Australian Geoscience Council Inc.

The Council of Earth Science Societies in Australia

AUSTRALIAN GEOSCIENCE TERTIARY EDUCATION PROFILE 2003-2021

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CONTENTS

SUMMARY **3**

INTRODUCTION **5**

METHODS **6**

Data collection and report development 6
Terminology 6
Data verification and pre-processing 7

RESULTS AND COMMENTS **8**

University structures 8
Undergraduate degree offerings 8
Composition and curriculum in undergraduate programs 10
Postgraduate degree offerings and micro-credentials 11
Undergraduate student numbers 11
Retention rates 16
Degrees awarded 16
Staffing profiles 19
The primary and high school sector (K-12) 21
Attracting students into geoscience 23
University funding 23
Research fields 24
Research funding 24
University rankings 25

Acknowledgements **29**

Appendix 1: Data dashboards for AGC universities survey, with results presented for whole sector and for universities clustered into resource intensive and resource non-intensive states. *30*

Appendix 2: AGTEP survey questionnaire *34*

Appendix 3: ERA rankings for the 2-digit and 4-digit earth science FOR codes for all Australian Universities in the 2018 ERA assessment. *42*

SUMMARY

The Australian Geoscience Tertiary Education Profile 2021 (AGTEP 2021) summarises the results from a series of surveys[1] of geoscience departments or schools within Australian universities, spanning the period 2003–2021.

Nineteen universities offered degrees or majors in geoscience[2] at undergraduate and postgraduate levels in 2021, but two of these are discontinuing their geoscience majors. Most offer a BSc or equivalent degree with one or more majors in the general fields of geology, environmental geoscience, geophysics and related areas. Some universities provide more specialised bachelor programs. These universities offer extensions to the basic undergraduate degree through provision of an additional Honours year (the 3+1 structure), embedded Honours in 4-year degrees and/or articulated Masters programs (the 3+2 structure).

Geoscience groups are contained within various university structures. Some universities maintain dedicated geoscience departments whereas others combine geoscience with other cognate areas such as physical geography, atmospheric science and oceanography to form broader earth science departments. Some locate geoscience within much larger departmental or faculty structures. Internally or externally funded research centres are contained within, or closely associated with, many of the departments.

Undergraduate geoscience enrolments in Australia increased to nearly 3,230 EFTSL[3] in 2013 from 1,500 in 2003. Enrolments subsequently declined to around 1,900 EFTSL in 2021, up from a low of 1,850 in 2020. Three universities currently have total undergraduate and postgraduate taught load (in geoscience programs) of over 250 EFTSL, seven are between 150 and 250 and the remainder below 150. Higher degree research cohorts generate load (and income), and contribute to research quanta. Enrolment patterns differ substantially between the “resource intensive” states of Western Australia, South Australia and Queensland and the “resource non-intensive” states or territories of New South Wales, ACT, Victoria and Tasmania. The resource intensive states display larger amplitude swings in enrolments. During troughs in national enrolments, the resource non-intensive states graduate the largest number of geoscientists. Overall patterns in Australian undergraduate enrolments are mirrored by those in much of Europe and North America, though the former display long-term decline.

There were 624 BSc, BSc(Honours) and coursework Masters completions in 2021, down from a peak of nearly 950 in 2014. Honours completions have followed the overall EFTSL trends (with a 3-year lag), but Masters coursework graduations have continued to climb from relatively low numbers in the early 2000s, bolstered by a move to a “Bologna-style” model at some universities. PhD and Masters-by-research graduations declined to just 80 in 2011 but have subsequently increased to 139 in 2021.

Drivers for overall undergraduate enrolments are complex. They are broadly related to the mineral exploration expenditure cycle, though this relationship is weakening and the “peaks” tend to be sharper than the “troughs”. There was a 2-year lag between the peaks in mineral exploration expenditure in 2011 and enrolments in 2013, but the lag between the troughs in expenditure in 2015 and enrolments in 2020 was five years. There is a close correlation between enrolments in successive undergraduate levels, except between years 1 and 2 in the resource non-intensive states which is showing a decline at level 2 but a near-constant taught load at level 1 since 2015.

[1] Surveys were conducted in 2007, 2012, 2017 and 2021.
[2] The term “earth science” is used rather than “geology” or “geoscience” in the naming of some programs.
[3] EFTSL is the equivalent full time student load.

The number of academic staff has followed the EFTSL trend to some extent, with a few departments increasing in size from 2008 to 2013 but a decreasing number of junior staff since 2016. Two earth science departments have effectively closed. There were 397 FTE geoscience academic staff in 2021 compared with 492 FTE in 2017, 419 FTE in 2012 and 380 in 2007. In 2021, there were 203 academics classed as research-and-teaching or teaching-focussed and mainly funded through university operating budgets.

There have been marginal increases in the number of high school students undertaking "Earth and Environmental Science" subjects in Year 12 in NSW, no substantial change in Queensland but losses over the last few years in WA. Support for the school education sector is provided through bodies such as TESEP, AusEarthEd and various science teacher associations, as well as geoscience outreach and educational support activities by universities, Geoscience Australia and the AGC.

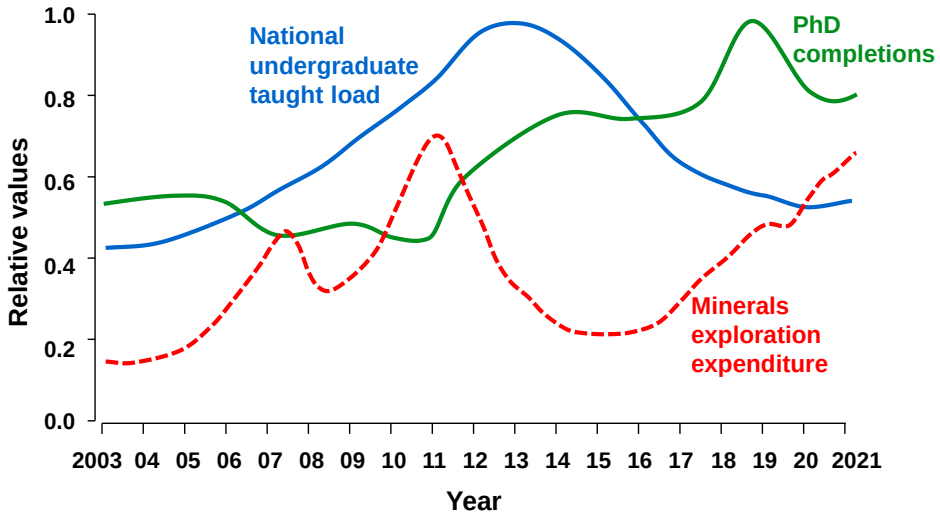
University geoscience syllabi and teaching strategies continue to evolve in response to changes within the fields in which our graduates find professional employment (in addition to the resources sector). The Australian Universities Geosciences Educators Network (AUGEN) serves as a vehicle for disseminating good teaching practice and innovations.

Australian universities continue to rank highly in the "earth sciences" and sub-disciplines under various national and international ranking systems, such as the ARC *Excellence in Research Australia*, the QS and ARWU. Around 10% of ARC funding is provided to the "earth sciences" (excluding LIEF grants), The MinEx Cooperative Research Centre has secured very substantial funding and involvement of many universities and other research organisations.

University budgets are complex with substantial cross-subsidisation of the sciences by other high volume/low delivery cost disciplines, and unfunded costs of research by teaching revenue. Substantial cross-subsidisation of geoscience occurs in most universities and reflects the continuing strength of research performance by the geosciences relative to other science disciplines, and a variety of strategic decisions by university management.

Snapshot of Geoscience in the Australian Tertiary Sector 2003–2021

	2007	2012	2017	2021
Undergraduate (incl. Honours) EFTSL	1998	3115	2127	1920
Honours graduations	156	235	183	118
PhD graduations	75	96	109	120
Academic staff (FTE)	354	418	482	398



INTRODUCTION

This report summarises the results of the fourth Australian Geoscience Tertiary Education Profile (AGTEP), based on four- or five-yearly survey of Australian geoscience departments[4]. It follows from the 2007 and 2012 surveys (Powell, 2008 & 2013)[5] and the 2017 survey (Cohen, 2018)[6]. This survey extends the existing database on geoscience degrees, majors and subject offerings, academic staff numbers and appointment types, student enrolments and completions, and the fields of research undertaken by universities.

The geosciences continue to be a major contributor to Australia's reputation in scientific research and public debate on issues ranging from resources to climate change and tourism. Geoscience professionals underpin the resources sector which is critical for the Australian economy. The place of geoscience in the university sector has, however, been less secure than the other fundamental sciences (physics, chemistry and biology) and mathematics due to various factors.

The first AGTEP survey (in 2007) was initiated by the AGC to evaluate the health of the sector following a severe drop in undergraduate geoscience student numbers and associated risks of departmental closures and loss of academic staff (AAS, 2003)[7]. With closure of geoscience majors in two universities and on-going decline in undergraduate enrolments at many universities from the 2012 peak, the AGC brought forward the planned 2022 AGTEP survey by a year.

This report spans an entire minerals exploration expenditure cycle, from the 2003 trough and 2012-13 peak to the 2015-16 trough (ABS, 2020)[8]. This provides opportunity to evaluate the extent to which the fortunes of geoscience departments are still tied to the minerals cycle. The report also provides opportunity for the university sector, industry and the professional bodies to reflect on the trends and consider the implications for longer term planning by universities and others.

The previous AGTEP report noted:

- A close correlation between the mineral exploration expenditure cycle and undergraduate enrolments (with a two-year lag).
- Some contraction in academic staff numbers in line with recent decreases in enrolments, but limited change in the number of subjects offered at each institution.
- Ongoing strong research performance by the earth sciences at national and international levels.
- A lack of correlation between enrolments in university earth science programs and senior high school Earth Science subjects.

The current survey partly spanned the COVID-19 epidemic, during which period there was contraction of staff numbers at a number of universities.

[4] The term "department" is used to cover all formal geoscience teaching and research units within universities and may include stand-alone departments or school, or entities within larger administrative or organisational units.
[5] Powell, T.G., 2008 and 2013. Australian Geoscience Tertiary Education Profile 2008 and 2013. Reports to the Australian Geoscience Council. www.agc.org.au/reports.
[6] Cohen, D.R., 2018. Australian Geoscience Tertiary Education Profile 2017. Report to the Australian Geoscience Council. www.agc.org.au/reports.
[7] AAS, 2003. National Strategic Plan for the Geosciences. Australian Academy of Science. Canberra.
[8] ABS, 2018. 8412.0 – Mineral and Petroleum Exploration, Australia. www.abs.gov.au/ausstats/abs@.nsf/mf/8412.0.

METHODS

Data collection and report development

A questionnaire, based on the previous surveys, was distributed to the heads of departments or directors of teaching of 19 university departments in October 2021 (Appendix 2). Eighteen departments responded with full submission by August 2022 and one provided some enrolment data. Universities were selected on the basis of having previously completed AGTEP surveys, membership of AUGEN or geoscience majors being offered. The surveys included both quantitative data and comments by departments on the source of the data, factors affecting changes in the data from previous surveys and some more open-ended questions.

With various geoscience groups or departments part of broader “earth science” schools or larger administrative or operations entities, and a variety of interpretations on the definition of “geoscience”, arbitrary decisions were taken by survey respondents as to which subjects, majors, degrees and staff needed to be included in their submissions. Some included aspects of physical geography, GIS and remote sensing, oceanic and atmospheric sciences and others did not. This was partly dictated by the classifications under the Earth Sciences division of the Australian and New Zealand Standard Research Classification (FOR codes) (ABS, 2020)[9].

As far as possible, respondents attempted to maintain consistency with the approach taken in compilation of previous AGTEP surveys. The data were then combined with that of previous surveys. A draft of the report was distributed to the respondents and AGC Member Organisations (AGC MOs) in September 2022 to allow comments on the interpretation of the results.

Terminology

"Geoscience"	is defined for the purposes of this survey as incorporating subject material that would allow graduates to gain membership of umbrella learnéd or professional societies such as the Geological Society of Australia or the Australian Institute of Geoscientists. In many instances it is synonymous with “earth science”.
"Subject"	denotes a specific discipline offering such as "Introduction to Mineralogy" and is equivalent to the terms "course" or “unit” used in some institutions.
“Level”	is the academic level of a subject, typically ranging from 1 (introductory) to 4 (advanced or Honours). Levels typically coincide with the year of a degree.
"Major"	denotes a set of cognate subjects leading to a specific disciplinary naming such as "Geology" or "Earth Sciences" within a degree. It is equivalent to the term "specialisation" or "stream" in some institutions.
"Degree"	carries the normal meaning. Studies leading to the award may be referred to as a "program" in some institutions.
“EFTSL”	is the *equivalent full-time student load*. It is based on the definitions of normal full-time study for students and forms the basis for payment to universities by the government and students.
“AQF”	is the Australian Qualifications Framework (AQF), which differentiates degrees between bachelors (AQF level 7), Honours degrees requiring an additional year or embedded in four-year program (AQF 8), coursework and research Masters (AQF 9) and Doctorates (AQF 10).

[9] https://www.abs.gov.au/statistics/classifications/australian-and-new-zealand-standard-research-classification-anzsrc/latest-release

For ease of reference the following institutional abbreviations have been used:

Adelaide	University of Adelaide (incl. Australian School of Petroleum)
ANU	Australian National University
Canberra	University of Canberra
Curtin	Curtin University
Federation	Federation University (formerly University of Ballarat)
Flinders	Flinders University
JCU	James Cook University
LaTrobe	La Trobe University
MacQ	Macquarie University
Melb	University of Melbourne
Monash	Monash University
Newcastle	University of Newcastle
QUT	Queensland University of Technology
RMIT	RMIT University
Sydney	University of Sydney
UNE	University of New England
UNSW	University of New South Wales
UQ	University of Queensland
UTas	University of Tasmania
UWA	University of Western Australia
UoW	University of Wollongong

Data verification and pre-processing

Data were checked against previous surveys for internal consistency and continuity. Some respondents were asked to modify their submissions to correct errors or ambiguities such as providing head counts rather than EFTSL. Unless otherwise indicated, subject head counts (if reported) were converted to EFTSL by applying a factor of 0.125, as most universities operate a two-semester model with four subjects taken each semester. The Honours year was counted as 1.0 EFTSL and Masters graduations as 1.5 to 2 EFTSL based on the normal length of candidatures.

In cases of missing data, gaps were filled by interpolation of other data from the institution to reduce bias in the reporting of national data and interpretation of trends. Missing data for BSc graduations in 2003-2007 were calculated on the basis of typical ratios of year 3 enrolments to graduations. The data for the whole sector and clusters representing resource intensive or non-intensive states are presented in Appendix 1.

As in previous years, the results of the questionnaire were supplemented by examination of the various university web sites of the school structures, staffing and course options available to students.

Given some issues with data completeness and other factors, it is emphasised that the data presented should be considered indicative rather than authoritative.

RESULTS AND COMMENTS

University structures

There is significant diversity in university organisational structures in which geoscience staff are located, and from which geoscience majors and graduate programs are delivered. A few universities maintain separate geoscience departments or schools. A majority of institutions have combined geology with one or more of the disciplines of geography, environmental science and even oceanography or atmospheric science, into broader "earth science" departments. Some geoscience groups are part of very large multi-disciplinary departments or faculties that span other physical and/or biological sciences (e.g. UNSW and UTas). Such departments or schools are typically placed within "Science" faculties.

The last four years have seen further amalgamations of disciplines into larger units at some universities. Intake of new students to geoscience programs at two universities ceased (Newcastle and Macquarie). Amalgamations have the advantage of reducing administrative costs and enhancing integration between geoscience and related fields, but also present a risk of dilution of core geoscience disciplines relevant to the demands of traditional geoscience graduate employers.

