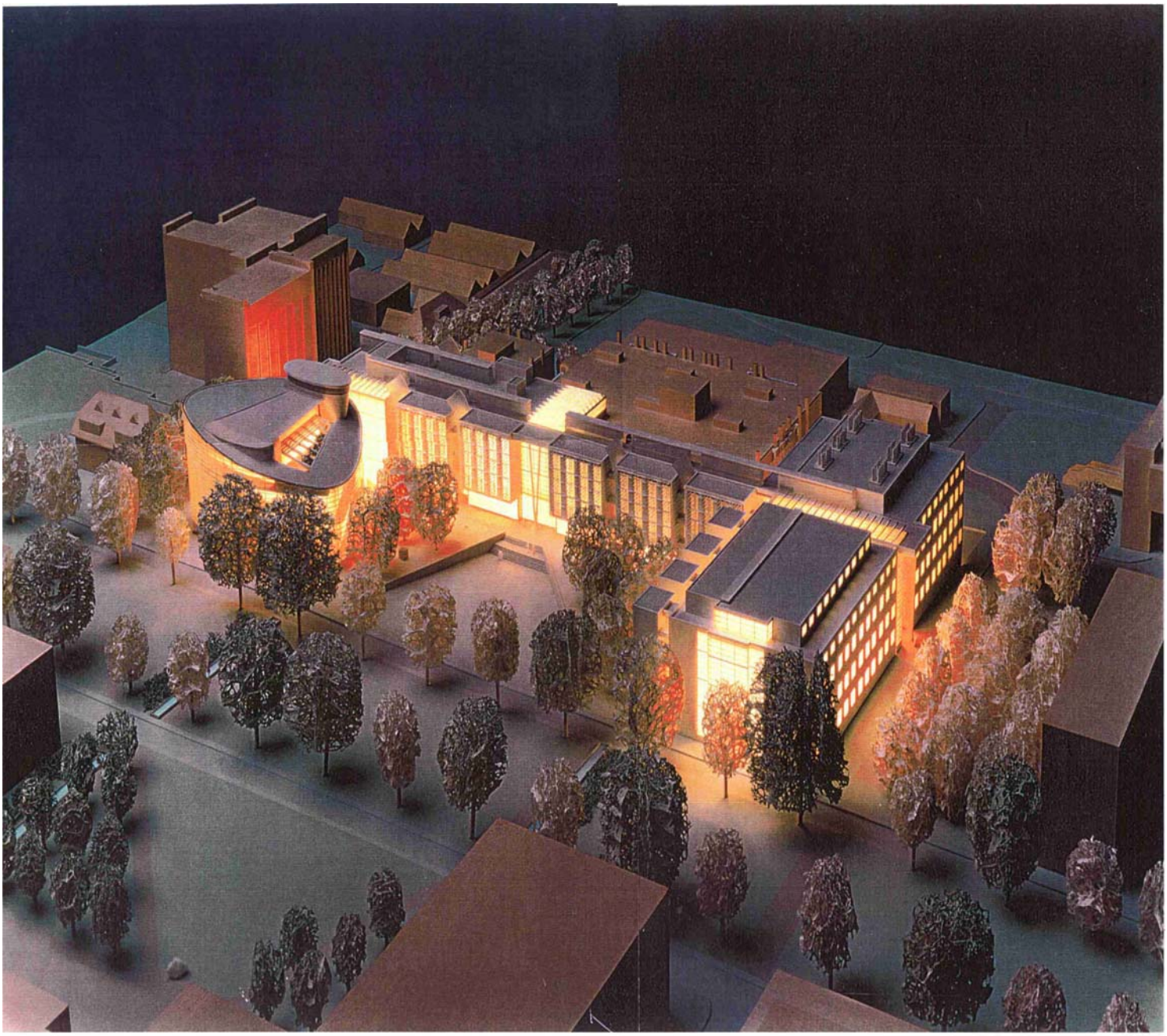
Earth and Ocean Sciences

The EOS Alumni and Friends Newsletter

Number 8 (2005)



The EOS Dream

" We believe that the Department has almost unlimited potential to become an international force in the earth, ocean and atmospheric sciences and that it should settle for nothing less."

EOS External Review Committee Report, 2005.

MESSAGE FROM THE HEAD

It is hard to believe that I have been Head of EOS for 5 years. As the anniversary approached, any fatigue had to take a back seat because the anniversary automatically triggered an external review of the Department and it was this event that dominated the past year. In the fall of 2004, the Dean's office struck an international External Review Committee charged with providing a report on our progress and problems to be submitted to the Vice President Academic and Provost at UBC, Lorne Whitehead. The Committee consisted of Glenn Caldwell (Earth Sciences, University of Western Ontario (Chair)), Alan Green (Institute of Geophysics, ETH, Switzerland), Louis Legendre (Laboratoire d'Oceanographie, Villefranche, France), Paul Mueller (Geological Sciences, University of Florida) and Peter Taylor (Earth and Space Science and Engineering, York University). We set up a web site dedicated to the Review Committee through which the members had access to all pertinent information on EOS research, teaching, enrolment, administration, space, infrastructure and finances. In December 2004, the Committee spent a tightly packed two days in EOS, taking tours and meeting with the entire Department (Faculty, staff, students), senior administrators at UBC, and representatives from government and industry.

The report arrived in February of this year and, in short, we got an 'A'! The Committee commented on the constellation of senior EOS stars with internationally recognized research programs, now complemented by a large group of young rising stars brimming with creativity and new ideas. They commended EOS for curriculum reform and teaching innovations that have led to an increase of over 70% in undergraduate enrolment and almost 50% in graduate enrolment since 2000. We were also recognized as a leader in outreach to both the rest of campus and the community at large. In this edition of the newsletter we cover recent achievements in most of these areas and, where appropriate, we have interleaved pertinent comments (in blue) from the External Review Committee. What I want to do in my message, however, is focus on the main problem that the Review Committee identified.

To some extent we have become victims of our own success. Laboratory space for new Faculty has been difficult to come by and to finance, offices are full to bursting, and we are still scattered across campus in four different buildings and as many satellite sites. We now offer more classes than ever and some have large enrolments. Unfortunately, there are only seminar and small classrooms in our buildings and, consequently, EOS instructors have become nomads lugging equipment and teaching materials across campus in search of adequate classroom space. We also have ambitions to expand the Pacific Museum of the Earth to promote an understanding of the Earth, its history and resources to the public at large. We are particularly interested in greater involvement with schools, both directly through school visits and indirectly through helping the Faculty of Education train Earth Science teachers. All this requires space. As many of you will know, EOS drew up plans for a new building some time ago and the External Review Committee made a strong recommendation for the resurrection of these plans as a sure route to the long term success for our Department. The senior administration at UBC seems to have heeded the External Review recommendation to the extent that committees are now meeting to discuss the scale of the building and potential sources of funding. The photograph on the front page shows a model of the building as originally conceived. There is no doubt that, given our record and current trajectory, this accommodation would help establish EOS as one of the foremost Earth Science departments in the world.

At the beginning of this article, I mentioned fatigue and I must confess that I need to take a short break from administration so that I can recharge my research program and update my teaching skills. In the meantime, the rudder will be in the very capable hands of Kelly Russell as Acting Head (krussell@eos.ubc.ca; (604) 822-2703) and Raymond Andersen as Associate Head (randersen@eos.ubc.ca; (604) 822-4511). I will return next year to begin a second contract as Head of EOS and I very much look forward to communicating with you all again about the challenges and opportunities that await us.

Paul L. Smith

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RESEARCH HIGHLIGHTS

"EOS scientists are highly regarded nationally and internationally for their original research in a wide range of disciplines and sub-disciplines. The quality of the research is demonstrated by the good to excellent quality of their published scientific papers, which for the most part appear in national and international journals of the highest repute. The annual volume (quantity) of scholarly publication is another measure of the stature of the EOS scientists and a contributing factor to their increasing national and international recognition. *For the size of the faculty and the fields in which they work, an annual publication rate of well over 200 peer-reviewed contributions to books, journals, and conference proceedings that rate maintained now for several years -- is commendable in the extreme.* Prestigious medals and research fellowships awarded to EOS scientists by national and international organizations, and numerous prizes awarded to them for their publications and presentations, offer still further testimony in support of the Committees judgment."

EOS External Review Committee Report, 2005

MINING AND GLOBAL CHANGE
Greg Dipple and his Research

Professor Greg Dipple leads the UBC research team that is documenting uptake of atmospheric carbon dioxide in mine residue.

Carbon Sequestration in Mine Residue
Greg Dipple, Principal Investigator

Some mine tailings react with the atmosphere to fix carbon dioxide (CO2) within mineral structures, thereby sequestering it from the atmosphere where it has been linked to global warming. The rapidity and extent of CO2 fixation is due to the vast increases in silicate mineral surface area that are a direct result of mineral processing. Mine residues may thus provide the optimal environment for CO2 disposal and therefore have unrealized environmental and economic value.

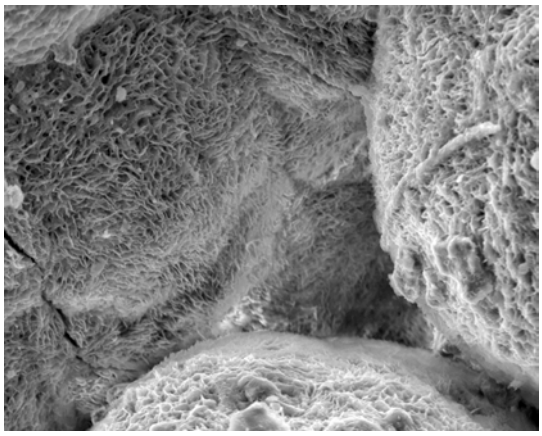
A new research project within the Mineral Deposit Research Unit examines the mechanisms and rates of CO2 uptake in tailings from active mines, and is developing a verification protocol for bound CO2. The project has attracted international media coverage, including this review from the American Chemical Society journal Environmental Science and Technology.

Mine tailings soak up greenhouse gas

Researchers have shown for the first time that tailings, the mountains of rubble left after mining for nickel and asbestos, absorb significant amounts of CO2. The discovery, made at mines in Québec, British Columbia, the Yukon Territory, and Australia, could help mines earn credit for what is considered the most permanent form of greenhouse gas sequestration.

"We were examining tailings to characterize them as a feedstock for an industrial reactor for CO2 sequestration but found that the tailings were already reacting directly with the atmosphere," says Greg Dipple, a geologist at the University of British Columbia. The surprising discovery, presented November 23 at the Yukon Geoscience Forum in Whitehorse, came after scientists used isotopic tracers to show that atmospheric CO2 was the precursor of the carbon-containing compounds in the rocks.

EOS graduate student James Thom sampling surface waters from waste rock of the Cassiar Mine, British Columbia.



Scanning electron photomicrograph of dypingite mineral rosettes that trap one third of their mass in atmospheric carbon dioxide. The rosettes formed within tailings of the Clinton Creek Mine, Yukon. The field of view is 0.2 millimetres.

