

SIMON FRASER UNIVERSITY

OFFICE OF THE VICE-PRESIDENT, ACADEMIC

MEMORANDUM

To: Senate

From: D. Gagan 
Chair, Senate Committee on Academic Planning

Subject: Revised M.Sc. Program in Earth Sciences

Date: April 11, 1996

Action undertaken by the Senate Graduate Studies Committee and the Senate Committee on Academic Planning gives rise to the following motion:

Motion:

"That Senate approve and recommend to the Board of Governors as set forth in S.96 - 38 , the proposed revised M.Sc. in Earth Sciences"

SIMON FRASER UNIVERSITY**MEMORANDUM**

To: Alison Watt, Secretary
Senate Committee on Academic
Planning

From: B.P. Clayman
Vice-President Research/
Dean of Graduate Studies

Subject: Proposed M.Sc. in Earth
Sciences

Date: March 26, 1996

The proposed Master of Science Program in Earth Sciences was approved by the Senate Graduate Studies Committee, at its Meeting on March 25, 1996, and is now being forwarded to the Senate Committee on Academic Planning for approval.



B.P. Clayman
Vice-President Research/
Dean of Graduate Studies

The following courses are part of the M.Sc. Earth Sciences

EASC 600-0	Introduction to Graduate Studies
EASC 611-3	Sedimentology
EASC 612-3	Stratigraphy
EASC 613-3	Groundwater Hydrology
EASC 614-3	Subsurface Techniques
EASC 615-3	Applied Geophysics
EASC 616-3	Fluvial Systems
EASC 617-3	Quaternary Geology
EASC 618-3	Structural Geology
EASC 619-3	Environmental Geoscience
EASC 701-1	Special Topics in Earth Sciences I
EASC 702-2	Special Topics in Earth Sciences II
EASC 703-3	Special Topics in Earth Sciences III
EASC 898	M.Sc. Thesis (Earth Science)

SIMON FRASER UNIVERSITY

GS.96.10

DEAN OF GRADUATE STUDIES

Memorandum

TO: B. P. Clayman
Dean, and Chair,
Senate Graduate Studies Committee

FROM: Phyllis Wrenn
Associate Dean
Chair, ACNGP

SUBJECT: Proposal for MSc in Earth Sciences **DATE:** March 6, 1996

I am pleased to report that the Assessment Committee for New Graduate Programs (ACNGP) has approved and recommends to the SGSC for approval the proposal for a **Master of Science in Earth Sciences**. The first draft of the proposal was received on April 26, 1995.

Please place this proposal on the agenda of the next meeting of the SGSC. By copy of this memorandum, I am inviting E. Hickin or his designate to attend this meeting as a representative of the proposed program.

Phyllis M. Wrenn

Encl.

c: E. Hickin
M. Roberts
M. McGinn

THE EARTH SCIENCES PROGRAM (EASC)
Faculty of Science

THE GRADUATE PROGRAM

I GENERAL INFORMATION

1. Title of program: Earth Sciences Graduate Program
2. Credential to be awarded to graduates: Master of Science, M.Sc.
3. Faculty & unit to offer program: Faculty of Science, Earth Sciences Program
4. Date of Senate approval: The Graduate Program in Earth Sciences was approved by the Senate and Board of Governors in October 1988.
5. Schedule of implementation: The Earth Sciences Program was first funded by the Academic Enhancement Fund and the Faculty of Science in 1993. Five faculty have been appointed and an additional position authorized for 1995/6. It is planned to admit the first graduate students in September, 1996 (as specified in the Calendar).

II PROGRAM DESCRIPTION AND RELATED MATTERS

1. Objectives: To provide research training and experience for earth scientists and to meet the University commitment to the research programs of the Earth Science faculty members.
2. In relation to the role and mission of the University: The Earth Sciences graduate Program will diversify the research and graduate educational experience offered in the Faculty of Science and in the University and will significantly strengthen the Faculty's role in environmental education on campus. Furthermore, it will allow the Earth Science faculty members to mount their research programs.
3. In relation to programs at other institutions: In the sense that the SFU Earth Sciences Graduate Program is designed to attract students in the environmental/Quaternary/"soft-rock" areas, it most closely parallels the Environmental Sciences Program at the University of Waterloo and contrasts sharply with the "hard-rock" and prospecting focus of most other geology programs.

4. Complementarity and distinctiveness: Since SFU has no other geology program, the EASC graduate program is distinct from other graduate programs at SFU. It complements the Physical Geography M.Sc. Program and may lead to some interaction of students and sharing of resources if that is seen to be mutually beneficial.

5. Curriculum: The Earth Sciences M.Sc. program conforms structurally to the other M.Sc. programs offered by the Faculty of Science. It is based on a mentoring/apprenticeship model in which the role of the Senior Supervisor and the thesis are central to the degree. In addition, the completion of five graduate courses are required from the Earth Science courses listed below or in certain circumstances from those in other programs.

EASC courses:

EASC 600-0	Introduction to Graduate Studies (a mandatory non-credit course)
EASC 611-3	Sedimentology
EASC 612-3	Stratigraphy
EASC 613-3	Groundwater Hydrology
EASC 614-3	Subsurface Techniques
EASC 615-3	Applied Geophysics
EASC 616-3	Fluvial Systems
EASC 617-3	Quaternary Geology
EASC 618-3	Structural Geology
EASC 619-3	Environmental Geoscience

EASC 701-1	Special Topics in Earth Sciences I
EASC 702-2	Special Topics in Earth Sciences II
EASC 703-3	Special Topics in Earth Sciences III

EASC 898	M.Sc. Thesis (Earth Science)
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III NEED FOR THE PROGRAM

1. General: As predicted in the 1988 program rationale, the demand in industry and government for geoscientists broadly trained in environmental geology has grown significantly to date. The demand for graduate-level environmental geoscientists

currently far outpaces the very limited supply. The Provincial Ministry of Forests, for example, are unable to fill most of the regional environmental geology/geomorphology positions required under the Forest Practices Code. Similarly, shortages of geoscientists to undertake environmental geoscience in watershed restoration and management in industry has pushed starting salaries to the Associate Professor range during the last two years. These circumstances are recognized by the External Reviewers and are confirmed by the Association of Professional Engineers and Geoscientists of British Columbia (Dr Gerath's letter is appended).

2. Student demand: In this climate of strong interest in environmental geology there is a strong and growing client interest in graduate degrees in this area. The Earth Sciences faculty have received numerous enquiries from prospective students about graduate studies and experience in the Physical Geography Program suggests that the Earth Sciences M.Sc. Program will be in a position to be quite selective even at the first student intake.

The Earth Sciences M.Sc. Program likely will not exceed 12-15 students in its first few years of operation and likely will remain small in the intermediate term (~20 students).

3. Types of jobs: The Earth Sciences M.Sc. will qualify its candidates immediately for many supervisory/project director - type geoscience positions in government and industry. Depending on their first degree background (geology, geological engineering, environmental science, physical geography) graduates of the Earth Sciences M.Sc. program will find management-training positions as engineers, geologists, and professional geoscientists.

IV PRESENT AND PROJECTED RESOURCES

1. Administrative personnel: Resources for the EASC M.Sc. Program have been committed by The Dean of Science and the Academic Enhancement Fund. An EASC Program Assistant and Laboratory Instructor have been appointed. A secretarial position will be added when Program growth warrants the appointment.

2. Faculty: Five faculty are already hired and the search for a sixth currently is underway. Three additional faculty will be appointed over the next several years.

3. Library resources: Library resources are adequate in the main and deficiencies will be met through committed money in the Program Operating Budget.

4. Capital costs: Present needs have been met by the Dean of Science and future offices and labs will be allocated as needed by the Faculty of Science.

5. Faculty research awards: All faculty are established scientists and are NSERC supported or have applied for the first time this year. Industry funding in kind has been very generous (Pan Pacific has made a large gift of core samples for teaching and research) and Geological Survey of Canada geoscientists are committed to developing cooperative research projects with the new SFU EASC M.Sc. Program (Three senior GSC research scientists are waiting on the Earth Science M.Sc. Program implementation in order to formalize Adjunct status with the Program.

CALENDAR ENTRY

Earth Science Program

Location: SSB 8103
Telephone: 291- 4657
Director: M.C.Roberts BSc (Lond), MA (Tor), PhD (Iowa), PGeo
Graduate Program Chair: E.J. Hickin BA, PhD (Syd), PGeo

Faculty and Areas of Research

E.J. Hickin	Fluvial geomorphology and sedimentology
J.A. MacEachern	Ichnology, sedimentology, stratigraphy of clastic rocks
P.S. Mustard	Cordilleran sedimentary basins
M.C.Roberts	Geomorphology, modern deltaic environments
D. J. Thorkelson	Cordilleran tectonics

MSc Program

The Earth Sciences Program offers an M.Sc. degree in Earth Sciences, with emphases on earth surface processes and environmental geoscience, surficial and Quaternary geology, and sedimentology.

