Australian Geoscience Council Inc.

The Council of Earth Science Societies in Australia

AGC

AUSTRALIAN GEOSCIENCE TERTIARY EDUCATION PROFILE 2007

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SUMMARY

In response to increasing concern amongst the member societies about the health of Tertiary geoscience education in Australia, the Australian Geoscience Council (AGC) has undertaken a survey of 20 universities with 'geoscience departments' to establish an Australian Geoscience tertiary Education Profile. The survey was undertaken preparatory to a "*National Summit on the Plight of University Geoscience Education and the Supply of Geoscience Graduates" to be held in Canberra on 27th September 2007.*

Sixteen universities have been identified in their own right as currently having the capacity to teach geoscience as a major in some form in their undergraduate programs. Of these 5 maintain distinct geoscience departments. In the remainder, the geoscience discipline has been amalgamated into schools of 'earth, geography and environmental science' or 'schools of physical sciences'. The consequence for the structure of the undergraduate majors on offer varies. Some schools have created 'geoscience degrees' from a blend of physical geography or environmental courses and traditional 'solid earth science' courses with less variety in the latter compared with traditional geoscience degrees. Others have maintained a clear distinction between degree types.

The extent to which course work is undertaken in the completion of BSc (Hons) varies slightly with institution. Several universities participate in the Minerals Shortcourse Program at Honours coordinated and financed by the Minerals Tertiary Education Council (MTEC). All institutions offer MSc by research, but there are a substantial number of Master's degrees being offered predominantly by course work with a lesser component allowed for a dissertation or thesis. These degrees are often specifically aimed at training candidates in knowledge and techniques required for employment in industry.

Each institution identified areas where thesis topics could be supervised at honours, masters and doctorate levels. Ten of the institutions surveyed identified themselves as having the capability to supervise theses across an almost full range of solid earth sciences (Geology including Economic Geology) with the balance of the institutions having capabilities in particular areas only. Eleven institutions were identified as having capability in Petroleum Geology. Eight institutions were identified as having a wide capability in Geophysics and eight institutions were identified as having wide capability in Geochemistry. Eleven institutions were identified as having capability in Hydrogeology. Several institutions indicated an expansion of capability in hydrogeology was planned.

Nationally student enrolments have increased 20% over the last 5 years, but all of this increase has been in levels 1-3 with enrolments in Honours/level 4 declining a further 9% over the 50 % drop that occurred in the previous decade. However there is a wide variation with some universities showing increases in all levels and other showing decreases at all levels. The 'Honours retention rate" has actually increased at two universities. There is also a wide variation in student load. The total Equivalent Full Time Student Load (EFTSL) across all levels ranges from less than 50 to in excess of 200 with 8 universities having EFTSL values above 100. There are 6 universities with values below 100 of which 2 have values below 55.

Output of post-graduate degrees has remained relatively constant over the last five years. Several institutions comment on the difficulty of obtaining new enrolments for post-graduate degrees particularly in the case of Australian students.

In 2007, 170 academic staff were engaged in some level of teaching of geoscience whilst 187 staff were engaged in research with no formal teaching commitment. The latter are very unevenly distributed with almost all research staff confined to 10 institutions with the two largest having 52 and 22 researchers respectively. Nationally 11 of the teaching positions are funded externally and the EFTSL per teaching academic is 11.7 with values for individual institutions ranging from 5 to 21 with 6 institutions below 10, 7 between 10 and 15 and 3 above 15.

The survey shows that the various institutions vary widely in their viability as teaching institutions with only those with the highest EFTSL appearing to be economically viable under current conditions. Although student numbers have been increasing in levels 1-3, mechanisms to attract students in geoscience courses are crucial to the longer term sustainability of departments. However it has to be concluded that in general Honours and post graduate degrees are not attractive to students completing their basic degrees. This matter has to be addressed by the geoscience community.

Many of our 'geoscience departments' appear to be non-viable in the longer term and the only solution would appear to be the actual or virtual merger of like departments to obtain the a critical mass of teaching and research capability creating a vibrant and attractive education experience which is fundamental to retaining tertiary geoscience educational opportunities in Australia and delivering the skilled graduates required by our economy. Even if funding per student is increased significantly, as has been advocated, then many geoscience departments in their present form would remain unsustainable. There is a substantial challenge in addressing the fundamental structural problems of our Tertiary geoscience education system.

INTRODUCTION

In the last decade, there has been increasing concern within the geoscience community about the health of geoscience education in Australia and the demise of some earth science educational opportunities, university earth science teaching departments and staffing levels[1] [2]. The concern is the ability of the higher educational system to provide the appropriately trained geoscientists required by the economy and Australian society, and general education of Australian society about the discipline of geoscience into the future. In the next few years it is thought this situation will rapidly reach a crisis point.

The Minerals Council of Australia (through the Minerals Tertiary Education Council – MTEC) have contributed to strengthening some earth science educational capabilities by sponsoring courses in some departments particularly as they relate to the minerals industry[3] and some employers (e.g. Geoscience Australia)[4] have offered student cadetships. Despite these efforts, the problem continues and is growing[5] [6] [7] [8]. The decline in earth science departments and their capability is also reflected in the ABS figures on research where earth science research has shown a 22% decline as a proportion of the national research effort over the last 10 years (Figure 1).

The situation has been succinctly put as follows[8].

"In 1990, 28 departments offered earth sciences around the country and it was a small, but mainstream science. By the end of the this year (2006) there will be five of the original geoscience/earth science departments left in Australia and it is a niche science albeit vital to the nation The other departments have either closed or been forced into unions with biology, geography, physics, maths, or environmental science. This decade the number of honours graduates and students currently enrolled in honours courses has more than halved"

(Note the numbers are around 260 graduates in the year 2000 to just over 100 graduates in the year 2005 of which close to 90 percent are in departments which have received support form MTEC – indeed as the authors note these departments have generally sustained their student levels through this period).

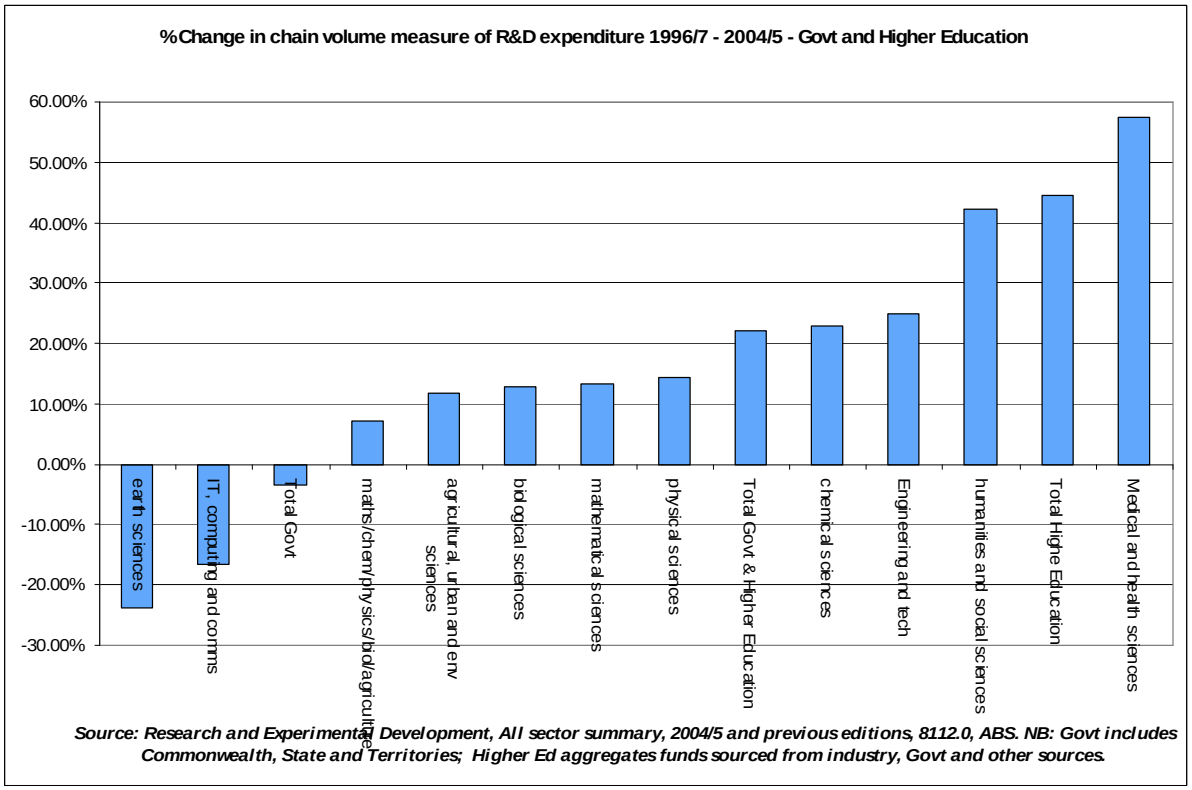
There has been a significant decline in teaching capacity[2].

"In the period 1990 to 2003 there was a decline in tenured teaching staff of 34 percent. Against international benchmarks geoscience-teaching departments are understaffed. The Australian Geoscience Council Working Party expressed this concern in 1992 and the situation has since deteriorated. A recent comparison (in 2003) *was undertaken by*

[1] Mineral Council of Australia, Back from the Brink: Reshaping Minerals Tertiary Education, MCA National Tertiary education Taskforce, MCA, Canberra 1998.
[2] National Committee for Earth Sciences, National Strategic Plan for the Geosciences, Australian Academy of Science , Canberra 2003.
[3] www.minerals.org.au/education
[4] www.ga.gov.au/jobs/#cadet
[5] Australian Institute of Mining and Metallurgy, Pre - budget Submission 2007.
[6] Cas, R. Geosciences – An endangered species, 18th AGC – Australian Earth Sciences Convention, 2006
[7] Hall, M & Hill, K. Time to Invest in Earth Sciences. PESA News Oct/Nov 2006, Petroleum Exploration Society of Australia Ltd, p 118-119.
[8] Webb, G.E. Some thoughts on Australian universities and the petroleum industry in 2006. PESA News Aug/Sept 2006, Petroleum Exploration Society of Australia Ltd, p38-39.

one of the largest Australian geoscience departments with two overseas departments, one in the United States and one in the United Kingdom, that were broadly similar in terms of student numbers. The comparison revealed that the two overseas departments had 2.5 and 2.9 times the number of academic teaching staff compared with the Australian department, …….."

Figure1. Change in earth science share of national R& D Expenditure. Data provided by the Federation of Australian Scientific and Technological Societies.[9]



The explanation, which seems to have general consensus, has been stated by Webb[8]

"The current university funding model provides funds on a per-student basis, with the salaries of staff (academic, support and administrative) infrastructure and expendables (including field teaching) being paid from those funds. However with low student numbers such funds are inadequate to pay for the necessary infrastructure to support study in expensive and technologically sophisticated fields like geology, geophysics and petroleum engineering. …… Thus the fundamental problem: teaching areas that by their nature have low student numbers (such as geology) provide little money for the university. Thus with low student numbers, expensive science and engineering programs are not economically viable, and are thus vulnerable to closure.

[9] Is this what you had in mind? Science and the changing profile of Australian R&D expenditure. (18 June 2007) Part 1 and Part 2. Federation of Australian Scientific and Technological Societies Discussion Paper. www.fasts.org.

Universities themselves are under no obligation to maintain teaching or research areas that are strategically critical to Australia's economy. Instead, through economic rationalization, they have been forced to depend upon market forces that are dominated by student choices for their primary funding. Popular, well attended courses that are perceived as easy options by students (e.g. arts and business) are well-funded and help the university's bottom lines, whereas expensive-to–teach, poorly attended courses (such as geoscience and engineering) are considered detriments to university finances."

As a result, some earth science departments have been closed or have been amalgamated with other science departments and staffing reduced to the point where their capacity to deliver a serious undergraduate major in geoscience has been severely compromised.

Once university teaching and research capability declines, it takes an extremely long time before it can be re-built. Apart from the work undertaken by MTEC from the perspective of the minerals geoscience education, to date there is no national perspective on these issues which are complex.