The sequestration reaction requires water, which comes from rainfall and ponds in which tailings are sometimes stored, Dipple says. Atmospheric CO2 forms carbonic acid in water, and as the water evaporates it reacts with metallic cations, such as magnesium(II), to precipitate stable carbonate minerals, he explains. Serpentine-group minerals, found in tailings from white asbestos (chrysotile) and nickel mines, are the most abundant and widespread source of magnesium cations, adds Grant Abbott, chief geologist at the Yukon Geological Survey.

Because mineral carbonation was so prevalent in the tailings of one mine, Dipple estimates that the mine may be fixing tens of thousands of tons of CO2 per year. Mining companies could boost carbon fixation at the mine to roughly 1 million tons per year by introducing more water, lowering the pH, and increasing the surface area of the tailings, he speculates.

If costs can be lowered to about $8–10 per ton, mining companies could set up reactor sites that could absorb nearly 1 billion tons of CO2 per year, which is one-third of the global carbon sequestration target set by policy makers, Dipple says. Work is under way to determine how to accelerate carbon sequestration for the lowest cost, but field experiments are still a couple of years away, he adds. However, Abbot warns, “Mineral carbonation sounds promising as a form of carbon sequestration, but it all depends on the CO2 credit market.” —JANET PELLEY

EOS graduate student Sasha Wilson stands with white dypingite-nesquehonite crusts (near notebook) in tailings of the Clinton Creek Mine, Yukon.

DRUGS FROM THE OCEAN
Ray Andersen and his Research Team

This is a condensed version of an article on *Bioprospectors* that appeared in the 10th Annual Environment Issue of Canadian Geographic. Reproduced here with permission by the author, Allen Abel.

Raymond Andersen of the University of British Columbia is leading the way in ethical bioprospecting as he investigates compounds derived from marine animals for medicinal use.

Out of the foaming Pacific, like the "creature from the Black Lagoon," Mike LeBlanc arises with treasure in his hand. A .scuba diver with more than 30 years of experience, LeBlanc is quilted from top to tail fin in a rubber suit against the briny chill. Popping the regulator from his mouth after 40 minutes underwater, he hands his mesh bag to a waiting crewman aboard our sleek little boat.

We are sailing this April day along the west coast of Vancouver Island. near the village of Bamfield, where Barkley Sound meets the sea. In other places on our blue-water planet, the dive plan might be a simple lust for loot. A frogman might surface with an ancient Roman amphora in his grasp, or the Empress of Ireland's silverware, or a handful of Spanish doubloons. But this time, as LeBlanc flippers and flops his way on deck, the bounty squishing within his sack may hold - we can only hope - the cure for cancer or arthritis or AIDS.

The enterprise that brings us here to the Bamfield Marine Sciences Centre is called "bioprospecting." It is a worldwide, intensely competitive and increasingly feverish search for natural-source medicines, fuelled by a simple premise, which history will prove to have been either prophecy or myth: namely, that the cures for the worst of our plagues lie waiting to be discovered on the reefs and in the rain forests of a ravaged world.

Find them now, the bioprospectors cry, or lose them forever. LeBlanc, who grew up in landlocked Guelph, Ont., and did not see the sea until he was eight years old, is a research assistant in the Earth and Ocean Sciences department at the University of British Columbia (UBC). A marine biologist by training, he is part of UBC's elite bioprospecting team, a mission that has taken him from Barkley Sound to Papua New Guinea and from the Caribbean to Newfoundland.

Today, LeBlanc and two UBC graduate students, Katherine Woods and Kelsey Desjardine, are scavenging the basement of the sound for marine invertebrates - the starfish and sponges and other squiggly little creatures that carpet the tide-swept bay. Although the odds are heavily against success, something in or on the bodies of these organisms may prove to be effective against some grievous human malady. So the divers strap on another silver tank and plunge overboard again.

One of the specimens they deliver when they return is a burnt orange species of hydroid, which looks like a fragile, frondlike plant, but is actually a carnivorous condominium of thousands of individual animals. Another is that saltwater slug *Diaulula sandiegensis*.

Diaulula is a nudibranch, which rhymes with tank, not ranch. It is a lovely little thing, pearly grey with leopard-like "eye" spots warning predators that the thumb-sized beast, which is probably both blind and senseless, is also toxic.

Common in these waters - and as far south as Baja California - its fate, alas, is to be pickled, diced and whipped into a thick shake of protoplasm in the UBC labs, then centrifuged until the molecular structures of its bodily constituents can be accurately mapped.

Woods hopes - though the evidence is far from conclusive - that one or more of *Diaulula*'s bodily chemicals may somehow mitigate type 2 diabetes, a disease that affects 16 million people in North America and recently killed one of her aunts. Certainly, the experiment is worth trying.

"The ultimate goal," she says, "is to find out whether there is any interesting chemistry in *Diaulula* that would be useful to medicine in general. These nudibranchs do very interesting things. The dream would be to see if they have some sort of anti-diabetic activity on their skin.

Aboard the Barkley Star (from left), Woods and Ana Diaz-Marrero show writer Allen Abel (centre) photographs of organisms found in tropical and cold temperate ocean habitats off Papua New Guinea and Canada's west coast.

"A sea slug has no natural physical defences - no hard shell, no claws, no fangs. So it just sort of goes along, and if a fish decides to eat it, it can't do much about it. But if it can produce something on its skin that will make the fish spit it out or will kill the fish, then it can survive. What we try to find out in the lab is what that 'something' is.

"People always ask me whether the nudibranch gets hurt. I tell them that it doesn't really feel anything - it doesn't have a brain area, so it doesn't perceive pain the way we perceive pain. At least, I hope not!"

The marine bioprospecting program at UBC is led by Raymond J. Andersen, a professor of chemistry and oceanography from the thoroughly un-oceanic community of Drumheller, Alberta., where his father sold farming supplies.

Unlike LeBlanc, who gained the coastline as a teenager, Andersen didn't see salt water until he was a grad student at the University of California, Berkeley in the early 1970s, a time when a firestorm of free speech and anti-war turmoil, in his words, "made it difficult to study."

"1 had no innate interest in the ocean," says Andersen, admitting his prairie-boy prejudice. "1 didn't even realize that you *could* study the ocean."

Three decades later, he is one of the world's leaders in extracting biologically active and potentially useful compounds from the liquefied corpses of maritime beasts.

Between his boyhood in Drumheller and his tenure at UBC, Andersen studied natural-product chemistry at the Massachusetts Institute of Technology and at the Scripps Institution of Oceanography near San Diego, where he was thrown, literally, into a scuba certification class, despite the fear that he barely knew how to swim. For a landlubber, learning how to dive changed everything.

"You could go out in the backyard and find plants," he says, "but until the invention of scuba, people kind of ignored the ocean. There was no folk medicine from the ocean. Once chemists could get underwater [around 1960), the whole field really started to take off.

"The thesis was that we were looking for antibiotics. At that time, *anything* you picked up had new chemicals in it. These organisms were bathed in bacteria, so they probably had antibiotics in their body chemistry in order to survive.

"If you keep collecting everything you can find, you'll get thousands and thousands of compounds. It's a giant pyramid and maybe one of them will be useful."

So two decades ago, Andersen, LeBlanc and their colleagues set off around the globe, trying to. beat the Americans and the Europeans to the farthest reefs, the most distant isles, the least-explored atolls. In the 1980s, off the southwest coast of Papua New Guinea, they collected a couple of species of sponge and, it seemed, hit pay dirt.

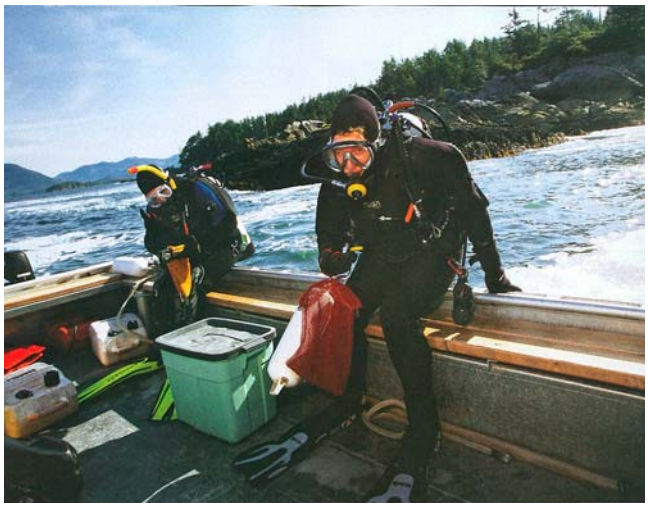
Like the clawless, clueless *Diaulula*, sponges own no weaponry against predators, other than foul-tasting flesh. But among their secondary metabolites, as they are known, are some unique and rather complicated organic molecules that can be isolated and, most important, synthetically reproduced.

Laboratory replication is at the nucleus of bioprospecting. This is because, Andersen says, "the natural sponge itself is never going to be a source of medicine. No pharmaceutical company is going to base a billion-dollar drug on collecting sponges from a coral reef

"What we're really looking for is inspiration. Sponges make a lot of exotic compounds. We hope to be able to make a synthetic analogue of a natural substance. It's a huge challenge to develop a drug from a sponge."

That challenge was accepted by a Vancouver-area pharmaceutical company called Inflazyme, which took Andersen and Leblanc's sponge-based compounds from Papua New Guinea, synthesized and slightly altered them, and produced a substance that appears to possess some efficacy against asthma.

Inflazyme has taken the asthma drug all the way to human clinical trials, where, in phase-one resting, it has been shown to be non-toxic. Phase two - the crucial effectiveness testing - began in 2003. This should prove whether the sponge from the New Guinea reefs really *can* treat your asthma, or Raymond Andersen's. He suffers from it too.



LeBlanc adjusts his regulator (above, left) as he and Woods (Kate) prepare for their first dive of the day.

"I tell my students that the probability of developing a drug or even getting a drug to clinical trials is approximately zero," he says. "I long ago realized that if you set your bar of success as a drug that is used to treat humans, you're doomed to failure.

"If it were that easy - if people really thought the cure for AIDS was in these organisms - there would be more people doing it. 'the drug companies would be doing it themselves. It's not that simple.

"There could easily be a milIion species of invertebrates, and tens of millions of bacteria. After 20 years of prospecting, looking at 4,000 organisms out of X thousand species, we got two drugs to clinical trials. We've been very, very lucky.

"While we're looking for things that have intrinsic value, it's not like somebody can go out and find a nugget and become an instant millionaire. Nobody has made any money from this yet."

Here is another issue. Why should Canadians think that just because they pluck SpongeBob CureCancer from a reef in Papua New Guinea, they can simply stuff him into a sack and beat it back to British Columbia?

This message was borne out rather memorably to LeBlanc one day as he dove for sponge and hydroids and nudibranchs off the north coast of the western Pacific country.

"We were out in the boat off Bagabag Island," he recalls, "bringing things up, paying 5 or 10 dollars to the locals for

helping us. Suddenly, the headman of the nearest village came paddling out, saying, 'Don't take anything else! Get out of here!'"

"His son had been to the capital in Port Moresby, and he had heard about the so-called riches of the sea. The chief figured that whatever we were taking was worth money - his money."

