

THE PLIGHT OF GEOSCIENCE DEPARTMENTS IN AUSTRALIAN UNIVERSITIES: CAUGHT BETWEEN A ROCK AND A HARD PLACE

INTRODUCTION

Geoscience is one of the main disciplines underpinning the current resources boom and the national economic and stock market boom. The natural resources sector *consistently* generates 40% of Australia's export earnings, with major input from both the minerals and energy sectors. Geoscience is therefore a strategically vital discipline for Australia. It will continue to perform an essential role in the ongoing discovery and extraction of minerals and energy resources for a long time, and with Australia's emerging water and climate change problems, it will play an increasingly vital role in helping to solve our water problems and in the monitoring of water quality.

Despite the current "boom" in the natural resources industry, university geoscience departments are suffering. The principal issues facing geoscience departments in Australia, including even their survival, are considered below.

THE ROLE OF TERTIARY GEOSCIENCE EDUCATION IN AUSTRALIA

In addition to the obvious role of being a provider of graduates to the natural resources and government sector, tertiary geoscience educators have the responsibility for educating the community at large about the fascinating origin and evolution of our planet Earth during its 4.5 billion years of history because geoscience has no presence in the school curriculum in most states except recently in Western Australia. Academics and researchers also play a leading role in international level pure and applied research. We are also in a position to use our expertise and understanding of the Earth's dynamic processes and history of climate change to contribute to understanding the nature of current climate change trends and helping to resolve the problem of water resources needs for the future. We are also in a position to make educated and scientific contributions to the somewhat misguided and irrational debate on creationism.

There is therefore no reason why the number of geoscience departments nationally, should be controlled just by the number of graduates needed by industry. However, the facts are that in the last ten years at least ten geoscience departments have either been closed or downsized to the point of being ineffectual. If any more were to decline it would impact significantly on the natural resources sector nationally, eventually on the national economy, and on the need to lift the educational profile of geosciences.

THE STATE OF GEOSCIENCES DEPARTMENTS IN AUSTRALIAN UNIVERSITIES

The geoscience industry has traditionally been a cyclical industry, experiencing "booms" and "busts", with employment trends for existing professionals and new graduates following these trends. During the boom periods undergraduate enrolments at universities rise and during the busts they decline. However, there is always a two to three year lag in either enrolment trend taking effect. In the past the busts by and large had little impact on the health of geoscience academic departments because

departments were allocated a base level of funding, to cover a fixed minimum number of established academic positions and some equipment infrastructure. On top of that, a maintenance budget was allocated, determined by student numbers, research performance and needs. Departments were able to weather the years of downturn, and survive to the next boom.

The adoption of budget models driven by a nearly linear relationship between student numbers and budget by most universities in the last ten to fifteen years, has had a huge and detrimental impact on the health of geoscience departments. Geoscience never attracts large numbers of students, even during the boom periods, compared with most other disciplines, because geoscience has no presence and profile in the school system, with the exception of Western Australia where geoscience has recently been reintroduced into the secondary school curriculum. Very few students go to university specifically to study geoscience. 95% of undergraduates “discover” geoscience by accident when selecting their third, fourth or even fifth subjects in first year at university. As a result, enrolments in geoscience will never be at the level of the mainstream sciences, and other high profile disciplines, such as chemistry, IT, law, economics, engineering, which have an every day presence at all levels of secondary education and in society. This is in spite the much greater strategic and economic importance of geoscience to Australia than most other disciplines.

The effect of a downturn in enrolments in a small discipline such as geoscience can be catastrophic on budget when budget is driven mostly by student numbers. This is especially a problem for a discipline which has significant laboratory and fieldwork infrastructure needs, like geoscience. In Australia this has resulted in the closure, or amalgamation and downsizing to the point of ineffectiveness, of at least ten geoscience departments in the last ten years, largely due to the industry downturn of the 90's to early 2000's. These include the previously significant geoscience departments at LaTrobe, RMIT, Bendigo, Deakin, Flinders universities, the University of Canberra, University of New South Wales (once the largest department in Australia), University of New England, University of Technology (Sydney), and University of South Australia, as well as other smaller regional departments. Amalgamation of many geoscience departments with other disciplines such as geography and environmental sciences has inevitably led to a rationalisation and decrease in geoscience staff numbers (e.g. University of Sydney, Wollongong University, University of Western Australia, Melbourne University and Ballarat University). Allowing staff numbers to drop below a critical mass endangers the integrity and depth of degree major programs and the value of professional qualifications, and of course means that the fewer staff are spending more time trying to service the needs of a degree program at the expense of research productivity. It becomes a vicious downward spiral.