Admission

For admission requirements, refer to the General Graduate Regulations. Students should normally have a B.Sc. degree, or equivalent, in an honours program with at least a good second-class standing (3.0 GPA) in the Earth Sciences (for example: geology, geological engineering, geophysics, geomorphology, soil science, or physical geography).

Degree Requirements

Course Work

All students in the program will be required to take EASC 600 (Introduction to Graduate Studies) and a minimum of 12 semester hours composed of at least four courses from the list below, or with the Graduate Chair's approval, from related graduate course offerings in other Departments such as Geography, Chemistry, Physics, Biological Sciences, and Natural Resources and Environmental Management. Course selections will include no more than 3

credit hours from 700-numbered Earth Sciences courses. In addition a thesis is required for the degree. The actual course selection will be a reflection of the student's research interest and guidance from the Advisor.

Research

Graduates of this program will be required to conduct original research and report their results in a thesis.

Graduate Courses

EASC 600-0	Introduction to Graduate Studies
EASC 611-3	Sedimentology
EASC 612-3	Stratigraphy
EASC 613-3	Groundwater Hydrology
EASC 614-3	Subsurface Techniques
EASC 615-3	Applied Geophysics
EASC 616-3	Fluvial Systems
EASC 617-3	Quaternary Geology
EASC 618-3	Structural Geology
EASC 619-3	Environmental Geoscience
EASC 701-1	Special Topics in Earth Sciences I
EASC 702-2	Special Topics in Earth Sciences II
EASC 703-3	Special Topics in Earth Sciences III
EASC 898	M.Sc. Thesis (Earth Science)

X-Sender: gobas@popserver.sfu.ca
X-Sender: gobas@popserver.sfu.ca
Mime-Version: 1.0
Date: Mon, 04 Mar 1996 08:19:55 -0800
To: hickin@sfu.ca (Ted Hickin)
From: gobas@sfu.ca
Subject: Re: Earth Science graduate courses

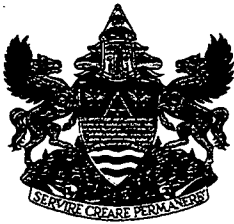
Dear Ted

This is to confirm that there appears to be no significant overlap in the course contents of the proposed Earth Sciences program with current courses being offered in REM. The only REM course that has some overlap with the proposed Earth Sciences curriculum is MRM631 (Geomorphology). However, I do not think that this overlap is significant. MRM631 is an applied course focussing on streams and river morphology with a focus on site remediation.

If you wish to discuss in more detail, please let me know.

Regards

Frank Gobas



The Association of
PROFESSIONAL ENGINEERS AND GEOSCIENTISTS
of the Province of British Columbia

February 20, 1996

**Simon Fraser University
Earth Sciences Program
Burnaby, British Columbia
V5A 1S6**

**Attention: Dr. Michael Roberts, P.Geo.
Chair, Earth Sciences Program**

Dear Dr. Roberts,

It has come to our attention that there may be some concern at Simon Fraser University over the marketability of graduate students from your new Earth Sciences Program.

It may be important to note that the practices of geoscience and engineering in B.C. are legally limited to members of our Association. Our academic training standards in geoscience are higher than any other province in Canada, and most U.S. states. These standards reflect unique geoscience challenges in British Columbia.

There is a very high demand for professional geoscientists with academic training or experience in Quaternary geology, geomorphology, aerial photo interpretation, hydrology, environmental geoscience, slope hazard work, and broad geology skills. Salaries are correspondingly high.

The demand is driven by legislation such as the B. C. Forest Practices Code, elements of the B. C. Municipal Act, and growing unease over seismic risks in the lower mainland. Current need is expressed by forest companies, consultants, and the Provincial Government. The demand has never been as high as it is at present; it will extend well into the future.

Until May, 1994, I was a practicing (20-yr) professional geoscientist (geotechnics) with a major geotechnical engineering company in Vancouver. Over 30 years ago, this company recognized

the importance of interactions between engineers and geoscientists. It and many other such companies generally hire professional personnel at an M.Sc. level.

The Association of Professional Engineers and Geoscientists of B.C. strongly encourages Simon Fraser University to develop a graduate program in Earth Sciences. I can also give the encouragement of our Joint Practices Board with the Association of B. C. Professional Foresters and our Division of Engineers and Geoscientists in the Forest Industry.

I will be pleased to provide more information on these matters and am willing to address members of the SFU community in support of an Earth Sciences graduate program.

Please do not hesitate to contact me if you have any questions.

Yours truly,



Robert F. Gerath, P.Geo.
Assistant Director, Professional Practice

letters\roberts.1\kb

F

SIMON FRASER UNIVERSITY

DEAN OF GRADUATE STUDIES
BURNABY, BRITISH COLUMBIA
CANADA V5A 1S6



telephone (604) 291 - 4255
facsimile (604) 291 - 3080
email sfu-dgs@sfu.ca

December 7, 1995

Dr. E. R. Ward Neale
Geological Survey of Canada
3303 33rd Street NW
Calgary, AB
T2L 2A7

same letter to D. Tempelman-Kluit
H. Morris
R. Rogerson

Dear Dr. Neale,

As you may recall, there was a proposal, in 1986, to form a Department of Earth Sciences at Simon Fraser University. At that time, you contributed to the external review of the proposal for a Master of Science in Earth Sciences. The proposed program subsequently received Senate approval, but was not implemented at that time.

Implementation has now become feasible, the proposal has been reactivated, and the Assessment Committee for New Graduate Programs, which I chair, has been directed to obtain an external review. I am accordingly writing to you to request your assistance in updating your original review. I would be most grateful to receive, by the year-end or at your earliest convenience in the new year, your evaluation with reference to the academic merit and structural integrity of the proposed program.

You will find attached a copy of the revised and updated program proposal, including new course proposals and course outlines. I have also enclosed, to assist you in your evaluation, a copy of your previous report, which has been considered by the current Assessment Committee. I have also included, finally, at the request of Dr. Michael Roberts, draft of his letter to you presenting the philosophy and guiding principles of the Earth Sciences program.

Please feel free to contact me if any clarification is required.

I greatly appreciate your willingness to assist us in the review of this proposal.

Yours truly,

Phyllis M. Wrenn
Associate Dean of Graduate Studies

cc: E. Hickin
M. Roberts
C.H.W. Jones

EXTERNAL REVIEW FOR M.SC. IN EARTH SCIENCES

**Dr. E. R. W. Neale
Geological Survey of Canada
3303 - 33rd Street N.W.
Calgary, Alberta T2L 2A7**

RECEIVED

JAN 12 1996

DEAN OF GRADUATE
STUDIES OFFICE



E R W NEALE
5108 CARNEY RD NW
CALGARY ALTA
T2L 1G2

Dr. Phyllis Wrenn,
Associate Dean of Graduate Studies,
Simon Fraser University

96/01/03

Dear Dr. Wrenn:

This is in answer to your request to (again) review the proposal for a Master of Science program in Earth Sciences at S.F.U. My review has entailed reading all the documentation that you provided and also discussing the proposal with a knowledgeable colleague, Dr. Robert Vance of the Geological Survey of Canada. I find that most or all the criticisms that I made of the original program, in my letter of January 5, 1987, have been adequately addressed. I conclude that the MSc program, as presently proposed, is well-conceived, well-balanced and should fill an academic niche that is presently unoccupied in British Columbia.

I am favourably impressed by the range of courses that will be available and also by the emphasis that will be placed on the thesis. Also, in these hard times, the promise of providing adequate library and laboratory facilities is reassuring. The proposed program does not appear to overlap with the largely marine-based environmental work underway at University of Victoria or with the program in the UBC Geography department. Your earth science MSc graduates should be welcomed by industrial and governmental employers throughout Canada.

In the attached memorandum addressed to me, Bob Vance makes several good points that could help strengthen the program. One is the need to emphasize the multidisciplinary nature of environmental studies and to increase student awareness of the importance and the availability of training in other disciplines. My own view is that with people such as Rolf Mathewes of Biology and David Huntley of Physics on hand, interactions

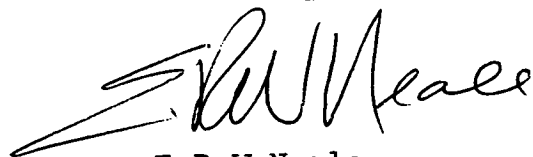
will occur spontaneously. Also, the proposed adjuncts: John Clague, John Luternauer and Lionel Jackson are all renowned for their interdisciplinary interests. Still, Vance's point is valid that EASC 600-0, the mandatory non-credit course, could be made much more useful by eliminating much of the procedural instruction and, instead, introducing students to the opportunities for cooperation in SFU and external labs.

Bob Vance is right in stating that global change should be a mandatory part of the curriculum. This is a criticism that deserves serious attention. His concern about the amount of course work was based on a misconception, namely that these were full year rather than term courses. I also had that concern but now it is cleared up, I realize that a good student could complete the degree in two academic years or less.