A cure for asthma, of course, would be worth billions. But billions for whom? For Inflazyme? For UBC? For Raymond Andersen and Mike LeBlanc? Or for the people of Bagabag Island?

A new word has joined our lexicon: biopiracy. It is not the sort of accusation that Canadians enjoy having directed at themselves. So in August 2002, UBC took the unprecedented step of sending the University of Papua New Guinea a cheque for $100,000 as a down payment on royalties, should they ever come, from the asthma medicine or the cancer cure that might be derived from the sponges of Bagabag.

"We *do* owe them for being able to go in and collect," says leBlanc. "It's their country, and in recent years, at least, they're putting in the effort to preserve these environments. It's easy for us to set aside a couple of square miles, but for a country like Papua New Guinea, it's really difficult for them to do that."

"It was not an act of charity," says Andersen. "We recognized that there was a moral obligation and an ethical obligation. We stood behind that obligation. It's a resource that's in their water. Some people argue that they should get everything. We felt that it was only fair - that it was the right thing to do.

"One of the most positive things that has happened so far is that they were able to turn an old dormitory into a suite of 15 labs. To me, the nicest thing would be if they got the drug back to use for their own citizens. For free."

Ana Diaz-Marrero processes sponges in the lab at UBC.

From Plant To Medicine

Close to half the world's pharmaceuticals consist of compounds that were originally found in living things. But just how are these medically important ingredients discovered, and how did they end up in a pill in your medicine cabinet? According to Mike LeBlanc, a research assistant in Raymond Andersen's lab at the University of British Columbia, whether compounds are found in rain forests or in the sea, the basic steps are the same.

1. Researchers go to an area rich in biodiversity and take small samples --- in the 200 to 300-gram range --- of hundreds of organisms, such as plants or, in the sea, algae and sea sponges. These are preserved in alcohol or frozen until they can be tested.
2. The sample's organic compounds are extracted using methanol, and the methanol extract is then concentrated until it is gum like.
3. Tests called assays are conducted to see whether the preparation has any useful biological activity. For instance, researchers look for signs that an extract kills cancer cells but not healthy cells.
4. If there is promising activity, chemists try to isolate and purify the compound responsible and understand its chemical structure.
5. Once the active compound is isolated from an extract, it is tested in animals to see whether it is safe to use.
6. Chemists then synthesize the compound in the laboratory, ensuring that it can be made in larger batches, for testing in humans in carefully controlled clinical trials.
7. If the compound achieves the desired effect and has low toxicity, it can be approved for use in humans.

The process of finding a pharmaceutical compound and getting it to market as a new drug takes about 15 years and costs several hundred million dollars. Fewer than one in 10,000 promising compounds are ultimately turned into useful drugs.

Pippa Wysong

On June 18, 2004, Inflazyme Pharmaceuticals Ltd. announced it was discontinuing all human trials of the anti-asthma compound that had been derived, with modifications, from Andersen and LeBlanc's Papua New Guinea sponge.

In clinical trials, that formula or a placebo had been given to 169 American men with "mild to moderate persistent asthma." In the end, there was no significant difference between the effects of the drug and those of the sugar pill.

Last fall, the pharmaceutical giant Wyeth completed phase-2 testing in the United States of a potential tumour suppressing compound that also was derived from the bounty of sponges off Papua New Guinea but decided not to proceed to the next stage. As Gilbert and Sullivan proclaimed in their opera *The Mikado*, "There's lots of good fish in the sea!" It's just that not many of them seem to turn into effective medicines.

"This is maybe what people don't realize," says Andersen. "There's a lot of disappointment. It's a low-probability business. It's a very tough process to discover a new drug.

"Most of the time, it doesn't succeed. But that doesn't mean you stop looking. And, on the way, you hope you learn some science."

Writer Allen Abel is, based in Toronto and Page, Arizona. Photographer Quinton Gordon lives on Gabriola Island, B.C.

OTHER SCIENTIFIC ACHIEVEMENTS

Extracts from the EOS External Review Committee Report, 2005 (In Blue)

A small number of recent selected references are provided to illustrate the comments made by the External Review Committee. A full list of references can be seen on the EOS Web site. Please note that because these citations are excerpted from Faculty member's CVs, only their names are highlighted. Many of the co-authors are EOS research personnel and graduate students.

"Over the past decade, EOS scientists have been responsible for an impressive array of scientific achievements. A selection of these are highlighted to illustrate the point."

Life in the oceans

"EOS biological oceanographers have demonstrated that viruses play critical roles in the structure and function of aquatic food webs. They have also addressed the long-term decline in krill stock and increase in salps within the Southern Ocean (krill being the staple food of many fishes, birds, and mammals in that ocean)."

Selected Recent Publications:

Atkinson, A., Siegel, V., **Pakhomov, E.A.** and. Rothery, P. (2004) Long-term decline in krill stock and increase in salps within the Southern Ocean. Nature, 432: 100-103.

Pakhomov, E.A. and Froneman, P.W. (2004) Zooplankton dynamics in the eastern Atlantic sector of the Southern Ocean during the austral summer 1997/1998. Part 1. Community structure. Deep-Sea Research II, 51(22-24): 2599-2616.

Daughney C.J., Chatellier X., Chan A.M., Kenward P., Fortin D., **Suttle C.A.**, Fowle D.A.. 2004. Adsorption and precipitation of iron from seawater on a marine bacteriophage (PWH3A-P1). Marine Chemistry 91:101-115

Wen, K., A.C. Ortmann and **C.A. Suttle**. 2004. Accurate estimates of viral abundance by epifluorescence microscopy. Applied and Environmental Microbiology 70:3862-3867

Lawrence, J.E. and **C.A. Suttle.** 2004. The effect of viral infection on sinking rates of *Heterosigma akashiwo* and its implications for bloom termination Aquatic Microbial Ecology 37:1-7

Crustal and mantle dynamics

"By analyzing the characteristics of earthquake-generated waves recorded in Canada, EOS geophysicists have shown that the shallow mantle at subduction zones is greatly hydrated, a result that has important implications for understanding great thrust earthquakes and the genesis of arc magmas. Their work also suggests that ancient continental masses were stabilized by way of low-angle imbrication of oceanic lithosphere during multiple episodes of shallow subduction. In addition to providing clues to the carbon source of diamonds, their analyses suggest the presence of ultra-deep (350-400 km), neutrally buoyant fluids that may play a role in the genesis of the kimberlite magmas that transport the diamonds to the surface."

Selected Recent Publications:

McNeill, A., **Bostock, M.G.**, Rogers, G.C., and Shragge, J. (2004). The effect of forearc mantle serpentinization on ground motions from megathrust and intra-slab events in the Cascadia subduction zone, Bull. Seismol. Soc. Am., 94, 147-154.

Currie, C.A., Cassidy, J.F., Hyndman, R.D., **Bostock, M.G.** (2004) Shear wave anisotropy beneath the Cascadia subduction zone and western North American craton, Geophys. J. Int., 157, 341-353.

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Gonnermann, H.M., **Jellinek, A.M.**, Richards, M.A. and Manga, M., Modulation of mantle plumes and heat flow at the core-mantle boundary by plate-scale flow: Results from laboratory experiments, Earth Planet. Sci. Lett., 226, 53-67, 2004.

Kopylova, M.G. , Caro G.2004. Mantle xenoliths from the Southeastern Slave craton: The evidence for a thick cold stratified lithosphere. Journal of Petrology, 45, 5, 1045-1067

Piercey, SJ, Murphy, DC, **Mortensen, J.K.** and Creaser, RA,. 2004. Mid-Paleozoic initiation of the northern Cordilleran marginal backarc basin: Geologic, geochemical, and neodymium isotope evidence from the oldest mafic magmatic rocks in the Yukon-Tanana terrane, Finlayson Lake district, southeast Yukon, Canada. Geological Society of America Bulletin, v. 116, pp. 1087–1106.

Chen, J., and **Oldenburg, D. W.**, 2004, Magnetic and electrical fields of direct currents in a layered earth. Exploration Geophysics, Vol 35, p 157-163.

Doucet S, **Weis D, Scoates JS**, Debaille V and Giret A (2004) Geochemical and Hf-Pb-Sr-Nd isotopic constraints on the origin of the Amsterdam-St. Paul (Indian Ocean) hotspot basalts. Earth and Planetary Science Letters, v. 218, p. 179-195.

Geophysical fluid dynamics

"EOS atmospheric scientists have pioneered the use of artificial neural network models for analyzing meteorological data and for short-term climate prediction. Their non-linear methods, which require substantial computing effort, produce markedly more reliable forecasts than the standard linear approaches. A numerical model has been developed by EOS geological engineers for the dynamic analysis of rapidly moving debris flows, avalanches, and volcanic lahars."

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Balmforth, N.J. & S. Mandre "Dynamics Of Roll Waves", J. Fluid Mech., V. 514, P. 1-33, 2004.

Balmforth, N.J., R. V. Craster & R. Sassi "Dynamics Of Cooling Domes Of Viscoplastic Fluid Ii", J. Fluid Mech., V. 499, P. 149-182, 2004.

Hsieh, W.W., 2004. Nonlinear multivariate and time series analysis by neural network methods. Reviews of Geophysics, 42, RG1003, doi:10.1029/2002RG000112.

Wu, A. and **W.W. Hsieh**, 2004. The nonlinear association between ENSO and the Euro-Atlantic winter sea level pressure. Clim. Dynam. 23: 859-868. DOI: 10.1007/s00382-004-0470-5.

Rattan, S.S.P. and **W.W. Hsieh**, 2005. Complex-valued neural networks for nonlinear complex principal component analysis. Neural Networks, 18: 61-69, doi:10.1016/j.neunet.2004.08.002.

Berg, L. K., and **R. B. Stull**, 2004: Param. of joint frequency distrib. of potential temperature and water vapor mixing ratio in the daytime convective boundary layer. J. Atmos. Sci., 61, 813-828.

De Wekker S.F.J., **D.G. Steyn**, J.D. Fast, M.W. Rotach, and S. Zhong, 2004: The performance of RAMS in representing the convective boundary layer structure in a very steep valley. Environmental Fluid Mechanics (In Press).

Global environmental change

"EOS glaciologists have suggested that cryospheric processes associated with the last great ice age triggered abrupt climate changes, perhaps analogous to today's conditions. Other EOS scientists interested in the environment have identified sequestration methods that may help to offset the present rise in carbon dioxide and methane, the two main greenhouse gases. Particularly promising approaches involve selective adsorption of carbon dioxide and methane in coal seams and accelerated carbonation reactions in mine residues."

Selected Recent Publications:

Hildes, D.H.D., **Clarke, G.K.C.**, Flowers, G.E., and S. J. Marshall. Subglacial erosion and englacial sediment transport modeled for North American ice sheets. Quaternary Science Reviews, 23:409-430 (2004).