Predictably, there has also been a significant decrease in geoscience graduate numbers across the country in the last ten years because the size of the student catchment has decreased dramatically as a result of closure of departments. The recent submission made by the Australian Geoscience Council (see below), the peak umbrella organization for geoscience professional and learned societies, to the federal Department of Education, Science and Technology's (DEST) review of tertiary funding clusters and funding levels indicates that graduate numbers have halved in the last ten years. Because students are not aware of the existence of geoscience or what it

entails before they go to university, they do not change preferences and switch to another university when geoscience is no longer offered at their institution of choice. For example, the closure of the Department of Earth Sciences at LaTrobe University two years ago did not lead to an increase in geoscience student numbers at Monash and Melbourne universities.

Now that the natural resources sector is “booming”, there is a huge undersupply of geoscience graduates because of the department closures in the 90’s and early 2000’s. As a result industry is having to pay geoscience graduates exorbitant salaries. Thankfully, at the university level, enrolment numbers are now increasing at second and third year levels, because as knowledge of the employment opportunities is communicated to first year geoscience students, retention levels at second and third year levels are rising. This year the Monash University School of Geosciences is hosting record numbers of students in second year and third year, and has the largest student numbers of any geoscience department in Australia. However, our first year numbers have not increased above the 200 plus level because of the continuing lack of profile in the school system.

Predictions are the current boom is likely to be long lasting because of the expected long term demand for natural resources by the major emerging economies of countries like China and India. This is a healthy forecast for the surviving geoscience departments. Unfortunately, increasing enrolments is not providing a major budgetary benefit to most geoscience departments because of the budgetary issues raised above, and because surviving department budgets have been subsidised for a long time. Increasing student numbers simply reduce the size of the budget subsidy.

There is also a lack of understanding in industry about the demography of graduate catchment nationally, and the crucial role geoscience departments in the eastern states play. Despite most activity in the resources sector happening in the west, the largest graduate catchment is in the big cities of the eastern states. For example, the VIEPS departments, Monash and Melbourne universities currently supply 30 to 40% of the nation’s geoscience graduates annually. The city of Melbourne is the largest catchment hub for geoscience students. Monash is currently amongst Australia’s largest producer of geoscience graduates, and given current record high second (more than 100 students) and third year (about 50 in total) student numbers, it will be the largest over the next 5 years. The demise of the University of New South Wales and the downsizing of the University of Sydney departments has significantly reduced geoscience graduate numbers from the Sydney area. If industry continues to ignore the health of the surviving geoscience departments in the eastern states it does so at its own peril. The surviving departments can continue to play an important role for the natural resource sector, but only if the industry at large gets behind them and provides both political and financial support.

A CASE STUDY - THE STATE OF THE SCHOOL OF GEOSCIENCES AT MONASH UNIVERSITY

The School of Geosciences at Monash University has been one of the top geoscience departments in Australia since it was established in 1972 and remains so. The following is testimony to this statement:

- In national research benchmarking amongst the Group of Eight universities in

Australia, the School of Geosciences has never been ranked at lower than 3, in many years we have been number 2 and twice, including the latest ranking based on 2005 data, we are ranked number 1.