Most important to the success of the program will be the new appointments. The three most recent seem to have solid backgrounds on paper but all are fairly junior in research and instructional experience. Might it be worthwhile seeking a more experienced person with an established reputation for the next opening? Could it be worthwhile seeking input from the designated adjuncts when choosing this person?

In conclusion, I heartily endorse the proposal to implement this Earth Sciences graduate program at S.F.U. and I wish it the success it richly deserves. My best wishes to all involved

Sincerely Yours,

A handwritten signature in black ink, appearing to read "E.R.W. Neale". The signature is fluid and cursive, with a long horizontal stroke at the beginning.

E.R.W. Neale



MEMORANDUM

NOTE DE SERVICE

RECEIVED

JAN 12 1996

DEAN OF GRADUATE

Security Classification - Classification de sécurité

Our File - Notre référence

Your File - Votre référence

Date

3 January 1996

To
A
Dr. E.R.W. Neale
GSC, Calgary

From
De
R.E. Vance
Hazards and Environmental Geology Subdivision
GSC, Calgary

Subject
Objet
Proposal: Earth Sciences M.Sc. Program at Simon Fraser University

As a Simon Fraser graduate I am especially pleased to see that the new Earth Sciences graduate program is ready to begin this year. I feel that the program will make a great step toward addressing the growing need for well rounded geoscientists capable of evaluating and formulating realistic solutions to environmental problems. With few reservations, I find the proposed program to be well structured and feel that it should be successful in attracting students. Graduates should have reasonable employment opportunities, and will be well qualified to move on to doctoral studies. The program is well designed to capitalize on the expertise of the two long standing members of the Simon Fraser faculty, and the three recent additions appear well qualified to teach in their fields of expertise. I am particularly pleased to see that the program is research oriented and that a thesis is required.

Earth and Environmental Sciences are extremely broad, multidisciplinary fields of study that, in my view, present great challenges to post secondary educators. Programs must produce graduates that have a solid, working understanding in their chosen speciality, but at the same time must be well versed in a variety of other fields to successfully interact in the multidisciplinary environment that is increasingly required to tackle current environmental issues. Addressing this balance is becoming more of a challenge, given the scope and complexity of current environmental issues and declining university resources. This is a difficult tightrope on which to manoeuvre, but I must admit that my main reservation about the Earth Sciences M.Sc. program as outlined is that it may be too narrow in focus. For example, in the enclosed overview a need for broadly trained geoscientists is identified as justification for launching the program, and is supported by an example of the inability of the B.C. Ministry of Forests to fill regional environmental geology/geomorphology positions. A graduate of the program outlined here would certainly be able to fill this need, but would surely benefit greatly from some training in and exposure to, for example, forest ecology (specifically for background on disturbance regimes), biogeography and paleoecology (the historical development of the coastal rainforest), since it is the forest resources that are the important component of the complex earth system the graduates will be expected to contribute toward managing, even if they are focused on other issues such as slope stability. I realize that there is neither the time nor resources to train students in all disciplines, but I feel the program should make a greater effort to increase student awareness of graduate programs in other departments at SFU, or even UBC, that may better train them for the multidisciplinary field they will be entering as professionals. To this end, I think the EASC 600-0 mandatory introduction to graduate studies course could be restructured to meet this need by eliminating sections on graduate studies, the role of the Dean, sources of summer fieldwork support, the

of APEGBC, intellectual property rights, etc. (couldn't the students be supplied with resource packages to read through and discuss with their supervisors to meet these needs, rather than taking valuable instruction time?), replacing these sections with time spent outlining course offerings in other departments or institutions (probably best done by a series of guest lectures highlighting current environmental research), thereby broadening the student's understanding of the discipline's scope and the options of study available. In that way, students would still be positioned to capitalize on the expertise in sedimentology and geology available within their own department, but at the same time be encouraged to look beyond this foundation to meet their own needs and interests.

I find restriction of global warming to one section of an optional(?) course puzzling. The broader issue of global change is at the heart of geological sciences, since geology is in essence the study of past global change, and is at the forefront of many environmental and policy issues today. Moreover, global change will significantly impact many of the areas of study highlighted in the current program (e.g. slope stability, floods and floodplains, sea-level, groundwater, etc). In my view, the topic should be front and center in the overview of environmental geology, perhaps best included in EASC 600-0, given the program's current structure. To follow up, a 'special topics' course could be encouraged to allow meaningful development of the student's interests, should they exceed the department's current expertise, with two 'core' courses in the realm of sedimentology and geology remaining compulsory. In short, by solidifying and broadening the introductory course and encouraging students to widen their scope of study I feel the program could become more innovative and produce students with a wide-ranging understanding of environmental geology, at the same time consistently turning out graduates with a solid grounding in 'hard science'.

While I am encouraging expansion of program boundaries and applauding the thesis requirement, I must admit that the thesis in addition to four courses may look rather daunting to prospective students, particularly at a time when M.Sc. bypasses to a Ph.D. are becoming more common. When I graduated from SFU in 1991, there were rumours that the Dean of Graduate Studies was about to impose a two year limit for completion of a M.Sc. (and four years for a Ph.D.). If such limitations have indeed been imposed, it may be expecting a great deal from a student to complete course work, research a topic and produce a meaningful thesis in such a short time. Such demands may actually discourage students from entering the program. Again, I can appreciate what a high wire act it must be to develop a program that will produce high quality graduates in such an all encompassing field, at the same time not appearing too demanding to prospective students. Given these concerns, I wonder if as many as 15-20 students will consistently enroll in the proposed program.

In summary, I feel that the existing program is a timely addition to the SFU calendar and would produce valuable graduates as it stands. With some fine tuning though, I feel the program could become truly innovative and ultimately turn out graduates with a distinctive stamp of the M.Sc. Earth Sciences Program of Simon Fraser University.

Yours sincerely,



Robert E. Vance

EXTERNAL REVIEW FOR M.SC. IN EARTH SCIENCES

Dr. Dirk Tempelman-Kluit
4697 West 4th
Vancouver, B.C V6R 1R5

FEB - 31996
DEAN OF GRADUATE
STUDIES OFFICE
✓ *Amcours*
2/5/96

Dr Phyllis M. Wrenn
Associate Dean of Graduate Studies
Simon Fraser University
Burnaby, B.C.
V5A 1S6

Dear Dr. Wrenn

This is in delayed response to yours of December 15. You asked me for my evaluation of the academic merit and structural integrity of the proposed MSc in Earth Sciences to be offered by your new Earth Sciences unit. I take this opportunity to congratulate the University on funding the new Earth Science Program; the decision recognizes our society's dependence on the Earth for life, sustenance and resources. It recognizes the important niche in Environmental geoscience that until now was unmet in western Canada.

The undergraduate program is well underway. It has excellent leadership in Professor Roberts, has attracted three outstanding new faculty in Mustard, Thorkelsen and MacEachern and benefits from the reassignment of Professors Roberts and Hickin. The first two years of courses offered make sense and fit well in the context of an four year program focussed on environmental geoscience. The strong link to the existing department of Geography at SFU are further plus for the program.

Let me turn to your specific request about the proposed graduate (MSc) program. As to the need for the program I continue to feel that this is strong and hitherto still unmet in western Canada. Formal training in Environmental Earth Science at the undergraduate and graduate level have not been available in western Canada. Environmental issues are as important as they are anywhere and the concern for matters environmental is arguably higher. The demand in industry for individuals with an environmental focus in earth Science continues. There are more jobs than well qualified applicants in this field; this is in marked contrast to traditional Earth Science. Increasingly these jobs require a graduate degree with a sound undergraduate grounding. The undergraduate program is a good start, but only that; augmenting it with an advanced degree will improve the offering and its attractiveness to students and employers. The advanced degree will not only increase the relevance of what SFU offers it will strengthen the undergrad program in a kind of symbiosis or positive feedback.

Further on the academic merit and structural integrity question which you posed. I will comment on the planned

philosophy and the people. The idea of grounding the MSc through a strong thesis requirement with a mentoring approach and a requirement for four graduate credit courses seems sound and I think will work well.

It will be important to make sure that each thesis topic chosen is relevant to the department's mission and meets a real need in society. There is no shortage of topics and wise choices will ultimately reflect on the staff and on the department who will guide the decisions.

Similarly it will be key to ensure good long term connections between each student and her/his supervisor as the fundamental offering of the program will be the apprenticeship. For the thesis topic decision and the student-teacher linkage the decision of which individuals you have hired or transferred as faculty is paramount. I have known Professors Roberts and Hickin for many years; they will provide thoughtful leadership and have a long record of working closely and well with graduate students. They will set excellent examples for the three new staff. Two of your three new staff (Mustard and Thorkelsen) I also know through having worked with them as graduate students or Post Doctoral Fellows during the last decade. They are wonderfully enthusiastic, energetic and respected professionals with productive track records and good communication and people skills. They will certainly be attractive mentors to prospective MSc candidates in your proposed program. I don't know MacEachern except by his CV which you sent me, but he looks equally impressive from this.