Mangerud, J., Jakobsson, M., Alexanderson, H., Astahkov, V., **Clarke, G.K.C.**, Henriksen, M., Hjort, C., Krinner, G., Lunkka, J.-P., Möller, Murray, A., Nikolskaya, O., Saarnisto, M., and Svendsen, J.L.. Ice-dammed lakes and rerouting of the drainage of Northern Eurasia during the last glaciation. Quaternary Science Reviews, 23:1313-1332 (2004).

Wu, A., **W.W. Hsieh** and A. Shabbar, 2005. The nonlinear patterns of North American winter temperature and precipitation associated with ENSO. J. Climate (accepted 2004/10/22).

Cui, X., **Bustin, M., Dipple, G.M.**, 2004, Differential transport of CO2 and CH4 in coalbed aquifers: implications for coalbed gas distribution and composition, American Association of Petroleum Geologists Bulletin, 88, 1149-1161.

Resources, hazards, and environmental quality

"Innovative tools relevant to mining exploration and exploitation have been developed by EOS researchers. As examples, EOS inversion methods for interpreting diverse geophysical data sets are now being used by numerous companies and university groups worldwide under license to UBC, and EOS geochemists have developed extremely sensitive isotopic techniques for identifying the sources of various pollutants.

The Mineral Deposits Research Unit – a joint effort with industry – is highly regarded by other academic departments and viewed most favourably by industry.

Research by EOS chemical oceanographers on novel metabolites produced by marine organisms has led to the development of new drugs for treating asthma and cancer. Some of these drugs are currently undergoing clinical trials on humans.

Collaborative air-quality and mesoscale meteorological field projects, such as Pacific 2001, have led to increased awareness and understanding of the complex nature of these issues in Vancouver and other coastal and mountainous environments."

Selected Recent Publications:

Kaoru Warabi, Lianne M. McHardy, Lohi Matainaho, Rob Van Soest, Calvin D. Roskelley, Michel Roberge, and **Raymond J. Andersen** "Strongylophorine-26, A New Meroditerpenoid Isolated from the Marine Sponge *Petrosia (Strongylophora) corticata* That Exhibits Anti-invasion Activity" Journal of Natural Products 2004, 67, 1387-1389.

David E. Williams, Brian O. Patrick, Akbar Tahir, Rob Van Soest, Michel Roberge, and **Raymond J. Andersen** "Boneratamides A-C, New Sesquiterpenoids Isolated from the Marine Sponge *Axinyssa aplysinoides*" Journal of Natural Products 2004, 67, 1752-1754.

Xiuxian Jiang, Baoguang Zhao, Robert Britton, Lynette Y. Lim, Dan Leong, Jasbinder Sanghera, Bin-Bing S. Zhou, Edward Piers, **Raymond J. Andersen**, and Michel Roberge. "Inhibition of Chk1 by the G2 DNA damage checkpoint inhibitor isogranulatimide" Molecular Cancer Therapeutics, 2004, 3, 1221-1227.

C. F. Harvey, K. N. Ashfaque1, W. Yu, A. B. M. Badruzzaman, M. Ashraf Ali, P. M. Oates, H. Michael, R. B. Neumann, **R. Beckie**, S. Islam, M. Feroze Ahmed, "Groundwater Flow and Arsenic Biogeochemistry in Bangladesh: An Analysis of Transience and Coupling", to appear in Chemical Geology, October, 2004.

Snyder, D., Rondenay, S. **Bostock, M.G.**, Lockhart, G. (2004) Mapping the mantle lithosphere for diamond potential, 77, 859-872.

Cui, X., **Bustin, M., Dipple, G.M.**, 2004, Selective transport of CO2, CH4 and N2 in coal: insights from modeling of experimental gas adsorption data, Fuel, 83:293-303.

Eberhardt, E., Stead, D. & Coggan, J.S. (2004). Numerical analysis of initiation and progressive failure in natural rock slopes – the 1991 Randa rockslide. International Journal of Rock Mechanics and Mining Sciences: 41 (1), 69-87.

Marshall, D.D., **Groat, L.A.**, Falck, H., Giuliani, G., and Neufeld, H.L..D. (2004) The Lened emerald prospect, Northwest Territories, Canada: Insights from fluid inclusions and stable isotopes, with implications for northern Cordillera emeralds. Canadian Mineralogist, 42, 1523-1539.

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Marshall, D.D., **Groat, L.A.**, Falck, H., Giuliani, G., and Neufeld, H.L..D. (2004) The Lened emerald prospect, Northwest Territories, Canada: Insights from fluid inclusions and stable isotopes, with implications for northern Cordillera emeralds. Canadian Mineralogist, 42, 1523-1539.

Jurjovec, J., D. W. Blowes, C. J. Ptacek, and **K. U. Mayer**, 2004, Multicomponent reactive transport modelling of acid neutralization reactions in mill tailings. Water Resour Res., 40, W11202, doi:10.1029/2003WR002233.

Stewart, M.S., **Russell, J.K.** & Hickson, C.J (2004) Discrimination of hot versus cold avalanche deposits: Implications for hazard assessment at Mount Meager, B.C. Natural Hazards & Earth System Sciences, 3, 713-724.

Freed, R., **Smith, L.**, and D. Bugai, The effective source area of 90Sr for a stream near Chernobyl, Ukraine, J. Contaminant Hydrology, 71,1-26, 2004.

Franssens M., Flament P., Deboudt K., **Weis D.**, Perdrix E. Evidencing lead deposition at the urban scale using "short-lived" isotopic signatures of the source term (Pb-Zn refinery). Atmospheric Environment, 38 (30), 5157-5168, 2004.

Canada's major national research project in the earth sciences

" Canada's acclaimed LITHOPROBE geoscience program has been superbly directed by a top UBC researcher since its inception in 1984. Many EOS faculty have been heavily involved in the program. LITHOPROBES activities have provided fundamental new insights into the structure and evolution of the continental lithosphere. Widely acknowledged to be the best national megaproject ever initiated, a number of countries have copied LITHOPROBE's approach to investigating the solid Earth."

Selected Recent Publications:

Hammer, P.T.C., **R.M. Clowes** and K. Ramachandran, 2004. High-resolution seismic reflection imaging of a thin, diamondiferous, kimberlite dike. Geophysics, 69, 1143-1154.

Hammer, P.T.C. and **R.M. Clowes,** 2004. The accreted terranes of northwestern British Columbia, Canada: Lithospheric velocity structure and tectonics. Journal of Geophysical Research, 109, B06305, doi:1029/2003JB002749. [19p]

Welford, J.K. and **R.M. Clowes**, 2004. Deep 3-D seismic reflection imaging of Precambrian sills in southwestern Alberta, Canada. Tectonophysics, 388, 161-172.

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Fernandez Viejo, G. and **R.M. Clowes**. Constraints on the composition of the crust and upper mantle in northwestern Canada: Vp/Vs variations along Lithoprobe's SNorCLE Transect. In press.Canadian Journal of Earth Sciences

Gorman, A.R., B. Németh, **R.M. Clowes** and Z. Hajnal. A comparison of upper mantle heterogeneities imaged by Lithoprobe's controlled-source seismic experiments beneath the Archean and Proterozoic crust of western Canada. In press. Physics of the Earth and Planetary Interiors.

McClymont A.F. and **R.M. Clowes**. Anomalous crustal structure of northern Juan de Fuca plate – A consequence of oceanic rift propagation? In press. Tectonophysics.

NEWCOMERS

"The principal research strengths of EOS rest on the breadth of expertise and experience of its established senior faculty members, the early promise and enthusiasm of the more recently appointed younger faculty, and the state-of-the-art facilities with which they have been provided to support their investigations. Seventeen new faculty members have been recruited over the past five years, most at the level of Assistant Professor. Even allowing for the expanded numbers that resulted from the creation of EOS, this represents a degree of rejuvenation that can have few parallels in the country and one that must be the envy of other earth-science departments."

EOS External Review Committee Report, 2005

NEIL BALMFORTH

Neil Balmforth came to UBC in 2003 with a joint appointmet in EOS and the Department of Mathematics. Neil's doctoral thesis at the Institute of Astronomy, University of Cambridge, completed in 1990, was on the Theory of Stellar Oscillations (Supervisor: D.O. Gough).

Here's his synopsis of interests and activities, from his website in the Department of Mathematics.

My research interests are in applied mathematics, which means just about anything. Most problems are interesting, and many of them can be couched in a mathematical language that provides insight into them. More specifically, my interests have in the past focused on astrophysics, chaos and dynamical systems, and fluid mechanics with particular application to geophysical fluids. I am closely associated with the Geophysical Fluid Dynamics summer school, Woods Hole Oceanographic Institution, and have directed various summer programs ("Astrophysical and Geophysical Flows as Dynamical Systems", "Stirring and Mixing", "Conceptual Models of the Climate", "Non-Newtonian GFD" and "Tides"). With Antonello Provenzale, I have also organized the Gran Combine Summer School, at Aosta in Italy. The theme of the school was "Geomorphological Fluid Dynamics," which draws together ideas and mathematical technology from a variety of problems including the evolution of river basins, the sculpting action of glaciers and volcanic landforms.

ROGER FRANCOIS
(Tier 1 Canada Research Chair Holder)

I had a rather uneventful upbringing in Tournai, a small town in the French-speaking part of Belgium, a country renowned for its uneventfulness, fine beers, expensive chocolates and good living in general. In my early twenties, I found myself with a diploma in textile engineering (option weaving and dyeing) and a good prospect for continuing an uneventful life, dyeing and weaving from 9 to 5, drinking fine beers and eating expensive chocolates in the evenings, and doing much the same on weekends. …Oh yes, but first I had to show my mettle by roughing it in the army for 9 months… compulsory military service at the time (wisely, the practice has now been discontinued). Since I am a kind soul and did not want to subject the military to the frustrating task of teaching me skills for which I had very little natural ability (like firing a gun without hurting myself, or not apologizing when shooting someone), I decided to opt for an alternative, which was spending two years working in a less fortunate country. I ended up in a textile factory on the shores of Lake Tanganyika, weaving and dyeing from 9 to 5, but not drinking fine beers or eating expensive chocolates in the evenings and weekends. In fact, this two-year stint took pretty well care of the uneventful aspect of my life, and I got introduced to mayhem, tropical diseases and the resilience of the human spirit. Did acquire a bit of resilience of my own in the process, in between bouts of existential angst, but got out pretty much unscathed (at least, I think so…, but I may not have, had I accepted this offer to smuggle diamonds to Burundi…), and left with a somewhat changed perspective on life, the universe and everything. …Well, I had some good times too, like a communal breakfast every morning with my cats, watching the sunrise over the lake. I, munching on toasts and jam and my cats munching on their night kills (mostly lizards and snakes). Or buying fresh fish on the beach each Sunday morning with Siskje, an old female "sausage" dog, who was fond of kidnapping kittens, vainly attempting to nurse them…. (for old time sake, I guess, … we were quite the pair). Or this ride I got on the lake in a dugout at sunset after I lost my way in the bush (I do this a lot..). We had to watch for hippos, as they tend to behave in the water like bulldozers on the UBC campus... By the end of my stay there, however, I had done all the weaving and dyeing and munching at sunrise that I could care for, and I had to find another line of work... Oceanography!?, pourquoi pas? So, off I went to the UK and found myself enrolled in a M.Sc. program in Oceanography at the University of Southampton. I had a good background in weaving, math, and chemistry but could only speak French and a bit of Swahili…. No matter. The beer was pretty decent (unlike the chocolate, which at least was cheap) and I really got into it. I soon became convinced that this was way more exciting than textile engineering. After two years I knew quite a bit about oceanography (and I coold speek Engleesh prettee whale too…. still doo!) and decided to apply my new-found skills to pursue a PhD on another continent. That's when I first came to Vancouver. It was lucky timing too, as I arrived when Steve Calvert was looking for students. So started six of my most exciting and productive years, learning about marine geochemistry from one of the top guys in the field and sharing my time between fieldwork in the local fjords (mostly on the R/V "Vector", with that French cook who could easily have passed for a Belgian cook) and fieldplay in the local mountains, getting introduced to the joy of mountaineering, telemarking, bear-baiting and assorted activities that I learned avidly from my new "Crazy Canucks" friends (notwithstanding the fact that, as a native flatlander, I freak out when I stand on a chair…). Not only this, but you could also find fine Belgian beers and expensive Belgian chocolate in this town. What else could you ask for….!!? Of course, I ended up by graduating and had to move on to other pastures. But I got lucky again and landed a job at Woods Hole Oceanographic Institution where I put all I learned in Belgium (weaving), Africa (the nature of things), England (English and oceanography) and Canada (marine geochemistry and bear baiting) to good use. I got increasingly involved in paleoceanographic and paleoclimate research and devoted much of my last seventeen years to developing and applying geochemical tracers that tell us something about how the ocean affected and reacted to past climate changes. I must have done a pretty good job at it, because that led to my last lucky strike; a Canadian Research Chair and a faculty job back at UBC, where I just started this January.

