Geoscience Canada

Oil Sands Geologists in an Industry-School Partnership: A Resource and Teaching Opportunity

Jon S. Dudley et Ted Doram

Volume 26, numéro 1, march 1999

URI : https://id.erudit.org/iderudit/geocan26_1ser02

Aller au sommaire du numéro

Éditeur(s)

The Geological Association of Canada

ISSN

0315-0941 (imprimé)
1911-4850 (numérique)

Découvrir la revue

Citer cet article

Dudley, J. S. & Doram, T. (1999). Oil Sands Geologists in an Industry-School Partnership: A Resource and Teaching Opportunity. *Geoscience Canada*, *26*(1), 39–43.

Résumé de l'article

Dans certaines écoles canadiennes ledomaine des sciences de la Terre n'estenseigné qu'à l'intérieur d'un cours gé-néral de science. Dans ce contexte, ilest possible qu'un élève ait complétédes études secondaires axées sur les sci-ences et n'ait peu ou pas entendu parlédes sciences de la Terre. Toutefois, unpartenariat entreprise privée-école se-condaire peut offrir des solutions trèsintéressantes à ce problème. Ainsi, enAlberta, ce genre de partenariat a per-mis le développement d'un cours accré-dité sur la géologie et les sables bitumi-neux, dans le cadre du programme pro-vincial sur les carrières et les étudestechnologiques pour les élèves desécoles secondaires ayant axé leursétudes en sciences. Par des ateliers pra-tiques en milieu de travail, du travail enéquipe et l'utilisation de matériaux pré-levés sur le site, ce genre de cours aideles élèves à comprendre comment lesprincipes scientifiques généraux s'ap-pliquent en sciences de la Terre. Nousespérons que ce programme et ses re-tombées serviront d'exemple pour l'éla-boration de projets similaires ailleurs aupays.

SERIES

Oil Sands Geologists in an Industry–School Partnership: A Resource and Teaching Opportunity

Jon S. Dudley[1]
Imperial Oil Resources
3535 Research Road N.W.
Calgary, Alberta T2L 2K8

Ted Doram
Bowness Senior High School
4627 77 Street N.W.
Calgary, Alberta T3B 2N6
tadoram@cbe.ab.ca

SUMMARY
In some Canadian schools earth science is offered only within general science courses. As a result, science majors may encounter little or no earth science in school. Industry-school partnerships can, however, present an excellent opportunity to overcome this shortcoming. In Alberta, such a partnership developed a credit course within the province's Career and Technology Studies Program on the earth science of oil sands for senior high school science major students. This course, through activity-based workplace site visits, resource material, and team work, helps students understand the relevance of their basic sciences as applied in earth science. We hope that this program and its development will be an inspiration and guide for others to initiate similar projects elsewhere in the country.

RÉSUMÉ
Dans certaines écoles canadiennes le domaine des sciences de la Terre n'est enseigné qu'à l'intérieur d'un cours général de science. Dans ce contexte, il est possible qu'un élève ait complété des études secondaires axées sur les sciences et n'ait peu ou pas entendu parlé des sciences de la Terre. Toutefois, un partenariat entreprise privée-école secondaire peut offrir des solutions très intéressantes à ce problème. Ainsi, en Alberta, ce genre de partenariat a permis le développement d'un cours accrédité sur la géologie et les sables bitumineux, dans le cadre du programme provincial sur les carrières et les études technologiques pour les élèves des écoles secondaires ayant axé leurs études en sciences. Par des ateliers pratiques en milieu de travail, du travail en équipe et l'utilisation de matériaux prélevés sur le site, ce genre de cours aide les élèves à comprendre comment les principes scientifiques généraux s'appliquent en sciences de la Terre. Nous espérons que ce programme et ses retombées serviront d'exemple pour l'élaboration de projets similaires ailleurs au pays.

INTRODUCTION
Earth scientists are becoming participants in public awareness and education activities as indicated by the development of resources such as Earthnet (Bates *et al.*, 1998), the Geoscape products (Turner *et al.*, 1997), and the incorporation of education symposia into Geological Association of Canada annual general meetings. These individuals realize how critical an informed public is to the vitality of our science and perhaps ultimately to the health and stewardship of our planet. Part of the challenge is to recognize and capitalize on every opportunity to expose the public to earth science. This article discusses an industry-school partnership that exposes students in specialist high school curricula to some of the careers and technology associated with applied earth science.