The graduate course offerings list of 600 and 700 level courses is appropriate to the mission of the Environmental Earth Science unit. It certainly matches the qualifications of your new and transferred staff so that these offerings will be done justice. In time the offerings might be broadened to include other subjects. For example the distribution, movement and concentrations in the environment of organic and inorganic chemicals, both injurious and beneficial to human health are poorly studied and represent a largely untapped field of research. Understanding this huge field will become increasingly important to questions about agriculture and food growing, questions about water supply, for waste disposal decisions and for answers about healthful living environments for people.

I continue to feel that familiarity and comfort with earth materials is the critical gift that must be imparted to earth science students. Real opportunities exist among the proposed graduate course offerings to maximize this exposure. For example the Quaternary Geology course can

take advantage of new construction excavations all over Greater Vancouver to give students this tool, to increase relevance of the courses to students, to build strong links with an important industry and to improve the understanding of the subsurface geology of this region.

In summary I think there continues to be a strong need for the proposed MSc program, I like the philosophy as conceived that the degree should be rooted in a strong thesis with emphasis on apprenticeship, and I consider you have done well to attract and transfer outstanding individuals to guide and deliver it. I say "Go for it" in the words of the other university's motto "tuum est".

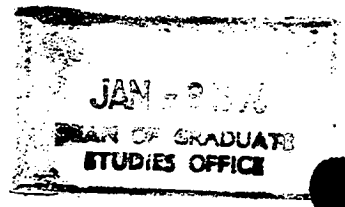
Yours truly

A handwritten signature in black ink, appearing to read 'Dirk Tempelman-Kluit', written in a cursive style.

Dirk Tempelman-Kluit

EXTERNAL REVIEW FOR M.SC. IN EARTH SCIENCES

**Dr. Hugh C. Morris
Padre Resources Corp.
5326 - 4A Avenua
Delta, B.C V4M 1H5**



PADRE RESOURCES CORPORATION

P.O. Box 1205, Station "A", Delta, B.C., Canada, V4M 3T3

Phone/Fax 604-943-5066

January 4, 1996

Dr. Phyllis M. Wrenn,
Dean of Graduate Studies
Simon Fraser University
Burnaby, British Columbia
V5A 1S6

Dear Dr. Wrenn,

Thank you for your letter of December 7 regarding the proposed Master of Science program at the newly constituted Department of Earth Sciences at Simon Fraser University. It is a pleasure to see that this initiative is now about to be fulfilled and I wish Simon Fraser every success in its implementation.

My comments on the material which you have sent to me in some ways repeat those made in 1987. In this letter I have tried to re-assess remarks made in my past letters (Jan. 26, 1987 and Mar. 30, 1987) together with some observations on the proposed Masters Program in the context of the evolution of Earth Sciences in Canada over the past 9 years. There are also a few specific thoughts I would like to offer based on my reading of the proposed graduate program and its course requirements.

THE PROGRAM IN GENERAL

As in 1987, I continue to support the principle that a Department of Earth Science is essential at Simon Fraser University. Now, as then, I believe it would be wise to maintain a practical focus on selected areas of the discipline and not try to spread too broadly. Today, perhaps even more than in 1987 a Master's Degree program is a most desirable component of the work of a successful Department. The current proposal aims at specialization in surficial and environmental geology. Now as before I believe this is a wise choice.

The program which will be offered has good academic content and focus while still providing sufficient built-in flexibility to accommodate the needs of individual research initiatives. It will be important that the "Special Topics" courses be selected and given with proper relevance. This should be readily achieved from the proposed mix of faculty and adjuncts.

It must be noted, however, that the environmental industry has discovered over the past half decade that it, too, is not immune from the employment contraction. Six to ten years ago it appeared that environmental activity, and with it environmental geoscience, was virtually recession-proof. Today the market is quite mixed with environmental firms being forced to down-size in a number of areas due to the absence of work while at the same time in some regions, regulators have been actively stimulating the employment of trained professionals. The situation is further complicated by the nationwide current focus on restraint with its attendant pressure to reduce the staffs of government professional and scientific organizations. What this will likely lead to is a continued demand for post-graduates from a handful of schools which have the most appropriate and effective graduate programs. For Simon Fraser, I suspect this means simply that continued attention, flexibility and upgrading will be most important for the future prosperity of the program.

In the recent Allocation Committee exercise undertaken by NSERC in 1994, the dynamics of all disciplines were studied. The forecasts provided by Statistics Canada suggested that there would be continuing but modest growth in employment in environmental areas. It can also be noted that the research funds allocated to this sub-committee of NSERC were trimmed more than the average. Clearly it will be important for the new graduate program at Simon Fraser to attend carefully to all the prospective sources of funding, including those from less conventional sources than NSERC.

These problems face all Earth Science Departments in Canada and to that extent may provide Simon Fraser with as much of an opportunity as a difficulty. There is considerable financial pressure on many of the smaller universities in the East with a resulting de-emphasis of their environmental earth science programs. A well conceived Masters program at Simon Fraser should be at a distinct advantage.

The nature of earth sciences and earth science research is under considerable debate in Canada at this time and has recently been reviewed comprehensively by the Canadian Geoscience Council. There is considerable support for a highly integrated, inter-disciplinary approach, - Earth Systems Science, as it is frequently described, wherein the boundaries between the traditional sub-disciplines are disappearing. To achieve this approach requires a much larger and more diversified department than that planned for Simon Fraser. It is not recommended that an attempt be made to pursue this philosophy, but it is noted here because a smaller specialized department may have profitable opportunities for "partnership" with research groups at other institutions in developing, implementing important research initiatives, and funding them. In addition, modern geoscience is increasingly dependent on expensive, complicated and specialized equipment which will doubtless be beyond the scope of the capital available to the department and program. Here again, the concept of partnership with other allied or related researchers may be of critical importance in the success of research projects.

SOME SPECIFIC COMMENTS

The content of the course work for the Masters Program focuses heavily on physical and mechanical as well as chronological aspects. There is little reference to geochemistry. This is a concern since chemical aspects of environmental processes are of steadily increasing importance.

Land use planning at all levels, from provincial to municipal, is rapidly becoming a major part of the "economic geology" of surficial and environmental earth science. The connection is perhaps implicit in some parts of the documentation. However, I suspect more advantage could be taken of explicit attention to this area and to the relevance of the proposed courses to the topic.

The comments regarding library resources underscore the importance that this function has in any post-graduate activity. I suggest that the new department may benefit through a call soliciting donations of texts and/or past holdings of serial publications for addition to the expanded earth science section of the library. It is a little startling to see such prominent and relevant journals as "The Canadian Journal of Earth Sciences" and "Geology" omitted from the offered list of serials. The library may also wish to approach Canadian Geoscience Associations such as the Geological Association of Canada, the Mineralogical Association of Canada, and The Canadian Society of Petroleum Geologists for donated copies of their high-inventory publications.

CONCLUSIONS

To sum up, I believe that present plans to implement an Earth Science department and Masters degree program at Simon Fraser University are timely, important and complementary. The proposal as presented is wise in its decision to retain substantial focus on surficial and environmental geology, which are still under-represented in western Canada and particularly in British Columbia. The Masters program outline is sound and well-conceived and the only amendment suggested would be an increased reference to chemical aspects of surficial geology and hydrology.

I hope that these remarks will be of some assistance to you in your further deliberations. Please do not hesitate to call me for any further clarification or comment.

Yours sincerely,



Hugh C. Morris
President

EXTERNAL REVIEW FOR M.SC. IN EARTH SCIENCES

**Dr. Robert Rogerson
Department of Geography
University of Lethbridge
Lethbridge, Alberta T1K 3M4**



The
University of
Lethbridge

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11-176
OFFICE OF GRADUATE
STUDIES OFFICE
DEPARTMENT OF GEOGRAPHY

26th January 1996

Phyllis M. Wrenn
Associate Dean of Graduate Studies
Simon Fraser University
Burnaby, British Columbia
V5A 1S6

Dear Ms. Wrenn,

I have completed a careful review of the proposal for the offering of a Master of Science in Earth Sciences at your university. I would like to make the following comments:

1. General

I have no doubt that there is a need for a program of this type and that it will attract sufficient enrolment to develop into an established program very quickly. There appear to be good employment prospects in BC at present and positions must be filled with qualified personnel, but whether prospects 5 or 10 years from now remain a selling point for the program, no-one knows. The program appears to complement rather than compete with other graduate programs in the earth/environmental sciences in British Columbia, indeed, there will be nothing quite like it anywhere in western Canada, unless the new department of Earth and Atmospheric Sciences at University of Alberta decides to move in a deliberate fashion in this direction: they have the personnel and facilities, but as far as I know have not come together as they should to design a program like this.