So, what now? Well, the theme of my CRC is "Marine Biogeochemistry and Global Change Studies". One of my first tasks is to foster Canadian participation to the GEOTRACES program and to position the Earth and Ocean Sciences department at the forefront of this major international undertaking. GEOTRACES main goal is to identify and quantify processes that control the distribution of key trace elements and isotopes in the global ocean. This program is prompted by increasing evidence that many of these trace elements or their isotopes play a crucial role as regulators or recorders of important biogeochemical and physical processes in the ocean and their distribution in the water column and sediments can provide a wealth of information on questions pertaining to global climate. For instance, some of them are essential micronutrients that could limit marine primary production and control the structure of marine ecosystems, thereby affecting atmospheric CO_2 uptake by the ocean. Isotopic tracers provide quantitative information on particle flux to the seafloor, particle dynamics and remineralization in the water column, all of which affect CO_2 sequestration to the deep sea. Trace elements and isotopic tracers are also being developed to improve our understanding of the marine carbon, nitrogen, phosphorus and silica cycles and their complex interactions. Large scale ocean circulation patterns and rates, ocean mixing and their impact on solar heat redistribution, atmospheric CO_2 and climate can also be examined with trace elements and their isotopes in the water column. In addition, downcore sediment profiles of many trace elements and isotopes provide important constraints on the evolution of these processes in the geological past. My research activities match with many of these research themes. I study the biogeochemical behaviour of selected tracers within the context of modern ocean circulation and biogeochemistry, and I record and interpret their sedimentary signatures within the context of past climatic changes. My expertise centres primarily on measuring long-lived isotopes from the uranium-decay series in seawater and sediments. I am also investigating the potential of barium as a tracer of past changes in marine productivity and I am contributing to the development of nitrogen isotopes systematics to study the nitrogen cycle in the modern ocean and during past climate changes. In addition, I am involved in synthesizing global data sets to establish the factors that control the efficiency of the biological pump in sequestering CO_2 in the deep sea, and I recently started becoming involved in investigations of heavy metal isotopes. My interests meshes very well with that of other faculty members at UBC, UVic and IOS, and with our combined expertise, ready access to UBC's outstanding mass spectrometric facility, and with DFO's infrastructure support for sea-going work, we are well positioned to play a leadership role in the international GEOTRACES program and maintain our prominence as a centre for global climate change research.

Now, looking back, leaving the easy comfort of Belgium was a darn good move and I can't wait for what's coming next. Mind you, it's still good to go back to the old country from time to time, drinking some of those fine beers by the old XIIth century belfry on the Grand Place in Tournai and ponder about life, the universe and everything.

RETIREMENTS

F.J.R. "MAX" TAYLOR, *FRSC*

Hubbard Glacier, Yakutat Bay, August 2004

F.J.R. "Max" Taylor retired in December, 2004 after forty years on the faculty at UBC. Max was born in 1939 in Cairo, Egypt, the only son of a South African-born officer serving in the Royal Air Force and an Australian mother. When it appeared that Rommel might conquer Egypt in 1941, Max and his mother were shipped out to his father's family home in Durban. This was only the first of many wartime dislocations: others landed Max in Dar es Salaam, Tanganyika (where Max and his mother contracted malaria), Northwood, Middlesex (RAF headquarters) and Leuchars, Scotland (where his father commanded the RAF base).

After WW II the family moved back to South Africa where Max received most of his education, except for a year in Australia in a small coastal village south of Sydney. Boarding school featured prominently, if not happily, in his school years, as his parents roamed, including his father's few years as General Manager of a sugar estate in Southern Rhodesia (now Zimbabwe), in the middle of the southern African "Lowfeld" (African bush with riverine forest), 120 miles from the nearest town. Malaria, *bilharzia* and wild animals abounded. Max and his friends would ride horses, to reduce but not eliminate exposure to the highly abundant snakes. Wearing bush hats with fur around them and rifles alarmingly and semi-competently at the ready (lions, leopards and Cape Buffalo were still in the vicinity) was heady stuff for a teenager.

Nevertheless it was during earlier, happy childhood days, surfing off the beaches at Durban, that the ocean won Max's love and curiosity. At first shark research appealed to him, but involvement with the International Indian Ocean Expedition led to a career in microscopic phytoplankton (Later, at UBC, Max served as analyst in this field for the Smithsonian Institution) with a speciality in harmful algal blooms (HABs): red tides, brown tides, ciguatera fish poisoning and the like. Max has been doing research in this field longer than anyone else, having published his first paper on a mass mortality of marine life in

False Bay, near Cape Town, in *Nature* in 1962 (he recently returned from the 10th.HAB conference he has attended, in beautiful Cape Town, in November, 2004, a poignant "closing of a circle" in his career). Max has published 157 papers and there are more on the way.

In 1962 Max met Margaret Duckitt, principal dancer at the Cape ballet company (now CAPAB): they married a year later and moved to Vancouver in late 1964 after Max answered an advertisement in *Nature* that described his qualifications and experience almost exactly. A double major in Zoology and Botany no doubt helped, as at this time Biology 101 replaced the botany and zoology semi-equivalents in first-year courses at UBC. Children Andrew, Belinda and Christopher arrived and a granddaughter and grandson have followed. Margaret has supported him all the way, having put up with many absences for conferences, especially in the early days when children needed looking after and money was tight. Max was promoted to Professor in 1974: As punishment for such early promotion he ran out of CPI increases after 20 years!

Max enjoys teaching and has been fortunate to instruct in subjects he finds fascinating, including introductory biology (he always preferred students who hadn't had biology before), protistology (a course he developed from scratch in the late 1970s), marine phytoplankton ecology (taught with Paul Harrison), lectures in toxicology and a highly popular Ocean Ecosystems and Marine Resources for non-science students, part of a two-term course he developed with Paul LeBlond. He has won three teaching awards while at UBC.

The microscopic critters that have held Max's closest attention are single-celled dinoflagellates. After marvelling at their idiosyncrasies for many years, editing and writing nearly a third of "The Biology of Dinoflagellates" for Blackwell, he teamed up with some palynologists to combine the classifications of living and fossil dinos, an effort that won them the Paleontological Society's *Golden Trilobite Award* in 1995. They are currently greatly expanding this classification for the *Treatise of Invertebrate Paleontology,* the bible of such fossil group research. Max is also the single author of articles on *Shellfish Poisoning* and *Dinoflagellate*s for the contemporary *Nature Encyclopaedia of Life Sciences.*

Max became convinced that single-celled protists such as dinoflagellates, foraminifera, radiolaria, coccolithophorids, and diatoms have far more in common than their groupings as "algae" and "protozoa" indicated. He became part of a revival of protistology, a 19th-century idea of Ernst Haeckel, that these were neither simple plants nor animals. He introduced a course in Protistology at UBC in the late 1960s, later joined by Jim Berger, which is still going strong. It is one of the very few in North America. UBC now has a strong protistology group, including Patrick Keeling, Naomi Fast, Brian Leander and Juan Saldarriaga (Max's last Ph.D student) and so this enterprise should not die.

Max has a strong on-going interest in cell evolution. In 1974 he formalized the serial endosymbiosis theory (SET) that in non-bacterial cells (i.e. cells like ours) certain major components called organelles (the mitochondria and chloroplasts) had a symbiotic origin from bacteria. These were old independent proposals that were revitalised and combined by Lynn Margulis in the 1970s. Although they were highly unpopular at the time they made complete sense to Max, who published further papers as the evidence accumulated. Sophisticated biochemical data, gathered by others over the next twenty years overwhelmingly supported this theory. It was largely this body of work, plus the protistological contributions, which earned Max a Fellowship in the Royal Society of Canada in 1997.

HABs dominate his current interests but Max still mourns the lack of interest that greeted what he believes was his most exciting and significant discovery: the highly ordered "code within the codons", the way in which DNA specifies the construction of proteins in cells. This was the fruit of a sabbatical at Oxford University in 1986-87. Although the codons (the triplet bases that determine which amino acids will be incorporated in proteins) were claimed to be randomly assigned but unchanging, he and his co-author, David Coates, found that it is the most highly ordered data set they ever encountered. Many studies since then have reinforced this, often without awareness of this "old" paper.

Max, now an Emeritus Professor, lives in a remodelled waterfront house in Deep Cove, near Vancouver, trying not to take the beautiful view for granted (except when the water turns the colour of HABs). In addition to continued research on dinos at UBC, he hopes to travel more. He became a cruise lecturer in 2002, something he plans to do a lot more of.

A YEAR IN THE MUSEUM

"The new, reconstituted Pacific Museum of the Earth is an important element of EOS's outreach to the general public and, in particular, to the school-age population of Vancouver and district. The blending and expansion of the old museums to produce this new visual centre for the earth sciences is a commendable initiative and one the Committee believes that Department and University could well capitalize upon further in the future" EOS External Review Committee Report, 2005

It has been another exciting year for the Pacific Museum of the Earth (PME). This year has seen the consolidation of the museum with the department of Earth and Ocean Sciences (EOS), the wider university and the lower mainland community.

A helping hand for teachers

Growing numbers of school parties. interest groups and the general public have been visiting the museum. 'The word is out' to schools in the lower mainland that their earth science curriculum has an ally at UBC. In part this increased attention has been aided by a feature on the museum in the eXpress on Shaw T.V.