THE PARTNERSHIP
Partnerships between industry and schools are a relatively new but increasingly common occurrence. The Conference Board of Canada lists 100 such partnerships in its annual "IdeaBook" for 1997 (Conference Board of Canada, 1997), in which the formation of business-education partnerships across Canada is encouraged. Partnerships are mutually beneficial relationships between employers and educators designed to enhance the quality and relevance of students' education. Through partnership activities, students are exposed to the skills and qualities sought by the workplace. These include communication, adaptability, team work, and science literacy and its application (Conference Board of Canada, 1997). An industry partner who is also an employer of earth scientists provides an opportunity to present earth science to the school partner. This article describes such a situation in the Bowness Senior High School-Imperial Oil Partnership in Calgary, Alberta.

The Bowness Senior High School-Imperial Oil Partnership was initiated in

[1] Current address: Jon S. Dudley Earth Works, 2540-32 Avenue S.W., Calgary, Alberta T3E 0V8, jdudley@nucleus.com

1992. A major goal of this partnership is to enhance the science curriculum and thereby the scientific literacy among the students. Imperial Oil Resources is both a major producer of oil sands and an employer of earth scientists in a variety of careers in which a range of technologies is applied. One of the challenges faced by any school partner lies in exposing science majors to specific disciplines such as earth science, which may be offered only in the general science curriculum. In addition, the Alberta Education science curriculum stresses the need to illustrate the multidisciplinary nature of applied science. There is little room, however, to add such material to existing courses. Accordingly, the question was asked, " Is there something we could do within the partnership to help meet these challenges?" The industry partner, Imperial Oil Resources, was willing and able to offer its earth science expertise, but how could this be best utilized by the school? Science teachers at Bowness Senior High were emphatic that it would be of little use to simply assemble a resource kit, for example, as this would amount to adding to an already full agenda. After some homework, the school partner, anxious to capitalize on a potential opportunity, arrived at a solution, in the form of Alberta Education's Career and Technology Studies program.

CAREER AND TECHNOLOGY STUDIES (CTS)

This is a credit study program, initiated in 1992 by Alberta Education, to expand secondary students' knowledge of the industry sector by introducing them to careers, occupations, job opportunities, education and training required, as well as the need for lifelong learning. This program also attempts to expose students to careers and associated technologies on site in labs, work sites, and the community (Alberta Education website http://ednet.edc.gov.ab.ca/cts). Each credit requires 25 hours of student time.

The CTS Program consists of 21 areas or "strands" ranging from forestry to tourism to cosmetology. Much of the material that former students received in industrial arts and home economics courses is now offered within optional CTS Programs in Alberta. Schools are not expected to offer all strands, but to adapt and match existing resources in order to develop programs to prepare students for post-secondary training or to enter the job market (Sweet, 1998). The strand that caught the attention of the Bowness High School-Imperial Oil Partnership was "Energy and Mines."

Table 1 A sample of the reading material contained in the resource kit. Full citations are provided in the References.

Title	Prepared by	Contents
Our Petroleum Challenge	Petroleum Communication Foundation	• an introduction to all aspects of the petroleum industry
The Cold Lake Project	University of Calgary	• a review of Imperial Oil's oil sands development at Cold Lake
Canada's Oil Sands Industry: Yesterday, Today & Tomorrow	Oil Sands Task Force	• a readable outline of the size and importance of oil sands to Canada's petroleum resources
The Land Before Us Edmonton Beneath Our Feet	Tyrrell Museum of Paleontology/ Edmonton Geological Society	• brief, readable introductions to Alberta subsurface geology including the paleo-environments in which the oil sands were deposited

The "Energy and Mines" strand, as outlined by Alberta Education, consists of 27 different possible modules including an introductory level "Overview of Alberta Geology," an intermediate level "Oil Sands Resource Exploration," and an advanced "Oil Sands Recovery and Production."

This was a fit, and this was a solution! By developing a single credit course within the "Energy and Mines" strand and offering this as an option to interested students, earth science could be presented to science majors without adding material to their existing basic science courses. Both partners, represented by Dudley (industry) and Doram (school), agreed to develop such a course in order to take advantage of the industry partner's expertise in oil sands and to include on-site visits to its research centre. The resulting course is entitled "The Earth Science of Oil Sands" and has now been offered for four terms.