Undergraduate degree offerings

Nineteen universities deliver undergraduate programs that focus on geoscience or contain geoscience majors. This is a decrease of two over the 2012 survey. Some departments offer Masters by coursework and all offer Masters by research or PhD programs (Table 1). Other universities offer aspects of geoscience as part of broader majors such as environmental science or ecology. Where departments have closed or earth science majors discontinued, some Year 1 and 2 earth science units (and teaching staff) have been retained to support other majors such as environmental sciences. The most common host for geoscience majors is the traditional three-year BSc, with the option to undertake an Honours year involving completion of a research thesis and variable amounts of coursework.

The larger departments and universities are generally able to offer a wider range of majors and units due to the availability of teaching academics. There has been renaming of "geology" or "geoscience" programs as "earth sciences" in some universities to reflect broadening of the syllabus and a term that may be more familiar with high school students. There have been increases offerings of "advanced science" programs with a higher research component to attract high performance students.

Uncertainty in Federal Government university funding models has resulted in little change in degree structures across the country, with most universities retaining the classic Honours model of 3-year undergraduate + 1-year Honours or the equivalent 4-year model with embedded Honours, rather than a move to a Bologna-style model[10] of a 3-year undergraduate plus a 2-year Masters. Both models permit students to undertake PhDs.

Entry to geoscience programs is normally set by the general degree in which the program or major is offered (typically the BSc). Entry to Honours is dependent on meeting minimum generic or geoscience subjects performance criteria in the first three years. Group of Eight universities require an unadjusted Australian Tertiary Admission Rank (ATAR) of 75 to 85, or an adjusted ATAR that reflects strong performance in science and mathematics subjects in the Higher School Certificate or equivalent of 70 to 75 (Figure 1). Other research-intensive universities that deliver geoscience majors typically set lower admissions criteria, though many have advanced science programs with high entry ATARs. All universities are providing alternate pathways into degrees,

[10] www.coe.int/t/dg4/highereducation/EHEA2010/BolognaPedestrians_en.asp#P132_13851.

including conditional or unconditional offers prior to completion of the final high school year. ATAR requirements are not necessarily linked to the difficulty of programs, but to market demand.

Table 1 Degrees and geoscience majors at surveyed Australian universities in 2021.

University	AQF 7 or AQF 8 (Bachelors) (Honours)		AQF 9 (Masters)	AQF 10 (PhD)
Adelaide	**BSc/BSc(Hons)** *Geology; Geophysicsl Earth Res; Palaeon.*	**BSc (Miner. Geosci.)**	Y	Y
ANU	**BSc** *Earth Sci.; Marine Sci.; Water Sci.*	**BSc (Hons)** *Earth & Marine; Physics of Earth*	Y	Y
Canberra	**BSc / BSc(Hons)** *Environ. Sci. (incl eart)*			Y
Curtin	**BSc (Appl. Geol.)** *Appl. Geol; Mining Geol.; Petrol. Geol.*	**BSc (Hons)** *Geophys; Appl. Geol*	Y	Y
Federation	**BGeosci**		Y	Y
Flinders	**BSc / BSc(Hons)** *Earth Sci.*		Y	Y
JCU	**BSc / BSc(Hons)** *Earth Sci.*	**BGeol / BGeol(Hons)** *Earth Sci.*	Y	Y
Melbourne	**BSc (Earth Sci.) / BSc (Hons)** *Geology; Clim & weather 'Envir. Sci.*		Y	Y
Monash	**BSc / BSc(Hons)** *Earth Sci; Climate & Atmos*		Y	Y
QUT	**BSc** *Earth Sci.*		Y	Y
Sydney	**BSc / BSc(Hons)** *Geol. & Geophys ; Marine Sci ; Env. Sci.*		Y	Y
UNE	**BSc / BSc(Hons)** *Geosci.*	**BGeosci**	Y	Y
UniSA	**BSc** Geosci.; Geochem & Biogeochem.	**BEnvSc** *Earth Sci.*		Y
UNSW	**BSc / BAdvSci (Hons)** *Earth Sci.; Climate Sci.*	**BEnvMgmt** *Earth Sci.; Climate Sci.*	Y	Y
UoW	**BSc / BSc(Hons)** *Geology; Environ. Sci.*	**BMarineSci; BEnvSc(Hons)**	Y	Y
UQ	**BSc / BSc(Hons)** *Earth Sci*		Y	Y
UTas	**BSc / BSc(Hons)** *Earth Sci,*		Y	Y
UWA	**BSc / BSc(Hons)** *Geology*	**BEarthSci.** *Earth & Marine*	Y	Y
Geology or Earth Science programs discontinued or being taught out				
Macquarie	**BSc**			
UN	**BSc / BSc(Hons); BEnvSci & Mgmt**			
LaTrobe	**BSc**			

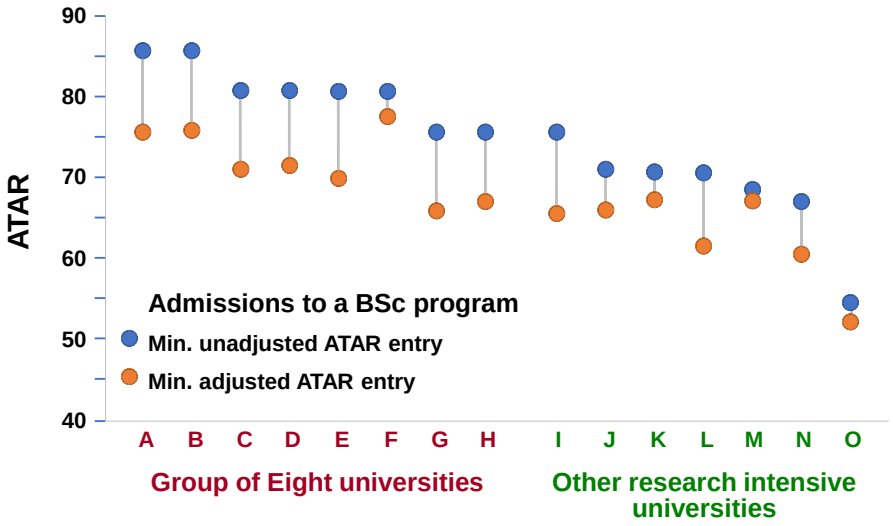


Figure 1. ATAR entry requirements (adjusted and unadjusted) in 2020 to general science degrees.

Composition and curriculum in undergraduate programs

The previous AGTEP report noted that as the geosciences have evolved, so too has the content, delivery and characteristics of geoscience programs. Part of the evolution relates to the nature of the science itself and the need for integration of teaching and research and part to the rise of new technologies, the contraction of teaching staff numbers in some universities and the need to broaden the range of elective subjects that students can draw upon to complete their degrees.

Departments are cognisant of the need for degrees and majors to span the skills and knowledge that will permit graduates to obtain employment as geoscientists. This generally includes units directly relevant to the resources and environmental sectors. It is also recognised that many professions, in which geoscientists can gain employment, demand increased mathematical and computer skills (including coding), given requirements to effectively manipulate, interrogate, visualise and interpret large and complex datasets[11]. It is also essential that potential students at both high school and first year university levels understand the diversity of areas within the geosciences and that this is reflected in the subjects and content on offer.

Over the last four years, the main change in content delivery has been transition of a substantial portion of subject material (especially lectures) to asynchronous online and on-demand delivery. This has been accelerated by the response to COVID-19. It is a common observation by staff across all science disciplines that attendance at lectures (certainly at first year level) is far more irregular than attendance at laboratories, field trips and tutorials.

A number of comments and observations incorporated in submissions by departments in the 2017 survey remain current in this survey, including:

- Requirements for breadth components in programs (outside the field of education of the major or even the entire degree).
- An increase in environmental geoscience options.
- Growth in double degrees with discounts on the total units of credit required outside the majors to make such combinations tractable.
- Maintenance of the traditional and solid earth geoscience areas such as petrology, structural geology, tectonics and ore deposits; contraction in geophysics, sedimentology and

[11] Cohen DR, 2017. Educating the next generation of geologists. *In:* Proceedings of the Tenth International Mining Geology Conference 2017. Australasian Institute of Mining and Metallurgy, Melbourne. 3–10.

palaeontology; expansion of data analysis courses including GIS and general statistics.

- Subject sharing or substitution at Honours and postgraduate level through the Victorian Institute of Earth and Planetary Sciences Honours Program (VIEPS),
- Continuation of the Adelaide-hosted and MTEC-funded National Exploration Undercover School (NExUS) that provides opportunity for senior undergraduate students across Australia to participate, and the ANZIC-funded marine geoscience master classes and related educational programs (ANZIC 2017)[12].
- Maintenance of field-based studies and introduction of work-integrated learning (essentially practicum) subjects to improve the skillsets of graduates and attractiveness of geoscience programs, despite the high cost and growing health and safety regulation.

Postgraduate degree offerings and micro-credentials

As observed in previous surveys, most institutions continue to offer a Masters-by-research. Unless underpinned by a Bologna model, coursework Masters may be cost or time ineffective for staff to deliver unless they have a vocational focus or attract significant international student numbers. Masters programs cannot be largely delivered as a series of co-badged senior undergraduate subjects, as TEQSA regulations and the AQF require Masters courses to contain content, expectations and assessments that are substantially different or extend beyond material offered to undergraduates.

Universities and the various professional organisations and associations are developing more comprehensive continuing professional development (CPD) and micro-credential systems. As noted previously, there may be a market for stacking such credentials for credit against subsequent formal qualifications, but the ultimate value probably lies just in the micro-credential itself as a means of meeting professional association CPD requirements or enhanced professional capabilities. CPD systems provide greater opportunity for collaboration between industry and the universities in the design and delivery of CPD units or offerings.

Undergraduate student numbers

Total annual undergraduate EFTSL (including Honours students) for the universities surveyed for the period 2003–2021[13] is presented in Figures 1 and 2. It is again emphasised that the definition of "geoscience" varies between institutions and that some adjustment of the raw data and interpolation was necessary to provide a common basis for calculating taught load and continuity of the data from 2003 to 2021. It is also noted that the data relate to all geoscience subject enrolments, including those undertaking or intending to undertake geoscience majors, those completing geoscience courses that are core to other programs (e.g. marine sciences) and those undertaking geoscience subjects as free electives. Specific servicing subjects offered in other non-science degrees have generally been excluded.

Total EFTSL for the sector and contributions at each level displayed an exponential rise from 2003 to 2012, with a more than doubling of undergraduate enrolments from ~1,500 to ~ 3,230. This was followed by a rapid decrease 2014–2017, a lesser rate of decline to the 2020 minimum of 1,865 (the peak of the COVID pandemic) and slight upturn in enrolments in 2021 to 1,920.

Variations in total enrolments were much greater in the resource intensive states (WA, SA and Queensland) than in the resource non-intensive states/territories (NSW, Victoria, Tasmania and the ACT). Over the entire period of the survey, the former went from ~500 to just over 1,600 and

[12] ANZIC, 2017. The Australian and New Zealand International Ocean Discovery Program Committee. iodp.org.au/for-scientists/for-junior-scientists.

[13] Some universities first reported data in the 2017 survey, and there have been steps to fill in gaps for the previous surveys.

back to ~800, whereas the latter went from ~1,100 to 1,600 and back to 1,100. The greatest difference between the two clusters is in Year 1, with the resource non-intensive states displaying far less relative variation than the resource intensive. This suggests a higher proportion of students taking introductory geoscience units but not progressing further in the geosciences.

The proportion of total undergraduate load in the resource non-intensive states has generally exceeded that of the resource intensive states, especially during periods of downturn in the minerals exploration cycle (over 60% of load prior to 2008 and after 2016), though with honours graduations displaying the opposite pattern (Figure 3). This is partly linked to the proportion of the population and number of universities with geoscience programs between those two clusters. During industry upturns the enrolment share of resource intensive states markedly exceeds their state population share.

The pattern of national undergraduate load is closely linked to the minerals exploration cycle (ABS, 2021), though this relationship has weakened after 2017 (Figure 4). There was a 2-year lag between the peaks in mineral exploration expenditure in 2011 and enrolments in 2013, but the lag between the trough in expenditure in 2015 and enrolments in 2020 was five years. The link between the minerals exploration expenditure cycle (certainly in third year EFTSL that reflects the number of students completing geoscience majors) is more pronounced in the resource intensive states. There was only weak temporal correlation with petroleum expenditure. The data indicate different enrolment patterns in upturn versus downturn parts of the minerals exploration cycle, and the dampening effects of stable first year numbers in the non-resource intensive states.

The post 2012 decline in enrolments is less than the pre-2012 increase, despite similar troughs in mineral exploration expenditure (adjusted for inflation). This is partly attributed to universities, especially in the non-resource intensive states, integrating geosciences into other programs and attracting students from other science or non-science programs to complete geoscience subjects (mitigating against the effects of the minerals cycle). Universities in resource non-intensive states appear less susceptible to minerals cycle influence. Some of these patterns were identified in the previous survey.

There is a significant pipeline effect in enrolments from level 1 to upper level units. This does not mitigate against swings, but delays the response in student numbers to changes in the external environment and university intake profiles.

Patterns in earth science enrolments are remarkably similar between different countries, irrespective of the prominence of resource exploration and extraction (Figure 5). The peaks and troughs in Australia, Canada, the US, the UK and Italy are coincident when adjusting for the fact that some of the data is for first year enrolments and some for total enrolments or completions. The UK and Italy show long-term decline in enrolments, whereas the US and Canada display long term increases (notwithstanding mineral cycle induced variations).

The proportion of earth sciences within total science enrolments varies substantially between universities (Figure 6). In general the proportion is lowest in the larger universities but there is otherwise no obvious systematic pattern across the country. It is noted that there has been substantial growth in domestic student university enrolments since 2003 in all disciplines, and by international students in medical-related biosciences.