Support for schools will soon be further aided as the museum has successfully secured a grant that will support a $9,000 renovation of a room attached to the main floor into the Teachers Resource Centre (TRC). The TRC will be available for teachers to book and hold class before engaging in activities in the museum proper. It will contain curriculum specific displays, A.V. material, lesson plans and material.

New displays and features – A few highlights

Further money has been channeled into a real time weather forecasting display. This will highlight the work of Roland Stull's group within EOS and, incidentally, provide forecasts of the weather that will be far more accurate than anything currently available on TV or the radio. Thanks go to Roland's research group who are providing the program for this display at no charge to the museum.

Mock up of the real time weather display as it may appear in its final form. Phase 1 (the central display) will be installed later this summer.

Another atmospheric sciences based display that is already operational and which has proved very popular with visiting school groups is the Tornado Machine. This device simulates the development of a funnel cone with out any of the associated capitol damage or rotating cows.

The Tornado machine whirls into action

On the Solid Earth side of things, Phil Hammer (Geophysics group, EOS) has produced an informative and accessible series of posters based around our seismic centre and a fascinating TransCanada Crustal Section that builds on the work of Lithoprobe within EOS.

Beautiful mineral specimens still form the core of the museum and we are pleased to report that we are well on our way to restoring the vault (one of the main features of the old

Pacific Mineral Museum) in the PME. The vault will house the valuable gem and precious metal samples that we currently have to keep under wraps due to security issues. Those of you who remember the old display downtown will understand why we are excited to be getting close to our goal of opening the vault within the PME. Following an application to the Geological Foundation of Canada for funds to support this initiative (we were awarded $2,000), the museum now has $16,730 towards the $23,230 needed to install the vault in the PME, a shortfall of just $6,500.

New vision, new plans.

Now that the first phase of the museum development is complete and all of the original material from the Pacific Mineral Museum (including the shop) has been installed, it is time to adjust the outlook of the PME.

It is intended that the museum will develop along Earth System Science concepts, focusing on the interconnectedness of Earth systems, from deep Earth processes through plate tectonics and the interaction of the lithosphere, hydrosphere and biosphere. Several sub-themes will be developed under this umbrella theme;

1. Earth's Environmental Evolution

Unraveling the history of the Earth's environmental evolution as revealed by rocks and fossils. This theme will develop close ties with the Beaty Biodiversity Centre and explore the concepts of the geological history of life, its interconnectedness with the evolution of the Earth as a whole

and the periodicity of mass extinctions (developed further in the following two themes).

2. Natural Disasters

An exploration of the science, prediction and mitigation of natural disasters. Particular focus will be given to the seismisity of BC (including tsunami threats), the Cascadia volcanic system, landslides, atmospheric hazards (pollution/extreme weather) and impacts from space.

3. Resources and the Environment

Highlighting the exploitation of natural resources with a particular focus on British Columbia. This theme will showcase the beauty of rocks and minerals but also examine how sensitive resource exploitation (minerals and petroleum) can be employed to protect the environment and the consequences that result from poor practice.

This approach will not only more effectively highlight the current diversity of expertise within the host department but also produce a more cohesive thematic direction for the museum. Confirmation that the Beaty Diversity Centre and the associated museum is to be built facing EOS means that we can develop this area of campus as a great outreach tool to the community. Members of EOS and the PME are already in consultation with the Beaty Centre design and production team to ensure the PME and the new museum will develop in conjunction. Each museum will contain displays that relate to the other and hopefully be linked by an outdoor 'Geological Walk through Time,' which will physically link the two bodies.

The Friends of the Museum

The museum relies heavily on the support and good will of the Earth Science community and the general public. If you would like to become a friend of the museum please contact Kirsten Parker: kparker@eos.ubc.ca. The friends of the museum receive a quarterly newsletter which includes information about new displays and initiatives at the museum, a 10% discount in the shop and invitations to attend members functions, generally held in the evening. For example, this year the PME hosted and catered an informative talk by Kirk Makepeace about B.C. Jade.

STUDENT NEWS

"Based on assessments provided by external parties from the resource industries who hire honours graduates in the earth-science fields, EOS students rank among the best educated in Canada and appear to be competitive internationally. They are well equipped to work in either exploration or exploitation and to do so either domestically or abroad. Essentially the same view is held recruiters for provincial and national governmental agencies which hire graduates with such qualifications. Honours graduates of EOS are well qualified to enter graduate programs throughout North America."

EOS External Review Committee Report, 2005

STUDENT SOCIETIES

G.M.Dawson Club

Club events during the fall included Back-from-the-Bush Bash in September, a Hallowe'en ball, and a joint beer garden with metallurgical, mining and geological engineers in November. During study break in February, we organized a field trip to Baja California: after introductory talks from Dr Grimm, twenty-two geology students, three geophysicists, two biologists and a geographer, with TA's Eric Scheel and Jenny Dickinson, flew from Vancouver to Los Angeles and boarded a Green Tortoise bus to drive down the Baja California peninsula as far as San Ignacio and back. We snorkelled, watched whales, hiked up a cinder cone and to an abandoned gold mine, and toured a turtle rescue operation at Bahia de Los Angeles.

(from Nikki Commodore,Vice-President)

Georox Club

For the GeoRox club, September started off with our "Back from the Bush" BBQ, our annual welcome-back event that we run with the Dawson Club. Midterm time put a little damper on things, but we soon picked it up again with the Hallowe'en party. Turnouts were especially strong this year. The end of November (nearly the end of classes) saw us all come together for our Christmas potluck party. The food and drink was plentiful, and the alumni presence was strong. The term was capped off with a food drive for charity. Despite our small size, we collected more food than any of the other engineering clubs. The second term began with the Western Interuniversity Geology Conference in Saskatoon. GeoRox sent four delegates: Saskatoon hardly knew what hit'em! Later in the month, some of our members attended and volunteered at the Cordilleran Roundup Mineral Exploration Conference in downtown Vancouver. After midterms, GeoRox held our 3rd annual alumni-industry dinner at the University Golf Course. Turnouts were the best on record: seventy industry members and students came out to enjoy the food and drink, presentations and conversations with the old and new. We recently held our club elections and had exceptional enthusiasim for positions. Pride and involvement is hitting a high point.

Storm Club

The Storm Club, comprising students of Atmospheric Science at UBC, has weekly weather meetings and organizes trips that bring the members closer to its namesake, storms. One such trip, held annually, is a gliding trip from Hope, BC. The photo shows Amy Thai, Isabel Chan (back), Charlotte Gabites (front), Cindy Yu, Robin McQuinn, and Brad Pyke after a glider trip in April, 2004.

Other excursions were to Environment Canada and the CTV weather-forecasting facility. The Club produces daily weather reports for the CiTR UBC campus radio station. We are proud to be part of Earth and Ocean Sciences and look forward to increased participation on all fronts. (from Brad Pyke, President, and Robin McQuinn, Vice President)

Enrolments

Total enrolment in undergradust courses offered by EOS. Numbers in brackets indicate increase over preceding year.

	2001	2002	2003	2004
1st Year	854 (+52%)	1330 (+56%)	1414 (+6%)	1966 (+39%)
2nd Year	211 (-6%)	300 (+42%)	465 (+55%)	580 (+25%)
3rd and 4th Yr	1144 (-8%)	1190 (+4%)	1200 (+1%)	1458 (+22%)
Service Courses	756 (+10%)	861 (+14%)	889 (+3%)	771 (-13%)
TOTAL	**2965 (+12%)**	**3681 (+24%)**	**3968 (+8%)**	**4775 (+20%)**
Summer	450 (+35%)	537 (+19%)	621 (+16%)	446 (-28%)
Distance Ed	383 (+1%)	386 (+1%)	399 (+3%)	363 (-9%)
Grand Total	**3798 (+13%)**	**4582 (+21%)**	**4988 (+9%)**	**5584 (+12%)**

Number of Major and Honours students in EOS Programs

	2001	2002	2003	2004
EOS - Major	22	42	58	69
ATSC	27	31	31	35
GEOL	52	45	38	38
GEOE	70	73	73	85
GEOP	10	9	9	8
OCGY	24	16	16	17
TOTAL	205	216	225	252

Graduate Enrolment: 2004-2005

	ATSC	GEOE	GEOL	GEOP	OCGY	TOTAL
MASc/ MEng		7				7
MSc	5		41	9	11	66
PhD	15	3	24	13	16	71
TOTAL	20	10	65	22	27	144

GRADUATE THESES COMPLETED IN 2004

(Name of Supervisor in Brackets)

Ph.D.

Ainslie, Bruce: A Photochemical Model Based on a Scaling Analysis of Ozone Photochemistry (D. Steyn)

Amundrud, Trisha: Geometric Constraints on the Formation and Melt of Ridged Sea Ice (R.G. Ingram)

Fleming, Sean: Comparative Statistical Hydroclimatology of Glacial and Nival Rivers in Southwest Yukon and Northwest British Columbia (G. Clarke)

Hawke, Michelle: Elemental Characteristics of Organic Deposits from an Area Surrounding Lead-Zinc Smelter: Concentration, Distribution, Mode of Occurrence and Mobility (R.M. Bustin)

Lhomme, Nicolas: Modelling Water Isotopes in Polar Ice Sheets (G. Clarke)

Modzelewski, Henryk: Investigation into Nonlocal turbulence-closure at Higher Statistical Order (R. Stull)

Quane, Steven: Welding in Pyroclastic Deposits (J.K. Russell)

M.A.Sc.

***Meilleur, Desiree**: Characterization of Arsenic in a Tailings Impoundment Under Post Depositional Conditions (R. Beckie; thesis program external to EOS)

M.Sc.