- The School has never had a single academic member of staff who was deadwood.
- Every member of staff has held national competitive and in most cases industry research grants, has attracted and supervised research students and consistently published research papers during their appointments at Monash, a proud achievement that probably no other discipline can claim.
- Our academic and research staff have been consistently sought after to undertake collaborative research by industry, and still are.
- Staff in the School have won nationally competitive ARC grants every year of its existence, and in most years multiple grants.
- We have been able to consistently attract postdoctoral research fellows and postgraduate students, especially from overseas, which is indicative of an excellent international research profile as well as nationally.
- We have had the largest postgraduate student numbers per effective full-time academic staff member of all geoscience departments in Australia for as long as I can remember, and even within Monash we have been in the top tier for a long time.
- The School of Geosciences at Monash is currently perhaps the highest producer of graduates for industry, and together with the University of Melbourne produces the highest number of graduates of any city in Australia, producing in the order of 30-40% of all graduates annually. We are therefore a vital cog in the geoscience industries nationally, even though the minerals industry in Victoria is not as big as in other states. Most of our graduates take up jobs interstate, especially in Western Australia.
- Our graduates have always been able to find employment even during the industry downturns because of the fundamentally strong scientific base of our undergraduate program. This program has not been diluted by amalgamations, and is underpinned by a continuing emphasis on fieldwork training, which although expensive, is fundamental to producing excellent professionals and research scientists in geoscience. Virtual fieldwork is not an alternative.
- We remain one of the few stand-alone geoscience (i.e. geology and geophysics) departments in Australia, which is one of the reasons why our research expertise and graduates are so highly sought after in industry. We are nationally and internationally recognised as being a very strong department dedicated to producing excellent graduates. We are not seen as having gone “soft science” because we have not been amalgamated with geography or environmental science or any other disciplines. Although we teach an environmental geoscience major, it is essentially a hydrogeology program. This is a relatively recent development, but an increasingly important one, given Australia’s current water and climate change problems.
- We currently have the highest undergraduate student numbers of any geoscience department in Australia, with over 100 in our first semester second year unit and a combined total of about 50 students doing third year units. These are record numbers, and auger well for Honours enrolments in the foreseeable future.
- The current Australian of the Year, the very high profile Professor Tim Flannery, is a Masters graduate of this department. He frequently speaks highly of it and of its staff.
- The School of Geosciences has been a key member and contributor to two national CRCs, including the former Geodynamics CRC and the current *pmd**CRC.

In spite of being one of the most successful geoscience departments in Australia, the School of Geosciences is struggling financially under the current funding model in place at Monash, and at the larger scale, as a result of the long term decline in real terms of federal government funding to the Tertiary sector. Since the introduction of the linear student numbers funding model at Monash, our face-value budget has been consistently in deficit, as has the entire Faculty of Science's budget. Both have been saved every year by a bottom line subsidy or transfer. Despite significant improvements in efficiencies, the sciences at Monash, as well as nationally, remain under funded. If the government wants a quality national science program, it needs to improve its level of funding for the science and technology areas. The financial screw has been turned so far that the prospect of doing long-term damage is now real.

Our budget has been static and therefore declining in real terms for several years. We have no money from recurrent budget for long overdue refurbishments of teaching and research laboratories built in the 1960's. We could be more efficient with our teaching if we could fit our teaching laboratories with 80 computers, but we can't afford them. Ironically, our students had better and more modern laboratories at their secondary schools than they have at Monash in geoscience, which is a sad indictment. Our current budgetary situation is in stark contrast to the days of the previous, relative funding model, in which research achievements, and the real cost of teaching and doing science was given a higher and more realistic weighting. So in spite of increasing our student load to the highest of all geoscience departments nationally, this will not assist us financially, because much of the extra funding that increased student numbers generates will be used to decrease our level of budget subsidy. We will have to do more with the same budget, and spend more time doing it, which will potentially have significant effects on research productivity and our research standing. It is going to be extremely difficult to maintain our number one research benchmark ranking with the current pressures on us. And comments from other departments indicate that our situation is not unique. For example, Ross Large, Director of CODES has said several times that if CODES had not been renewed as an Australian Research Council funded Centre of Excellence last year, the student numbers at the University of Tasmania would only justify three or four staff positions. Every other department is in this position.

