Deep Seismic Profiling of the
Continents and their Margins - post conference field guide |
| 86. | Oct 12-15, 2004
(OSC, Toronto) | LITHOPROBE - The Celebratory Conference (Programme & Abstracts) |
| 87. | October, 2004 | Teachers' Companion Material - Dancing Elephants and Floating Continents |

B.12 LITHOPROBE Electronic Publications List (APPENDIX to LITHOPROBE PUBLICATION LIST)

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| E-pub 1 | Title for KSZ Transect CD (not yet received) |
| E-pub 2 | Hynes, A. and L. Morotti (compilers) 2002. The LITHOPROBE Abitibi-Grenville Transect - CD. Published by the LITHOPROBE Secretariat, University of British Columbia, Vancouver, Canada, E-Publication No. 2. |
| E-pub 3 | Title for ABT Transect CD (not yet received) |
| E-pub 4 | Wardle, R., J. Hall and P. Honarvar (compilers) 2002. The LITHOPROBE Eastern Canadian Shield Onshore-Offshore Transect (ECSOOT) - Transect Synthesis. Published by the LITHOPROBE Secretariat, University of British Columbia, Vancouver, Canada, E-Publication No. 4. |
| E-pub 5 | Clowes, R.M. and C. Li (compilers), 2005. LITHOPROBE Celebratory Conference Oral and Poster Presentations. Published by the LITHOPROBE Secretariat, University of British Columbia, Vancouver, Canada, E-Publication No. 5, 2 CDs. |