Bolton, Mark: Aqueous and Mineralogical Analysis of Arsenic in the Reduced, Circumneutral Groundwaters and Sediments of the Fraser River Delta, British Columbia (R. Beckie)

Caulkins, Joshua: Characterization and Investigation of Submarine Groundwater Discharge From a Coastal Aquifier into the Nearshore Environment (L. Smith)

Doerksen, Geoff: Parameterization of Net Radiation in Urban and Suburban Environments (T. Oke)

Grant, Andrew: Extra-tropical Cyclone Climatology and Shifts in Climate Regime in the Northern Hemisphere (L. Pandolfo)

Harder, Margaret: The Llangorse Volcanic Field: Volcanology and Mantle Petrology (J.K. Russell)

Hayman, Patrick: Lower Mantle Diamods from the Rio Soriso, Juina, Brazil (M. Kopylova)

Heffernan, R. Scott: Temporal, Geochemical, Isotopic and Metallogenic Studies of Mid-cretaceous Magmatism in the Tintina Gold Province, Southeastern Yukon and Southwestern Northwest Territories, Canada (J. Mortensen)

Hewson, Chadwick: Developing Learned Regularization Fuctionals for Geophysical Inversions (D. Oldenburg)

Laine, Alexandre: Forcing Mechanisms Controlling Surface and Subsurface Temperature Anomalies Along Line-P, Northeast Pacific Ocean (W. Hsieh)

Lefebvre, Nathalie: Petrology, Volcanology, and Diamonds of Archean Calc-Alkaline Lamprophyres, Wawa, Ontario, Canada (M. Kopylova)

McClymont, Alastair: Crustal Structure of the Northern Juan de Fuca Plate (R. Clowe)

Neufeld, Heather: The Tsa da Glisza (Regal ridge) Emerald Occurrence, Southeastern Yukon Territory, Canada: Descriptive, Genetic, and Exploration Models (L. Groat/J. Mortensen)

Ramos, Sharleen: The Effect of Shale Composition on the Gas Sorption Potential of Organic-rich Mudrocks in the Western Canadian Sedimentary Basin (R.M. Bustin)

Rattan, Sanjay: Nonlinear Complex Principal Component Analysis: Theory & Applications to Tropical Pacific Wind Velocity Anomalies (W. Hsieh)

Ross, Daniel: Sedimentology, Geochemistry and Gas Shale Potential of the Early Jurassic Nordegg Member, Northeastern British Columbia (R.M. Bustin)

Scullard, Christian: A Statistical Model of Reversals in the Geodynamo (B. Buffett)

Severin, Jordan: Landslides in the Charlie Lake Mapsheet, Fort St. John (O. Hungr)

Smithson, David: Late Eocene Tectono-magmatic Evolution and Genesis of Reduced Porphyry Copper-Gold Mineralization at the North Fork Deposit, West Central Cascade Range Washintgon, USA (S. Rowins)

Wagner, Karin: Characterization of the Geochemistry of Discharge Waters, Pore Waters, Primary and Secondary Minerals of an Experimental Waste Rock Pile, Cluff Lake Mine, Saskatchewan, Canada (R. Beckie)

Webb, Fern: Computer Modeling of Temperature Profiles in Freezing Ground (G. Clarke)

Whittle, Phillip: The Biogeochemistry of the Equity Silver Mine Pit Lakes (T. Pedersen)

AWARDS & HONOURS

Faculty

Raymond Andersen received a Killam Teaching Prize for 2005, UBC's top prize for teaching.

Edward Carmack, Adjunct Professor, was elected a Fellow of the AGU, an honour restricted to 0.1 percent or fewer of the total membership

Ron Clowes was awarded the Logan Medal of the Geological Association of Canada, the country's top geological sciences award.

Erik Eberhardt was chosen to present the 2005 Canadian Geotechnical Colloquium. The Colloquium is a work commissioned by the Canadian Geotechnical Society and is awarded annually. Erik will be "joining a distinguished group of very distinguished researchers who have given the Colloquium in past years." (Dr. Jim Graham, Secretary General, CGS.)

Lee Groat was elected Canadian Representative to the American Crystallographic Association.

Oldrich Hungr received the award for 2004 from the editorial board or the Association of Professional Engineering and Geoscientists of BC for his article "Landslide Hazards in BC: Achieving Balance in Risk Assessment", published in the April 2004 issue of "Innovation."

Tad Ulrych was given Honorary Membership in the Society of Exploration Geophysicists in recognition of his outstanding contributions to the development of seismic signal analysis and inversion, his long career as a mentor to generations of geophysical students and for his service to SEG.

Graduate Students

Jamin Cristall, masters student, and **Moritz Beyreuther**, visiting Diploma Student from Ludwig-Maximilians-Universitat, Munchen, were cited for "Best Student Paper"at the 2004 CSEG National convention

Eric Galbraith won a "Best Student Poster" award at the 8th International Congress on Paleoceanography in Biarritz, France for a presentation entitled Glacial-Interglacial Modulation of the Marine Nitrogen Cycle by Physical oxygen supply: sediment records and model results

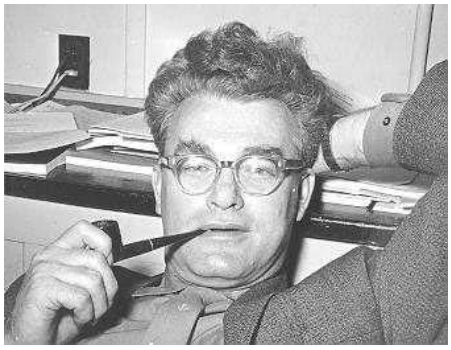
Two of Kelly Russell's recent graduates won the GAC-sponsored Gelinas Medals for best theses in volcanology: **Steve Quane** won the 2005 GAC-sponsored Gelinas Gold Medal for top PhD thesis in volcanology for his thesis "Welding in

pyroclastic deposits" and **Maggie Harder** won the Gelinas Silver Medal for top M.Sc. thesis in volcanology for her thesis "Mantle Petrology & Volcanology of Llangorse Mountain Basanites."
NSERC Canada Graduate Scholarships went to **Laurens Beran** (PhD), **Diane Hanano** (MSc) and **Krista Michol** (MSc)
NSERC Postgraduate Scholarships went to **Scott Napier** (MSc), **Nina Nemcek** (MSc) and **Gwen Williams** (MSc)
University Graduate Scholarships were won by **Rich Amos, Andrew Greene, Julie Granger, Paulo Herrera, Louise Longridge,** and by **Goran Markovic, Peyman Poor Moghaddam, Alex Strouth** (MASc), and **James Thom**

Undergraduates

Victor Leung, Robin, Foubister, and **Kelly Hood** won Dr. Aaro E. Aho Foundation Scholarships for undergraduate students. These students transferred from a community college or another university into Honours Geological Sciences, Major in Earth and Ocean Science or Geological Engineering at UBC this year, and have an interest in mineral exploration.
Reza Tafti won Third Prize for her poster at the British Columbia and Yukon Chamber of Mines Annual Mineral Exploration Roundup in January.

REMEMBRANCE



Robert William Stewart, FRS, FRSC
1923-2005.

Bob Stewart, professor at the UBC Institute of Oceanography from 1955 to 1970, passed away in hospital in Victoria on 2005 January 19th. He was 81.

Bob was born on August 21, 1923 at Smokey Lake, Alberta, and grew up in Olds and Calgary. He completed the B.Sc. in engineering physics at Queens' University in 1945, the M.Sc. in physics at Queens', 1947, and the Ph.D. at Cambridge in 1952. His dissertation concerned grid-generated turbulence. Returning to Canada in 1950, he took up a position as Defence Scientific Service Officer at the Pacific Naval laboratory in Esquimalt. From 1955 to 1960, he was on loan from the Defence Research Board to UBC, with rank of Honorary Associate Professor. During these years, Bob, with Harold Grant and Tony Molliet, measured the spectrum of turbulent velocity fluctuations over a range from about 100 m to 1 mm, near Seymour Narrows, providing the first experimental confirmation that Kolmogorov's "5/3" power law applied also in the ocean. Bob was a visiting professor at Dalhousie, Harvard, and Pennsylvania State Universities during this period.

Bob was appointed Professor in the Institute of Oceanography and the Department of Physics, UBC, in 1961, and remained until his departure in 1970 to become the first Director-General of the Institute of Ocean Sciences at Sidney, B.C. Bob left IOS, first to be Assistant Deputy Minister, then Deputy Minister, of BC's Ministry of Universities, Science and Communication (1979-84) and then President of the Alberta Research Council (1984-87). From 1987-89 he was the interim director of the University of Victoria's Centre for Earth and Ocean Research, an attempt to consolidate and build on collaboration between UVic, the Instute of Ocean Sciences and the Pacific Geoscience Centre. A summary for 1967-68 illustrates his active life-style during his years at UBC. In that year, as well as supervising four graduate students, Bob was President of the Faculty Association, a member of the UBC Senate, a member of the UBC Senior Appointments Committee, met in Kyoto as member of the joint committee of the International Association of Physical Oceanographers and the International Association of Meteorology and Applied Physics on Air/Sea interaction, met five times in various cities in the United States with the American Committee on Atmospheric Sciences (he was the only non-American member), met twice with the Advisory Panel of the America National Centre for Atmospheric Research Field Observing Facility (there too, the only non-American member). He attended meetings of the ICSU Committee on Atmospheric Science in Geneva and Stockholm. He presented an invited paper on the Mechanics of the Air/Sea interface in Kyoto, another invited paper on Non-linear effects in surface gravity waves to the First Canadian Congress of Applied Mechanics, in Quebec City, also presenting invited papers at University of Washington and University of Southern California. He and Ron Burling published an article on Ocean-Atmosphere Interaction (microprocesses) for the Encyclopedia of Oceanography (edited by Fairbridge), and two papers in the Proceedings of the First Canadian Conference on Micrometeorology. He was also at work on Physics, 2nd edition, (Marshall, Pounder and Stewart (editors)) and on an educational film on turbulence that is still in use.

Bob received numerous awards: he was a Fellow of the Royal Society of Canada and the Royal Society of London. He received the Patterson Medal of the Canadian Meteorological Society (1973), the Sverdrup Gold Medal of the American Meteorological Society (1976), the Order of Canada (1980), CMOS's Tully Medal (1989) and various honorary degrees. Bob is survived by his wife, Anne-Marie, four children, four grandchildren and a great-grandson. In accord with his wishes, Bob's ashes were scattered into the sea from the Research Vessel 'Tully' at the mouth of Saanich Inlet on May 8, 2005.

Walter Holyk, (1921-2004), BASc (Geol Eng) 1949, died June 1, 2004 in Kelowna, BC. Walter was born March 21, 1921 in Mount Cartier, south of Revelstoke, BC. He served as navigator in the RCAF during World War II (1942-45). After graduating from UBC, he attended MIT, receiving the PhD in Geological Engineering in 1952. Walter joined Texas Gulf Sulfur as a geologist and set out to locate pyrite deposits from which sulphur could be produced in eastern Canada. As a result of his studies on massive sulphide sediments, Walter sought sulphide ores in close association with rhyolites and sediments under certain structural conditions. Half Mile Lake Mine, New Brunswick, Nanisivik zinc-lead mine, Baffin Island, and Kidd Creek deposit (zinc-copper-lead-silver) Ontario were deposits found as a result of his implementation of this hypothesis. Walter was inducted into the Canadian Mining Hall of Fame in 1997, received CIM's Dufresne Award for Mineral Exploration in 1980, and the PDAC's Distinguished Service Award in 1992. Upon retirement in 1976, Walter became an orchardist in East Kelowna (He likened this to a sentence to ten years hard labour). Walter leaves his wife Helen (B.Com, UBC, 1946), son Nicholas, and grandchildren Angela and James Bailey.

G.Alan West, B.A. Geological Sciences, 1950
Of Halfmoon Bay, BC. deceased 2002 January 24

Edward W. Batchelor, B.ASc., Geological Engineering, 1966 passed away on June 6, 2004. Notified by his wife, Mrs. Linda Batchelor, Arms of the Cross, #315 - 555 Burnell St., Winnipeg, MB R3G 3L7

Patricia Anne Fischer (neé Torrey) (1951 – 2005) BSc Geology, 1974 passed away peacefully surrounded by friends and family after a lengthy battle with cancer on Thursday, January 27, 2005 at the age of 53 years. Patricia was born on March 7, 1951 in Dawson Creek, BC. Calgary became her home after she graduated from UBC in 1974. Pat worked for Gulf Canada Resources as a geologist and land person for over twenty-one years. After several years as a consultant, she joined Shell Oil Canada as a Land Systems Coordinator in 2000. Patricia is survived by her husband Alfred, her daughter Janet, and her son Errol.