Earlier in 2007, the Australian Geoscience Council on behalf of its nine member professional and learned societies made a submission the Government Review of the Higher Education Support Act which outlined its concerns based on evidence accumulated from previous reviews and articles in various society newsletters.
In its submission the AGC urged that a national perspective be taken of the issue and undertook to organize a National Summit to facilitate development of this national perspective. In order to inform the Summit discussions and to provide a factual basis for discussion, the Australian Geoscience Council has undertaken a survey of Australian universities with a known geoscience capability in order to establish an Australian Geoscience Tertiary Education Profile and a health check on our national geoscience teaching capability. The survey aimed to:

- Obtain an overview of the issues confronting Tertiary geoscience education at the present time including the supply of geoscience graduates.
- Determine where we stand in regard to the various teaching departments offering geoscience?
- Ascertain where viable and comprehensive undergraduate majors are offered and the capability to support a full range of postgraduate programs.
- Assess what geoscience is being offered as part of a broader environmental or other science program?

METHOD

An AGC sub-committee was formed comprising Dr Trevor Powell (AGC President) Mr Mike Smith (AGC Past-president and now Chair), Professor Andy Gleadow (University of Melbourne and President of the Australian Geological Society), Professor Ray Cas (Monash University) and Kaylene Camuti (Chair AGC Education Committee). Twenty university departments were identified as having some geoscience teaching or research capability. An invitation was sent to the heads of departments in May 2007 inviting them to participate in the Summit and complete a questionnaire designed to inform the deliberations of the Summit. A copy of the questionnaire used in the study is presented in Attachment A. Results from 19 of the departments were received by August 31st 2007

and formed the basis for the Draft report which as considered by the AGC Summit of the Plight of University Geoscience Education and the Supply of Graduates, 27 September 2007. Following discussions at the Summit the Data Tables in the draft report were circulated to the universities in order for any amendments to be made in case of any misunderstanding of the questionnaire or in the interpretation of results. A number of amendments were received by early December 2007.

The results of the questionnaire were supplemented by examination on the various university web-sites of the school structures and course options available to students. This enabled some but not all incomplete data sets to b e enhanced. Notes are provided on incomplete data sets in the Tables section. The results are presented in the following Tables.

Table 1 Earth science degrees offered by Australian universities

Table 2 Earth science courses offered at levels 1-3 in Australian universities

Table 3 Minerals geoscience courses sponsored at Honours and Masters Levels by Minerals Council of Australia (Minerals Tertiary Education Council)

Table 4 A profile of capability at Australian universities to supervise geoscience theses for Honours and higher degrees.

Table 5 Enrollment data for undergraduate geoscience courses at Australian universities in the period 2003-2007

Table 6 Trends in undergraduate enrollment at Australian universities through time as measured by Equivalent Full Time Student Load.

Table 7 Completed post-graduate degrees in earth science at Australian universities for the period 2003-2007.

Table 8 Teaching and research position in earth science at Australian universities in 2007

For ease of reference the following abbreviations have been adopted in this report:

Adelaide	University of Adelaide
ANU	Australian National University
- RSES	Research School of Earth Sciences
- DEMS	Department of Earth and Marine Sciences
Ballarat	University of Ballarat
Canberra	University of Canberra
Curtin	Curtin University, WA
Flinders	Flinders University, Adelaide
JCU	James Cook University
Macquarie	Macquarie University, Sydney
Melbourne	University of Melbourne
Monash	Monash University, Melbourne
Newcastle	University of Newcastle
QUT	Queensland University of Technology

Sydney	University of Sydney
Tasmania	University of Tasmania
UNE	University of New England
UNSW	University of NSW
UQ	University of Queensland
UTS	University of Technology Sydney
UWA	University of WA
Wollongong	University of Wollongong

RESULTS

Institutional Status of Geoscience and Composition of Geoscience Courses and Degrees

Sixteen universities have been identified as currently having the capacity to teach geoscience in their own right as a major in some form in their undergraduate programs. (Table1). UNE proposes to continue to offer a geoscience major through collaborative arrangements with Newcastle.

The position of the geoscience discipline within the university structures varies widely and reflects the extent to which universities have re-organised themselves in response to student demand, the funding environment, search for administrative efficiencies and/or the opportunity through amalgamations to introduce flexibility into the structure of degrees particularly related to the environment and natural resource management.

Whilst in some cases these amalgamations result in a diminution in the importance of geoscience, this cannot be generalized and each case must be taken on its merits. The impact of amalgamations on undergraduate courses available at each institution also varies.

In the case of Canberra, UNE and UTS, the creation of 'schools of environment' has reduced the geoscience discipline to the extent that majors in geoscience cannot be offered or are under serious threat (Table 1).

Geoscience constitutes a distinct department or departments at the ANU, Curtin, Macquarie, Monash and Tasmania. At Melbourne the department is named "Earth Sciences" but includes ocean and atmospheric sciences. At Sydney, the department is named "Geosciences" but includes geography and environmental sciences

In most cases earth science constitutes a component of 'schools of earth, geography and environmental science' variously linked to 'life sciences' – Adelaide, JCU, Newcastle, NSW, UWA and Wollongong and QUT (Table 1). In other cases, the discipline sits within a 'school of physical sciences' – Ballarat, Flinders and UQ.

The degree of integration of courses from the different disciplines and the consequence for the structure of the undergraduate majors on offer varies (Table 1). The majors offered at Adelaide, ANU, JCU, Macquarie, UNSW, Sydney, Tasmania and UWA are all based on clear themes related to particular disciplines – e g geology, geophysics, hydrogeology, environmental geoscience. Degrees are constructed from a selection of courses particularly in year 3. At Curtin there are a variety of named degrees with

proscribed courses. The choice of courses is also restricted for institutions offering single or perhaps two majors – Ballarat, Flinders, Melbourne Newcastle, UQ, QUT, and Wollongong. Monash appears to be reducing the number of majors on offer.

A major change is taking place in the structure of undergraduate degrees at Melbourne (see comments in Table 1).

In some of the amalgamated schools and within the framework of a 'geoscience major', the number of environmental geoscience courses has been increased whilst courses in the "solid earth science disciplines" have been consolidated. In order to illustrate this (Fig 2) the courses on offer in year 3 (Table 2) have been classed as "Solid Earth, Minerals and Petroleum Science" Environmental and Surficial Geoscience" and "Hydrogeological Science". Comparison of the relative proportions of these courses has been facilitated by normalizing for each courses "Equivalent Fraction of a Full Course Load" (EFTSL) (Fig 2). Thus a course with an EFTSL of 0.25 is rated as equivalent to 2 courses with an EFTSL of 0.125 and a course with an EFTSL of 0.0625 has been rated as equivalent to 0.5 of a course.

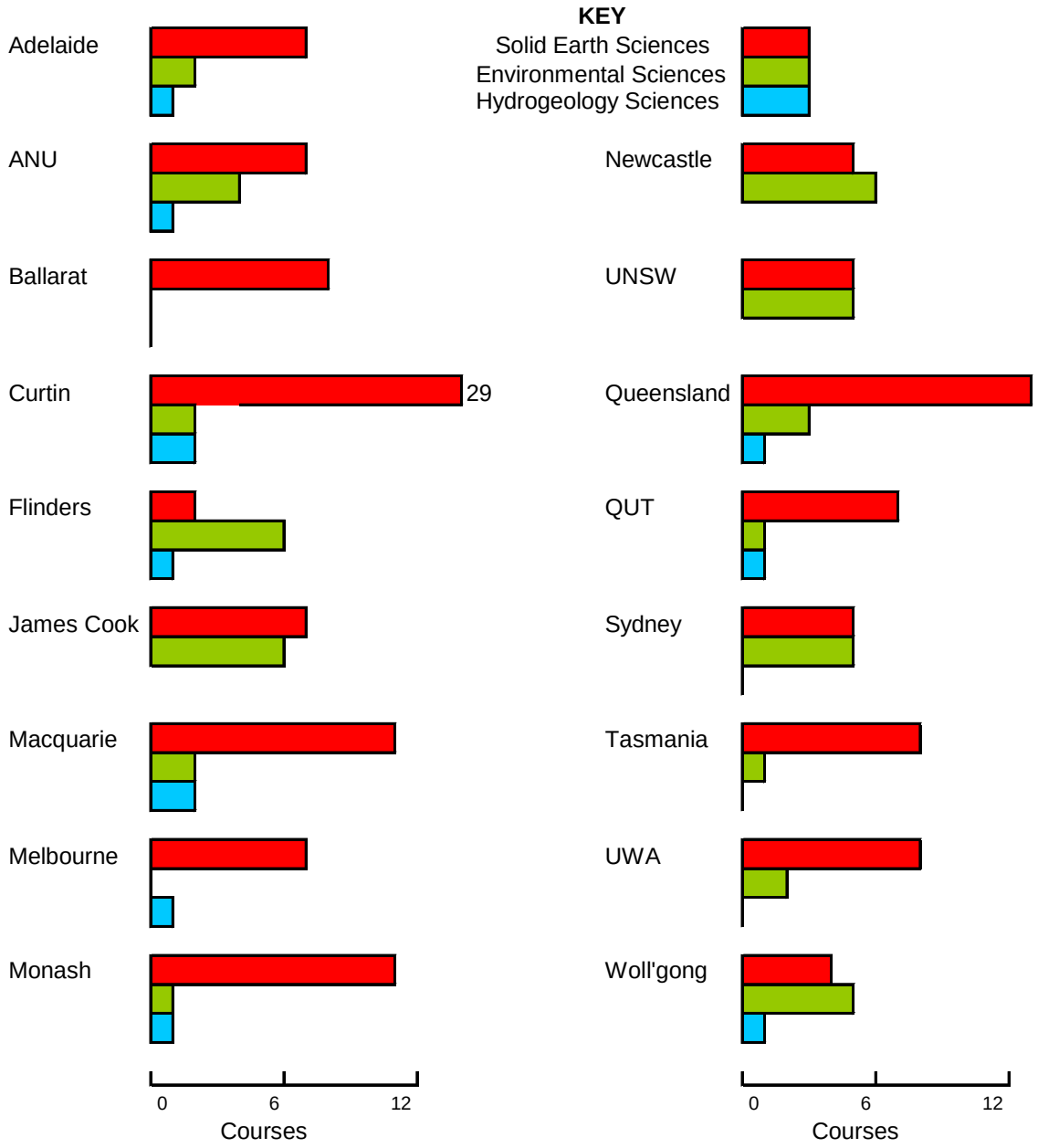
Thus the geoscience majors at Wollongong and Flinders have a strong bias to natural resource management, with water resources being characteristic of Flinders. There appears to be increasing emphasis on environmental geoscience at JCU, Sydney, UNSW and Newcastle. However, Sydney will implement a revised geology/geophysics major in 2008 emphasizing the 'core skills expected of graduates'.

In other cases of the amalgamated schools (e g. Adelaide and UWA), the "solid earth science" and "environmental and surficial science" streams are kept separate in different majors. In the latter cases and in the remaining universities, the courses in Year 3 remain dominated by the "solid earth science " disciplines with levels of teaching in "ore deposits " "petroleum geoscience" and "geophysics" varying from institution to institution. Curtin is unique in the breadth of its offerings in defined degrees (with no electives) covering applied geology, environmental geology, hydrogeology, mining geology and geophysics.

The extent to which coursework is undertaken in the completion of BSc – (Hons) varies ranging typically from around 25% to around 50% with subject matter requirements also varying considerably between institutions. Several universities participate in the Minerals Shortcourse Program at Honours (Table 3) coordinated and financed by the Minerals Tertiary Education Coucil (MTEC). Others offer access to these courses at institutions through collaborative arrangement (e.g. ANU)

All institutions offer MSc by research, but there is a substantial number of Master's degrees being offered predominantly by course work with a lesser component allowed for a dissertation or thesis (Table 1). These degrees are often specifically aimed at training candidates in knowledge and techniques require for employment in the resources industry. Again MTEC offers a Mineral Geoscience Master Program at three universities aimed predominantly at candidates with some professional minerals experience (Table 3). The School of Petroleum at the University of Adelaide also has strong industry backing and offers a range of courses tailored for entry into the petroleum industry. Curtin University has a wide variety of post- graduate course options. Under Melbourne's new model, 2 – year MSc degrees with a significant coursework component will replace an honours degree (see comments in Table 1).

Figure 2 Number of courses of different geoscience categories taught in undergraduate level at Australian universities.