EARTH SCIENCE OF OIL SANDS CTS

Objectives

The following objectives for the course were developed, and agreed upon, by both partners:

- to increase students' awareness of the variety of careers and technology in earth science
- to demonstrate the application and relevance of the basic science curriculum
- to increase students' awareness of how both technical and personal skills suit different jobs
- to foster team work among the students.

Not included among the objectives is any attempt to convince students that the petroleum industry and/or earth science is any more or less desirable a career than any other.

STUDENT SELECTION

The school partner, represented by Doram, determined the criteria for selection of student candidates for the course. Each term, science majors are invited to attend an information meeting on the course and to submit an application. Five students are selected based on such criteria as organizational and interpersonal skills, and science background. The numbers are limited to five to ensure an optimal learning experience. Although demand indicated the need to increase the number of students accepted each term, the students' feedback was to keep the numbers small to ensure full participation by all individuals.

COMPONENTS

There are three components to the course: a reading resource kit, site visits to the research centre workplace, and a final team presentation by the students, highlighting what they learned.

Resource Kit

A reading resource kit was developed by Dudley to introduce the students to the petroleum industry, oil sands, and Alberta geology. Each student is provided with this resource kit for the duration of the course, returning it after his or her final presentation. The school has

one resource kit on permanent file in its library. The kit was designed to accommodate variable levels of knowledge of earth science. An annotated summary is included in the kit, which highlights selected readings with a brief summary of the information to be thus derived. Interested students are, of course, invited to read more of the material, but the selected readings are the most critical to understanding concepts introduced during the site visits.

The resource material was assembled from readily obtainable, affordable literature either available commercially or from various institutions/associations representing different aspects of oil sands business and earth science. Table 1 is a summary of some of the material included in the kit.

The resource kit is updated continually by adding copies of recent news articles pertaining to the oil sands industry and/or geology. Eight of the twenty-five hours spent on the course are allotted for the students to read and study the material in the resource kit.

Site Visits

Students visit the Imperial Oil Resources Research Centre (Fig. 1) on five different occasions (9-10 hours total). The first visit is a brief introduction during which the students receive their resource kits, are given a short lecture on oil sands, and view a video on oil sands thermal *in situ* recovery at Cold Lake, Alberta. This first visit is also an opportunity for the students to meet the earth scientists who host them on subsequent visits.

Over the four ensuing visits, students spend an afternoon meeting professionals representing a variety of disciplines including sedimentology/stratigraphy, geophysics, palynology, geochemistry, and oil sands operations geology. The 6-7 staff, who spend about 1½ hours each with the students, not only review their current jobs, but also give a brief biographical sketch of how their career paths evolved from their own secondary school days. It is important to emphasize that an individual's career does not necessarily follow a linear path from school days. Relatively few of us in our current professions in earth science had decided, or knew at the age of these students, that this is where we were headed. Many different experiences, such as that offered by the CTS course, help to define one's interests and passion, which can be key to finding an exciting and challenging career path.

Curriculum Applied

Earth science is a relatively unfamiliar topic to many of the CTS students. Although they learn some earth science in the CTS course, perhaps the most significant lesson lies in seeing much of their basic, or pure, science curriculum being applied within earth science.

An example which students find most compelling is the illustration of basic physics and chemistry in the mechanics of a scanning electron microscope, which the students see in operation. Physics is also seen to be applied in seismic geophysics used to map oil sands. Biology and paleoecology are fundamental to the use of palynology as applied in the stratigraphic and sedimentologic analysis of the oil sands deposits. The professional scientists take care to ensure that these basic principles and lessons are emphasized in their contacts with the students.

Activity-based

A key to successful site visits is to provide the students with an activity-based experience. Each visit is designed to include an informal introduction to the host scientist's job and discipline, and a short exercise. For example, in the sedimentology/stratigraphy session, students are introduced to the concept and identification of bedforms and trace fossils as used to interpret environments of sediment deposition. They are then given the opportunity to describe some core themselves and to make an interpretation. In the chemistry and palynology sessions, students are briefed on how mineral and palynomorph identifications are made and used. They are then provided with simplified diagrammatic identification keys and turned loose on petrographic and palynologic microscopes to make their own identi-

Figure 1 The Imperial Oil Resources Research Centre in Calgary, Alberta visited by students from Bowness Senior High enrolled in the Earth Science of Oil Sands Career and Technology Study.