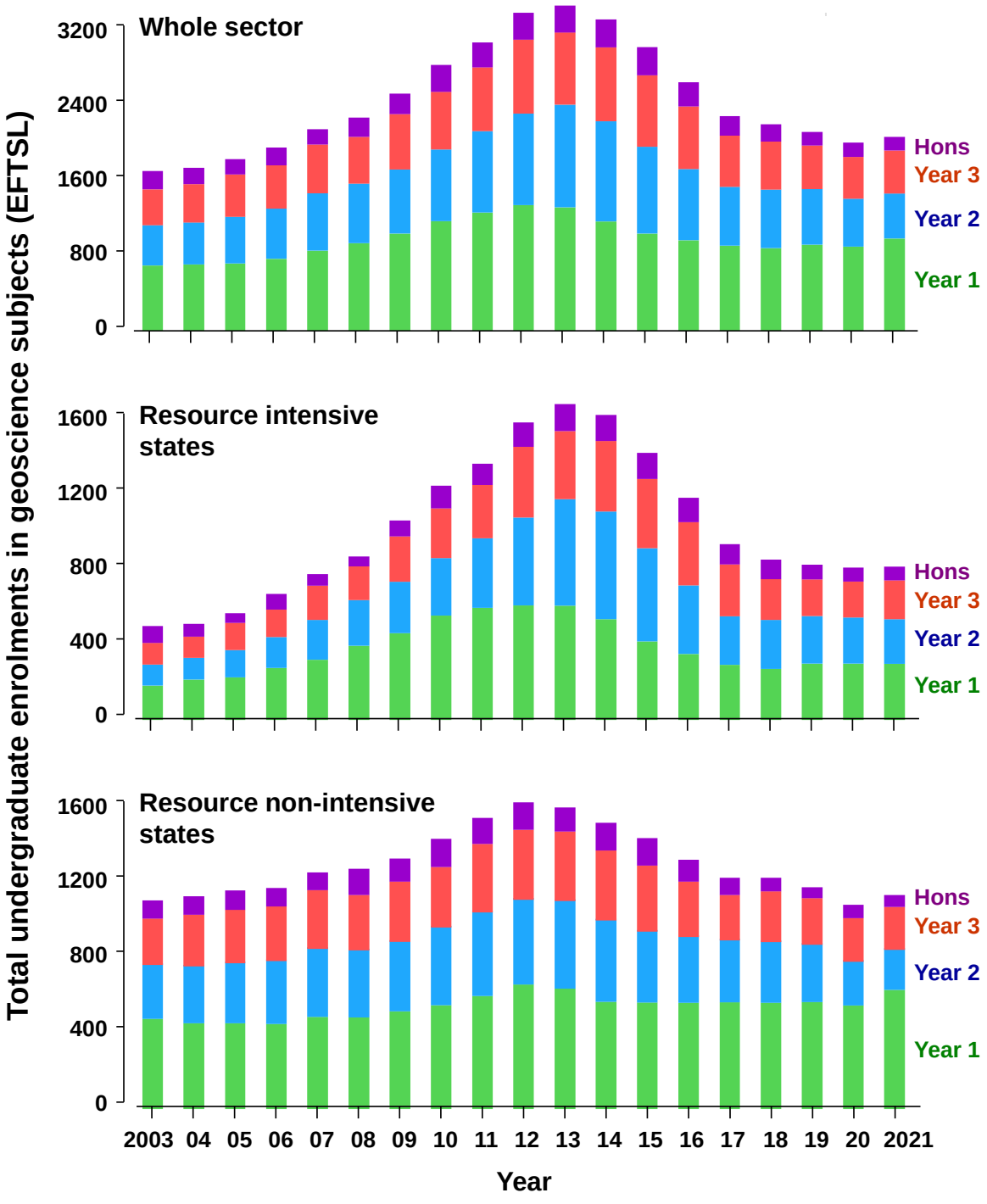


Figure 2. **Comparison of undergraduate taught load (EFTSL) at all levels across the period 2003–2021 between the whole sector and universities clustered into those in resource intensive or in non-intensive states and territories.**

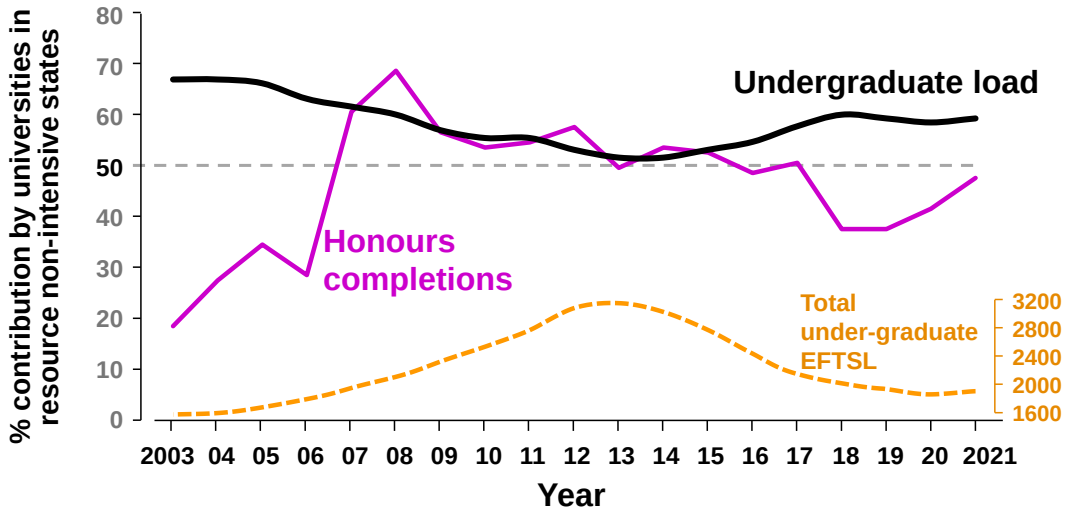


Figure 3. **Proportion of the national total undergraduate load (including Honours) and Honours completions for universities in the resource non-intensive states from 2003–2021.**

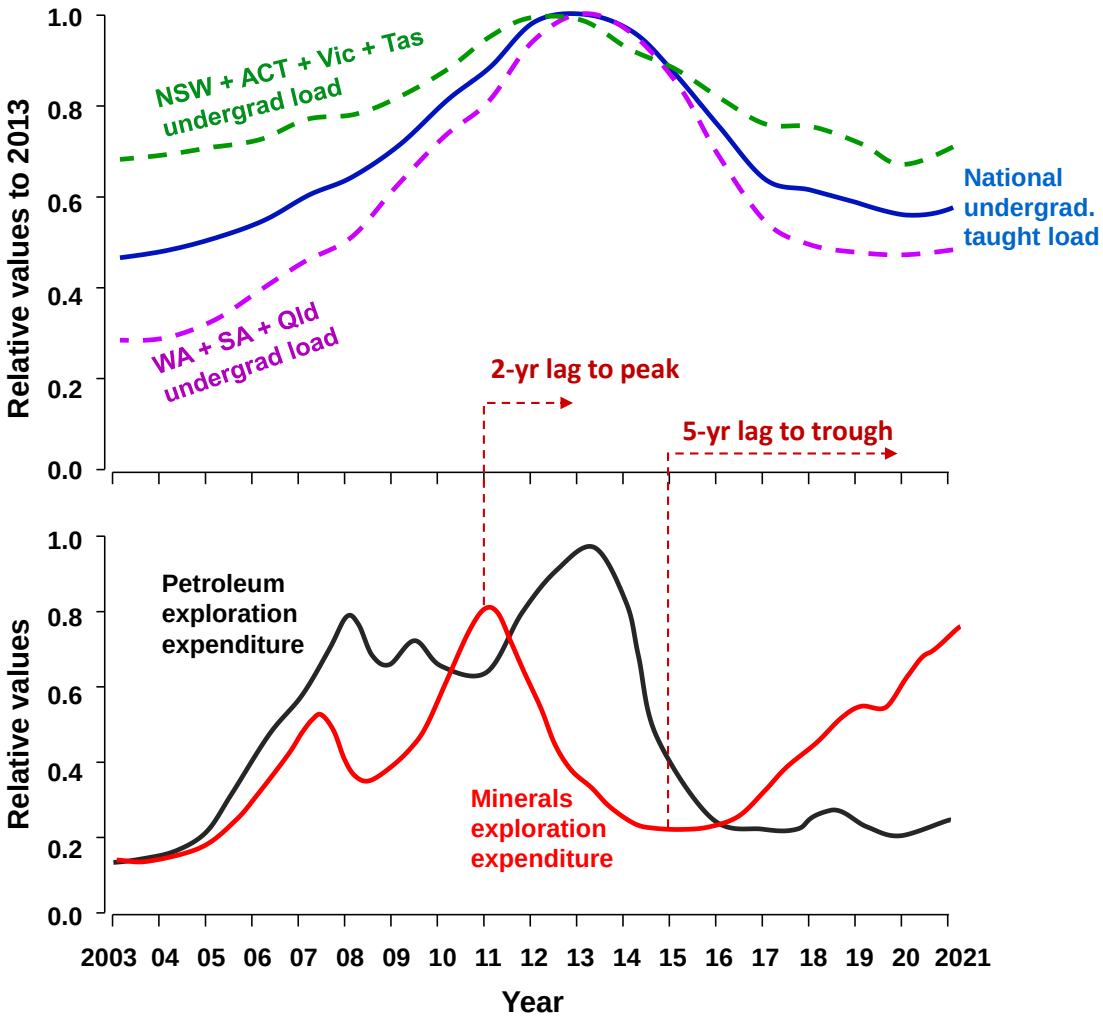


Figure 4. **Comparison between total undergraduate enrolments (including Honours) in geoscience programs universities and expenditure on minerals and petroleum exploration in Australia 2003–2021.**

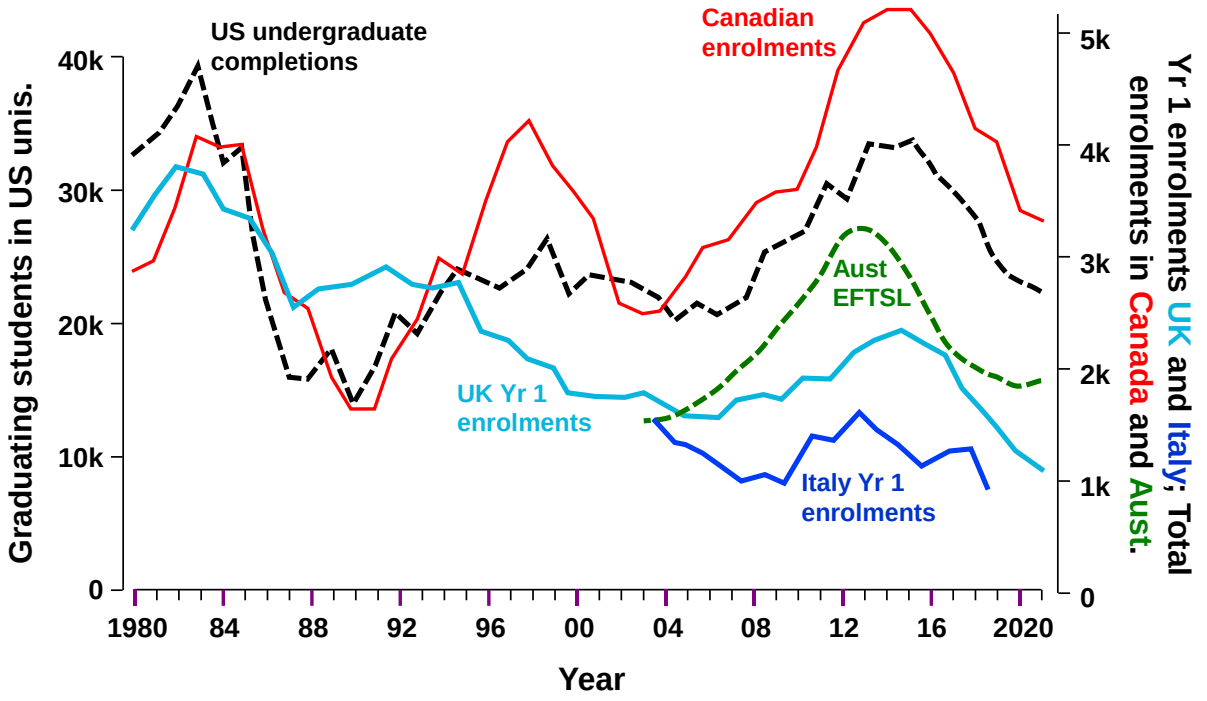


Figure 5. **Comparisons of earth science enrolment trends in the US, UK, Canada, Italy and Australia[14].**

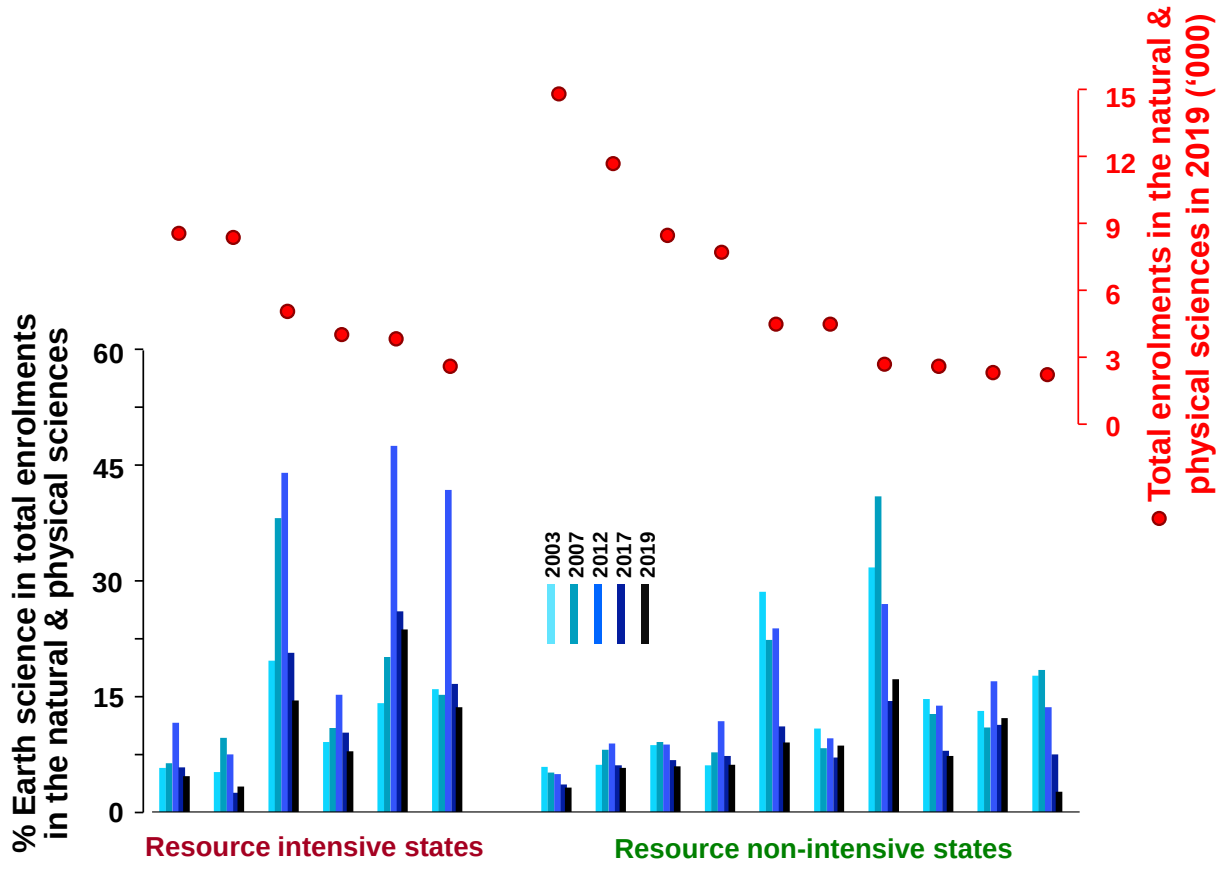


Figure 6. **Proportion of earth science in total science enrolments for different universities. All data from DESE (2022)**

[14] Sources – AGI www.americangeosciences.org/sites/; www.ags.org.uk/content/uploads/2020/10/Figure-1.png; http://cccesd.acadiau.ca/rep2020.html; Bonaccorsi et al. (2020), Euro Geologist, 50, 34-38.

Retention rates

As noted in previous surveys, retention rates are difficult to determine for Years 1 → 2 as many students in Year 1 are in general science programs and have not declared their major or are taking geoscience subjects despite being enrolled in non-science programs. Unless individual students are tracked, average class sizes can deliver misleading indications of retention rates from Year 1 through to Honours.

There is a high correlation between total geoscience enrolments in Year X versus the next level up in Year X+1 within both university clusters (Figures 7 and 8). This high correlation has been preserved in the years leading up to the 2012 peak and after the peak, though they follow different trajectories on the way up and the way down. One exception is the Year 1 → 2 relationship in the resource non-intensive states where there has been a very strong decline in enrolments in Year 2, despite very little variation in Year 1, resulting in a steady decline in the Year 1 → 2 retention rates.

In resource intensive states, the proportion of students retained from Year 1 → 2 and 2 → 3 have median values of 0.78 and 0.8 respectively, compared with 0.7 and 0.8 in the resource non-intensive states. Retention from Year 3 → Hons is around 0.35 in both clusters. In essence, the pipeline is dictated by enrolments in Year 1 geosciences and subsequent retention in all years up to Honours is largely predictable. The "first year experience" is probably the key driver to increasing enrolments in upper-level years or geoscience majors, especially in the non-resource intensive states.