Each institution was asked to identify, using the ABS Research Classification codes, areas where thesis topics could be supervised at honours, masters and doctorate levels. These are mapped for each institution in Table 4. Not surprisingly the distribution of capability generally followed the teaching profile outlined above. Ten of the institutions surveyed identified themselves as having the capability to supervise theses across an almost full range of solid earth sciences (Geology including Economic Geology) with the balance of the institutions having some capabilities in particular areas. Eleven institutions were identified as having capability in Petroleum Geology. Eight institutions were identified as having a wide capability in geophysics and eight institutions were identified as having wide capability in geochemistry. Eleven institutions were identified as having capability in hydrogeology. Several institutions indicated an expansion of capability in hydrogeology was planned (e.g. JCU, UNSW, UWA). UWA has flagged an expansion in petroleum geology.

Student Numbers

The long term viability of teaching departments depends upon attracting sufficient students to justify the academic staff for the teaching and thesis supervision role. Whilst in most universities academic staff with a teaching role also have a research and research mentoring role, the basic premise is that unless sufficient undergraduates are taking geoscience courses and generating the necessary income then it will be difficult for a university to justify maintaining a geoscience academic capability unless there is a very strong and distinct research rationale which the university is willing to support.

It is difficult to compare the significance of raw student numbers from the different universities because of the variety of different courses on offer and the different value of the courses for crediting purposes. In order to normalize the figures from different universities, student numbers are expressed as "Equivalent Full Time Student Load (EFTSL)" (Table 5) - for a particular course this is the number of students multiplied by the proportion that that course represents a full work load in a given year or level.

EFTSL values for particular courses range from 0.0625 to 0.25 for courses in levels 1-3 with the most common value being 0.125. Thus a total EFTSL of 50 in year 1 may correspond to 2 courses each with an EFTSL of 0.125 and an average class size of 200 whereas an EFTSL of 50 in year 3 may correspond to 9 courses each with an EFTSL of 0.125 and an average class size of 30. In the honours year, the total EFTSL approximates the number of students since at this stage students are usually studying geoscience full-time. The total EFTSL across all years is a measure of the total equivalent full time students undertaking geoscience courses and is also a measure of the overall educational load (Table 5). It is a rough indicator in relative terms of financial viability of the teaching programs. Post – graduate courses are not counted here but can be important contributors to the viability of the geoscience teaching program e.g. Curtin. The average number of students per course and the number of courses taught at a particular level are also given and this gives a rough indicator of the overall teaching load. The sum of the average course size across the years approximates the total number of individual students engaged in geoscience.

There is a wide variation in the total EFTSL for the 16 universities offering a geoscience major, ranging from less than 50 to in excess of 200 indicating a wide variation in student load with a 10 universities having total EFTSL values above 100 with 2 universities in excess of 150. There are 6 universities with values below 100 of which 2

have values below 55. Most universities currently have large number of students in year 1. Comparison of the average class sizes in year 3 with the corresponding class size in year 1 two years earlier show 'retention rate' for 10 of the universities is between 15-25% with two universities below 15% and 4 universities above 25%. Not surprisingly the latter are universities with the proscribed courses outlined above and tend to have smaller classes in year 1. In other words once a commitment is made to study geoscience related subjects retention rates tend to be higher. In contrast the major metropolitan universities have large classes in year 1 and a wider range of options so that retention rates tend to be lower.

Table 5 gives the Total EFTSL for the surveyed universities for the last 5 years. Overall the number of students and hence the educational load nationally has increased 20% when comparing the last 2 years of the five year period with the first 2 years of the same period. However, this increase has occurred at levels 1-3 and particularly at level 2 (31%). In contrast there has been a 9% decrease in Honours/Year 4 students over 5 years. This continues the dramatic decrease observed in previous surveys prior to 2003[7] although at a reduced rate

However there is a wide variation between universities Overall, Adelaide (53%), Curtin (66%) and UWA (119%) have shown a particularly strong increase in student numbers – although UWA has been off a lower base than the others. Ballarat, Monash, UNSW, QUT and Sydney have also shown an increase. The remainder have broadly static numbers overall except ANU which has shown a consistent decline overall.

Table 6 shows that there is a greater level of variation between levels with a larger proportion of universities showing a strong increase student numbers in levels 1-3. Only Adelaide, Monash, Sydney and UWA show an increase in Honours students, with 9 universities showing a greater than 10 percent decline and another two universities (Melbourne and Wollongong) being static or showing a slight decline.

As would be expected, comparison of the size of the "Honours Class" with the average size of the Level 3 class of the preceding year shows that the "Honours Retention Rate" has been dropping, though there are some notable exceptions (Adelaide and UWA)

The output of post - graduate degrees has remained relatively constant over the last five years (Table 7). Because of the small number of degrees completed on an annual basis at each institution no institutional trends are evident. Several institutions however comment on the difficulty of obtaining new enrolments for post – graduate degrees particularly in the case of Australian students. Several universities comment on the dependence on overseas students. One institution considers declining enrollment of post-graduate students to be a severe financial threat in future years.

Staffing Profiles

The long time viability of 'geoscience schools and departments" is dependent upon a combination of both teaching and research. Although the emphasis is placed in this survey on teaching, institutions were asked to identify positions that were funded by the university and externally in both teaching and research order to gain an impression of the overall strength of various schools (Table 8). It has been commented that it is only the strength of research activities that have kept some schools open.

In 2007, 170 academic staff are engaged in some level of teaching of geoscience in Australian universities whilst there are a further 187 staff are engaged in research with no formal teaching commitments. There are 3 departments with more than 12 teaching positions, 12 with 8-12 teaching positions and 1 with less than 8 teaching positions. These include geography and environment teaching in some merged departments. The research positions are unevenly distributed with 52 at the ANU (RSES – all but 2), 20 at Curtin, 19 at Melbourne; 16 at Tasmania and UWA; 12 at Macquarie, 11 at Adelaide, JCU and Monash and 5 at Newcastle. The high number at ANU reflects the unique nature of the Research School of Earth Sciences. The combination of teaching and research positions result is a wide range in capability between the 'geoscience' universities with 3 having in excess of 30 geoscience positions, 6 having between 20 - 30 positions, 4 having between 10 and 20 positions and 3 having below 10 positions.

Nationally, the total EFTSL per teaching academic is 11.7 with values for individual institutions ranging from 5 to 21. There are 6 institutions below 10, 7 between 10 and 15 and 3 above 15 (Table 8).

Nationally 11 of the teaching positions are externally funded. Six of these positions are funded by MTEC at Tasmania, Monash, JCU, UWA Melbourne and CRCLEME reflecting the commitment of MCA to minerals education.

DISCUSSION OF THE ISSUES

The context for this survey is that AGC Member Societies are concerned that, as a result of earth science departments having been closed or amalgamated with other science departments, staffing was being reduced to a point where their capacity to deliver a serious undergraduate major in geoscience had been severely compromised.

This survey has shown that there are two fundamental issues underlying the present situation comprising a balance of:

- demand by students for geoscience places at university, particularly for honours and/or post-graduate study
    - an issue of interest in geoscience and job opportunities for graduates

- capacity at universities to deliver a quality undergraduate degree.
    - an issue of critical mass and appropriate levels of funding.

This study does not address the issue of attracting students into 'earth science courses" from high school. However it is worth noting that AGC member societies and resource industry bodies are increasingly active in introducing school students and the wider community to earth science through various educational programs. The results of this survey show that the number of students commencing undergraduate study in geoscience has been increasing and is independent of location. However, the capacity of universities to capitalize on this interest varies enormously. The reasons for this situation are not clear. Some of the geoscience departments in this study have outreach programs to schools and the broader community. This indicates a proactive attitude to presenting geoscience in a positive way to the community and may result in departments presenting a more attractive face to geoscience for prospective students. Whilst there is no simple correlation, those schools that have no or minimal outreach program appear

not to be capitalizing on the growing student interest compared with those institutions that do engage in outreach programs.

In WA, both Curtin and UWA have been able to capitalise upon the extensive and growing program of activities supported by industry and professional societies aimed at stimulating interest in the geosciences and the profile afforded to the geosciences by the resources boom on their doorstep. In Adelaide, considerable support is provided by the State Government and its institutions.

Mechanisms to attract students in geoscience courses are crucial to the longer term sustainability of many departments. However it has to be concluded that in general Honours degrees are not attractive to students completing their basic degrees. Obviously with the resources boom there are alternative options, notably immediate employment at attractive rates. It is instructive that those departments which offer a wide variety of options at Honours level and have access to specialist industry courses appear to be doing better in their retention rates in translating from Level 3 to Honours (Table 8). However with the notable exception of Adelaide, Queensland and Western Australia, these retention rates have been declining.

Several universities comment upon the threat implied by the low enrollment rates into Honours and post graduate courses. This matter requires active consideration by the geoscience community. The change in structure of the undergraduate degree at Melbourne and the replacement of Honours by a 2 years MSc degree is very interesting in this context.

Mechanisms to attract students to geoscience courses both into level 1 and in continuing years are fundamental to sustainability and warrant further support and coordination by AGC Member Societies in partnership with universities.

It is very clear from this survey that, despite the reduction in academic staff that has occurred over the last decade, most of our 'geoscience degrees' are uneconomic on purely teaching basis. It has been suggested (P. Vasconcelos – Pers. Comm.) that the absolute minimum of academic staff required to teach well rounded geoscience majors is 8 and desirably it should be 10 -12. All but 4 universities surveyed are in this position.

Assuming 10 academic positions, an average academic salary of $80000 to $100000, a conservative multiplier of 2.5, operating expenses of say $400,000 to $600, 000 and 2008 Government funding of $14363 per student, then the student EFTSL per academic has to be of the order of 15 to 20 to break even on government funded undergraduate teaching alone. Even if government were to increase student funding for geoscience to the top funding cluster now applying to Agricultural Science ($18227 – as has been recommended by AusIMM to a variety of government reviews and also by AGC in its submission to the HESA Review), then the student EFTSL per academic would still required to be 12 to 16. Many of the 'geology teaching entities' in this survey would appear to be uneconomic even at higher student funding levels. This suggests the total EFTSL teaching load for a 'geoscience department' comprising 10 teaching academics has to be of the order of 150 – 200 to be economic on a teaching basis on current government funding levels.

However it is not simply a matter of increasing the number of students per academic. Several universities have commented that class sizes for laboratory and field work have

a maximum effective size for practical teaching. In the past graduate students have been relied upon to carry the 'demonstrator' role. Already universities are suffering from inadequate capabilities in this area and any increase in class sizes would exacerbate this problem. University geoscience departments are now faced with the problem that staffing levels have shrunk in the past decade, student numbers are now increasing so that the work load of academics have increased significantly, but support for teaching practical and fieldwork has diminished. The lack of funds in university geoscience departments underpins the many comments in the survey on inadequacy of facilities, lack of resources for teaching including support staff, limitations on fieldwork and appearance of teaching capability gaps.

Although the funding scenario outlined above is unrealistic since funding for university departments is not solely dependent upon government funded undergraduate teaching, it raises the question "What is the minimum economic department size that is sustainable in the longer run?" This has to have consideration of government funded student load, fee paying students, academic staff numbers, service teaching to other degrees, external funding for teaching and research funding.

For sustainability it demonstrates that departments or schools have to be larger with a wide variety of teaching and research options, including post-graduate students and be capable of attracting considerable external funding to be sustainable in the longer term. In this regard the comments provided by Curtin in the survey are germane:

"The resources available to support education in the Department of Applied Geology have improved significantly in the last year or two due to the increased student numbers and a resulting operational surplus. We have this year been able to fully replace all of our teaching microscopes at a cost of $190k (assisted by $100k strategic funding from the Vice Chancellor), and the geology building has been completely redecorated. However, Geology does carry a significant financial deficit (about $1.8M) accumulated between 1999 and 2005 as a result of low enrolments, and the department is expected to use much of its expected operating surplus over the next few years to eliminate this deficit. So although current student levels would be sufficient to fully resource our courses and teaching facilities, we are unable to utilize much of this funding due to the financial hangover of previous years.