2. The Program

The form of programs is always subject to the vision and experience of the individuals concerned, as indeed it must be. I see the program as somewhat 'technical' in orientation with courses which for the most part incline towards sub-specialties. Yet there is no course which is concerned with 'geotechnique' as a whole: surely many of the technical methods for individual courses might be served by an appropriate geotechniques course which could act as a core. I see no course in Geomorphology as such, yet note that the two most experienced faculty are well-known in the field. Is it possible that the Earth Science students could do a graduate course in Geomorphology in the Geography Graduate program? Which makes me wonder why articulation or cross-listing seems to be absent from the material here. Is it regarded as a bad thing at SFU? Other areas of contact, with Geography or other departments, might cover those areas which must loom as important to practising earth

scientists in the coming decades. I see these as being:

1. Remote sensing image analysis: this is an important tool in forestry and many of the contexts within which environmental geology will be practised will require an understanding of the use and manipulation of such images.
2. Geographical Information Systems: particularly the use of analytical modeling techniques involving digital terrain models on which so many monitoring programs depend.
3. Environmental Philosophy: this is one of the most rapidly advancing areas of knowledge. It is important that newly graduated representatives of an environmental field are not ignorant of the major issues which are galvanizing society and industries in British Columbia, and that they learn the importance of seeing issues from a variety of different views.
4. Glaciology, Glacial and Mountain Geomorphology: I know that these will be touched on in other courses, but for my money they are sufficiently important in British Columbia that I would expect to see these topics appear more evident in the program.

It is very likely that graduate courses in these areas already exist in Simon Fraser and I am simply wondering whether they could be accessed by Earth Science graduate students.

It may seem that I now proceed to contradict myself by pointing out that I consider the required course load to be quite heavy, especially if the courses presented are tough, as I expect. Combining four credit courses with one compulsory non-credit course and the expectation that the Master's thesis reports on "original research" is quite demanding. It will fall within the capability of 10 to 20% of your students to complete this in 24 months of full-time study, but I expect the majority will take significantly longer. This is entirely in accord with the Canadian average for Masters degrees with thesis. The latest report from the Canadian Association for Graduate Studies indicates that the average time for completion in the category 'Natural and Applied Sciences' is 36.5 months, while my own calculations suggest it is more like 40 months. We may throw up our hands at these statistics, in dismay, but we cannot ignore them. The Canadian Masters is a tough degree, and probably the toughest in the English-speaking world. So be it: it is also worthwhile and a significant qualification for those who graduate. Most of us would be loath to alter that.

3. The Faculty

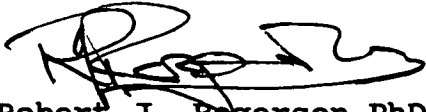
Perhaps the strongest part of this proposal is the small team of excellent faculty that has been formed to be involved in teaching and supervision in this program. I have met only the two senior members of the group, Dr. Roberts and Dr. Hickin: they are both excellent established scholars who exemplify both individual scholarly excellence and recognized academic leadership. I would hope that their involvement in this program does not detract from their involvement in Geography: as a discipline we cannot afford to lose them. But I also recognize that like many academic leaders they are both inclined to seek new challenges and respond, as society requires us, to new opportunities. I imagine they have 'hand picked' the new faculty members, and I hope that they prove to be as excellent as their resumés indicate. As a group they probably represent the strongest academic team of this size in Earth Sciences: certainly the strongest that I have ever seen: a kind of 'dream team'! If they work together as well as they have worked prior to arriving at Simon Fraser, you have an enviable group and I would forecast considerable success.

You asked me to comment on the academic merit and structural integrity of the program. I believe the program will have considerable academic merit, since such usually derives from a combination of good faculty, good courses, good supervision, a good institution, relevance to the local community. All you need now are good students, and I cannot doubt that you will attract them.

As for structural integrity, well I am sure it is there, although my vision differs slightly from that on which this program is based. I would have inclined towards a core course in environmental philosophy, a core in geotechnique, then one and only one course (for a total of 3) where the first two are applied in a number of areas of earth science practise. There is no reason why you could not move towards this model if your experience of the model of 4 credit courses in four discrete areas does not appear to work. Your model will be a good foundation, and indeed may from some viewpoints be superior to mine. I accept that, and I do not mean my comments to detract from your program in any way, only to provide some food for thought or some basis for future discussion as your program evolves.

I hope the program is approved and I hope it is as successful as it appears to me it should be. Please do not hesitate to contact me if you feel I could help you further or if you need further explanation of my opinion.

Yours sincerely,

A handwritten signature in dark ink, appearing to read 'R. Rogerson', with a stylized, flowing script.

Robert J. Rogerson PhD
Professor and Chair

SIMON FRASER UNIVERSITY
EARTH SCIENCES PROGRAM
Memorandum

FEB 12 1996

DEAN OF GRADUATE
STUDIES OFFICE

To: Phyllis Wrenn
Associate Dean, Graduate Studies

Date: 12 February, 1996

From: Ted Hickin, Graduate Studies Chair

Subject: Earth Science M.Sc. reviews

We are pleased to note that the four external reviewers of the academic merit and structural integrity of the Earth Science graduate program unanimously and enthusiastically support its implementation without change.

Our responses to the few suggestions for consideration contained within the review letters follow:

From Dr E.R.W. Neale

- He suggests that EASC 600 might be more useful if it contained less material on "procedural" matters and more on "opportunities for cooperation in SFU and external labs": We agree that this course should fully explore all such local resources for graduate students and fulfilling that role is among its intended functions. It is our experience in the Physical Geography M.Sc. Program that new students find a course like EASC 600 (with its concern for "procedural" matters) to be extremely useful in rapidly developing candidate orientation and focus.
- We agree with the observation that "global change" is important; indeed, its consideration is implicit in almost all aspects of geology (which is concerned with behaviour of geological systems over *all* time and space scales). Nevertheless, our graduate program is not designed for, nor would we admit, students interested in modeling global climatic change, for example.

From Dr Dirk Tempelman-Kluit

We agree that the program could be further strengthened if "in time the offerings might be broadened to include.....for example, the distribution, movement, and concentration in the environment of organic and inorganic chemicals....". It may be possible to achieve this sooner rather than later when our next faculty appointment (in hydrogeology/environmental geology) is completed in the next few weeks.

From Dr Hugh C. Morris

- Although the comment does not bear directly on the review mandate, we agree with his suggestion that our faculty seek "partnerships" to enhance graduate research and employment opportunities. In fact, this is part of our *modus operandi* and has already resulted in new substantive links with industry and government.
- We also agree with his suggestions for strengthening our offerings in geochemistry and environmental geochemistry and we propose to do so (see the response to Dr Templeman-Kluit's review above) as the program grows. Meanwhile, of course, our graduate students do have access to very relevant low-temperature geochemistry

expertise in the Departments of Geography (Lance Lesack in particular) and in Chemistry.

- We do not agree that landuse planning should become the primary subject of new graduate courses in Earth Sciences. These broader resource management issues are beyond the scope of our graduate program by design and introducing them would detract from what we believe to be the highly desirable physical research focus of this particular M.Sc.. Such landuse-oriented programs are available, of course, elsewhere in the University (in Geography and REM, for example).
- We have no idea why The Canadian Journal of Earth Sciences and Geology are missing from the serials list - SFU has subscribed to these journals for many years.

From Dr Robert J. Rogerson

- We concur that there is a technical orientation to the coursework program. It is designed, in part, to produce graduates who are immediately attractive to employers as working scientists rather than generalists in need of considerable technical-skills training. Remember that we will be admitting only graduate students already broadly trained in earth science.
- We do not believe that a general "Geotechnique" course is as useful as the present model in which techniques appropriate to each graduate course are developed within each offering. This opinion is based on prior experience in the Physical Geography Program at SFU.
- We confirm that EASC graduate students will have access to geomorphology (including glacial geomorphology) in graduate courses in the Physical Geography Program as well as to remote sensing image analysis, and GIS, among others. There is a strong tradition in the Physical Geography Program, which will be emulated in the Earth Sciences Program, of encouraging graduate students to complete appropriate courses in other Departments. Indeed, neither the undergraduate program nor the graduate program in Earth Sciences at SFU could function as effectively if it were not for these cross-Department arrangements. Although this is a necessity dictated by finite resources, it also turns out to be one of the great strengths of the SFU program because it minimizes course duplication across the University while ensuring healthy cross-disciplinary thinking.
- We share Dr Rogerson's view that the Canadian M.Sc. research degree (as opposed to a coursework degree) represents one of the most demanding credentials offered by universities anywhere. We further agree that the four-course requirement for the M.Sc. is heavy for a research degree and certainly we would prefer to see this load reduced. Meanwhile, however, we are obliged to meet this University requirement.

SIMON FRASER UNIVERSITY

New Graduate Course Proposal Form

CALENDAR INFORMATION:

Department: Earth Sciences Program Course Number: EASC 600 - 0

Title: Introduction to Graduate Studies

Description: A required course designed to acquaint new graduate students with the research strengths of the Program, research facilities in the university and its vicinity. Procedures and policies relating to preparation, conduct and presentation of thesis research will be discussed.