Research Vessel named after Bill Mathews.
A group of Canadian university researchers investigating sediment in lakes in western Canada have named their small research boat 'W.H.Mathews' after the late Bill Mathews, (Faculty, Geology, 1951-1984, Head, Geology 1964-71). The group comprises Joseph R.Desloges (Chair, Department of Geography, University of Toronto) John Clague (Professor, Earth Sciences, SFU), Bob Gilberts (Queen's University) and Brian Menounos (UNBC). Bill was John Clague's PhD supervisor, and at the same time a member of Bob Gilbert's supervisory committee in Geography. Later, Bill was a member of Deslogues' committee in Geography.

ALUMNI FEEDBACK

Feedback - Reminder: We mail this newsletter to over 2,000 recipients, and we would really like to hear how YOU are doing.

R. James Kirker, B.A. Honours Geology, 1950, Retired from Canada Northwest Energy (Sherritt International) in 1996 after involvement in oil discoveries in offshore Europe (North Sea, Spain, Italy). Honorary membership in Can. Society Petroleum Geologists, Recipient Stanley Slipper Gold Medal for Successful Exploration. Currently My-Garuda Resources Ltd. is involved in offshore gas storage project on Spain's East Coast and in applying for exploration permit in Alboran Sea with brother Bill's (B.A. in 1951) Taurus Industries Ltd.

Wilfred Gordon Holland, B.A., 1952, Exploration Geologist, 1953-1982; Imperial Oil , Regina, Dawson Creek, Edmonton, Calgary; Canterra 1982-1988, Calgary; Husky 1988-1990, Calgary; Consulted for 3 years and now retired. Occasional lunches with, Ron Johnson, Bill Smith until his death in 2001.

Ron Johnson, B.A. Honours (Geology) 1952; M.Sc. Geology, 1956; Ph.D. Geology/Oceanography 1974; Adjunct Prof. Petroleum Geology 1987-91; seconded by UBC to Asian Technical Institute (AIT), Bangkok, 1992-94 (Energy). Ron operated a geological consulting company (R.D.Johnson & Assoc. Ltd.) for over 40 years and organized a marine consulting company (Seaconsult Marine Research) from 1975 to 1983. Ron is now retired: he and Shirley spend summers at their cabin on Lake Windemere, BC, and winter months at La Penita, Mexico.

R. Anthony Hodge, B.A.Sc, 1972, M.A.Sc, 1976, Continue working as an independent consultant. Recently led the North American portion of the project "Mining, Minerals, and Sustainable Development". Am currently part of a team looking at the issue of long term management of high-level nuclear waste in Canada. The focus throughout is on practical application of sustainability ideas. See www.anthonyhodge.ca

Warren Newcomen, B.A.Sc., Geology, 1985, My wife, Nan Stevens, and I are expecting our second child in October, 2005. I have also started my own geotechnical consulting firm (H.W. Engineering Ltd.) in 2004. The company specializes in rock mechanics investigation and design for the resource transportation and utilities sectors.

Peter Fischl, B.Sc., Geology, 1986, I've been keeping busy with gold exploration in the last couple of years, spending the summers in Russia with Bema Gold (Kupol Project) and the winters in Mexico with Ross River Minerals (El Pulpo Project). I finally got the chance to use some of the Russian I had learned while taking Beginning Russian as an Arts elective when I was at UBC 18 years ago.

Philip Benham, B.Sc., 1987, Since completing my M.Sc. MUN, I have worked for Shell Canada for the last 10 years. My work largely focussed on the Jumping Pound-Wildcat Hills area of the foothills before my current focus on development of the Niglintgok Gas field in the MacKenzie Delta. I am currently the CSPG Paleoritology Division Chair and also Technical Program Director for the Alberta Paleontological Society. I am married

and have two boys, aged 8 and 13. In my spare time I am working on a book on roadside geology and palaeontology of Western Canada. Any funds generated from this project will be donated in memory of the late 1987 grad Bret Thomas, to a non-profit organization dedicated to science education. I would love to hear from fellow 1987 grads as our twentieth (already?) anniversary approaches.

Gary Sutton, B.Sc., Geology, 1987, After graduating from UBC, I embarked on a successful career as a Geologist. I spent 4 years travelling the remote parts of BC, Yukon, Montana, and Nevada. I met a lot of wonderful people in mining camps and enjoyed swatting mosquitoes, being rained on day after day, but it came to an end when I accepted a position as a Mine Geologist at Ruttan Mine for Hudson Bay Mining and Smelting in northern Manitoba where I spent the next 3 years (including 3 winters) developing my skills in mining. Then in search of warmer climates, I accepted a position as the Chief Geologist of the oxide operation of San Manuel Mine (Magma Copper then BHP Copper) in Arizona. I spent 5 years making copper the cheap way before economics finally closed the mine. I then returned home (Vancouver) to take part in my family business of manufacturing conveyer pulleys which coincidentally get shipped to many mining operations around the world. I'm now married with 2 children and living near White Rock. Hey! What happened to the geology graduating class of 1987? I have only seen or heard from one member in the last 10 years.

John Baril, B.Sc., Geology, 1988, Hello everyone. I'm now living in Vancouver; am happily married and have two wonderful boys (1 year and 4 years old). I am a paramedic in Vancouver (my passion) and own and operate a First Aid Training Agency, Life Force First Aid. I worked in mineral exploration for a total of 6 years. Geology and UBC was great phase in my life, but I have now happily moved on. No regrets.

Kenneth Kuo, B.Sc., Geology, 1990, I've been working at the Greater Vancouver Transportation Authority (GVTA) as Sr. Transportation Planner since 1999, and at the GVRD between 1994 to 1999. Obtained advanced diploma (GIS) from BCIT in 1994. Married to Margot (née Purdon, B.Sc., 1990, Microbiology, Master of Public Health, Univ. of Washington, 2003). Would love to hear from others in the 1990 class!

Greg Crawford, Ph.D. Oceanography, 1993, Greg received tenure at Humboldt State University last year (2003). He's now an Associate Professor and Chair of the Oceanography Department. On the personal front, he, wife Abby, and 11-year old son Alec, travelled to China last fall to adopt an orphaned baby girl, Rachel into the family.

Laura Jane (Prellwitz) Ferguson, B.Sc., 1996, Baby girl born July 27, 2004 in Calgary, Alberta - Sadie Anneliese Ferguson - our first child. Married Ryan Ferguson on August 18, 2001. Currently working as an exploration geologist for Burlington Resources Canada.

Alice S. Chang, B.Sc. Honours, 1995; M.Sc., 1997, I finished my Ph.D. degree in the Department of Earth Sciences at Carleton University in Ottawa in January, 2004. I am now a post-doctoral researcher in the School of Earth and Ocean Sciences at the University of Victoria, working under the supervision of another UBC alumnus, Dr. Tom Pedersen. I'm working on geochemistry of marine sediments from the Vancouver Island shelf.

Robert Janssen, B.Sc., 1995, Dip. Enviro. Tech. (1999), B.Ed., 2002, What have I been up to over the last couple of years? Well, another career change. After having changed careers from geological sciences to environmental protection technology way back in 1997 (Kwantlen's environmental program) I discovered that I still wasn't happy with my career options and so in around 2000 I decided to make a career move I had not previously considered -- teaching. Who knew?!

So in 2002 I went back to UBC and within 12 months I had my B.Ed. -- best decisionI think I ever made (other than getting my degree in geological sciences of course). Since graduating I have been teaching math (on and off) for the Vancouer School Board's Main Street Education Centre. Within 2 or 3 month of graduating from UBC I was hired, and I haven't looked back since. I love teaching -- I'm even a bit silly when I teach (you really do need to make math fun). Now I don't teach full-time yet, I still have to pay my dues like any other teacher sitting in the wings here in BC, but I am able to pay the bills. Speaking of bills I bought my first home last year, a condo, and I AM LOVING IT. Only wish I could have done it 10 years ago. Oh well.

My future goals are to teach a few more courses other than math such as chemistry 11 and 12, maybe physics 11 and 12, and if I am lucky... geological and/or environmental sciences 11/12 (OK, so maybe that last course is another reason for changing my career twice -- darn environmantal conscience!).

Well there you have it. A very brief note about what I have been up to over the past 10 years. Wow, 10 years. Hard to believe!

Rhea J. Hamilton, B.A.Sc., Geological Engineering, 1997, Although I have remained in the energy sector, after my MBA in Spain and tough job in Investor Relations for Royal Dutch Shell, I have moved on to greener pastures as the Finance Manager for Shell Hydrogen.

Diana Varela, Ph.D. Oceanography, 1998, I started my new position as a tenure-track Assistant Professor in the Department of Biology and the School of Earth and Ocean Sciences (SEOS) at the University of Victoria. I have a 60% (Biology) and 40% (SEOS) joint position. My job officially began on September 15, 2003, but I arrived on campus a little bit later, on January 15, 2004. I am establishing a biological oceanographic laboratory, with the focus on marine biogeochemical cycles and physiological ecology of marine phytoplankton. I obtained this position after a 2-year post-doc at EOS, UBC with Dr. Paul J. Harrison (1998-2000), a one-year (2000-01) maternity leave, a 2-year NSERC post-doctoral position (2001-03) split between the Marine Science Institute at the University of California, Santa Barbara (with Dr. Mark Brzezinski) and the Department of Biological Sciences at Simon Fraser University (with Dr. Lynn Quarmby and Leah Bendell-Young).

Karen Reid, M.Sc., 2003, After working at VGH's Facility, I'm back at UBC working at the Mine Research Centre.

KEEP IN TOUCH

Enjoy keeping up with friends and classmates in the Alumni News section? Why not return the favour - drop us a line. Please fill in your currect address below even if the Newsletter was correctly addressed - it helps us maintain our records, or email us at alumni-contact@eos.ubc.ca . Please do not provide any information that you would not want published in the next Alumni Newsletter.

PLEASE PRINT

Name:_____

UBC Degree: _____ Graduation Date: _____

Address:_____

_____

_____

Telephone:_____ Fax_____

Email Address:_____

Has the above changed since last year? ☐ Yes ☐ No

What's new with you?

☐ Married?	☐ New job?	☐ Back in school?
☐ Take a trip?	☐ Promoted?	☐ See a classmate?
☐ Retired?	☐ New Baby?	☐ Other?

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THANKS FOR YOUR RESPONSE

Contacting Us

UBC Dept. of Earth & Ocean Sciences, Alumni Contact, 6339 Stores Rd., Vancouver, B.C. Canada V6T 1Z4

E-mail: alumni-contact@eos.ubc.ca

The EOS Website: www.eos.ubc.ca

Earth and Ocean Sciences, UBC
Faculty, Staff and Graduate Students
September, 2004

THE UNIVERSITY OF BRITISH COLUMBIA

Department of Earth & Ocean Sciences
6339 Stores Road
Vancouver, B.C. Canada
V6T 1Z4