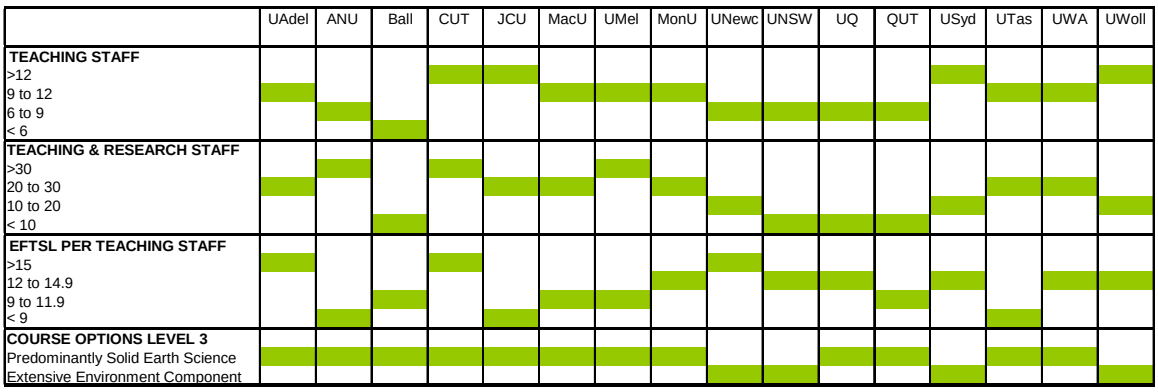
The Geophysics Department has managed to maintain a more healthy financial balance sheet, largely because it has always subsidized its teaching activities through substantial levels of industry research. However, the continual uncertainty of gaining research contracts creates significant year-by-year planning issues, compounded by the increasingly shorter timeframes of individual research projects.

To date, both geology and geophysics departments have managed to maintain the quality of their courses, although in geology the teaching loads are close to unsustainable. Field trip opportunities remain as they have been for 20 years, and facilities are as good now as they have ever been, but our ability to maintain this into the future is dependent upon continued student demand and research success. Any decrease in student or research income could render one or both departments unsustainable, and the continual erosion of Commonwealth student funding relative to costs will start to bite once student intakes stabilise. We are lucky that Curtin has identified minerals and energy education and research as its number one priority, and is therefore prepared to ignore the large financial deficit in Applied Geology. Any change in management or direction could reverse University policies, as could an industry downturn, resulting in the closure of Curtin Applied Geology (and therefore also Exploration Geophysics given that Applied Geology teaches much of the undergraduate geophysics course)."

It is worth noting that Curtin's EFTSL per staff member is 17.9 and the total EFTSL in 2007 was 234 with a teaching staff of 13.05 and research staff of 20.

Figure 3 compares the profile of the individual schools in terms of staff numbers EFTSL per staff member and a summary of the course profile. It gives a first order impression of the long term sustainability of each school and its strategic positioning. Whilst the economics of universities are clearly quite complex, consideration of the issues outlined above makes it perfectly understandable why university administrators have amalgamated previously independent schools and disciplines. In so doing the danger is that the courses are designed to suit the needs of the university and reflect the areas of expertise of inherited staff rather than the "core skills expected of graduates."

Figure 3: Profile of overall strength of Australian Universities in geoscience in 2007



The solution to this problem consists of two parts. The first option involves amalgamation across previously separate disciplines. Amalgamation can lead to differentiation and movement away from the traditional "solid earth science disciplines" to apply geoscience skills in combination with skills from other disciplines to meet the emerging needs in natural resource management. Clearly some universities have adopted this strategy in order to obtain the critical mass in student load and efficient utilization of academic staff. Of course, unless the strategy is successfully executed then the worst of both worlds obtains – lack of coherence in the academic program, with large gaps in teaching capability in the previous traditional disciplines leading to graduates that lack "core skills expected of graduates"

The second option is to consider mergers either actual or virtual of like departments. This is exemplified by ANU which is merging the RSES and DEMS to create a large department of critical mass in 2008.

Whilst physical merger is difficult for other institutions, virtual merger particularly at the higher teaching levels with clear differentiation of responsibilities is feasible and indeed has to some extent been undertaken through arrangements such as VIEPS – Victorian Institute of Planetary and Earth Sciences and, to a lesser extent, SUCOGG – Sydney Universities Consortium of Geology and Geophysics where teaching at higher levels is shared between universities for particular topics To gain the necessary economies of scale, however, there would need to be a far greater integration of staffing and enrollment of students and a clear differentiation of roles. Such an arrangement would

have the advantage of providing pathways for students from the large classes apparent in year 1 to a variety of options in majors and higher degrees and would overcome the issue of restricted catchments if there were fewer but larger departments.

Apparently it is common for students to consider the institution they attend as the primary source of their course interests. Since geoscience is not commonly taught at high school, attraction of students to years 2 and 3 geoscience courses and beyond is strongly dependent on capturing the interest of student in year 1 – hence there must be a logical pathway from their university level 1 course to a major and higher degree. This could be provided by virtual mergers as outlined above, but development and implementation of such a system would be a considerable challenge.

The results of this study strongly suggest that a critical mass of teaching and research capability creating a vibrant and attractive educational experience is fundamental to retaining tertiary geoscience educational opportunities in Australia. To achieve this requires some radical thinking as to options. This study strongly indicates that even if the funding per student was increased significantly, many geoscience departments in Australia are largely unsustainable in their present form and would be incapable of riding out the fluctuations in student numbers that has occurred in the past.

TABLES

Table 1 Earth science degrees offered by Australian universities. Notes are by respondents on significant changes and issues. Material in italics is derived from university websites. Note University of Canberra no longer offers geoscience.

Institution – School	Majors/Honours	Post Graduate Degrees
University of Adelaide School of Earth and Environmental Science School of Petroleum	**BSc /BSc (Hons)** - **Geology** - **Geophysics** - **Environmental Geoscience** **BSc (Hons) Petroleum Geoscience** Note: Honours Environmental Geoscience to be introduced in 2008. Also al courses will have 3-unit values in years 1, 2 and 3	**MSc by research in geoscience, PhD** **MSc** (by coursework and thesis) **in Petroleum Geoscience, Petroleum Geology and Geophysics and Reservoir Geoscience. PhD** Note: Difficulty in recruiting students required to maintain current post – graduate levels because of exciting employment opportunities and lack of access to scholarships
Australian National University Department of Earth and Marine Sciences Research School of Earth Sciences	**BSc /Hons** - **Geology** - **Double Geology** - **Environmental Geoscience** - **Marine Geoscience** - **Water Science & Policy** **Bachelor of Global and Ocean Sciences (Honours)** **BSC (Hons)** - **Geophysics** Note: In 2008 DEMS will be incorporated the Research School of Earth Sciences to form a new school. ANU contributes to the new MTEC program in 2008 (8 universities offering one Honours course each into the MTEC program)	**M.Phil by research, PhD** **MSc by coursework** - **Regolith Geoscience** **MSc by coursework** - **Physics of the Earth** **PhD**

Table 1 continued

Institution – School	Earth Science - Majors/Honours	Post Graduate Degrees
University of Ballarat School of Science and Engineering	**BAppSci/Hons** - **Geology** Note: Geoscience included in BAppSci - Metallurgy; Environmental Management: BEng Sci – Mining & Civil Engineering: Grad Dip of Mining & optionally In BEd and BAppSci. From 2008 it will be available in new BSc.	**MSc App Sci (research), PhD** Note: A MSc (Surfqce & groundwater) with embedded graduate Diploma and graduate Certificate of Surface & Groundwater is at an advanced stage of preparation.
Curtin University of Technology (Western Australian School of Mines - WASM). Department of Applied Geology Department of Exploration Geophysics	**Associate Degree in Mine Technology** - **Geoscience Major** **BSc/ BSc (Hons) - Applied Geology** - **Exploration/ Applied Geology stream** - **Environmental Geology Stream** - **Hydrogeology/Engineering Stream** **BSc / BSc (Hons) - Mineral Exploration and Mining Geology** **BSc/ BSc (Hons) – Land & Water Resource Science** **BEng - Mining Geology** **BSc/ BSc (Hons) – Geophysics** **BSc (Hons) – Petroleum Geoscience** Note: All Bachelors courses are named degrees and have prescribed content with no electives. There are plans to rationalize undergraduate degrees and make Mineral Exploration and Mining Geology a third-year stream within the BSc (Applied Geology) but with minimal effect on course content. Curtin/WASM is a partner in the national minerals geoscience honours program to run from 2008 with funding from the Minerals Council of Australia.	**Graduate Diplomas** (1 year conversion for graduates in other disciplines) - **Mineral Exploration Geoscience** - **Geophysics** **Postgraduate Diplomas**(1 year preliminary to Masters degree) - **Applied Geology** with majors offered in Economic Geology, Hydrogeology, Petroleum Geology and Specialist Geology. - **Geophysics** - **Mining Geology** **Masters degrees by coursework** (1 year) - **MSc (Geology)** - **MSc (Geophysics)** - **MSc (Geoscience Exploration)** with streams offered in Groundwater Exploration, Mineral Exploration and Petroleum Exploration. - **MSc (Mining Geology)** **Masters degrees by research** (1-2 years) - **MPhil (Geology)** - **MPhil (Geophysics)** **PhD** Note: There is a plan to reduce the number of postgraduate coursework degrees making mining geology a major/stream within broader geology courses. Curtin/WASM will join JCU, UTas and UWA as a core partner in the MTEC Mineral Geoscience Masters Program in 2008.

Table 1 continued

Institution – School	Earth Science - Majors/Honours	Post Graduate Degrees
Flinders University of South Australia *School of Chemistry, Physics and Earth Sciences*	***BSc/Hons*** - ***Earth Sciences*** - ***Environmental Hydrology and Water Resources*** - ***Ocean and Climate Science***	***Msc(Research), PhD*** ***Graduate Certificate, Graduate diploma, Masters – Coursework*** - ***Groundwater Hydrology*** - ***Water resource Management*** - ***Physical oceanography***
James Cook University School of Earth and Environmental Sciences	**BSc/BSc(Hons)** - **Geology/Economic Geology** - **Environmental Geology** - **Hydrology/Hydrogeology (new in 2008)** Note: New proposed degree in Bachelor of Geology under consideration	**MSc (Research), PhD** **Masters by coursework with minor thesis component.** - **National Mineral Masters** - **Master of Applied Sciences** Note: Latter is almost defunct being subsumed by National Minerals Masters. New enrollments for post-graduate degrees have plummeted and represent most serious threat to financial viability in the medium term.
Macquarie University Department of Earth and Planetary Sciences	**BSc/BSc (Hons)** - **Geology** - **Geophysics** - **Geology and Geophysics** - **Environmental Geology** - **Paleobiology** Note: Participant in SUCOGG consortium (See Sydney)	**Master of Geoscience (coursework)** **Master of Science (Palaeobiology) (coursework)** - both can include a thesis component **MPhil (research), PhD**
Monash University School of Geoscience	**BSc/BSc (Hons)** - **Goscience** - **Environmental Geoscience – to be discontinued** - **Geophysics** (basically defunct) - Note: Future staffing is uncertain and will make the curriculum more robust by offering a single major with identified streams	**MSc (research), PhD** Note: Monash plans to increase HDR load across all Schools and geosciences will need to attract more students, and fund more projects. This may involve a decision to design some "cheaper" projects. In recent times, most PhD students were from overseas, as demand from local students is limited. Monash is making available more PhD Scholarships, including many for overseas students and has a *minimum* requirement for a University Scholarship of an H1 with good undergraduate grades

Table 1 continued

Institution – School	Earth Science - Majors/Honours	Post Graduate Degrees
University of Melbourne School of Earth Sciences (includes ocean and atmospheric sciences)	**BSc/BSc (Hons)** - **Geology** - **Atmosphere and Ocean Science** Note: New Generation degrees will require students in to take one quarter of their subjects outside their course (i.e., non-Science such as commerce, a language, music, arts). Although this has required a consolidation of our "geology" and "meteorology" subjects in second semester of first year, most other subjects are likely to remain as they are. Both majors will remain (representing at least half of the subject load students are required to complete at third year), although it will no longer be possible for third year students to study only geology.	**MSc (Research)** – few undertaken**, PhD** **MSc (coursework)** with three streams Earth Systems, Geodynamics and Ore Deposits, Geodynamics and Petroleum Note: BSc (Hons) is being phased out and replaced by a new 2 year MSc coursework program in Earth Sciences.in in 2009 at the earliest and 2011 at the latest. This will extend the period students spend on research projects, increase the amount of advanced coursework, and provide access to other subjects in areas of business, communication and science advocacy, and broader science 'skills' (e.g., statistics, modeling, database management). Students progressing on to PhD studies will be better prepared and therefore able to complete in 3 years Students entering the workforce from the Masters program will be better prepared to apply their skills in a practical way, and interact/communicate with colleagues who are non-geologists (e.g., managers, engineers, business people
University of New England School of Environmental and Rural Science	B.Geoscience/Hons from 2008, Hons in limited topics. BSc Note: A professional major (double major) will only be available by students doing some units at the University of Newcastle. The basic BSc will not allow students to gain a professional major in Geology. A minor amount of Geology is incorporated into the BEnvSc and BNatRes	**MSc (research), PhD**
University of Newcastle School of Environmental & Life Sciences	**BSc/BSc (Hons)** - **Earth Science** Note: After amalgamation with Physical geography and course revision, situation has stabilized with 2 new appointments. To obtain a full professional geology major suitable for the minerals industry, students would need to do some units at University of New England or elsewhere	**MSc (research), PhD**