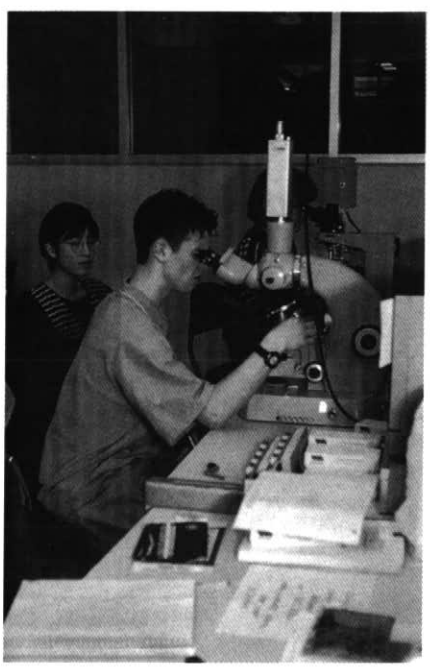

Figure 2 Students conduct their own palynologic and petrographic analyses as part of their hands-on activities during workplace site visits.

fications and comparisons of samples (Fig. 2).

This hands-on experience culminates in the final site visit during which the students participate in a "Development Drilling Game." Students are divided into two teams. Each team is provided with a lease map indicating two areas of potential future oil sands development. The teams must decide which area is preferable, based on given information such as budget, costs of facilities (*e.g.*, steam lines), core, cross sections, and petrographic and palynologic samples from each area. Each team presents and defends its proposal to the earth scientists they have met on past visits, who on this day, play the role of business managers and executives. This gives the students an opportunity to review, and to apply, all that they have learned during the course. It also emphasizes the importance of team work in the workplace. The students are forewarned of this activity during their first site visit. The activity was developed in response to student feedback to offer an activity-based review. The message is shared that there is not always an absolute answer in scientific endeavours, but commonly only a relative measure of certainty and risk. This exercise demonstrates well the importance of clear communication, a mastery of science alone rarely being sufficient for success. One must be able to articulate one's ideas to non-scientists and therefore be strong in language arts as well as science! This message is reiterated in the students' final course requirement, a review presentation.

Team Presentation

The final 8 hours of the course are allotted to the students' developing and presenting a review of their course experience. The content and organization are left entirely to the students. They commonly divide the presentation such that each student describes one earth science discipline. Another approach has been for each student to give his or her impressions of the entire course, covering both technical and career-related highlights. The presentation is given during an evening at the school to an audience of teachers, family, fellow students, and representatives from the industry partner, including some of the course instructors. The students are asked to keep a journal throughout the course, noting their readings, activities, thoughts and reflections. This journal is reviewed periodically by Ted Doram and is invaluable to the students in preparing their presentations.

FEEDBACK AND RESULTS

Students are asked to provide feedback and discuss any topics of interest at the end of each site visit. One industry host, Jon Dudley, meets them at the beginning and end of each visit, thus developing a rapport which pays off by the last visit, when half an hour or more is commonly spent discussing the students' overall impressions of their experience. This provides preliminary preparation for their final presentations. These discussions have resulted in some significant learning opportunities for both professionals and students alike.

On one occasion students shared their observation that certain personalities appeared to be better suited to some jobs than others. They noted that it would likely take an outgoing individual to succeed as an operations geologist, comfortable with and capable of making quick decisions when receiving phone calls at 2:00 a.m. on whether a well should continue drilling on the basis of logs just delivered to the individual's doorstep. On the other hand, it has been noted, a research geologist would have to be a persistent individual, patient and comfortable with detail.

One discussion began with a student declaring that the most striking lesson of the course was that "geology is actually quite boring" owing to the need for a level of attention to detail that might be intolerable! This evolved into a discussion in which it was determined that this observation might be characteristic of science in general. It is mostly problem definition, a lot of tedious data gathering and analysis and, if one is lucky, a "eureka" every now and then. These features were discussed as not being unique to geology, and rarely apparent when watching fictional Indiana Jones movies or science documentaries which condense the work and lives of numerous scientists into less than 1 hour of riveting entertainment. These realities are sometimes difficult to convey in a classroom situation and therefore are a very valuable lesson learned from seeing science in the workplace through the CTS course.

KEYS TO SUCCESS

This earth science course, developed in an industry-high school partnership, enjoys great success with ever-increasing demand regularly exceeding the number of positions available. The following are considered to be the key factors leading to the success of such a project.