While departments of mathematics, physics, chemistry (and sometimes biology) are largely funded by Year 1 subjects (many of whom undertaking those subjects as a requirement of non-science degrees), it is common for geoscience departments to draw a majority of their income from upper year undergraduate subjects (and higher degree research student supervision).

Along with biology, the geosciences maintain a high proportion of Year → 3 Honours students relative to other sciences. Departments emphasise the need for students to building up field or laboratory experience, project management and communication skills, to improve employment prospects or provide the pathway into research higher degrees. In effect Honours is the ultimate "capstone" component of the science degree.

Degrees awarded

Taught load relating to students intending to practice as geoscientists is generally indicated by Honours and Masters coursework graduations (Figure 9). It is, however, noted that resource intensive states have a higher proportion of students who leave university with just a three-year degree (Figure 3). In 2021, approximately 225 BSc (Honours) and MSc coursework degrees were awarded, compared with around 330 in 2012/13. The patterns are less consistent for the individual universities than for the sector as a whole.

PhD completions reached a low of 66 in 2011 but have since grown to around 120. Given a PhD in geoscience typically takes four years to complete, the patterns can be linked at a national level to both Honours completions and the minerals cycles (downswings generating "recession PhDs" as noted by the spike in PhD completions in 2019).

Analysing the temporal relationship between employment status of Australian Institute of Geoscientists members and enrolments is not simple (Figure 10). Peak employment in early 2010 preceded the peak enrolment in 2013, but peak unemployment or underemployment preceded enrolment lows by six years.

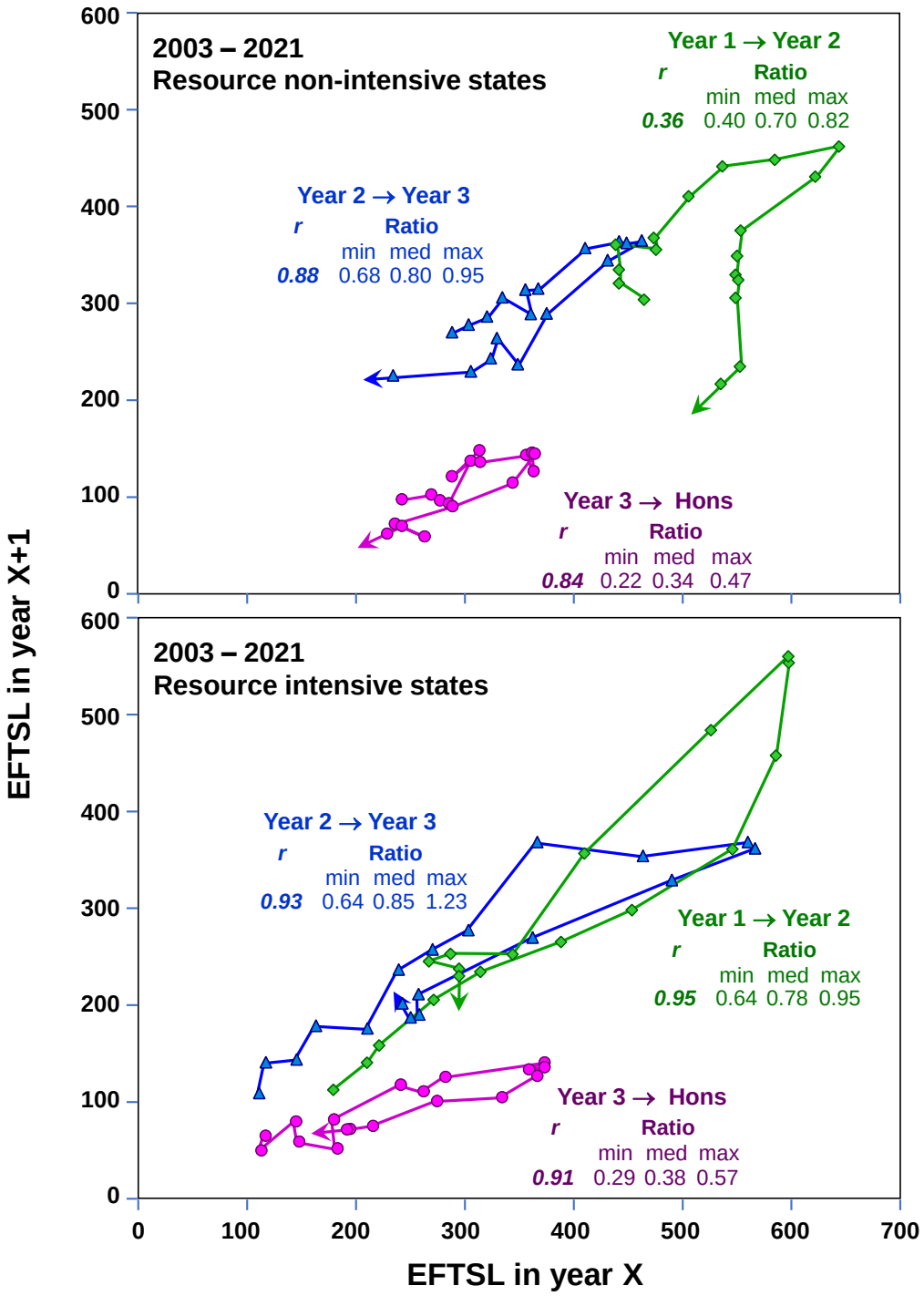


Figure 7. **Relationship between enrolments in a given year (X) and enrolments in the next level up the following year (X+1) over the period 2003-2021, as well as retention ratios, for Australian universities clustered into resource intensive and non-intensive states.**

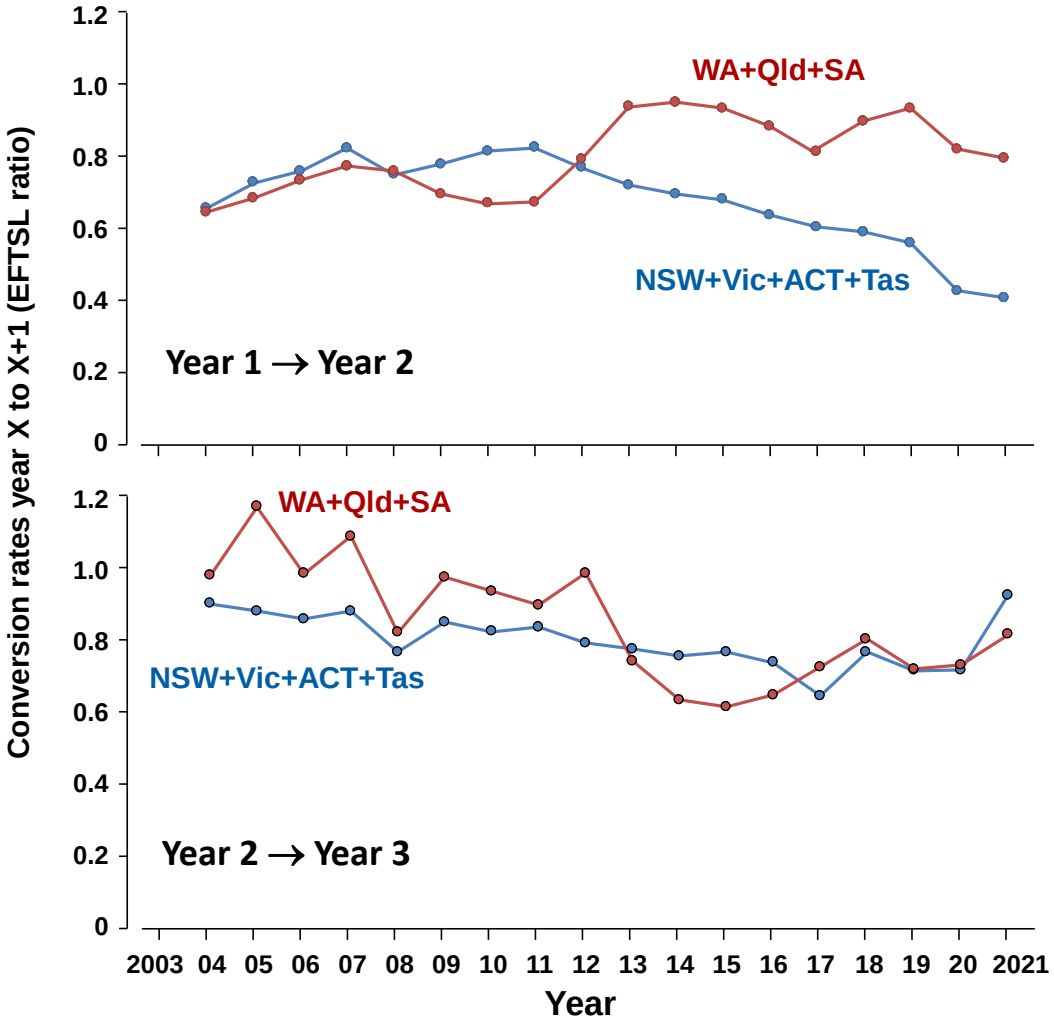


Figure 8. **Comparison of conversion rates from Year 1 to Year 2 and from Year 2 to Year 3 between resource intensive and non-intensive states. Note this is a comparison of EFTSL, not head counts.**

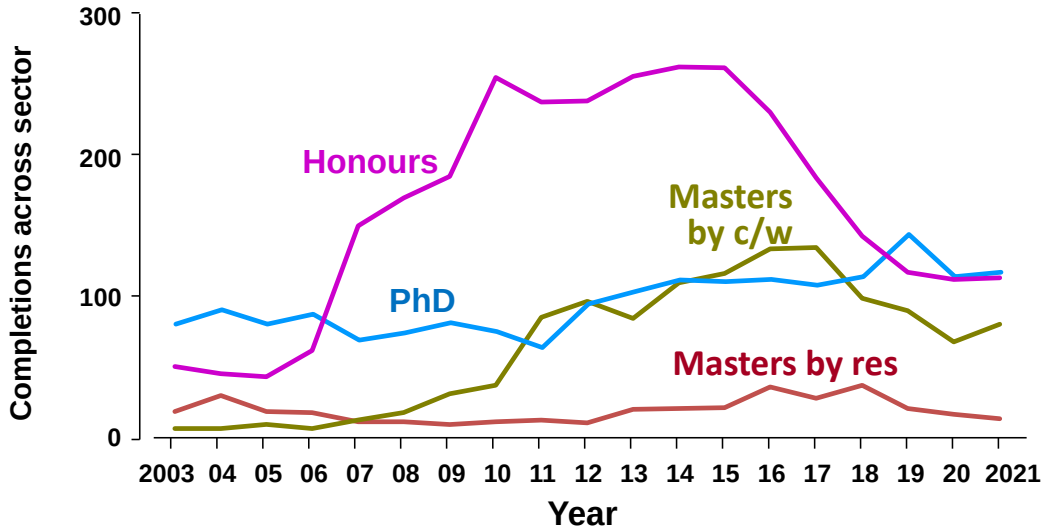


Figure 9. **National completions in Honours, Masters and PhD programs, 2003-2021.**

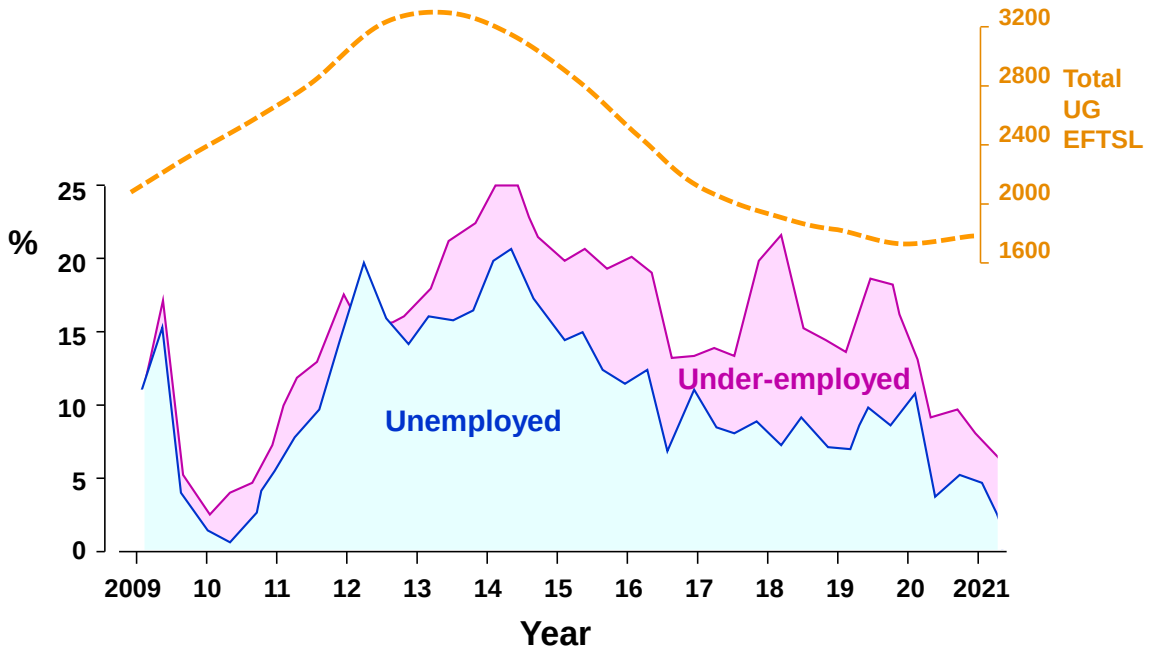


Figure 10. Variation in employment status of AIG members and national undergraduate earth science taught load 2003 – 2021.

Staffing profiles

Academic staff generally divide into the traditional research-and-teaching or education-focussed groups that are primarily funded from university operating budgets, and research-focussed[15] staff that are usually externally funded (e.g. by the ARC). The survey requested data on these various divisions. It is noted that there are significant inconsistencies in the reporting of staffing numbers between the various surveys which may reflect differences in interpretation of who was a "geoscience" staff member and whether short term contract positions (such as postdocs) were included.

The number of geoscience academic staff in Australia has not changed to any great extent in the last four years, although there has been a significant reduction in the proportion of junior staff since 2016, and two departments have effectively closed with loss of nearly all academic staff. There were 397 FTE geoscience academic staff in 2021 compared with 492 FTE in 2017, 419 FTE in 2012 and 380 in 2007 (Figure 11). In 2021, 203 academics were classed as research-and-teaching or education-focussed and mainly funded through university operating budgets.

Some of the staff changes continue to reflect on-going department mergers and others to the broadening of the definition of "geoscience" (e.g. the effects of merging atmospheric science and physical geography with geoscience at Monash and Melbourne, and the Climate Change Research Centre coming under the School of Biological, Earth and Environmental Sciences at UNSW).

There are just three departments with <10 academic staff (down from five in 2017), seven with 10-20 staff, seven with 20-40 staff and just two with >40 staff. The greatest single increase has been in level D academics (A/Profs) and greatest decrease in level B (lecturers). This may be indicative of both the general ageing of departments and the loss of junior externally funded research fellows. Some departments made significant cuts to earth science academic and support staff in response to actual or perceived reductions in university budgets due to COVID-19.

[15] Nearly all so-called "research-only" academics above level B undertake honours supervision and some teaching.

The question asked in AGTEP 2007 still remains highly pertinent: *"What is the minimum economic department size that is sustainable in the longer run*?". This should be linked to the question "*What is the minimum number and disciplinary spread of academic staff required to deliver a coherent geoscience program*?". The second will continue to be debated as departmental heads balance up the necessary geoscience syllabus, staff numbers, teaching loads and budgets. Anecdotal evidence indicates geoscience staff carry high teaching loads compared with other science departments.

Enrolments are significant drivers of budgets, and thus staff numbers. It is clear from enrolments data that universities have increased cross subsidies to the geosciences and possibly that the geosciences have been successful in acquiring some externally funded fellowships. Unlike mining engineering, it has been difficult for geoscience departments to secure industry-funded chairs.