Table 1 continued

Institution – School	Earth Science - Majors/Honours	Post Graduate Degrees
University of New South Wales School of Biological; Earth & Environmental Sciences	**BSc/BSc (Hons)** - **Geology** - **Environmental Earth Science** - **Marine Science(Geology)** - **Spatial Information Systems** **BAdvSc(Hons)** - **Geosciences** **BEnvSci** - **Geology** - **Geography** Note: course options are a blend of traditional geology and geography courses. Related fields covered in Schools of Mining Engineering and Petroleum Engineering.	**MSc (research) & MPhil, PhD** **MSc (Coursework)** - **Masters of engineering Science in Civil Environmental Engineering – Groundwater studies** - **Masters in Spatial Information Systems** Note: Hope to build capacity in groundwater
University of Queensland School of Physical Sciences	**BSc** - **Geological sciences** **BSc (Hons)** - **Geology** - **Earth Sciences** - **Applied Geophysics** Note: Whole of BSc program at UQ is under review.	**MSc (Research)** **MSc Mineral Resources (Exploration)**
Queensland University of Technology School of Natural Resource Sciences	**BAppSc/BAppSc (Hons)** - **Geoscience** Note: A revision in the BAppSc which incorporates a common first semester and a slight reduction in the number of subjects offered by the school (reduction in student choice).	**M AppSc** (is a generic Faculty of Science research degree with limited coursework tailored to the individual needs of each candidate. **PhD**

Table 1 continued

Institution – School	Earth Science - Majors/Honours	Post Graduate Degrees
University of Sydney School of Geosciences (includes geography, marine & environmental sciences)	**BSc/BSc (Hons)** - **Geology and Geophysics** - **Marine Science** - **Spatial Science** - **Geography** - **Environmental Sciences** **BMarSc(Hons)** Note: Will implement a revised Geology geophysics major in 2008 emphasizing the core skills expected of graduates. Joint delivery with Macquarie and UNSW of some courses; Sydney Universities Consortium of Geology and Geophysics (SUCGG) – 4th year honours courses are offered by individual institutions to any 4th year student in collaborating universities on an informal basis without need for cross-enrollment.	**MSc (research)** **MAppSc (coursework)** - **Environmental Science** - **Spatial Science** - **Coastal Management** Note: A graduate Diploma in Geology and geophysics has been proposed to enable science graduates with alternative majors to retrain in the field.
University of Tasmania School of Earth Sciences	**BSc** **BSc(Hons)** - **Geology** - **Geophysics** - **Geochemistry** - **Economic Geology**	**MSc (research)** **MSc (coursework)** - **Exploration geoscience**
University of Technology Sydney Department of Environmental Sciences	Nil BSc (Earth and Environmental Science) discontinued in 2003 **BSc (Hons) limited topics**	**MSc (research), PhD limited topics** Note: No pathways into earth science postgraduate degrees for UTS undergraduates

Table 1 continued

Institution – School	Earth Science - Majors/Honours	Post Graduate Degrees
University of Western Australia School of Earth and Geographical Sciences	**BSc/BSc(Hons)** - **Geology** - **Earth Science** - **Geochemistry** - **Environmental Geoscience** - **Marine & Coastal Management** **BSc (Hons) Geology & Resource Economics – 4 yrs** **BSc (Hons) Mineral Geoscience – 4yrs** **BSc (Hons) Petroleum Geoscience – 4yrs** Note: Further developments in petroleum geoscience, some ongoing adjustment to degrees	**MSc (research), PhD** **MSc (research - Hydrogeology new)** **MSc (coursework – Hydrogeology new)** **MSc (coursework – Ore deposit Geology and Evaluation)** Note: Centre for Exploration targeting State funding ceases mid 2008 but aim to retain as many research staff as possible via research project funding to maintain breadth of projects to students. New staff in Petroleum Geoscience (Professor and research fellow) should allow expansion of petroleum projects and continued attraction of overseas students. Potential new appointment in Hydrogeology. Employment opportunities in the resources sector impacting on availability of post graduate students.
University of Wollongong School of Earth and Environmental Sciences	**BSc/BSc (Hons** - **Geosciences** - **Physical Geography** - **Geosciences** **BEnvSc (Hons)** **BMarSc(Hons)**	**MSc MEnvSc (research), PhD** **MEnvSc (Advanced) MSc (coursework – geology)** **Graduate Diploma (coursework – geology)**

Table 2 Earth science courses offered at levels 1-3 in Australian universities. Material in italics derived from university websites.

Institution – School	Level 1 Courses	Level 2 Courses	Level 3 Courses
University of Adelaide School of Earth and Environmental Science/ School of Petroleum	Earth Systems I Earths Interior I Others Earths Environment I Geology for Engineers	Sedimentary & Structural Geology; Igneous & Metamorphic Geology ; Landscape, Processes & Environments;	*Geology Major* - Field Geoscience; Igneous & Metamorphic Geology; Tectonics; *Environmental Geoscience Major* – Environmental Geoscience Applications; Environmental Geoscience Processes; Remote Sensing III, *Geophysics Major* - Theoretical Geophysics; Mineral Exploration; Petroleum Exploration.
Australian National University Department of Earth and Marine Sciences	The Blue Planet; Australia's Environment Introduction to Earth Science in the Field	Structure/Field; Surficial Processes; Chemistry Earth/Ocean; Mineralogy; Lithosphere; Geophysics; Environmental Chemistry; Marine Paleontology;	Field Geology; Structure; Economic Geology; Planetary Geology; Magmatism Metamorphism; Global Cycles; Groundwater; Environment & Regolith; Geophysics; Coastal Earth Sciences; Carbonate Reef; Marine Biogeochemistry; Ocean & Atmosphere Modeling; Special Topics.
University of Ballarat School of Engineering and Science	*Earth Sciences* *Planet Earth* *Landscape Evolution* *Earth's Living History*	*Structural Geology, Sedimentology, Hydrology, Regolith Science, Optical Mineralogy, Economic Geology, Fieldwork Principles and Practice, Engineering Geology (no options)*	*Petrology, Applied Geochemistry, Fieldwork, Geographic Information Systems, Applied Stratigraphy, Applied Geophysics, Project, Advanced Fieldwork (no options)*
Flinders University of South Australia School of Chemistry, Physics and Earth Science	*Earth and Environment 1* *Marine Sciences 1*	*Selected from the following over 2 years:* *The Shelf and Coastal Zone; Water & Environment; Understanding the Earth; The Ocean, Geological Processes; Sedimentary Processes; Global Climate Change; The Atmosphere; Numerical modeling in the Sciences; Fluid Dynamics; Groundwater Hydrology; Water, Soil and Microclimates, Environmental Geophysics; Hydrogeochemistry; Physical and Dynamical Meteorology (2 courses); Air and Sea Measurements A&B; Earth Sciences Field Camp; Water Quality and Pollution; Environmental Chemistry*	

Table 2 continued

Institution – School	Level 1 Courses	Level 2 Courses	Level 3 Courses
James Cook University School of Earth and Environmental Sciences	Introduction Geology Introduction to Environmental Earth Science Other: Introduction to Geology for Engineers and Introduction to Earth Science for Education students	Hydrology; Sedimentology – Stratigraphy - Paleontology; Mineralogy & Petrology 1; Mineralogy & Petrology 2; Structural Geology; Economic Geology; Marine Sediments: Field Geology: Applied Soils.	Mine Site Rehabilitation; Land Degradation Field Studies; Soil & water Field Studies; Tectonics – Igneous; Structure & Metamorphism; ore Genesis: Mapping; Marine geology – Paleobiology; Coastal Sediments Field Studies; Earth & Environmental Geochemistry; Mining & Exploration Geology; Applied Soils
Curtin University of Technology. Department of Applied Geology	Geology; Evolving Earth Systems; Resource Geology; Environmental Geoscience, Data Analysis	Agricultural Soils; Landscape Evolution & Degradation; Paleontology & Stratigraphy; Sedimentology; Structural Geology; Mineralogy; Geochemistry; Igneous & Metamorphic Petrology; Geological Field Mapping; Remote Sensing; Geophysics- Introduction to Mineral Methods; Geophysics – Introduction to Oil and Gas Methods; Geographic Information Systems.	Hydrogeology & Engineering Geology; Groundwater Exploration and Quality; Groundwater Management; Water Resources; Community Restoration; Environmental Impact Assessment; Sustainable Production & Consumption; Environmental Geology; Sedimentology & Basin Analysis; Fossil Fuels; Geodynamics; Structural Geology; Tectonics; Petrogenesis; Petrology; Crustal Evolution; Regolith Geology; Regolith Exploration; Economic Geology; Ore Deposits; Applied Geochemistry; Mining Geophysics; Resource Estimation & Mining Geology; Mining Geology Design Project; Mine Geotechnical Engineering; Geological Field Mapping; Mapping Project.
Department of Exploration Geophysics	Geophysics; Geology; Geophysical Data Analysis; Properties of Matter and Electricity	Propagation of Energy; Electromagnetic Fields in the Earth; Introduction to Mineral Methods; Introduction to Oil and Gas Methods; Petrology & Geochemistry; Remote Sensing & Field Geological Mapping; Structural Geology & Mineralogy; Stratigraphy & Sedimentology. Note: All Proscribed courses for particular named degrees	Gravity & Magnetics; Introductory Seismic; Resistivity & Induced Polarisation; Global Geophysics; Electromagnetics & Radiometrics; Data Analysis; Data Processing (Minerals); Data Processing (Petroleum); Seismic Acquisition; Environmental Geophysics; Project Geophysics. Note: All Proscribed courses for particular named degrees

Table 2 continued

Institution – School	Level 1 Courses	Level 2 Courses	Level 3 Courses
Macquarie University Department of Earth and Planetary Sciences	The Planet Earth Earth Dynamics, Materials & the Environment; Marine Geoscience	Introduction to Field Geology; Field & Laboratory Studies in Geoscience; Paleontology; Minerals Energy and the Environment; Geological Maps & Structures; Marine Depositional Environments; Introduction to Geophysics Earth's Evolving Environment;	Field Geology & Mapping; Structural & Metamorphic Geology; Astrobiology; Invertebrate Paleontology; Magmas Fluids & Ore Deposits; Environmental & Groundwater Geophysics; Exploration Geophysics; Volcanic Geology Fieldwork; Environmental Geology; Global Tectonics; EPS Special Interest Seminar; Applied Paleontology & Biogenic Sediments
University of Melbourne School of Earth Sciences	The Global Environment; Understanding Planet Earth	Geology of SE Australia; Sedimentary Basins to Mountain Belts; Dangerous Earth; Minerals and Magmas; Field Geology (Buchan)	Structural Geology & Geodynamics; Sedimentary Geology; Geochemistry and Petrogenesis; Applied Geophysics; Economic Geology; Hydrogeology & Environmental Management; Digital Geoscience; Advanced Field Geology, Research Project
Monash University School of Geoscience	Planet Earth & its Environment - The Cosmic Connection; Planet Earth - Dynamic Systems; Environmental Changes & Resources	The Dynamic Earth I The Dynamic Earth II. Vertebrate Life on Planet Earth; Environmental Geosciences; Buchan field camp	Economic Geology; Broken Hill Field Camp; Hydrogeology; Project; Deformation & Metamorphism; Volcanology, Igneous Petrology; (Vertebrate Life on Planet Earth) ; Sediments – Basins; Geophysics - Regional Mapping, – Remote Sensing; Geodynamics; NZ Field Trip; Sediments Basins Resources, Igneous- Volcanology Climates;
University of New England School of Environmental and Rural Science	*Geology and the Environment I & II*	Introductory Paleontology; Environmental Geology; Field Mapping & Sedimentology; Resource Geology & Environmental Issues	Exploration & Environmental Geochemistry; Paleontology & Stratigraphy, Ore Deposit Geology, Project.
University of Newcastle School of Environmental & Life Sciences	Earth's Dynamic Systems Earth Processes & Products	Optical Mineralogy & Petrology; Geology Field Course; Earth's Sedimentary Rocks & Environments; Structural & Field Geology; GIS& Remote Sensing; River Basin Processes; Climatology & Soils;	Field - Carbonate Sediments; Geology of Fuels; Igneous Petrology & Crustal Evolution; Basin Analysis; Environmental Geology; Coastal Dynamics & Protection; Global Change; Geographic Information Systems; Advanced Field Course; Resource & Exploration Geology,: Advanced Structural Geology; Environmental Remediation