1. Earth scientists and educators must collaborate from the inception of such a project, so as to understand and accommodate the needs and constraints of each partner.
2. Such courses must be activity-based, not just a series of lectures, to ensure effective learning.
3. Preparation time for the industry participants must be minimized by using activity-based site visits rather than a formal presentation format.
4. One individual industry partner should be nominated as a co-ordinator to welcome students and receive feedback upon each site visit. This leads to a rapport between students and a professional, which facilitates discussion and clarification of unfamiliar concepts.
5. Students should be involved by encouraging team work in the site visit activities and in a final presentation. This helps the students learn from each other, and taps their innovative talents.

We hope that this article may inspire and assist other professional geologists and educators to collaborate on similar projects to present earth science to students.

ACKNOWLEDGMENTS

We thank those enthusiastic students who, through their participation and constructive feedback, make the course such a success and a pleasure to present. Thanks are also due to the Imperial Oil Resources employees who helped as instructors, and to the partnership leaders at Imperial Oil Resources and Bowness Senior High for their support in the development of this course. A special acknowledgement is made to Dr. R.P.W. Stancliffe of Imperial Oil Resources for his patient help and critiques as the course evolved from an idea to reality. This paper was greatly improved by reviewers Karen Wallace-Dudley, Godfrey S. Nowlan, and Roger W. Macqueen.

REFERENCES

Bates, J.L., Coflin, K.C., Williams, G.L., Mackin, P. and Vodden, C., 1998, Earthnet: an internet teaching resource: Geological Association of Canada, Annual Joint Meeting, Abstract Volume, p. A-11.

Bott, R., 1993, Our Petroleum Challenge Into the 21st Century: Petroleum Communication Foundation, Calgary, AB, 64 p.

Conference Board of Canada, 1997, 100 Best Business – Education Partnerships 1997 Idea Book: Conference Board of Canada, Ottawa, ON, 116 p.

Godfrey, J.D., ed, 1993, Edmonton Beneath Our Feet: Edmonton Geological Society, Edmonton, AB, 150 p.

National Task Force on Oil Sands Strategies, 1995, Canada's Oil Sands Industry: Yesterday, Today, and Tomorrow: Alberta Chamber of Resources, Edmonton, AB, 19 p.

Robinson, J.M.A. and Jessup, J.Y., 1990, The Cold Lake Project: University of Calgary, Canadian Major Projects Association Monograph, The Learning from Experience Series, Calgary, AB, 73 p.

Royal Tyrrell Museum of Palaeontology, 1994, The Land Before Us: Red Deer College Press, Red Deer, AB, 96 p.

Sweet, S., 1998, CTS opens new opportunities to students: The Collaborative, Calgary Board of Education, v. 3, n. 2, p. 10.

Turner, R.J.W., Clague, J.J. and Groulx, B.J., 1996, Geoscape Vancouver – living with our geological landscape: Geological Survey of Canada, Open File 3309 (published 1997).

Accepted as revised 15 March 1999

Position Available

QUEEN'S UNIVERSITY

DEPARTMENT OF GEOLOGICAL SCIENCES

The Department of Geological Sciences at Queen's University, Kingston, ON invites applications for a tenure-track faculty position at the assistant professor level, commencing July 1, 1999. We seek a geotechnical engineer with a strong background and continuing interest in structural geology and related fields (*e.g.*, natural hazards).

The appointee will teach undergraduate courses in structural geology and geotechnical engineering, and graduate courses primarily in the research area. S/he will be expected to develop a vigorous program of high-quality, externally funded research and to supervise graduate students at the M.Sc. and Ph.D. levels. The appointee will be expected to contribute significantly to the development and administration of the accredited undergraduate Geological Engineering Program of the Department.

Candidates should hold a Ph.D. in an appropriate field. Post-doctoral or industrial experience is highly desirable. The appointee must hold or be qualified to obtain registration as a Professional Engineer in Ontario. The salary will reflect qualifications and experience.

In accordance with Canadian immigration requirements, this advertisement is directed to Canadian citizens and permanent residents of Canada. The University is committed to employment equity and welcomes applications from all qualified women and men, including visible minorities, aboriginal people, persons with disabilities, gay men and lesbians.

Applications should include a current curriculum vitae, statement of research and teaching interests, samples of research writings, and the names and addresses of three individuals who have agreed to provide letters of reference. Completed applications should be sent to the following address by May 31, 1999:

Dr. H. Helmstaedt, Professor and Head
Department of Geological Sciences
Queen's University
Kingston, Ontario K7L 3N6

Additional information about the Department, its faculty and its academic programs can be obtained from the WWW at http://geol.queensu.ca