As a consequence of complexities in the budgetary drivers for staff appointments and various strategic considerations in the determination of staffing profiles, there is only weak correlation between undergraduate EFTSL and staff numbers (Figure 12). Teaching load expectations vary, with the research-intensive universities typically having smaller face-to-face teaching workloads but higher postgraduate supervision loads than the smaller teaching-intensive universities (partly a function of the number of staff versus the syllabus that needs to be covered). Some departments continue to place a proportion of upper-level subjects on a two-year rotation to maintain sufficient class sizes and reduce teaching loads.

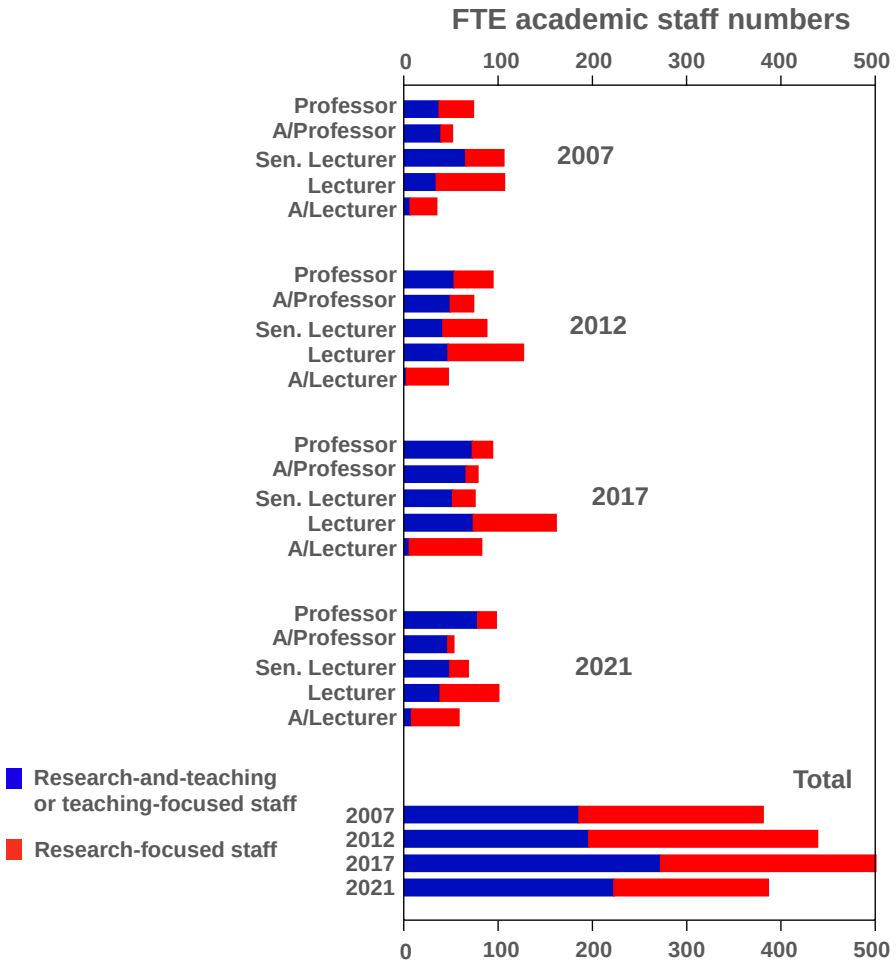


Figure 11. Academic staff numbers in Australian universities earth science departments in 2007, 2012, 2017 and 2021, divided into research and teaching or teaching-focussed staff and research-only staff. Most of the research-focussed staff are on external funds.

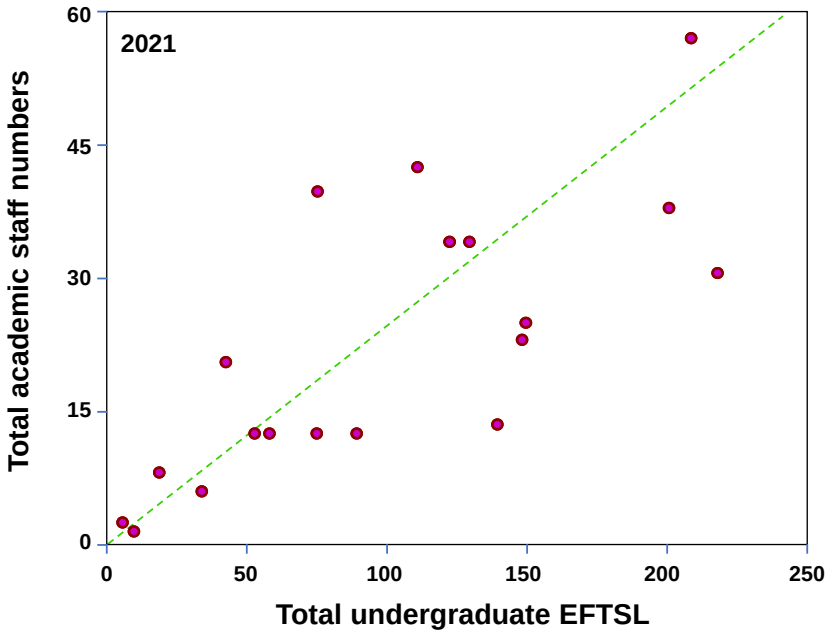


Figure 12. Correlation between undergraduate EFTSL and FTE academic staff.

The primary and high school sector (K-12)

The lack of exposure and awareness of geoscience in our secondary schools remains an issue. It is partly linked to the lack of earth science teachers and other problems in the STEM disciplines. A lack of scientific literacy in the general population does not serve the development of science policy, or assist the sector in encouraging support for higher education and research in geoscience. While the earth sciences are now more firmly ensconced in the K–10 national curriculum, the Australian Curriculum, Assessment and Reporting Authority (ACARA) has moved some topics into earlier years. This may reduce the number of students taking senior high school level earth and environmental science subjects. The ACARA promulgated indicative curriculum for use with year 11–12 Earth ± Environmental Science subjects (Table 2)[16] Is being adopted.

Table 2. Proposed Earth and Environmental Sci. syllabus (ACARA, 2017) – Examples in context.

Unit 1: Introduction to Earth systems	**Unit 2: Earth processes – energy transfers and transformations**	**Unit 3: Living on Earth – extracting, using and managing Earth resources**	**Unit 4: The changing Earth – the cause and impact of Earth hazards**
• Changing views on the age of Earth	• Biological soil crusts and nutrient cycling in Australian rangelands	• Carbon pricing	• Should scientists be held responsible for evaluation of earthquake risk?
• Evidence for a 'sixth extinction'	• Climate change and the global ocean conveyor	• Coal seam gas extraction in Australia	• Salinity in Australia
• Evidence for changes to the Australian environment over time	• Closed ecosystem models	• Food security and protecting agricultural biodiversity	• Urban development planning for severe weather events
• Water and the search for life on other planets	• Development of plate tectonic theory	• Locating and assessing resources for extraction	• Anthropogenic climate change –the evidence?
• Modern processes as analogues for ancient processes	• Geothermal energy	• Maximum sustainable yield models and fisheries	• Predicting future climate change and identifying action
• Monitoring Earth's atmosphere	• Marine primary production	• Putting a dollar value on ecosystem services	• Uncertainty and climate change science
• Understanding the interior of Earth	• Measuring plate movement		
• Evidence for origin of life	• Predicting the weather		

[16] ACARA, 2017. Earth and Environmental Science. Australian Curriculum, Assessment and Reporting Authority. www.australiancurriculum.edu.au/senior-secondary-curriculum/science/earth-and-environmental-science.

In Years 11 and 12, Queensland and South Australia offer an Earth Science course. NSW, the ACT and WA offer the slightly broader Earth and Environmental Sciences courses. Environmental Science offered in Victoria and Tasmania contains some earth science components but is biology-dominated. Enrolments in earth sciences at senior high school level (final two years) are very low compared with the other sciences, and is attributed to the limited number of schools offering such subjects (Figure 13). Enrolments continue to rise in NSW, are relatively flat in Queensland and have been in decline since 2016 in WA

The universities and the geoscience community continue to support organisations assisting teachers deliver earth science surjects, by developing new teaching resources and associated training, as well as undertaking outreach to schools. Universities and the AGC continue to provide some support for AusEarthEd (formerly ESWA)[17], the Teacher Earth Science Education Program (TESEP)[18], and earth science Olympiad teams[19].

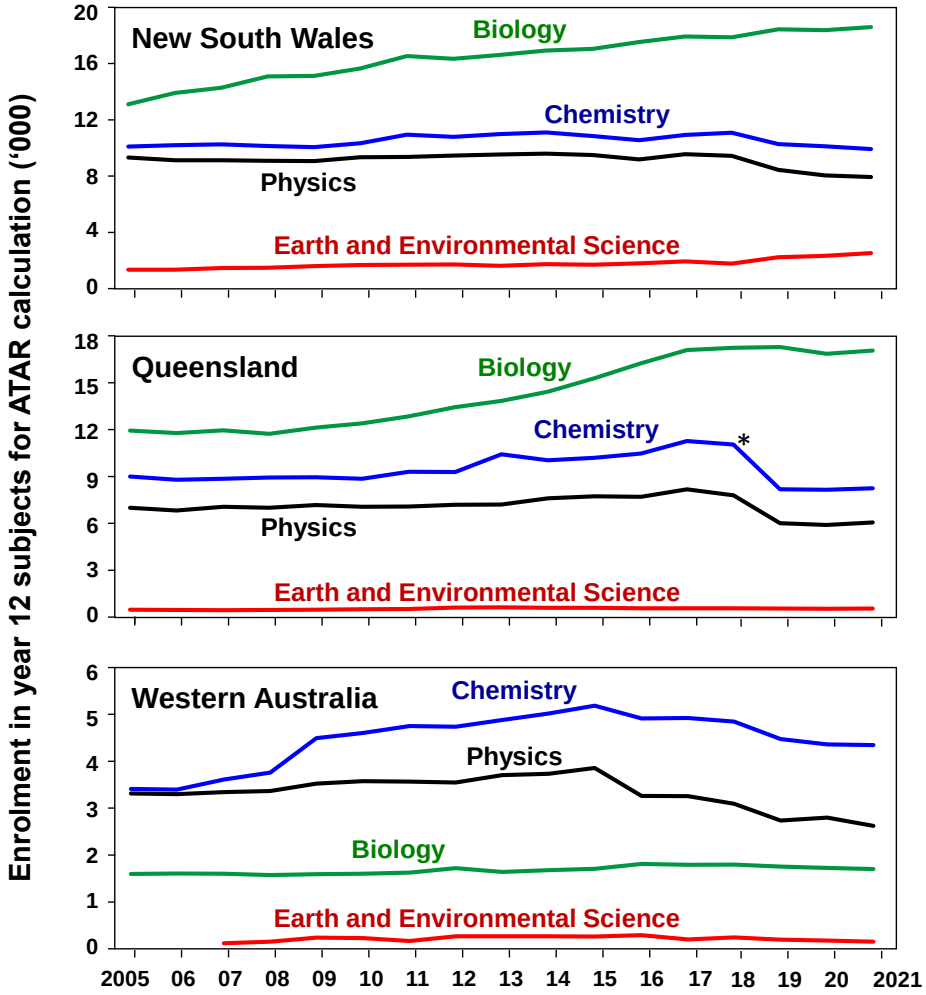


Figure 13. Year 12 enrolments in biology, chemistry, physics and earth & environmental sciences in NSW, Queensland and WA 2003-2021 (NESA, QCAA and WACC, 2006–2021)[20,21,22].

[17] https://ausearthed.com.au/#
[18] www.tesep.org.au
[19] www.asi.edu.au/programs/australian-science-olympiads/
[20] NESA, 2003–2021. HSC Facts and Figures. Series of reports. educationstandards.nsw.edu.au/wps/portal/nesa/.
[21] QCAA, 2003–2021. Subject enrolments and levels of achievement. Queensland Curriculum and Assessment Authority. Series of reports. www.qcaa.qld.edu.au/publications/statistics.
[22] WACC, 2006–2021, Senior Secondary Education Statistics, Curriculum Council, Perth. Series of annual reports. https://www.scsa.wa.edu.au/publications/reports/statistical-reports/secondary-education-statistics.

Attracting students into geoscience

There remains no statistical correlation between enrolments in Year 12 ES or E&ES and subsequent enrolments in Year 1 geoscience subjects at universities. As per long-standing tradition, many students take level 1 geoscience subjects as their "fourth option" to complete their breadth requirements or avoid the more numerically challenging disciplines.

Efforts to achieve a major lift in student enrolments in geoscience, by marketing to high schools, has had little overall demonstrated effect on university enrolments. Geoscience enrolments remain fairly strong in Victorian universities despite having no E&ES subject in senior high school.

This does not mean that earth science departments and professional associations should not continue to make significant efforts in marketing "science" and trying to attract high performing students into the geosciences to strengthen future undergraduate and PhD cohorts. There remain benefits in publicising geoscience stories in the media and elsewhere, given the effects this can have on general university reputations, the disposition of governments to funding education and research, and improvements in geoscience literacy within the general public.

University funding

Income for teaching of earth science undergraduates is dominantly derived from domestic students with Commonwealth Supported Places (CSPs). Compared with engineering and business, the geosciences do not generate significant international student load at the undergraduate level, but some departments do at postgraduate level.

Major changes to funding of different disciplines were introduced by the Federal Government in 2020. Most sciences and engineering were placed in a band providing $16,396 from the Government and a maximum direct HECS that students could be charged of $8,021, yielding a maximum of $24,417 p.a. per FTE student (Table 3). Maximum funding in 2017 was significantly higher at $27,021. After central and faculty overheads, 35 to 45% of the income generated is typically available for distribution to departments, but with a complex system of additional levies and cross-subsidies depending on the real cost of delivering different programs. The overheads are required to fund the research and academic divisions, and for building and maintenance.

The geosciences are generally cross-subsidised by other science disciplines and mathematics (as science faculties are typically cross-subsidised by business faculties). Part of the justification for this has been the strong research performance of the earth sciences. At the discipline level, departments cross-subsidise most upper-level courses with the income from the larger first year enrolments. For most universities, the financial breakeven in the sciences has risen with the reduction in per capita income for CSP places and now stands at around 40 students in a class. Across the whole sector, the average number of students in upper-level undergraduate courses is just 30 and only two universities exceed 40 students per class on average.

Education was Australia's fourth largest export after iron ore, coal and natural gas in 2020, delivering nearly $40b[23]. The dominant market is China. The main beneficiaries of overseas student growth have been engineering, IT and business, particularly in the eastern states. Secondary benefits have accrued directly to mathematics, chemistry and physics through service teaching, and indirectly to geoscience through the flow of funds into science faculties.

[23] https://www.dfat.gov.au/publications/trade-and-investment/trade-and-investment-glance-2021

Table 3. Annual funding clusters, Commonwealth Government funding (CSP places) and domestic student contribution bands according to field of education codes (DESE 2021)[24].

Fields	Max. student contribution	Commonwealth contribution	Total max. funding
Humanities; Law; Behavioural sci.	$ 14,630	$ 1,109	$ 15,739
Education; Languages; Mathematics	3,985	13,369	17,354
Nursing	3,985	16,396	20,381
Psychology, Performing arts;	8,021	13,369	21,390
Architecture; Computer science	8,021	13,369	21,390
Engineering; Science	8,021	16,396	24,417
Agricultural science	3,985	27,243	31,228
Medicine; Dentistry; Vet. science	11,401	27,243	38,644

Research fields

The distribution of research capabilities generally follows the teaching profile. Most universities surveyed indicated they can supervise research students (implying staff are working themselves in such fields) across most of the field of research codes under 04 Earth Sciences (now 37 Earth Science) (Figure 14). Sub-codes 0402 Geochemistry, 0403 Geology and 0406 Physical Geography and Environmental Geoscience are well-supported across the sector, whereas 0404 Geophysics has fewer departments with capabilities in more than one or two sub-fields.