Table 2 continued

Institution – School	Level 1 Courses	Level 2 Courses	Level 3 Courses
University of New South Wales School of Biological; Earth & Environmental Sciences	Fundamentals of Geology; Environmental Earth Science; Environmental Systems and Geographies	Ground and Surface Water; Life through Time.; Sedimentary Environments /Australian Surface Environments and Land Forms; Earth Structures; Earth Materials; Remote Sensing Applications	Field Methods & Mapping; Environmental & Contaminant Geochemistry; Petroleum Reservoir Geophysics; Mineral & Energy Resources / Mine Geology; Fundamentals of Petroleum Geology / Special topics in Petroleum Geoscience; Australian Soil Use & Management; Geomorphology; Environmental Change; Advanced Techniques in Remote Sensing
University of Queensland School of Physical Sciences	*Planet Earth: Its Global Environments* *Planet Earth: Elements of Earth Science*	*Paleobiology; Sedimentary Petrology & Stratigraphy; Deformation & Structural geology; Mineralogy; Igneous & Metamorphic Petrology; Field Geology;*	*Ore deposits & Exploration Geology; Introduction to Geophysics; Exploration Geophysics & Mining; Field Geology – Mapping in the Outback; Advanced Structural Geology; Isotope Geochemistry; Sedimentary Environments; Tectonics & Global Evolution; Marine Geology & Oceanography; Geochemistry of Surficial Environments; Energy Resources; Geochemistry; Geology of Coral reefs; Environmental Hydrology and Geochemistry;*
Queensland University of Technology School of Natural Resource Sciences	Planet Earth History of Life on Earth	Mineralogy; Sedimentary Geology; Stratigraphy; Structural Geology; Intro to Igneous & Metamorphic Petrology; Environmental Chemistry; Earth Surface Systems;	Geophysics; Basin Analysis / Petroleum Geology; Economic Geology; Geology of Fossil Fuels; Hydrogeology; Petrology & Geochemistry; Plate Tectonic; Field Mapping Spatial Analysis of Environmental Systems
University of Sydney School of Geosciences (includes geography, marine & environmental sciences)	Earth Environment & Society Introduction to Geography Introduction to Geology Other Engineering Geology	Natural Hazards & GIS Approach; Making the Australian Landscape; Volcanoes Hot Rocks & Minerals; Fossils & Tectonics; Global Oceans; Fluvial & Groundwater Geomorphology; Marine Ecosystems & Geomorphology; Landscape processes; Fluvial and Groundwater; Geo-morphology; Volcanic Hazards; Environmental Geology & Climate Change; Geological Methods; Fossils & Time	Dynamics of Continents & Basins; Geophysics Imaging Oil/Ore Production; Mineral Deposits & Spatial data Analysis; Remote Sensing – Imaging the Earth; Field Geology & Geophysics; Coastal Environments & Processes; GIS in Coastal Management; Environmental Geomorphology; Seafloor Processes & Imaging; Global Energy Exploration & Production

Table 2 continued

Institution – School	Level 1 Courses	Level 2 Courses	Level 3 Courses
University of Tasmania *School of Earth Sciences*	*Understanding Earth Systems* *Earth Resources; Environments & Evolution*	*Earth's materials & Interior; Earth's surface; Introduction to Geophysics & Computer Applications; Marine geosciences;*	*Petrology; Tectonics & Volcanology; Sedimentary Environments & Resources; Geological Mapping; Computers in Geoscience; Economic Geology; Exploration Geophysics; Mineral Exploration; Environmental Geology*
University of Technology Sydney Department of Environmental Sciences	Introduction to Earth Sciences	GIS & Remote Sensing	Marine Geosciences
University of Western Australia School of Earth and Geographical Sciences	Earth & Environment - Dynamic Planet Earth & Environment - Geological Perspective	Earth Materials; Field Geology; Earth History Methods; Structural& Metamorphic Geology; Introduction to Geochemistry, Introduction to GIS	Geological Mapping; Marine Geology; Mineralogy Geochemistry & Petrology; Structural Geology & Tectonics; Mineral Resources; Basin Analysis; Mineral Exploration Technology; Ore Deposit Genesis; GIS and Remote Sensing
University of Wollongong School of Earth and Environmental Sciences	Planet Earth; Earth Environment & Resources; Landscape Change & Climatology; The Human Environment: - Problems and Change; Modern Perspectives in Science; International Perspectives in Science	Earth Surface Processes & Products; Soils; Landscape & Hydrology; Biogeography a& Environmental Change; Intro to Spatial Science; ; Environmental Impact of Societies; Field Geology; Earth & Environmental Sciences Research Project; Introduction to Oceanography; Science Research Internship Other: Geology for Engineers	Directed Studies in Earth & Environmental Sciences A &B; Plate Tectonics Macrotopography & Earth History; Coastal Environments - Process & Management; Fluvial Geomorphology & Sedimentology; Geographic Information Science; Remote Sensing of the Environment; Resources & Environments; Water Resources & Management ; Science Research Internship

Table 3 Minerals geoscience courses sponsored at Honours and Masters levels by Minerals Council of Australia (Minerals Tertiary Education Council)

Shortcourse Program (Honours)

Courses offered by CRC for Landscape Evolution and Mineral Exploration (CRCLEME)

Environmental Mineralogy; Regolith Geology and Geochemistry; Regolith Mapping and Field Techniques; Introduction to Hydrogeochemistry; Advanced Remote Sensing for Mineral Exploration and Natural Resource Management

Courses offered by Victorian Institute of Earth and Planetary Sciences (VIEPS)

Geology of Gold; Igneous Geodynamics and Magmatic Ore Deposits; Tectonic Environments of Ore Deposition; Introduction to Hydrogeology; Geophysics -Geophysical Field Camp; Geophysics - Software Workshop; Physical Volcanology - Field Course; Radiogenic Isotope Geology; Geoscience Information Systems

Courses offered by ARC Centre of Excellence in Ore Deposits (CODES) University of Tasmania

Exploration Skills Mapping Camp (venue: Western Tasmania); Ore Deposit Models for Mineral Exploration (5 day) (venue: Melbourne); Ore Deposit Models for Mineral Exploration (2 day) (venue: Melbourne); Environmental Geology Field Techniques

Courses offered by University of Western Australia

Numerical Modelling of Ore Deposition Processes; Structural Geology and Metamorphism; Igneous Petrology & Isotope Geology

Courses offered by James Cook University

Advanced Practical Techniques for Economic Geologists

Minerals Geoscience Masters Program

The Minerals Geoscience Masters Program (Ore Deposit Geology and Evaluation) is supported by the Minerals Council of Australia. The program is designed for geoscientists with different levels of professional experience. It offers a highly regarded degree and a world-class opportunity to gain a thorough up-date of economic geology and mineral exploration skills. It comprises a varied range of short courses presented by both international and Australian experts, hands-on practical experience, field excursions and an opportunity to undertake research.

The overall structure of the program is flexible with courses offered jointly between the Centre for Global Metallogeny (CGM, The University of Western Australia), the Centre for Ore Deposit Research (CODES, University of Tasmania), James Cook University's Economic Geology Research Unit (EGRU), the Victorian Institute of Earth and Planetary Science (VIEPS) and the CRC for Landscape, Evolution and Mineral Exploration (CRC-LEME). Some Minerals Economics courses are also available from Curtin University (under Masters current courses).

Table 4: Profile of capability of Australian Universities to supervise geoscience theses for Honours and higher degrees at Australian universities.

Code	Topic	UAdel	ANU	Ball	CUT	JCU	MacU	UMel	MonU	UNE	UNewc	UNSW	UQ	QUT	USyd	UTas	UTS	UWA	UWoll	Code
260100	GEOLOGY																			**260100**
260101	Mineralogy																			260101
260102	Igneous & Metamorphic Petrology																			260102
260103	Vulcanology																			260103
260104	Sedimentology																			260104
260105	Petroleum Geology																			260105
260106	Ore deposit Petrology																			260106
260107	Structural geology																			260107
260108	Geotectonics																			260108
260109	Geochronology																			260109
260110	Biostratigraphy																			260110
260111	Other Stratigraphy																			260111
260112	Paleontology																			260112
260113	Palynology																			260113
260114	Geomorphology																			260114
260115	Glaciology																			260115
260199	Geology nec																			260199
260200	GEOPHYSICS																			**260200**
260201	Gravity																			260201
260202	Geomagnetism																			260202
260203	Electromagnetism																			260203
260204	Petrophysics																			260204
260205	Explosion sesimology																			260205
260206	Earthquake seimology																			260206
260207	Radiometrics																			260207
260299	Geophysics nec																			260299
260300	GEOCHEMISTRY																			260300
260301	Geochron. & Isotope Geochemistry																			260301
260302	Exploration Geochemistry																			260302
260303	Organic Geochemistry																			260303
260304	Inorganic geochemistry																			260304
260399	Geochemistry nec																			260399
260400	OCEANOGRAPHY																			260400
260401	Biological Oceanography																			260401
260402	Chemical oceanography																			260402
260403	Physical Oceanography																			260403
260499	Oceanography nec																			260499
260500	HYDROLOGY																			260500
260501	Groundwater Hydrology																			260501
260502	Surfacewater Hydrology																			260502
260599	Hydrology nec																			260599
260600	ATMOSPHERIC SCIENCES																			260600
260601	Meteorology																			260601
260602	Climatology (including Paleoclim.)																			260602
260699	Atmospheric sciences nec																			260699
269900	OTHER EARTH SCIENCES																			269900
269901	Physical Geography																			269901
300103	Soil Chemistry																			300103
300104	Land Capability and Soil Degradation																			300104
300105	Applied Hydrology																			300105

Table 5: Enrollment data for undergraduate geoscience courses at Australian universities in the period 2003-2007.
% change compares average of 2006 and 2007 EFTSL with average of 2003 and 2004 EFTSL.