Credit Hours: 0

Vector: Seminar

Prerequisite: None

ENROLLMENT AND SCHEDULING:

Estimated Enrollment: 10 When will the course first be offered: 96 - 3

How often will the course be offered: Once a year

JUSTIFICATION:

This course provides a mechanism for introducing students to the research strengths of the department, research facilities in the University and within the Faculty, and for developing an esprit de corps among the graduate student body.

New Program

RESOURCES:

Which Faculty member will normally teach the course: The Chairman of Graduate Studies

What are the budgetary implications of mounting the course: None

Are there sufficient Library resources (append details):

Library materials are not critical in this course

- Appended:
- a) Outline of the Course
 - b) An indication of the competence of the Faculty member to give the course.
 - c) Library resources

Approved: Departmental Graduate Studies Committee: *S. J. Nicks* Date: 15 MAR 95

Faculty Graduate Studies Committee: *ML* Date: 95/04/21

Faculty: *CHW Jones* Date: 24 April 95

Senate Graduate Studies Committee: *BPO* Date: 25 Mar 96

Senate: _____ Date: _____

Course Outline

INTRODUCTION TO GRADUATE STUDIES

Preamble

This course is a combination of seminars and occasional lectures by visiting speakers. At the beginning of the semester there will be a one day workshop dealing with such topics as graduate regulations, the rôle of the senior supervisor, teaching assistantships, the nature of thesis, and accessing the resources of local libraries.

Course Topics

1. Graduate studies at SFU: general regulations;
2. Dean of Graduate Studies office - function, funding sources;
3. Review of research projects in the Program;
4. Sources of summer fieldwork support;
5. Defining a problem within the context of the thesis;
5. Technical writing;
6. Practicing as a registered professional in BC; the rôle of the APEGBC;
7. Intellectual property rights and professional ethics;

Grading

Grading will be on a satisfactory/unsatisfactory basis (S/U).

SIMON FRASER UNIVERSITY

New Graduate Course Proposal Form

CALENDAR INFORMATION:

Department: Earth Sciences Program Course Number: EASC 611 - 3

Title: Sedimentology

Description:

Review of sediment transport, bedforms and sedimentary structures. Facies analysis of selected clastic environments.

Credit Hours: 3 Vector: 2-0-2

Prerequisite: Undergraduate course in sedimentology

ENROLLMENT AND SCHEDULING:

Estimated Enrollment: 5 When will the course first be offered: 1996-3

How often will the course be offered: Every other year

JUSTIFICATION:

One of the major research and teaching thrusts of the program is the study of sedimentary rocks; sedimentology deals with the physical and biological processes involved in the formation of sedimentary rocks. This course is fundamental to the analytical understanding and the field interpretation of sedimentary rocks. The course fulfills an academic requirement for professional registration (APEGBC).

New Program

RESOURCES:

Which Faculty member will normally teach the course: New faculty (Sept. 1995)

What are the budgetary implications of mounting the course:

\$5,000 for laboratory equipment and materials; this money will come from the departmental capital budget.

Are there sufficient Library resources (append details): Yes

Appended: a) Outline of the Course
b) An indication of the competence of the Faculty member to give the course.
c) Library resources

Approved: Departmental Graduate Studies Committee: E. J. Michini Date: 15 MAR 95

Faculty Graduate Studies Committee: W. A. K. Date: 95/04/21

Faculty: Ch. W. Jones Date: 24 April 95

Senate Graduate Studies Committee: B. R. C. Date: 25 March/96

Senate: _____ Date: _____

Course Outline

Sedimentology

General

The course during this semester will involve a detailed examination of Coarse Clastic Sedimentary Facies with a particular emphasis on deposits in high-energy alpine environments (Coast Mountains, BC)

Textbook

Walker, R.G., 1984, Facies Models. (2nd Edit.), Geoscience Canada Reprint Series No. 1. 317pp.

Course Topics

1. Coarse alluvial fan deposits
Case study I - Cheakamus Fan
2. Braided gravel-bed river facies
Case study II - Squamish River
3. Wandering gravel-bed river facies
Case study III - Lower Fraser River
4. Deposits of mass movement (rockfalls & debris flows)
Case study IV - Hope Slide & Wahleach Creek)

Grading

- | | |
|-------------------------|-----|
| a. Research paper | 50% |
| b. Seminar presentation | 20% |
| c. Field project report | 30% |

SIMON FRASER UNIVERSITY

New Graduate Course Proposal Form

CALENDAR INFORMATION:

Department: Earth Sciences Program Course Number: EASC 612 - 3

Title: Stratigraphy

Description:

Evaluation of sequence and genetic stratigraphies. Basin concepts. Problems of clastic and non-clastic sedimentary deposition.

Credit Hours: 3 Vector: 2-0-2 Prerequisite(s) if any:

ENROLLMENT AND SCHEDULING:

Estimated Enrollment: 5 When will the course first be offered: 1998-1

How often will the course be offered: Every other year

JUSTIFICATION:

Stratigraphy is one of the fundamental areas of geology and this course will be an essential component of many MSc student's programs. The course fulfills an academic requirement for professional registration (APEGBC).

New Program

RESOURCES:

Which Faculty member will normally teach the course: New faculty appointment (Sept 1995)

What are the budgetary implications of mounting the course:

None, it is a course reliant on library sources.

Are there sufficient Library resources (append details): Yes

- Appended:
- a) Outline of the Course
 - b) An indication of the competence of the Faculty member to give the course.
 - c) Library resources

Approved: Departmental Graduate Studies Committee: T.J. Hickin Date: 15 MAR 95

Faculty Graduate Studies Committee: M. De Date: 95/04/21

Faculty: CHW. Jones Date: 24 April 95

Senate Graduate Studies Committee: B. P. C. Date: 26 Mar/95

Senate: _____ Date: _____

Course Outline
STRATIGRAPHY

General

This course will be devoted to the examination of the development of sequence stratigraphic concepts and their application to the interpretation of subsurface units. The Van Wagoner text will be supplemented by papers from the sequence literature.

Textbook

Van Wagoner, J.C., et al., 1990. Siliclastic sequence stratigraphy in well logs, cores, and outcrops. Amer. Assoc. Petroleum Geologists, Methods in Exploration Series, No. 7. Tulsa, Okla.

Course Topics

1. The contribution of Sloss and Vail
2. The scope of the contribution of the Esso Research Group to eustatic ideas.
3. Parasequence - definition
4. Sequence stratigraphy and the heirarchy of stratal units
5. Parasequence sets
5. Vertical & lateral facies relationships in parasequence sets
6. Application of sequence stratigraphy to oil plays and Quaternary settings

Grading

- | | |
|-------------------------|-----|
| a. Research paper | 70% |
| b. Seminar presentation | 20% |
| c. Field project report | 10% |

SIMON FRASER UNIVERSITY

New Graduate Course Proposal Form

CALENDAR INFORMATION:

Department: Earth Sciences Program

Course Number: EASC 613 - 3

Title: Groundwater Hydrology

Description:

Groundwater flow in the saturated and non-saturated zones; application to regional groundwater flow, groundwater recharge. Aquifer evaluation.

Credit Hours: 3

Vector: 2-0-2

Prerequisite(s) if any:

Undergraduate course in groundwater hydrology.

Appropriate standing in Applied Mathematics and in Physics

ENROLLMENT AND SCHEDULING:

Estimated Enrollment: 5 When will the course first be offered: 1997-3

How often will the course be offered: Every other year

JUSTIFICATION:

For those students who will enter the field of Environmental Geology upon completion of their MSc degree this course will the theoretical base of much of their work. The course fulfills an academic requirement for professional registration (APEGBC).

New program

RESOURCES:

Which Faculty member will normally teach the course: New faculty appointment (96-3)

What are the budgetary implications of mounting the course:

None

Are there sufficient Library resources (append details): Yes

- Appended:
- a) Outline of the Course
 - b) An indication of the competence of the Faculty member to give the course.
 - c) Library resources

Approved: Departmental Graduate Studies Committee: E. J. Hickin Date: 15 MAR 95

Faculty Graduate Studies Committee: W. De Date: 95/01/21

Faculty: Ch. W. Jones Date: 24 April 95

Senate Graduate Studies Committee: B. P. C. Date: 26 March 96

Senate: _____ Date: _____

Course Outline

GROUNDWATER HYDROLOGY

General

It is assumed that you taken an undergraduate course in hydrogeology. The main objective of the course, during this semester, will be the modelling of flow nets and the application of flow net models to groundwater evaluation.

Course Topics

1. Flow in perfectly confined aquifers
2. Flow through semipervious strata - leaky aquifers
3. Hydrodynamical conditions within an aquifer
4. Modelling of flow nets
5. An evaluation of modelling software
5. Groundwater evaluation

Grading

Seminar presentation	20%
Term paper	40%
Modelling exercise	40%

SIMON FRASER UNIVERSITY

New Graduate Course Proposal Form

CALENDAR INFORMATION:

Department: Earth Sciences Program

Course Number: EASC 614 - 3

Title: Subsurface Techniques

Description:

Advanced topics in subsurface exploration methods. Methods of drilling; core description and analysis; well logging.