There are some discrepancies between the span of disciplines indicated by the various departments and the fields where there were sufficient research outputs to be evaluated as part of the ARC ERA exercise in 2015 (Appendix 3).

Research funding

The principal sources of competitive funding for geoscience research are ARC grants (Discovery, Linkage, LIEF, Centres of Excellence, and various fellowship schemes) and the Cooperative Research Centres program. Nearly every university that maintains a geoscience department or group and delivers geoscience teaching programs has participated in one or more of the ARC CoEs or CRCs. There is substantial direct funding of research by companies in the geosciences. The ARC Centres of Excellence (CoE) program currently supports the CoE for Climate Extremes and the CoE for Australian Biodiversity and Heritage, with some geoscience content.

The MinEx CRC is being funded from 2018-2027 with $90M cash and over $130M in-kind support from industry and government partners[25]. A number of Linkage Infrastructure, Equipment and Facilities (LIEF) grants have been awarded to consortia of geoscience groups from a number of universities, including the $10m LIEF grant to fund the Australian and New Zealand IODP Committee (ANZIC) membership of the International Ocean Discovery Program. It has also funded major analytical instruments at various universities.

Within science, geoscience accounts for ~10% of the grants (Figure 15) and of this the largest proportion goes to geology followed by geochemistry. With ~5% of the overall ARC funding (excluding LIEF grants), significant income from other National Competitive Grants Schemes and other funding sources, geoscience is a major contributor to university research productivity and reputation. Most universities are therefore willing to underwrite the cost of delivery of geoscience programs and infrastructure via cross-subsidies.

[24] https://www.dese.gov.au/higher-education-loan-program/resources/2022-allocation-units-study-funding-clusters.
[25] https://minexcrc.com.au/about-minex-crc/what-is-minex-crc/

University rankings

Universities are very protective of their reputations and international rankings. This influences the choice of staff and students (especially international) as to the university they would like to work or study at. Many international students will not enrol in a university unless it is ranked in the top 100.

There is a large array of university quality and reputation ranking systems, including QS, ARWU, Times Higher Education, Excellence in Research Australia (ERA) and the Leiden. These tend to be research-dominated. Universities are becoming more concerned with educational rankings and performance including the Quality Indicators for Learning and Teaching student evaluation surveys (QILT-SES), course experience surveys, graduate outcomes and various internal university evaluation systems. In most cases, geoscience is grouped within larger physical sciences clusters.

Although only half of the Australian universities had sufficient research outputs in 04 Earth Sciences to be evaluated by the 2018 ARC ERA assessment[26], 11 universities were determined to be above world standard, six well above world standard, and none below world standard (Appendix 3). Some geoscience research outputs are incorporated into the environmental science cluster.

In the 2017 QS subject rankings (Table 4), Australia performed very well in the earth and marine sciences with 12 in the top 100 world-wide, led by ANU (14th), UWA (30th), UNSW (35th), Curtin (40th), Melb (42nd), Sydney (50th). JCU, UQ, MacQ, UTas, Adelaide and Monash were grouped in the 51–100th bracket and UoW in the 151-200th bracket. In the more complicated ARWU rankings, ANU (30th), Curtin (47th) and UNSW (49th) were ranked in the top 50, Monash and UWA in the 51-75 bracket and MacQ, Adelaide, UTas and Melbourne in the 76-100 bracket. These are spectacular result for the earth sciences when compared with other science disciplines in Australia.

[26] ARC, 2015. Outcomes of the 2015 ERA (Excellence in Research Australia). Australian Research Council, Canberra. www.arc.gov.au/era-outcomes-2015.

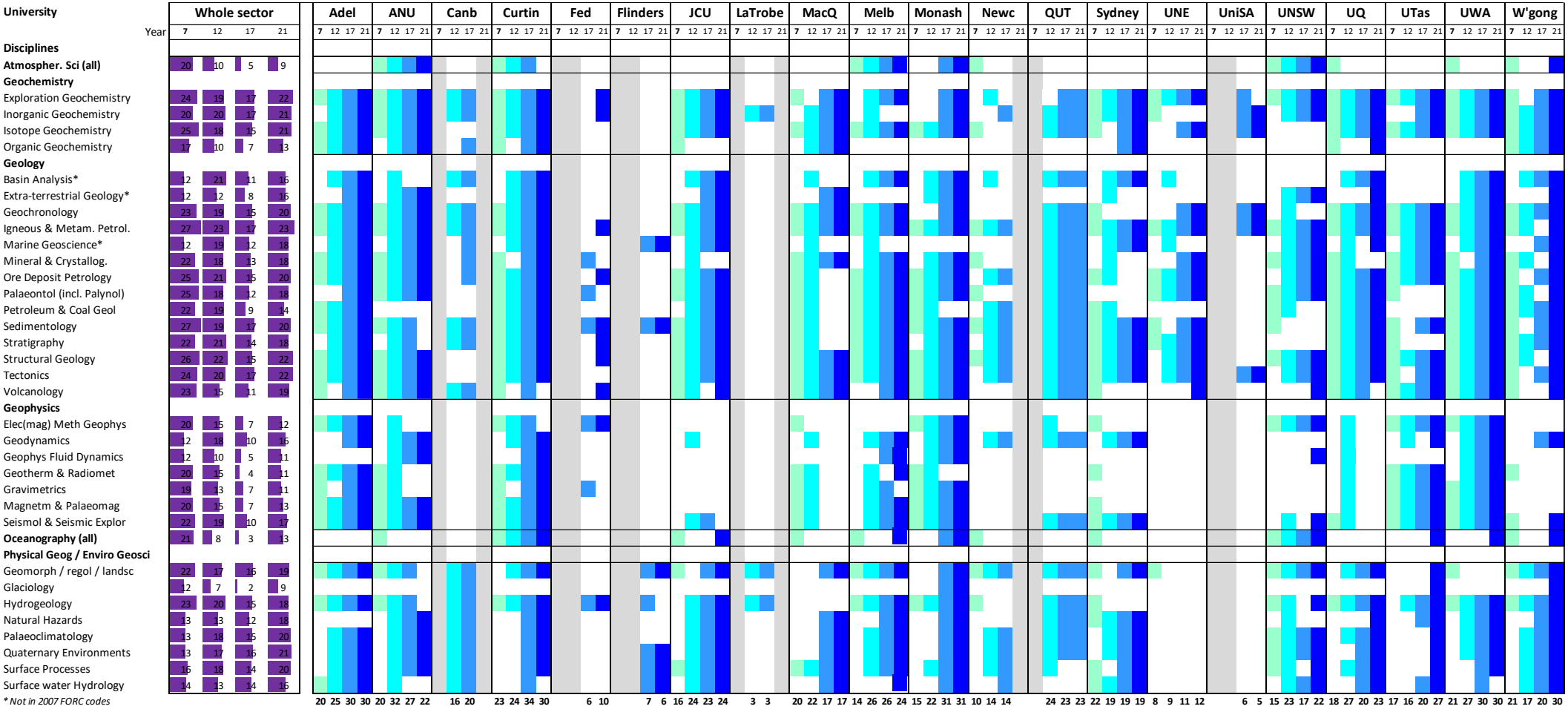


Figure 14. Profile of capability at surveyed Australian universities to supervise geoscience theses in the 2007, 2012, 2017 and this survey. * indicates not listed in 2007 filed of research codes. Grey columns indicated no data.

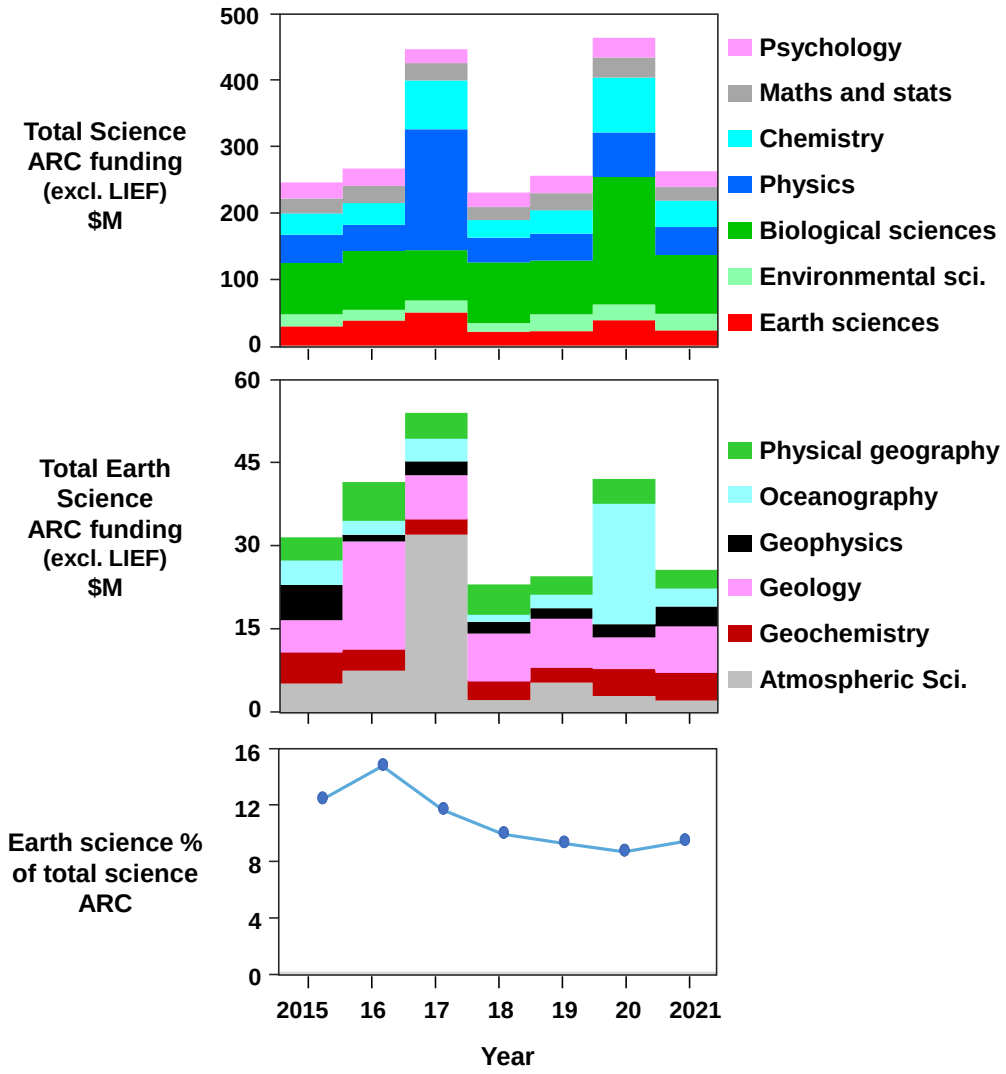


Figure 15. Changes in ARC funding for Discovery, Linkage and Centres of Excellence programs for the period 2003–2017 by main disciplinary clusters, two-digit and four-digit (geoscience) FOR codes, and relative portion of funding for the earth sciences.[27] Hydrogeology funding is distributed within other categories.

[27] ARC, 2003–2018. Research funding outcomes for the ARC National Competitive Grants Scheme. Australian Research Council, Canberra. www.arc.gov.au/grants-dataset.

Table 4. QS World university rankings for earth and marine sciences and ARWU for selected leading universities, and those Australian universities in the top 100 by the QS ratings system (QS, 2022, ARWU 2022)[28] [29].

QS rank	University	Overall	Reputation Academic	Reputation Employer
1	ETH	96.3	100	92.4
2	Harvard	95.0	91.0	100
3	MIT	94.3	95.1	97.5
4	Cambridge	93.9	93.5	96.6
5	UC Berkley	93.7	92.1	92.4
6	Caltech	93.5	90.9	86.5
7	Oxford	93.1	92.8	97.4
8	Stanford	92.6	92.6	96.4
9	Columbia	92.0	88.8	77.3
10	Washington	91.8	84.2	75.2
14	ANU	89.0	87.9	83.6
30	UWA	85.4	80.7	81.1
35	UNSW	84.3	79.1	87.1
40	Curtin	84.0	91.0	78.4
42	Melbourne	83.6	79.3	84.5
50	Sydney	82.8	77.2	78.1
51-100	James Cook		87.3	85.0
51-100	Macquarie		70.2	70.9
51-100	Monash		73.6	79.3
51-100	Adelaide		72.1	78.1
51-100	Queensland		80.2	87.7
51-100	UTasmania		76.9	64.1
151-200	Wollongong		87.0	60.1

ARWU rank	University	Overall Score
1	U Colorado (Boulder)	376.0
2	Caltech	352.8
3	Columbia	336.2
4	Cambridge	324.6
5	UC San Diego	306.8
6	MIT	295.6
7	Princeton	289.3
8	ETH	272.7
9	Harvard	260.7
10	Sorbonne	252.3
30	ANU	212.0
47	Curtin	198.2
49	UNSW	197.2
51-75	Monash	*Not reported*
51-75	UWA	
76-100	Macquarie	
76-100	Adelaide	
76-100	Melbourne	
76-100	Tasmania	
101-150	Queensland	
201-300	James Cook	
201-300	Newcastle	
201-300	Sydney	
201-300	UTS	
201-300	Wollongong	
301-400	Flinders	
301-400	Griffith	
301-400	QUT	
301-400	Southern Cross	
401-500	Western Sydney	

[28] QS, 2017. The QS World University Rankings. https://www.topuniversities.com/university-rankings/world-university-rankings/2022.

[29] ARWU, 2022. Academic Ranking of World Universities. Global Ranking of Academic Subjects. https://www.shanghairanking.com/rankings/gras/2022.

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Melbourne	A/Prof Sandra McLaren
Monash	A/Prof Ruth Reef
QUT	Dr Luke Nothdurft
Sydney	A/Prof Derek Wyman
UNE	Dr Luke Milan
UniSA	A/Prof Justin Payne
UNSW	Prof David Cohen
UQ	A/Prof Mark Kendrick
UTas	Prof Sebastien Meffre
UWA	Prof Annette George
Wollongong	Dr Lloyd White

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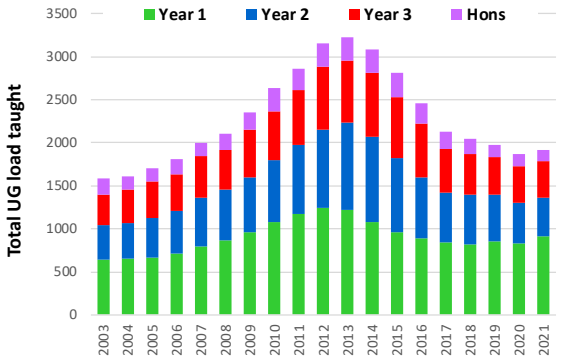
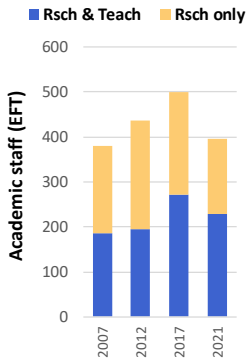
Appendix 1: Data dashboards for AGC universities survey, with results presented for whole sector and for universities clustered into resource intensive and resource non-intensive states.