MONITORING THE HEALTH OF AND STRENGTHENING THE GEOSCIENCE DISCIPLINE IN AUSTRALIA:

The Role of the Australian Geoscience Council, Industry and a National Summit on the Plight of Geoscience in Australia

Unfortunately, there has not been any single organisation in Australia mandated with the responsibility for monitoring the health of the geoscience discipline nationally, such as assessing the impact of the closure of departments. There have been periodic reviews of the geosciences, including one through the Minerals Council of Australia in 1998, and a more recent one under the auspices of the Australian Academy of Science's National Committee for the Earth Sciences in 2003. However, none of these organisations had any post-review authority to intervene on behalf the discipline. As a result, many universities have been able to make decisions about the financial viability of geoscience departments in isolation, and with little consideration of the long-term national good. Consequently, some ten geoscience departments have essentially been closed down or been downsized to the point of being ineffectual and

incapable of sustaining a credible professional major study in geoscience.

I am working with the Australian Geoscience Council (the peak geoscience organisation representing all learned and professional geoscience groups in Australia) and its current President, Dr. Trevor Powell, and immediate past-President, Mr. Mike Smith, to raise awareness of the plight of the geoscience discipline in Australian universities, to engage with the principal stake-holders, to develop strategies on how to improve the health of the geosciences, and to ensure the long term survival of this nationally endangered species, but strategically essential discipline. The following is in train:

- The AGC has made a submission to the current DEST inquiry on discipline funding levels to have geoscience grouped into the same discipline funding cluster as agricultural science, on the grounds of its similar importance to Australia and because of its expensive and multi-faceted (analytical, experimental, fieldwork, high powered IT) nature. If successful, this would raise the funding level per geoscience student by some \$3,000 per year. This is in parallel with the submission by the Mathematics discipline on having its funding level increased. In turn, the two highlight the gross under-funding for the sciences across the board nationally, a matter that is approaching crisis level as declining staffing levels, increasing student to staff ratios, inadequate infrastructure refurbishment, diminishing maintenance budgets (in real terms) for teaching and research make inroads on the quality of science programs nationally, including at Monash University.
- The AGC plans to organise a national summit of key stakeholders from academia, industry, governments, and learned and professional societies in the next few months to discuss the issues and develop strategies for alleviating the plight of the geosciences and ensuring its future health.
- Although the AGC is informally now monitoring the state of geoscience nationally and will be collecting data to document many of the issues summarised above, it is hoped that a formal arrangement or organisation for conducting this role will be established in the future, a matter that will be proposed at the national summit. Such a body should have the authority to audit changes to any geoscience department, assess the impact of those changes and make recommendations to government and to universities. Unless this happens there may be little left of a discipline that underpins Australia's long-term prosperity.

THE ROLE OF INDUSTRY

Industry is a key stakeholder and beneficiary of Tertiary geoscience education and already substantially assists and supports the geosciences at the Tertiary level. Through the Minerals Council of Australia, 6 salaried academic positions are supported at selected institutions considered to have an educationally strong undergraduate program that meets the needs of the minerals industry in Australia. It is unclear however for how long this will last, and universities must continue to work with the MCA to make the case of the importance of this scheme. There is only limited support from the energy sector in supporting the budgetary needs of geoscience departments, which is disappointing.

Industry also helps enormously at the Honours and postgraduate level, providing project funding support and summer vacation work experience opportunities. So

industry is already contributing, but will need to do more if it wants Australian universities to continue providing graduates of a high quality and in large enough numbers.

In particular it is essential that industry uses its position as one of Australia's biggest corporate sectors to lobby governments and universities to improve funding for the surviving geoscience departments and the sciences in general. If it does not act then in a few years there may only be four or five surviving departments at the most, and most recruitment will have to be done overseas. We need long term stability of budget so that strategic forward planning can be undertaken, rather than drifting from year to year with uncertain budget outcomes. Education cannot be manufactured on the run from year to year. New students are entitled to assurances that the program they sign up for will be viable for the duration of their studies, not a moving target.

Industry also needs to commit to a more steady employment policy to hiring a consistent number of new graduates from year to year, rather than the knee jerk, boom and bust mentality that has marked its approach to employment of graduates in the past. If it doesn't provide some assurance of demand and opportunities for graduates more geoscience departments will fall over during the next downturn.

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