Credit Hours: 3

Vector: 1-0-3

Prerequisite(s) if any:

ENROLLMENT AND SCHEDULING:

Estimated Enrollment: 5 When will the course first be offered: 98-1

How often will the course be offered: Every other year

JUSTIFICATION:

At one time subsurface analysis was only used in mineral exploration, but in the last two decades the use of subsurface information is now the norm in the solution of environmental geoscience problems. The course fulfills an academic requirement for professional registration (APEGBC).

New program

RESOURCES:

Which Faculty member will normally teach the course: M.C. Roberts

What are the budgetary implications of mounting the course:

\$5,000 from the program's capital budget

Are there sufficient Library resources (append details):

- Appended:
- a) Outline of the Course
 - b) An indication of the competence of the Faculty member to give the course.
 - c) Library resources

Approved: Departmental Graduate Studies Committee: E. J. Hickin Date: 15 MAR 95

Faculty Graduate Studies Committee: H De Date: 95/04/21

Faculty: Chn. Jones Date: 24 Apr. 95

Senate Graduate Studies Committee: B. P. C. Date: 25 May 95

Senate: _____ Date: _____

Course Outline

SUBSURFACE TECHNIQUES

Preamble

This course is an introduction to the collection, analysis and interpretation of drill cores and well logs. The course will include a series of field seminars on the operation of drilling and logging equipment.

Course Topics

1. Drilling technologies: rotary
hammer
coring
auger
vibracoring
2. Core recovery and logging
3. Establishment of drilling targets
4. Well logging: spontaneous potential & resistivity
gamma
5. Analysis of well logs
6. Field workshops

Grading

Log analysis reports	50%
Field project	50%

SIMON FRASER UNIVERSITY

New Graduate Course Proposal Form

CALENDAR INFORMATION:

Department: Earth Sciences Program

Course Number: EASC 615 - 3

Title: Applied Geophysics

Description:

Instrumentation, application and limitations of electrical, seismic, radar and gravity methods in the exploration for mineral resources and in engineering applications.

Credit Hours: 3

Vector: 1-0-3

Prerequisite(s) if any:

ENROLLMENT AND SCHEDULING:

Estimated Enrollment: 5 When will the course first be offered: 1997-1

How often will the course be offered: Every other year

JUSTIFICATION:

This course is designed for those students who specialize in the geophysical aspects of environmental geoscience. The course fulfills an academic requirement for professional registration (APEGBC).

New program

RESOURCES:

Which Faculty member will normally teach the course: New faculty appointment

What are the budgetary implications of mounting the course:

\$10,000 for equipment and software (some of this equipment will also be used in the undergraduate geophysics course).

Are there sufficient Library resources (append details):

- Appended:
- a) Outline of the Course
 - b) An indication of the competence of the Faculty member to give the course.
 - c) Library resources

Approved: Departmental Graduate Studies Committee: E. J. Hickin Date: 15 MAR 95

Faculty Graduate Studies Committee: ML Date: 95/04/11

Faculty: CHW. Jones Date: 24 APR 95

Senate Graduate Studies Committee: B. P. C. C. Date: 26 MAR 95

Senate: _____ Date: _____

Course Outline

APPLIED GEOPHYSICS

General

An introduction to the principles and application of selected geophysical survey methods.

Textbook

There is no textbook for this course; a reading list will be distributed at the first meeting.

Course Topics

1. Theory of refraction seismic surveying
Refraction seismic field survey
2. Theory of reflection seismic surveying
Reflection seismic field survey
3. Theory of ground penetrating radar
GPR field survey
4. Theory of resistivity surveying
Resistivity survey
5. Principles of downhole logging
Gamma logging - Fraser Delta

Grading

1. Field reports - 70%
2. Theory examination - 30%

SIMON FRASER UNIVERSITY

New Graduate Course Proposal Form

CALENDAR INFORMATION:

Department: Earth Sciences Program

Course Number: EASC 616 - 3

Title: Fluvial Systems

Description:

Fluid mechanics of open-channel flow; physical sedimentology and sediment transport in aqueous environments.

Credit Hours: 3

Vector: 2-0-2

Prerequisite(s) if any:

Appropriate standing in Applied Mathematics and in Physics

ENROLLMENT AND SCHEDULING:

Estimated Enrollment: 5 When will the course first be offered: 97 - 1

How often will the course be offered: Every year

JUSTIFICATION:

This course is an advanced treatment of fluvial depositional systems. The course fulfills an academic requirement for professional registration (APEGBC).

New Program

RESOURCES:

Which Faculty member will normally teach the course: E.J. Hickin

What are the budgetary implications of mounting the course:

None

Are there sufficient Library resources (append details):

- Appended:
- a) Outline of the Course
 - b) An indication of the competence of the Faculty member to give the course.
 - c) Library resources

Approved: Departmental Graduate Studies Committee: E.J. Hickin Date: 15 MAR 95

Faculty Graduate Studies Committee: WDR Date: 95/04/21

Faculty: Chw. Jones Date: 24 Apr 95

Senate Graduate Studies Committee: BPC Date: 26 March 96

Senate: _____ Date: _____

Course Outline

FLUVIAL SYSTEMS

General

Geography 726 is an advanced course in open-channel fluid mechanics and sediment transport. The course is organized in three distinct parts:

Course Topics

1. Review of basic mechanics; dimensional analysis; laminar & turbulent flow; Reynolds No., shear stress; flow resistance.
2. The energy equation.
3. The momentum-impulse equation.
4. Boundary layer theory & the derivation and application of the universal velocity distributions over smooth & rough boundaries.
5. Sediment transport - initiation of particle movement
6. General sediment transport theory

Textbook

There is no textbook for this course; several sets of course notes will be distributed in class.

Grades

1. Class assignments and seminars: 50%
2. Theory examination: 50%

SIMON FRASER UNIVERSITY

New Graduate Course Proposal Form

CALENDAR INFORMATION:

Department: Earth Sciences Program

Course Number: EASC 617 - 3

Title: Quaternary Geology

Description: Environments of deposition of glacial and proglacial deposits. Quaternary stratigraphy.

Credit Hours: 3

Vector: 1-0-3

Prerequisite(s) if any:

ENROLLMENT AND SCHEDULING:

Estimated Enrollment: 5 When will the course first be offered: 97-1

How often will the course be offered: Every year

JUSTIFICATION:

A course exploring advanced issues in Quaternary geology. It will, incidentally, fulfil an academic requirement for professional registration (APEGBC) in the province.

New Program.

RESOURCES:

Which Faculty member will normally teach the course: M.C. Roberts

What are the budgetary implications of mounting the course:

\$2,000 - for maps and aerial photography - from the program's operating budget.

Are there sufficient Library resources (append details):

- Appended:
- a) Outline of the Course
 - b) An indication of the competence of the Faculty member to give the course.
 - c) Library resources

Approved: Departmental Graduate Studies Committee: E.J. Hickin Date: 15 MAR 95

Faculty Graduate Studies Committee: M. D. Date: 25/04/91

Faculty: CHW. Jones Date: 24 Apr. 95

Senate Graduate Studies Committee: B.P. Cla Date: 26 May/96

Senate: _____ Date: _____

Course Outline

QUATERNARY GEOLOGY

This course will examine selected aspects of the stratigraphy, geomorphology and surficial geology of the Quaternary. The regional emphasis of the course will be on southwestern British Columbia and the adjacent parts of the U.S.

Two weekend fieldtrips are planned:

- (a) In early March, we will spend a weekend in the interior on a field mapping exercise. The exact date will be announced later.
- (b) In March, we will take a three day fieldtrip to Channeled Scablands of central Washington.

Required Text:

M. Hambrey, 1994, Glacial Environments, UBC Press.

Course Syllabus:

1. The Quaternary Period - an overview.
2. A review of glacial and periglacial geomorphology.
3. Stratigraphic concepts: stratigraphic procedures for surface outcrops and subsurface cores; concepts unique to the Quaternary; terminology; the application of the stratigraphic code; correlation; type sections.
4. Geochronological techniques applicable to the Quaternary.
5. Quaternary stratigraphy: the evolution of Quaternary stratigraphic concepts; the classical regions - Alps and Midwest.
6. The Quaternary of BC emphasizing the record of southwestern British Columbia.
7. Sea-level changes.

Grading

Field projects	60%
Seminar presentations	40%

SIMON FRASER UNIVERSITY

New Graduate Course Proposal Form

CALENDAR INFORMATION:

Department: Earth Sciences Program Course Number: EASC 618 - 3

Title: Structural Geology

Description:
Studies of natural deformation of rock using advanced techniques.