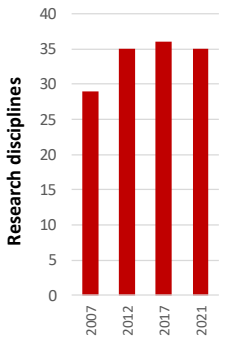
WHOLE SECTOR

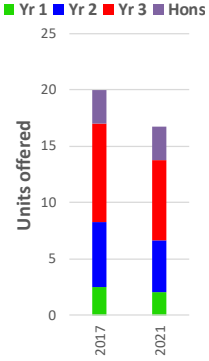
2003-2021 Australian Geoscience Tertiary Education Profile

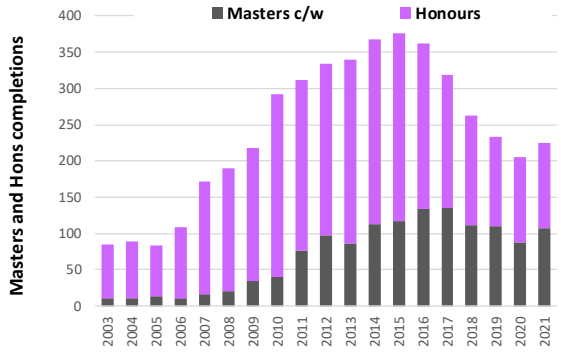
Disciplines	2007	2012	2017	2021
Atmospher. Sci (all)				
Geochemistry				
Exploration Geochemistry				
Inorganic Geochemistry				
Isotope Geochemistry				
Organic Geochemistry				
Geology				
Basin Analysis				
Extra-terrestrial Geology				
Geochronology				
Igneous and Metam. Petrol.				
Marine Geoscience				
Mineral and Crystallog.				
Ore Deposit Petrology				
Palaeontol (incl. Palynol)				
Petroleum and Coal Geol				
Sedimentology				
Stratigraphy				
Structural Geology				
Tectonics				
Volcanology				
Geophysics				
Elec(mag) Meth in Geophys				
Geodynamics				
Geophys Fluid Dynamics				
Geotherm and Radiomet				
Gravimetrics				
Magnetism and Palaeomag				
Seismol and Seismic Explor				
Oceanography (all)				
Physical Geog / Enviro Geosci				
Geomorph / regol / landsc				
Glaciology				
Hydrogeology				
Natural Hazards				
Palaeoclimatology				
Quaternary Environments				
Surface Processes				
Surface water Hydrology				

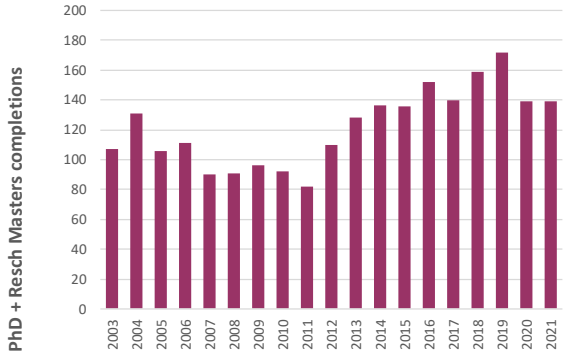












Staff		2007 Total	2007 R&T (Univ)	2007 R&T (Ext)	2007 RO (Univ)	2007 RO (Ext)	2012 Total	2012 R&T (Univ)	2012 R&T (Ext)	2012 RO (Univ)	2012 RO (Ext)	2017 Total	2017 R&T (Univ)	2017 R&T (Ext)	2017 RO (Univ)	2017 RO (Ext)	2021 Total	2021 R&T (Univ)	2021 R&T (Ext)	2021 RO (Univ)	2021 RO (Ext)
	Professor (level E)	**75.2**	35.2	2.5	22.5	15.0	**95.8**	50.6	3.0	21.2	21.0	**95.5**	65.1	7.6	14.2	8.6	**102.4**	80.8	0.5	15.1	6.0
	Associate Professor (level D)	**53.1**	38.7	1.0	2.0	11.4	**75.5**	49.5	0.0	12.5	13.5	**79.9**	59.0	7.0	4.8	9.2	**55.7**	46.0	2.0	2.0	5.7
	Senior Lecturer (level C)	**107.3**	63.1	2.5	12.5	29.2	**89.4**	40.3	1.5	13.0	34.6	**77.0**	46.4	5.6	7.1	18.0	**74.8**	52.6	0.4	4.7	17.1
	Lecturer (level B)	**108.0**	29.2	5.5	14.9	58.5	**128.0**	42.1	5.0	24.5	56.4	**162.6**	63.7	10.1	17.7	71.0	**103.8**	33.5	5.3	15.0	50.0
	Associate Lecturer (level A)	**36.7**	4.9	2.3	4.5	25.0	**48.9**	2.1	1.0	9.5	36.3	**84.1**	5.2	1.0	12.5	65.4	**60.1**	2.5	6.0	11.0	40.6
	Total	**380.2**	**171.1**	**13.8**	**56.4**	**139.0**	**437.5**	**184.6**	**10.5**	**80.7**	**161.7**	**499.0**	**239.4**	**31.3**	**56.2**	**172.1**	**396.7**	**215.4**	**14.2**	**47.8**	**119.4**

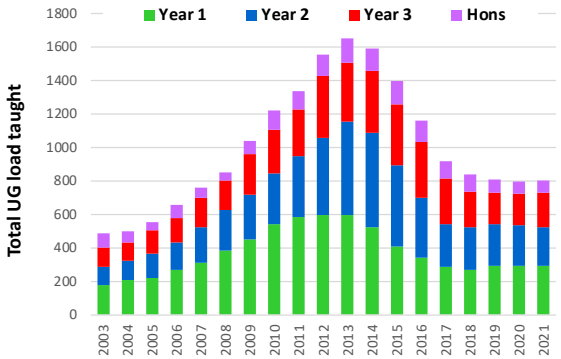
Enrolments		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Undergraduate teaching load (EFTSL)	Yr 1	646	654	665	712	792	864	961	1084	1172	1243	1221	1081	962	894	840	818	849	832	911
	Yr 2	398	419	464	496	569	593	636	712	806	910	1020	995	863	709	585	580	554	475	449
	Yr 3	356	379	419	430	485	465	551	573	635	733	717	734	707	619	507	476	434	417	427
	Hons	183	162	152	176	152	189	203	266	247	269	267	279	280	241	195	173	134	142	133
	Total Undergraduate	**1583**	**1614**	**1700**	**1814**	**1998**	**2111**	**2351**	**2635**	**2860**	**3155**	**3225**	**3089**	**2812**	**2464**	**2127**	**2046**	**1971**	**1865**	**1920**
Graduations from geosci. UG majors / Hons	BSc - geosci major	97	107	120	126	345	362	404	435	487	604	551	575	603	527	454	442	406	401	399
	BSc (Hons)	75	79	71	98	156	169	184	252	235	236	253	254	259	228	183	151	124	117	118
	Total	172	186	191	224	501	531	588	687	722	840	804	830	861	755	637	593	530	518	517
Graduations from PG programs.	Masters by research	22	33	22	21	15	15	13	15	16	14	24	24	25	39	31	42	26	22	19
	Masters by coursework	10	10	13	10	16	21	34	40	77	98	86	113	117	134	135	112	110	88	107
	Other (eg GradDip)																			
	PhD	85	98	84	90	75	76	83	77	66	96	105	113	112	113	109	117	146	117	120

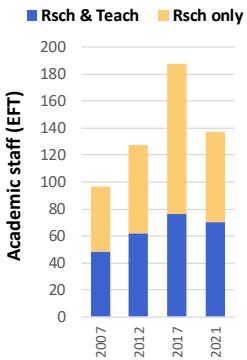
Units offered (ave)	
2017	2021
3	2
6	5
9	7
3	3
20	**17**

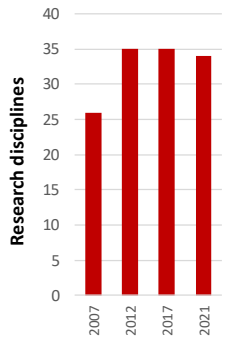
CLUSTER OF UNIVERSITIES IN RESOURCE INTENSIVE STATES

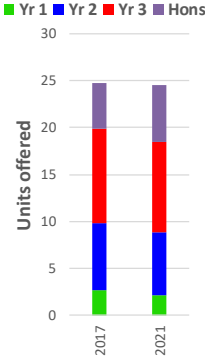
2003-2021 Australian Geoscience Tertiary Education Profile

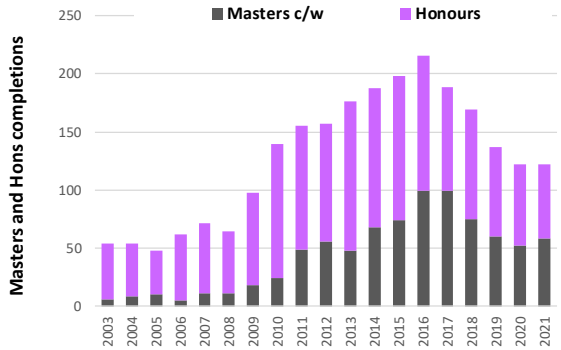
Disciplines	2007	2012	2017	2021
Atmospher. Sci (all)				
Geochemistry				
Exploration Geochemistry				
Inorganic Geochemistry				
Isotope Geochemistry				
Organic Geochemistry				
Geology				
Basin Analysis				
Extra-terrestrial Geology				
Geochronology				
Igneous and Metam. Petrol.				
Marine Geoscience				
Mineral and Crystallog.				
Ore Deposit Petrology				
Palaeontol (incl. Palynol)				
Petroleum and Coal Geol				
Sedimentology				
Stratigraphy				
Structural Geology				
Tectonics				
Volcanology				
Geophysics				
Elec(mag) Meth in Geophys				
Geodynamics				
Geophys Fluid Dynamics				
Geotherm and Radiomet				
Gravimetrics				
Magnetism and Palaeomag				
Seismol and Seismic Explor				
Oceanography (all)				
Physical Geog / Enviro Geosci				
Geomorph / regol / landsc				
Glaciology				
Hydrogeology				
Natural Hazards				
Palaeoclimatology				
Quaternary Environments				
Surface Processes				
Surface water Hydrology				

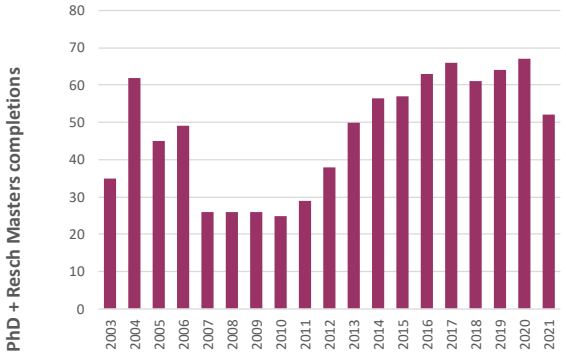












Staff		2007 Total	2007 R&T (Univ)	2007 R&T (Ext)	2007 RO (Univ)	2007 RO (Ext)	2012 Total	2012 R&T (Univ)	2012 R&T (Ext)	2012 RO (Univ)	2012 RO (Ext)	2017 Total	2017 R&T (Univ)	2017 R&T (Ext)	2017 RO (Univ)	2017 RO (Ext)	2021 Total	2021 R&T (Univ)	2021 R&T (Ext)	2021 RO (Univ)	2021 RO (Ext)
	Professor (level E)	**19.4**	8.9	1.0	5.0	4.5	**36.0**	25.2	3.0	0.5	7.3	**42.8**	23.2	4.6	10.7	4.3	**48.7**	34.8	0.0	11.9	2.0
	Associate Professor (level D)	**19.3**	12.7	1.0	1.0	4.6	**20.0**	17.0	0.0	0.0	3.0	**31.4**	22.0	1.0	2.8	5.7	**21.7**	16.0	1.0	2.0	2.7
	Senior Lecturer (level C)	**31.4**	21.6	0.5	0.5	8.8	**36.0**	17.4	1.0	5.0	12.6	**35.6**	21.2	0.6	6.6	7.3	**36.7**	27.8	0.4	3.2	5.3
	Lecturer (level B)	**42.0**	13.2	1.5	6.4	21.0	**59.5**	23.0	3.0	14.5	19.0	**79.6**	25.4	5.5	12.6	36.0	**54.2**	15.0	0.0	11.0	28.2
	Associate Lecturer (level A)	**14.7**	3.4	2.3	0.3	8.7	**20.6**	1.6	0.0	4.0	15.0	**43.2**	1.2	0.0	6.3	35.8	**22.4**	0.0	0.0	5.0	17.4
	Total	**126.8**	**43.2**	**5.0**	**12.2**	**36.0**	**172.1**	**56.2**	**6.0**	**22.5**	**42.5**	**232.6**	**67.5**	**8.5**	**31.8**	**80.0**	**183.6**	**68.9**	**1.4**	**24.1**	**42.7**

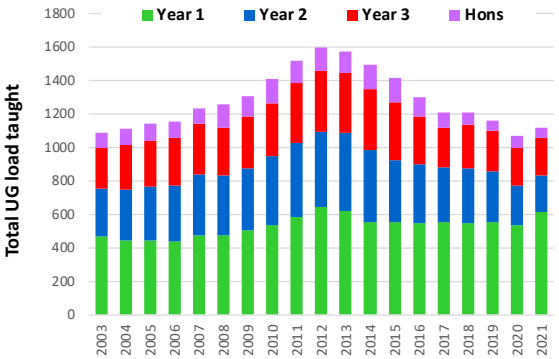
Enrolments		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Undergraduate teaching load (EFTSL)	Yr 1	179	210	221	271	314	388	453	545	585	597	596	525	409	343	287	267	294	294	293
	Yr 2	109	115	143	161	208	237	268	301	364	461	557	564	487	360	255	256	248	240	233
	Yr 3	114	110	142	145	180	177	238	259	279	370	356	370	363	331	271	213	192	189	203
	Hons	89	66	51	81	60	53	83	119	112	127	142	135	137	128	106	102	77	73	73
	Total Undergraduate	**491**	**501**	**557**	**658**	**762**	**855**	**1042**	**1224**	**1340**	**1555**	**1651**	**1594**	**1397**	**1162**	**919**	**837**	**810**	**796**	**802**
Graduations from geosci. UG majors / Hons	BSc - geosci major	30	35	40	45	91	123	145	189	178	247	341	338	365	322	284	227	195	174	179
	BSc (Hons)	48	46	38	57	60	53	80	116	106	101	128	120	124	117	90	94	77	70	64
	Total	78	81	78	102	151	176	225	305	284	348	469	458	489	439	374	321	272	244	243
Graduations from PG programs.	Masters by research	8	21	7	10	4	4	4	7	7	5	10	11	12	17	15	10	10	8	9
	Masters by coursework	6	8	10	5	11	11	18	24	49	56	48	68	74	99	99	75	60	52	58
	Other (eg GradDip)																			
	PhD	27	41	38	39	22	22	22	18	22	33	41	46	46	46	51	51	54	59	43

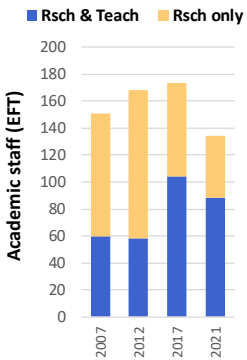
Units offered (ave)	
2017	2021
3	2
7	7
10	10
5	6
25	**25**

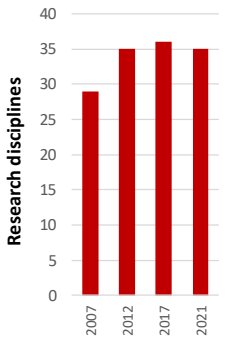
CLUSTER OF UNIVERSITIES IN RESOURCE NON-INTENSIVE STATES

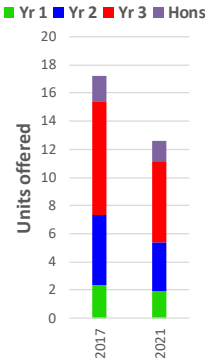
2003-2021 Australian Geoscience Tertiary Education Profile