	Average Course Size					No of Courses 2007		Equivalent Full Time Student Load					% Change
	2003	2004	2005	2006	2007			2003	2004	2005	2006	2007	
University of Adelaide (includes geoscience students in Australian School of Petroleum - ASP)													
Year 1	90	166	192	147	162	3		34	41	48	55	61	55
Year 2	35	31	52	52	68	5		27	23	31	30	40	40
Year 3	16	19	34	36	36	9		26	30	38	41	41	46
Hons	14	8	9	19	23			14	8	9	19	23	91
ASP Hons*	**10**	**10**	**6**	**8**	**5**		*	**10**	**10**	**6**	**8**	**5**	-35
Y3/Y1 Retention			37.78%	21.69%	18.75%		Total	111	112	132	153	170	45
Hons/Yr3 Retention 1		50.00%	47.37%	55.88%	63.89%								
Hons/Yr3 Retention 2		112.50%	78.95%	79.41%	77.78%		*	Includes a number of overseas students entering at honours level					
Australian National University (only averaged data given)													
Year 1	80	70	50	50	100			20	12	12	17	12	-9
Year 2	40	35	30	30	35			20	17	15	15	17	-14
Year 3	19	19	15	15	20			14	14	11	11	15	-8
Hons	15	15	15	14	7			15	15	15	14	7	-30
Y3/Y1 Retention			18.75%	21.43%	40.00%		Total	69.25	58.25	53.25	57.25	51	-15
Hons/Yr3 Retention		78.95%	78.95%	93.33%	46.67%								
University of Ballarat (only averaged data given)													
Year 1	15	14	23	23	28			7	7	11	11	14	79
Year 2	11	16	13	16	17			8	12	10	12	13	25
Year 3	11	9	11	16	17			8	7	8	10	12	47
Hons	5	5	3	2	2			5	5	3	2	2	-60
Y3/Y1 Retention			73.33%	114.29%	73.91%		Total	28	31	32	35	41	29
Hons/Yr3 Retention		45.45%	33.33%	18.18%	12.50%								

Table 5 continued	Average Course Size 2003	2004	2005	2006	2007	No of Courses 2007		Equivalent Full Time Student Load 2003	2004	2005	2006	2007	% Change
Curtin University													
Year 1	32	56	52	68	87	11		34	63	58	78	102	86
Year 2	13	13	21	20	36	21		28	29	46	45	67	96
Year 3	9	10	11	16	16	43		30	33	40	60	57	86
Hons/Yr4	14	5	5	8	2	4		25	12	9	19	8	-27
Y3/Y1 Retention			34.38%	28.57%	30.77%		Total	117	137	153	202	234	72
Hons/Yr3 Retention		55.56%	50.00%	72.73%	12.50%								
James Cook University													
Year 1	90	72	90	102	109	3		33	27	34	38	39	28
Year 2	15	24	24	27	23	8		17	24	24	27	23	22
Year 3	15	12	14	11	13	10		22	16	18	14	17	-18
Hons/Yr4	13	9	10	5	2	2		13	13	9	10	5	-42
Y3/Y1 Retention			15.56%	15.28%	14.44%		Total	85	80	85	89	84	5
Hons/Yr3 Retention		60.00%	83.33%	35.71%	18.18%								
Macquarie University													
Year 1	123	114	110	115		3		49	45	43	46	54	6
Year 2	37	28	28	29		7		39	26	26	28	27	-15
Year 3	14	22	16	18		9		20	30	21	25	20	-10
Hons/Yr4								6	1	11	5	***5***	43
Y3/Y1 Retention			13.01%	15.79%	0.00%		Total	114	102	101	104	106	-3
Hons/Yr3 Retention		0.00%	0.00%	0.00%	0.00%								
University of Melbourne													
Year 1	146	127	121	133	140	2		36	32	30	33	**35**	0
Year 2	32	51	52	43	48	5		20	32	32	26	**30**	8
Year 3	28	28	29	32	33	7		25	25	29	33	**29**	24
Hons	24	22	25	25	18			24	22	25	25	18	-7
Y3/Y1 Retention			19.86%	25.20%	27.27%		Total	105	111	116	117	112	6
Hons/Yr3 Retention		78.57%	89.29%	86.21%	56.25%								

Table 5 continued	Average Course Size 2003	2004	2005	2006	2007	No of Courses 2007		Equivalent Full Time Student Load 2003	2004	2005	2006	2007	% Change
Monash University													
Year 1	125	144	129	128	128	3		47	54	49	48	48	-5
Year 2	33	44	38	56	72	4		21	22	19	28	36	49
Year 3	16	18	21	17	30	13		24	28	31	28	49	48
Hons	6	7	14	16		2		4	4	11	13	***13***	225
Y3/Y1 Retention			16.80%	11.81%	23.26%		Total	96	108	110	117	146	29
Hons/Yr3 Retention		43.75%	77.78%	76.19%	0.00%								
University of New England (only EFTSL given)													
Year 1								20	20	18	15	16	-23
Year 2								7	8	12	12	7	27
Year 3								3	3	5	7	8	150
Hons								3	3	2	2	2	-33
							Total	33	34	37	36	33	3
University of Newcastle													
Year 1	132	100	87	101	105	2		66	50	44	50	52	-12
Year 2	31	31	36	41	41	7		47	47	54	62	71	41
Year 3	20	22	25	24	34	6		56	56	64	49	51	-11
Hons	4	5	5	2	6			4	5	5	2	6	-11
Y3/Y1 Retention			18.94%	24.00%	39.08%		Total	173	158	167	163	180	4
Hons/Yr3 Retention		25.00%	22.73%	8.00%	25.00%								
University of New South Wales													
Year 1	87	96	112	122	165	3		33	36	42	46	62	57
Year 2	23	19	16	19	20	6		15	14	12	14	15	0
Year 3	25	20	25	25	23	9		22	20	28	27	22	17
Hons	5	6	5	3	5			5	6	5	3	3	-45
Y3/Y1 Retention			28.74%	26.04%	20.54%		Total	75	76	87	90	102	27
Hons/Yr3 Retention		24.00%	25.00%	12.00%	20.00%								

Table 5	Average Course Size					No of	Equivalent Full Time Student Load					%
continued	**2003**	**2004**	**2005**	**2006**	**2007**	**Courses 2007**		**2003**	**2004**	**2005**	**2006**	**2007**	**Change**
University of Queensland													
Year 1	160	170	170	200	210	2		40	42	42	50	52	24
Year 2	21	19	18	26	33	6		13	12	11	16	21	48
Year 3	18	13	14	7	20	14		16	11	12	6	17	-15
Hons	13	11	9	11	5			13	11	9	11	5	-33
Y3/Y1 Retention			8.75%	4.12%	11.76%		Total	82	76	74	83	95	13
Hons/Yr3 Retention		61.11%	69.23%	78.57%	71.43%								
Queensland University of Technology													
Year 1	86	80	70	61	85	2		21	20	17	15	21	-12
Year 2	21	24	25	32	41	7		15	18	22	28	36	94
Year 3	15	15	19	12	20	8		15	15	19	12	20	7
Hons	5	2	5	3	2			5	2	5	3	2	-29
Y3/Y1 Retention			22.09%	15.00%	28.57%		Total	56	55	63	58	79	23
Hons/Yr3 Retention		13.33%	33.33%	15.79%	16.67%								
Sydney University													
Year 1	116	92	100	100	150	4		87	69	75	76	76	-3
Year 2	25	33	40	39	47	6		19	33	40	39	35	42
Year 3			19	22	21	10		***16***	***24***	24	27	26	33
Hons	5	8	5	11	9	2		5	8	5	11	9	54
Y3/Y1 Retention			16.38%	23.91%	21.00%		Total	127	134	144	153	146	15
Hons/Yr3 Retention				57.89%	40.91%								
University of Tasmania (only averaged data given)													
Year 1	81	127	90	105	95			20	32	22	26	24	-4
Year 2	25	29	46	43	32			9	11	17	16	12	40
Year 3	15	16	16	30	18			9	10	10	19	11	58
Hons	20	14	9	8	13			20	14	9	8	13	-38
Y3/Y1 Retention			19.75%	23.62%	20.00%		Total	58	67	58	69	60	3
Hons/Yr3 Retention		93.33%	56.25%	50.00%	43.33%								

Table 5	Average Course Size					No of	Equivalent Full Time Student Load						%
continued	**2003**	**2004**	**2005**	**2006**	**2007**	**Courses 2007**		**2003**	**2004**	**2005**	**2006**	**2007**	**Change**
University of Technology Sydney (Earth and Environment degree closed 2003)													
Year 1	55	52	91	71	93	1		7	6	11	9	12	62
Year 2	10	4	0	58	60	1		6	1	0	7	8	114
Year 3	12	12	8	0	20	1		6	6	1	0	3	-75
Hons	0	2	2	1	2			2	1	2	2	0	-33
							Total	21	14	14	18	23	17
University of Western Australia													
Year 1		70	90	139	169	2		***17***	17	22	35	42	126
Year 2		17	18	29	54	4		***9***	9	9	15	27	133
Year 3		7	14	11	20	8		***5***	5	15	12	23	250
Hons		10	4	11	12			***9***	10	4	11	12	21
Y3/Y1 Retention				15.71%	22.22%		Total	40	41	50	73	104	119
Hons/Yr3 Retention			57.14%	78.57%	109.09%								
University of Wollongong													
Year 1		123	153	108	171	2		***60***	61	76	54	86	16
Year 2		57	53	69	73	4		***68***	71	66	69	73	2
Year 3		43	27	31	40	4		***40***	43	36	41	54	14
Hons	3	4	4	3	4			3	4	4	3	4	0
Y3/Y1 Retention				25.20%	26.14%		Total	171	179	182	167	217	10
Hons/Yr3 Retention			9.30%	11.11%	12.90%								
National Total													
Year 1		1673	1730	1773	1997			631	634	654	702	808	19
Year 2		475	510	629	700			388	409	446	489	558	31
Year 3		285	318	323	381			357.25	376.25	410.25	422.25	475	22
Hons		143	135	150	117			185	144	142	163	137	-9
Y3/Y1 Retention				19.31%	22.02%		Total	1561.25	1573.25	1658.25	1784.25	1983	20
Hons/Yr3 Retention			47.37%	47.17%	36.22%								

Table 6 Trends in undergraduate enrollment at Australian universities through time as measured by Equivalent Full Time Student Load – compares average of 2006 and 2007 EFTSL with average of 2003 and 2004 EFTSL. EFTSL in 2007 is also shown for each institution.

Year	Strong Increase >30%	Increase 10-30%	Static +/- 10%	Decrease <-10%
Level 1	Adelaide 61 Ballarat 14; Curtin 102; UNSW 56; UWA 42	JCU 39; Queensland 52; Wollongong 86	ANU 12; Macquarie 54; Melbourne 35; Monash 48; Sydney 76; Tasmania 24	Newcastle 52; QUT 21
Level 2	Adelaide 40; Curtin 67; Monash 36; Newcastle 71 Queensland 21; QUT 36 Sydney 35; Tasmania 12 UWA 27 (	Ballarat 13; JCU 23;	Melbourne 30; UNSW 15 Sydney – 47; Wollongong 73;	ANU 17; Macquarie 27
Level 3	Adelaide 41; Ballarat 12; Curtin 57; Monash 49; Sydney 26; Tasmania 11; UWA 23	Melbourne 29; UNSW 22; Wollongong 54	JCU 17; QUT 20	ANU 11; Macquarie 20 Newcastle 51; Queensland 17;
Level 4- Hons	Adelaide (Geology) 23; Monash 13 Sydney 9	UWA 12;	Melbourne 18; Wollongong 4;	Adelaide (Petroleum) 5; ANU 7; Ballarat 2 Curtin 8 ; JCU 5 ; Newcastle 6; UNSW 3 Queensland 5; QUT 2; Tasmania 13;
Overall	Adelaide 170; Curtin 234 UWA 104;	Ballarat 41; Monash 146; UNSW 102; QUT 79; Sydney 146	JCU 84; Macquarie 106; Melbourne 112; UNE 33; Newcastle 180; Tasmania 60; Wollongong 217	ANU 51

Table 7 Completed post-graduate degrees in earth science at Australian universities for the period 2003-2007.