Credit Hours: 3 Vector: 2-0-2 Prerequisite(s) if any:

ENROLLMENT AND SCHEDULING:

Estimated Enrollment: 5 When will the course first be offered: 96-3

How often will the course be offered: Every other year

JUSTIFICATION:

For those students specializing in structural and / or stratigraphic topics an advanced treatment of structure is an essential component of their graduate education. The course fulfills an academic requirement for professional registration (APEGBC).
New program

RESOURCES:

Which Faculty member will normally teach the course: New faculty appointment (Sept. 1995)

What are the budgetary implications of mounting the course:

\$500 per semester for field work costs (from the program's operating budget)

Are there sufficient Library resources (append details):

Appended: a) Outline of the Course
b) An indication of the competence of the Faculty member to give the course.
c) Library resources

Approved: Departmental Graduate Studies Committee: E. J. Hickin Date: 15 MAR 95

Faculty Graduate Studies Committee: M. H. A. Date: 25/04/91

Faculty: Chris Jones Date: 24 April 95

Senate Graduate Studies Committee: B. P. C. Date: 26 March 96

Senate: _____ Date: _____

Course Outline

STRUCTURAL GEOLOGY

General

EASC 618 is an advanced course in the description and analysis of deformation of geological materials. The course will focus on the analysis of stress strain relations from geological evidence in hand samples, aerial photographs, geological maps and field relationships.

Course Topics

1. Structural analysis: descriptive, kinematic and dynamic
2. Structures: contacts, primary structure, faults, joints, folds, lineations
3. Introduction to computer models of deformation
4. Case studies in selected Cordilleran terranes

Readings

A reading list of relevant research papers will be distributed in the first class

Course Grade

- | | |
|-------------------------|-------|
| a) Term paper | : 60% |
| b) Field project report | : 40% |

SIMON FRASER UNIVERSITY

New Graduate Course Proposal Form

CALENDAR INFORMATION:

Department: Earth Sciences Program Course Number: EASC 619 - 3

Title: Environmental Geoscience

Description:

An examination of the concepts, methods and techniques used in advanced case studies of environmental geoscience problems.

Credit Hours: 3 Vector: 2-0-2 Prerequisite(s) if any:

ENROLLMENT AND SCHEDULING:

Estimated Enrollment: 5 When will the course first be offered: 97-1

How often will the course be offered: Every other year

JUSTIFICATION:

A course in applied geoscience that will assist those students who intend to enter geoscience practice. The course fulfills an academic requirement for professional registration (APEGBC).

New program

RESOURCES:

Which Faculty member will normally teach the course:

What are the budgetary implications of mounting the course:

\$2,000 for maps and aerial photographs for the case studies.

Are there sufficient Library resources (append details):

- Appended:
- a) Outline of the Course
 - b) An indication of the competence of the Faculty member to give the course.
 - c) Library resources

Approved: Departmental Graduate Studies Committee: S. J. Hickey Date: 15 MAR 95

Faculty Graduate Studies Committee: M. L. Date: 95/04/21

Faculty: CHW. Jones Date: 24 April 95

Senate Graduate Studies Committee: B. P. C. Date: 26 April 96

Senate: _____ Date: _____

Course Outline

ENVIRONMENTAL GEOSCIENCE

General

This course is designed to elaborate on the central rôle of geology in the interdisciplinary field of environmental science. The course is based largely on the examination of case studies of environmental problems in British Columbia in which geology plays a large part in the problem and in the geotechnical solutions.

Course Topics

1. Geologic hazards - earthquakes & tsunamis
 - slope failures
 - volcanoes
 - floods and floodplains
 - global warming and sea-level change
2. Risk assessment
3. Geology and land-use planning
4. Selected case studies:
 - Lions Bay debris flow hazards
 - The Barrier and planning response
 - Urban slope failure problems
 - Point Grey coastal erosion & engineering response

Grading

1. Term paper - 40%
2. Seminar presentation - 20%
3. Project analysis - 40%

SIMON FRASER UNIVERSITY

New Graduate Course Proposal Form

CALENDAR INFORMATION:

Department: Earth Sciences Program Course Number: EASC 701 - 1

Title: Special Topics in Earth Sciences I

Description:

Credit Hours: 1 Vector: 1-0-0 Prerequisite(s) if any:

ENROLLMENT AND SCHEDULING:

Estimated Enrollment: When will the course first be offered:

How often will the course be offered: At an appropriate time

JUSTIFICATION:

New program

RESOURCES:

Which Faculty member will normally teach the course:

What are the budgetary implications of mounting the course:

Are there sufficient Library resources (append details):

- Appended:
- a) Outline of the Course
 - b) An indication of the competence of the Faculty member to give the course.
 - c) Library resources

Approved: Departmental Graduate Studies Committee: Michael Roberts Date: 3 April 1995

Faculty Graduate Studies Committee: MWR Date: 9/8/91

Faculty: C. W. Jones Date: 24 Apr. 95

Senate Graduate Studies Committee: BPCQ Date: 26 March 96

Senate: _____ Date: _____

Simon Fraser University
Earth Sciences Program
Fall Semester, 1997

EASC 701 - 1
Faculty

Course Outline

SPECIAL TOPICS IN EARTH SCIENCES I

This course will be offered at infrequent intervals to accomodate those earth science topics which are not covered by the regular course rubric.

SIMON FRASER UNIVERSITY

New Graduate Course Proposal Form

CALENDAR INFORMATION:

Department: Earth Sciences Program

Course Number: EASC 702 - 2

Title: Special Topics in Earth Sciences II

Description:

Credit Hours: 2

Vector: 2-0-0

Prerequisite(s) if any:

ENROLLMENT AND SCHEDULING:

Estimated Enrollment:

When will the course first be offered:

How often will the course be offered: At an appropriate time

JUSTIFICATION:

New program

RESOURCES:

Which Faculty member will normally teach the course:

What are the budgetary implications of mounting the course:

Are there sufficient Library resources (append details):

- Appended:
- a) Outline of the Course
 - b) An indication of the competence of the Faculty member to give the course.
 - c) Library resources

Approved: Departmental Graduate Studies Committee: Michael Roberts Date: 3 April 1995

Faculty Graduate Studies Committee: W. W. Date: 25/04/95

Faculty: Chris Jones Date: 24 April 95

Senate Graduate Studies Committee: B. P. C. Date: 26 April 95

Senate: _____ Date: _____

Simon Fraser University
Earth Sciences Program
Fall Semester, 1997

EASC 702 - 2
Faculty

Course Outline

SPECIAL TOPICS IN EARTH SCIENCES II

This course will be offered at infrequent intervals to accomodate those earth science topics which are not covered by the regular course rubric.

SIMON FRASER UNIVERSITY

New Graduate Course Proposal Form

CALENDAR INFORMATION:

Department: Earth Sciences Program Course Number: EASC 703 - 3

Title: Special Topics in Earth Sciences III

Description:

Credit Hours: 3 Vector: 3-0-0 Prerequisite(s) if any:

ENROLLMENT AND SCHEDULING:

Estimated Enrollment: When will the course first be offered:

How often will the course be offered: At an appropriate time

JUSTIFICATION:

New program

RESOURCES:

Which Faculty member will normally teach the course:

What are the budgetary implications of mounting the course:

Are there sufficient Library resources (append details):

Appended: a) Outline of the Course
b) An indication of the competence of the Faculty member to give the course.
c) Library resources

Approved: Departmental Graduate Studies Committee: Michael Roberts Date: 3 April 1995
Faculty Graduate Studies Committee: M. J. J. Date: 25/04/95
Faculty: Chris Jones Date: 24 April 95
Senate Graduate Studies Committee: B. P. C. Date: 26 March 96
Senate: _____ Date: _____

Simon Fraser University
Earth Sciences Program
Fall Semester, 1997

EASC 703 - 3
Faculty

Course Outline

SPECIAL TOPICS IN EARTH SCIENCES III

This course will be offered at infrequent intervals to accomodate those earth science topics which are not covered by the regular course rubric.

SIMON FRASER UNIVERSITY

New Graduate Course Proposal Form

CALENDAR INFORMATION:

Department: Earth Sciences Program

Course Number: EASC ⁸⁹⁸ ~~899~~

Title: M.Sc. Thesis

Description:

Credit Hours:

Vector:

Prerequisite(s) if any:

ENROLLMENT AND SCHEDULING:

Estimated Enrollment:

When will the course first be offered:

How often will the course be offered:

JUSTIFICATION:

New Program

RESOURCES:

Which Faculty member will normally teach the course:

What are the budgetary implications of mounting the course:

Are there sufficient Library resources (append details):

- Appended:
- a) Outline of the Course
 - b) An indication of the competence of the Faculty member to give the course.
 - c) Library resources

Approved: Departmental Graduate Studies Committee: E.J. Hicken Date: 15 MAR 95

Faculty Graduate Studies Committee: M. W. Date: 25/04/91

Faculty: CHW. Jones Date: 24 April 9

Senate Graduate Studies Committee: B.D. Coe Date: 26 March/96

Senate: _____ Date: _____

Simon Fraser University
Earth Sciences Program
Fall Semester, 1996

898
EASC ~~898~~
Faculty

M.Sc. Thesis

There is no course outline for the MSc Thesis.