University / Degree	2003	2004	2005	2006	2007
University of Adelaide					
MSc/MPhilRes			1	1	1
MSc coursework					
PhD	3	4	3	4	5
Australian National University DEMS					
MSc/MPhilRes	2	2	3	4	4
MSc coursework	3	2	1	3	2
PhD	5	4	3	4	5
Australian National University RSES					
MSc/MPhilRes		1			
MSc coursework					
PhD	8	3	6	8	8
University of Ballarat					
MSc/MPhilRes	1				
MSc coursework					
PhD				1	1
University of Canberra					
MSc/MPhilRes					
MSc coursework					
PhD	2	2	1	1	1
Curtin University					
Grad Diplomas	1	2	1		
Postgraduate Diplomas	1	3	1	6	1
MSc/MPhilRes	0	6	1	0	0
MSc coursework	4	5	6	2	3
PhD	4	7	6	6	3

University / Degree	2003	2004	2005	2006	2007
Monash University					
MSc/MPhilRes	3	3	2	2	2
MSc coursework					
PhD	8	5	5	2	2
University of New England					
MSc/MPhilRes					
MSc coursework					
PhD	1		2	1	
University of Newcastle					
MSc/MPhilRes					
MSc coursework					
PhD	0	3	2	3	1
University of New South Wales					
MSc/MPhilRes	3	3	6	3	
MSc coursework					
PhD	4	3	1	2	3
University of Queensland					
MSc/MPhilRes	2			4	
MSc coursework					
PhD	5	5	7	6	
Queensland University of Technology					
MSc/MPhilRes	2	5	1	2	
MSc coursework					
PhD	0	5	1	2	1

Table 7continued

University / Degree	2003	2004	2005	2006	2007
Flinders University					
MSc/MPhilRes					
MSc coursework					
PhD					
James Cook University					
MSc/MPhilRes	3	4	1	0	0
MSc coursework	2	3	4	3	7
PhD	3	10	12	16	9
Macquarie University					
MSc/MPhilRes	2		1		1
MSc coursework					
PhD	3		5	5	4
University of Melbourne					
MSc/MPhilRes					
MSc coursework				1	1
PhD	10	9	8	8	9

University / Degree	2003	2004	2005	2006	2007
University of Sydney					
MSc/MPhilRes	4	3	3	2	3
MSc coursework					
PhD	5	7	4	6	4
University of Tasmania					
MSc/MPhilRes					1
MSc coursework	1		2	1	1
PhD	7	9	2.3	1.2	7.5
University of Western Australia					
MSc/MPhilRes	1	6	***3***	***3***	***3***
MSc coursework					
PhD	12	10	9	5	4
University of Wollongong					
MSc/MPhilRes					
MSc coursework					
PhD	***3***	***6***	***3***	***6***	***3***
National Total					
MSc/MPhilRes	23	33	22	21	15
MSc coursework	10	10	13	10	14
PhD	83	92	80.3	87.2	

Table 8 Teaching and research position in earth science at Australian universities in 2007

Teaching Positions	Total	Funding Source			Field of Term Appointment	**Research positions**	Total	Funding Source			Field of Application of Term Position - funding source
		University		External				University		External	
		Perm.	Term Position					Perm.	Term Positions		
	FTE	FTE	FTE	FTE			FTE	FTE	FTE	FTE	
University of Adelaide (geology and geophysics discipline)						**University of Adelaide**					
Professor	2.4	1	0.4	1	Mineral Exploration	Professor					
Associate Professor	2.5	2.5				Professorial Fellow	2			2	ARC Professorial Fellow
Senior Lecturer	2.5	2.5				Prin. Research Fellow	2			2	CRC LEME, QEII Fellow
Lecturer	2	2				Snr Research fellow					
Demonstrator	0.5		0.5			Research Fellow	2.5			2.5	ARC Postdoctoral Research Fellows (2.5)
Total	9.9	8	0.9	1		Research Associate	5			5	ARC (3), PIRSA (2)
2007 EFTSL/Staff	**16.7**					Total	11.5	0	0	11.5	
Australian National University (DEMS and RSES)						**Australian National University (DEMS and RSES)**					
Professor	3.5	3.5				Professor	9	9			
Associate Professor	1	1				Professorial Fellow	8.75	6.75		2	ARC Various
Senior Lecturer	2	2				Prin. Research Fellow	0.75			0.75	Regolith - CRCLEME
Lecturer	1.5	0.5		1	Regolith Geoscience	Snr Research fellow	13.4	7		6.4	ARC Various; 1Biogeochem regolith CRCLEME
Demonstrator						Research Fellow	11		3.5	7.5	ARC Various; 1Groundwater regolith CRCLEME
Total	8	7		1		Research Associate	9		0.7	8.3	ARC Various
2007 EFTSL/Staff	**6.4**					Total	51.9	22.75	4.2	24.95	
University of Ballarat						**University of Ballarat** (no positions)					
Professor											
Associate Professor											
Senior Lecturer	1.6	1.6									
Lecturer	2	2									
Demonstrator											
Total	3.6	3.6									
2007 EFTSL/Staff	**11.4**										
Curtin University						**Curtin University**					
Professor	1.5	1.5				Professor	2.5	1	1	0.5	Paleomag; Rock Physics - CSIRO
Associate Professor	4.4	4	0.4			Professorial Fellow	2		1	1	Sedimentology, Geochron - MERIWA/Industry
Senior Lecturer	4	4				Prin. Research Fellow	2.6		1	1.6	Rock Physics,Signal proc. - CO2CRC, WA Govt
Lecturer	3.15	2.7	0.45			Snr Research fellow	1.5		0.5	1	Groundwater, Geochron - CRCLEME
Demonstrator						Research Fellow	9.95	1.8	2.6	5.55	Various - CRCLEME, ARC, CO2CRC, WA Govt
Total	13.05	12.2	0.85	0		Research Associate	2			2	Geophys , Land Mgt GIS - CO2CRC, N.Ag Catchm't
2007 EFTSL/Staff	**17.93**					Total	20.55	2.8	6.1	11.65	

Table 8 continued

Teaching Positions	Total	Funding Source			Field of Term Appointment	Research positions	Total	Funding Source			Field of Application of Term Position - funding source
		University		External				University		External	
		Perm.	Term Position					Perm.	Term Positions		
	FTE	FTE	FTE	FTE			FTE	FTE	FTE	FTE	
James Cook University						**James Cook University**					
Professor	2	2				Professor	1		1		
Associate Professor	1	1				Snr Research fellow	2			2	Isotope & Envir Geochemistry - ARC
Senior Lecturer	7	6	0.5	0.5		Research Fellow	7.3		1	6.3	Econ Geol, Marine, Hydrol - pmdCRC, State Govt, ARC
Lecturer	4	2	0.5	1.5	Hydrology; Nat Min Masters	Research Associate	0.5			0.5	Sedimentary tectonics - ARC
Demonstrator	1.2		1.2								
Total	15.2	11	2.2	2		Total	10.8	0	2	8.8	
2007 EFTSL/Staff	**5.5**										
Macquarie University						**Macquarie University**					
Professor	2	2				Professorial Fellow	2			2	Geochemistry - Federation Fellowship
Associate Professor						Prin. Research Fellow	1	1			
Senior Lecturer	7	7				Snr Research fellow	2	2			
Lecturer	2	1	1			Research Fellow	4	3		1	Humbolt
Total	11	10	1	0		Research Associate	3	3			
2007 EFTSL/Staff	**9.6**					Total	12	9	0	3	
University of Melbourne						**University of Melbourne**					
Professor	3	3				Professor	0.5		0.5		
Associate Professor	4	4				Professorial Fellow	2.5			2.5	ARC various
Senior Lecturer	2.25	2	0.25			Prin. Research Fellow	2			2	ARC various
Lecturer	2	1		1	Digital geoscience/structural geol	Snr Research fellow	1			1	Geophysics - pmdCRC
Demonstrator	0.75		0.75			Research Fellow	8.5			8.5	var
Total	12	10	1	1		Research Associate	4			4	var
2007 EFTSL/Staff	**9.3**					Total	18.5	0	0.5	18	
Monash University						**Monash University**					
Professor	2.33	2.33				Professorial Fellow	2			2	Economic & Geophysics
Associate Professor	3.5	3.5				Snr Research fellow	2			2	Geophysics
Senior Lecturer	1			1	Economic Geology	Research Fellow	7	1		6	Volcanology (3) Geophysics (1) Paleo(1) Econ (1)
Lecturer	3	3									
Total	9.83	8.83	0	1		Total	11	1	0	10	
2007 EFTSL/Staff	**14.9**										

Table 8 continued

Teaching Positions	Total	Funding Source			Field of Term Appointment	Research positions	Total	Funding Source			Field of Application of Term Position - funding source
		University		External				University		External	
		Perm.	Term Position					Perm.	Term Positions		
	FTE	FTE	FTE	FTE			FTE	FTE	FTE	FTE	
University of New England						**University of New England**	(no positions)				
Associate Professor	1	1									
Lecturer	1	1									
Total	2	2									
2007 EFTSL/Staff	**16.5**										
University of Newcastle (includes physical geographers 5 staff)						**University of Newcastle**					
Associate Professor	1	1				Research Fellow	4			4	Climate Res, Hydrogeology - ARC, Council, Various
Senior Lecturer	4	4				Research Associate	0.5	0.5			
Lecturer	3.5	3.5									
Total	8.5	8.5				Total	4.5	0.5		4	
2007 EFTSL/Staff	**21.2**										
University of New South Wales						**University of New South Wales**		(no positions)			
Professor	1	0.5		0.5	hydrology						
Associate Professor	1	1									
Senior Lecturer	5.25	5.25									
Lecturer											
Demonstrator	0.75	0.75				Research Associate	1			1	Coal mineral matter
Total	8	7.5	0	0.5		Total	1				
2007 EFTSL/Staff	**12.8**										
University of Queensland						**University of Queensland**					
Professor	1	1				Professor					
Associate Professor	2.8	2.8				Professorial Fellow					
Senior Lecturer	2.6	2.6				Prin. Research Fellow					
Lecturer	1.5	1	0.5			Snr Research fellow					
Demonstrator						Research Fellow	1	1			
Total	7.9	7.4	0.5			Research Associate					
2007 EFTSL/Staff	**12.0**					Total	1	1			
Queensland University of Technology						**Queensland University of Technology**					
Associate Professor	2	2				Professor	1	1			
Senior Lecturer	2	2									
Lecturer	2	2									
Ass Lecturer	2		1.7	0.3	Sedimentology						
Total	8	6	1.7	0.3		Total	1	1			
2007 EFTSL/Staff	**9.9**										

Table 8 continued

Teaching Positions	Total	Funding Source			Field of Term Appointment	**Research positions**	Total	Funding Source			Field of Application of Term Position - funding source
		University		External				University		External	
		Perm.	Term Position					Perm.	Term Positions		
	FTE	FTE	FTE	FTE			FTE	FTE	FTE	FTE	
University of Sydney (includes geographers)						**University of Sydney**					
Professor	6	2	3	1	Geophysics	Professor	1			1	Geophysics - CRC Mining
Associate Professor	4	3	1			Prin. Research Fellow	3			3	Geology, Marine Science - ARC, International
Senior Lecturer	10	10				Snr Research fellow	1			1	Phys geog - ARC
Lecturer	2	2				Research Fellow	0.5			0.5	Marine Science - ARC
Demonstrator						Research Associate	3			3	Geophysics, Marine, Geography - ARC
Total Geol est	**11**	**8**	**2**	**1**		Total	8.5			8.5	
2007 EFTSL/Staff	**13.3**										
University of Tasmania						**University of Tasmania**					
Professor	4	4				Professor					
Associate Professor	3	2	1			Prin. Research Fellow					
Senior Lecturer	5	5		1	Mineral Exploration	Snr Research fellow	13		3	10	Ore deposit geology and diverse areas
Lecturer						Research Fellow	3			3	Diverse
Demonstrator						Research Associate					
Total	12	11	1			Total	16		3	13	
2007 EFTSL/Staff	**5**										
University of Technology Sydney						**University of Technology Sydney**		(no positions)			
Professor	1	1									
Associate Professor											
Senior Lecturer	1	1									
Lecturer											
Demonstrator											
Total	2	2	0	0							
2007 EFTSL/Staff	**11.5**										
University of Western Australia						**University of Western Australia**					
Professor	3	3				Professor	1			1	Lithospheric Modelling - Premier's Research Fellow
Professorial Fellow	1			1	Exploration Targeting	Prin. Research Fellow	1			1	
Associate Professor	4	4				Snr Research fellow	5.75			5.75	Min Deposits - Centre of Excellence
Senior Lecturer	2	2				Research Fellow	6.6			6.6	Various; ARC, Centre Excellence. MERIWA
Lecturer	2			2	Ore deposit Geol; 1st Year Geoscience	Research Associate	1.5		0.3	1.2	Tectonics, Min Deposits - ARC, Centre of Excellence
Demonstrator											
Total	12	9	0	3		Total	15.85	0	0.3	15.55	
2007 EFTSL/Staff	**8.7**										

Table 8 continued

Teaching Positions	Total	Funding Source			Field of Term Appointment	**Research positions**	Total	Funding Source			Field of Application of Term Position - funding source
		University		External				University		External	
		Perm.	Term Position					Perm.	Term Positions		
	FTE	FTE	FTE	FTE			FTE	FTE	FTE	FTE	
University of Wollongong (includes physical geography and environemntal sciences)						**University of Wollongong**					
Professor	6	6					2.2	1.2		1	
Associate Professor	6	6					1			1	
Senior Lecturer	3	3									
Lecturer	1	1								7	
Demonstrator											
Total	16	16	0	0							
2007 EFTSL/Staff	**13.6**					Total	3.2	1.2	0	9	
Total	**169.98**	**148.03**	**11.15**	**10.8**			**187.3**	**36.45**	**10**	**128.3**	
Overall EFTSL/Staff	**11.7**										