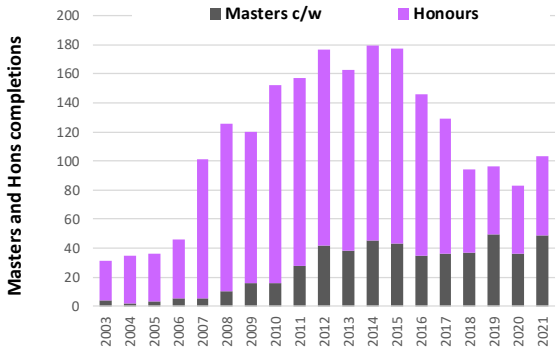
Disciplines	2007	2012	2017	2021
Atmospher. Sci (all)				
Geochemistry				
Exploration Geochemistry				
Inorganic Geochemistry				
Isotope Geochemistry				
Organic Geochemistry				
Geology				
Basin Analysis				
Extra-terrestrial Geology				
Geochronology				
Igneous and Metam. Petrol.				
Marine Geoscience				
Mineral and Crystallog.				
Ore Deposit Petrology				
Palaeontol (incl. Palynol)				
Petroleum and Coal Geol				
Sedimentology				
Stratigraphy				
Structural Geology				
Tectonics				
Volcanology				
Geophysics				
Elec(mag) Meth in Geophys				
Geodynamics				
Geophys Fluid Dynamics				
Geotherm and Radiomet				
Gravimetrics				
Magnetism and Palaeomag				
Seismol and Seismic Explor				
Oceanography (all)				
Physical Geog / Enviro Geosci				
Geomorph / regol / landsc				
Glaciology				
Hydrogeology				
Natural Hazards				
Palaeoclimatology				
Quaternary Environments				
Surface Processes				
Surface water Hydrology				

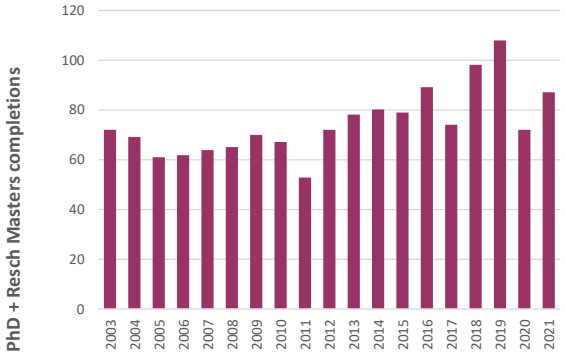












Staff		2007 Total	2007 R&T (Univ)	2007 R&T (Ext)	2007 RO (Univ)	2007 RO (Ext)	2012 Total	2012 R&T (Univ)	2012 R&T (Ext)	2012 RO (Univ)	2012 RO (Ext)	2017 Total	2017 R&T (Univ)	2017 R&T (Ext)	2017 RO (Univ)	2017 RO (Ext)	2021 Total	2021 R&T (Univ)	2021 R&T (Ext)	2021 RO (Univ)	2021 RO (Ext)
	Professor (level E)	**55.8**	26.3	1.5	17.5	10.5	**59.8**	25.4	0.0	20.7	13.7	**52.7**	41.9	3.0	3.5	4.3	**53.7**	46.0	0.5	3.2	4.0
	Associate Professor (level D)	**33.8**	26.0	0.0	1.0	6.8	**55.5**	32.5	0.0	12.5	10.5	**48.5**	37.0	6.0	2.0	3.5	**34.0**	30.0	1.0	0.0	3.0
	Senior Lecturer (level C)	**75.9**	41.5	2.0	12.0	20.4	**53.4**	22.9	0.5	8.0	22.0	**41.4**	25.2	5.0	0.5	10.7	**38.1**	24.8	0.0	1.5	11.8
	Lecturer (level B)	**66.0**	16.0	4.0	8.5	37.5	**68.5**	19.1	2.0	10.0	37.4	**83.0**	38.3	4.6	5.1	35.0	**49.6**	18.5	5.3	4.0	21.8
	Associate Lecturer (level A)	**22.0**	1.5	0.0	4.2	16.3	**28.3**	0.5	1.0	5.5	21.3	**40.9**	4.0	1.0	6.3	29.6	**37.7**	2.5	6.0	6.0	23.2
	Total	**253.4**	**55.3**	**4.5**	**28.5**	**62.5**	**265.4**	**55.5**	**3.0**	**30.9**	**78.5**	**266.4**	**87.3**	**16.9**	**10.4**	**59.1**	**213.1**	**76.3**	**12.3**	**8.7**	**36.8**

Enrolments		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Undergraduate teaching load (EFTSL)	Yr 1	467	444	444	441	478	476	508	539	587	646	624	556	552	551	553	551	555	537	618
	Yr 2	289	304	321	335	361	356	368	411	442	449	463	431	376	349	330	324	306	235	217
	Yr 3	242	269	277	285	305	288	313	314	356	363	361	364	344	289	236	263	242	229	224
	Hons	94	96	101	95	92	136	120	147	135	142	125	144	143	113	89	71	58	69	61
	Total Undergraduate	**1092**	**1113**	**1143**	**1156**	**1236**	**1256**	**1309**	**1411**	**1520**	**1600**	**1574**	**1495**	**1415**	**1302**	**1208**	**1209**	**1161**	**1069**	**1119**
Graduations from geosci. UG majors / Hons	BSc - geosci major	67	72	80	81	254	239	259	246	309	357	210	237	238	205	170	215	211	227	220
	BSc (Hons)	27	33	33	41	96	116	104	136	129	135	125	134	135	111	93	57	47	47	54
	Total	94	105	113	122	350	355	363	382	438	492	335	372	372	316	263	272	258	274	274
Graduations from PG programs.	Masters by research	14	12	15	11	11	11	9	8	9	9	14	13	13	22	16	32	16	14	10
	Masters by coursework	4	2	3	5	5	10	16	16	28	42	38	45	43	35	36	37	50	36	49
	Other (eg GradDip)																			
	PhD	58	57	46	51	53	54	61	59	44	63	64	67	66	67	58	66	92	58	77

Units offered (ave)	
2017	2021
2	2
5	3
8	6
2	1
17	**13**

Appendix 2: AGTEP survey questionnaire

Australian Geoscience Council Inc.

The Council of Earth Science Societies in Australia

Australian Geoscience Tertiary Education Profile

Profile 2021

Thank you for participating in the 2021 AGC survey.

Your feedback is important.

The following questionnaire is designed to extend the Australian Geoscience Tertiary Education Profile as a health check on our national geoscience teaching capability. The AGC conducted the first survey in 2007 due to concern about ability of the higher educational system to provide the number of appropriately trained geoscientists required by the economy, and the capability to generally educate Australian society about the geoscience into the future. This, the fifth AGC survey, is intended to extend these previous surveys and to provide an updated authoritative reference on ongoing geoscience trends in Australian Universities. The data will be used by the AGC in advocacy on geoscience matters. The report of previous surveys can be found at:

www.agc.org.au

The purposes of the survey are to:

Obtain an overview of the issues currently confronting Tertiary geoscience education including the supply of geoscience graduates.

Determine the status of the various teaching departments or schools offering geosciences.

Ascertain where undergraduate majors and postgraduate programs are currently offered.

Determine what geoscience is being offered as part of a broader environmental or other science program.

As with previous AGC surveys, the results will be publically accessible through the AGC website.

Specific data provided by universities (Qs 1 to 15) will be presented with the universities identified (unless individual universities request some or all of their institutional data be kept confidential, in which case the data will only form part of the summative data for the sector).

Information supplied in the open-ended responses will be kept strictly confidential by AGC. The comments will not be attributed to you or your institution. The comments will only be used to help form a general overview of the sector and emerging issues.

Data collected in this survey will be added to the database similarly collected in 2007, 2010, 2012 and 2017 by the AGC.

The results of this survey will be included in a report by the AGC that will be distributed to all participating institutions, AGC members institutions and may be presented publically.

The survey does not involve collection of data relating to any individuals (staff or students).

Questions may be directed to Prof David Cohen (President of the AGC) at d.cohen@unsw.edu.au, or Prof Ian Fitzsimons (Chair of the Heads of Geoscience Schools Forum) at i.fitzsimons@curtin.edu.au.

Australian Geoscience Council Inc.

The Council of Earth Science Societies in Australia

AGC

Australian Geoscience Tertiary Education Profile

Department /School and Institution:

Person completing the survey:

A. Current Geoscience Undergraduate Educational Offerings

Q1 Are you able to teach undergraduate (AQF level 7) and/or honours (AQF level 8) degree programs directed at or containing majors within the geosciences? (if no, go to Q. 2)

☐ Yes
☐ No

If there are specific majors, please indicate all degrees and contained majors.

Degree	Major #1	Major #2	Major #3

Notes on nomenclature:

"Subjects" denotes specific discipline offerings such as "Introduction to Mineralogy" and is equivalent to the term **"Courses"** in some institutions.

"Majors" denotes a set of subjects leading to a specific disciplinary naming such as "Geology" or "Earth Sciences" within a degree, and is equivalent to the terms **"Specialisation"** or **"Stream"** in some institutions. It may be the name of the honours program.

"Degree" should be taken as the normal meaning such as "BSc" or "BSc(Hons) ,and maybe referred to as a "Program" in some institutions.

"Geosciences" denotes areas of study that would **allow** graduates from a program to gain membership of umbrella geoscientific learnéd or professional societies such as the Geological Society of Australia, the Australian Institute of Geoscientists or the Australasian Institute of Mining and Metallurgy.

Q2 If geoscience subjects are offered as part of a more general science or other degree, please indicate the degrees on offer.

Degree

Q3 Please outline any formal arrangements with other institutions to jointly deliver geoscience majors or degrees.

Q4 Have any specific actions been taken in the last 3 years to address skills gaps (actual or perceived) in undergraduate majors or degrees in areas of geoscience related to industry and the work of public institutions?

Q5 Please indicate any changes that will or are likely to affect your undergraduate offerings (subjects through to degrees) in the next three years.

Q6 Does your school/department have an outreach or liaison program to stimulate interest in geoscience in the broader community and potential students in the geosciences?

☐ Yes
☐ No

If yes, briefly outline such programs

B. Current Geoscience Postgraduate Educational Offerings

Q7 Are you able to offer masters level (AQF 9) degrees in the geosciences?

☐ Yes
☐ No

If Masters degrees are offered, are there areas of specialisation? If so, please give titles.

Q8 Are you able to offer PhD (AQF 10) degrees in the geosciences?

☐ Yes
☐ No

If PhD degrees are offered, please indicate the ABS Research Classification Codes in which research can be undertaken (you may indicate more than 1).

☐	**0401**	**Atmospheric Sciences (all sub-disciplines)**
	0402	**Geochemistry**
☐	40201	Exploration Geochemistry
☐	40202	Inorganic Geochemistry
☐	40203	Isotope Geochemistry
☐	40204	Organic Geochemistry
☐	40299	Geochemistry not elsewhere classified
	0403	**Geology**
☐	40301	Basin Analysis
☐	40302	Extra-terrestrial Geology
☐	40303	Geochronology
☐	40304	Igneous and Metamorphic Petrology
☐	40305	Marine Geoscience
☐	40306	Mineralogy and Crystallography
☐	40307	Ore Deposit Petrology
☐	40308	Palaeontology (incl. Palynology)
☐	40309	Petroleum and Coal Geology
☐	40310	Sedimentology
☐	40311	Stratigraphy (incl. Biostratigraphy and Sequence Stratigraphy)
☐	40312	Structural Geology
☐	40313	Tectonics
☐	40314	Volcanology
☐	40399	Geology not elsewhere classified
	0404	**Geophysics**
☐	40401	Electrical and Electromagnetic Methods in Geophysics
☐	40402	Geodynamics
☐	40403	Geophysical Fluid Dynamics
☐	40404	Geothermics and Radiometrics
☐	40405	Gravimetrics
☐	40406	Magnetism and Palaeomagnetism
☐	40407	Seismology and Seismic Exploration
☐	40499	Geophysics not elsewhere classified
☐	**0405**	**Oceanography (all sub-disciplines)**
	0406	**Physical Geography and Environmental Geoscience**
☐	40601	Geomorphology and Regolith and Landscape Evolution
☐	40602	Glaciology
☐	40603	Hydrogeology
☐	40604	Natural Hazards
☐	40605	Palaeoclimatology
☐	40606	Quaternary Environments
☐	40607	Surface Processes
☐	40608	Surface water Hydrology
☐	40699	Physical Geography and Environmental Geoscience not elsewhere classified
☐	**0499**	**Other Earth Sciences**

C. Staffing Profiles and General Resourcing

Q9 Please provide data on your current staffing profile **in the geosciences.**

Note: In multi-disciplinary schools please attempt to allocate FTE derived from the geosciences part of the school where possible

(a) University and externally funded research and teaching positions (FTE)

	University Funded		Externally Funded		Total
	Continuing	*Contract*	*Continuing*	*Contract*	
Prof (level E)					0
A/Prof (level D)					0
Snr Lect (level C)					0
Lecturer (level B)					0
A/Lect (level A)					0

(b) University and externally funded research-only or research intensive positions (FTE)

	University Funded		Externally Funded		Total
	Continuing	*Contract*	*Continuing*	*Contract*	
Prof (level E)					0
A/Prof (level D)					0
Snr Lect (level C)					0
Lecturer (level B)					0
A/Lect (level A)					0

(c) University and externally funded teaching-focussed positions (FTE)

	University Funded		Externally Funded		Total
	Continuing	*Contract*	*Continuing*	*Contract*	
Prof (level E)					0
A/Prof (level D)					0
Snr Lect (level C)					0
Lecturer (level B)					0
A/Lect (level A)					0
Demonstrators					0

(d) University and externally-funded research support and administration positions (FTE)

	University Funded		Externally Funded		Total
	Continuing	*Contract*	*Continuing*	*Contract*	
Technical					0
Administrative					0

Q10 Outline any significant changes to your university-funded staffing profile over the past five years.

Q11 Outline any significant anticipated changes to your university-funded staffing profile over the next three years.

Q12 Comment on any significant changes in staff teaching loads over the past three years.

Q13 Comment on any significant changes in resources, support and any other initiatives that have affected or will affect the quality of the education experience for students (both positive and negative).

Q14 Outline any direct or in-kind support your department or school receives from industry or government agencies (excluding competitive grants schemes such as ARC LIEF or NCRIS) for equipment or other infrastructure

D. Geoscience Enrolments and Graduate Outcomes

Q15 Please complete the following tables to enable a national perspective on geoscience graduate trends. In order to provide comparable data between institutions we would appreciate if you could you could provide total students load (EFTSL) in geoscience subjects at each level.

Note: Where possible, exclude "servicing" subjects such as "Geology for Engineers". Numbers should include students taking geoscience majors, other science students completing geoscience subjects and students enrolled as part of general education or free electives from anywhere in your institution.

(a) Undergraduate teaching load (EFTSL)

	2013	2014	2015	2016	2017	2017
						No of subjects offered
Year 1						
Year 2						
Year 3						
Honours						

(b) Graduations from undergraduate geoscience majors or degrees (at BSc or BSc(Hons) levels).

	2013	2014	2015	2016	2017
BSc - geosci major					
BSc (Hons)					

(c) Graduations from postgraduate programs (if actual data are not accessible, then estimate by dividing enrolments by average length of time taken to complete degrees in FTE).

	2013	2014	2015	2016	2017
Masters by research					
Masters by coursework					
Other (eg GradDip)					
PhD					

Any comments on the basis of the above calculations or reporting (e.g. difficulty in separating earth science from physical geography majors)?

Thank you for completing this AGC survey

Australian Geoscience Council Inc.

The Council of Earth Science Societies in Australia

AGC

Australian Geoscience Tertiary Education Profile

Any further general comments you MAY wish to make about the delivery of geocience programs at your institution including areas where your department/school intends to specialise, infrastructure provisions, capacity to deliver programs, educational trends, etc

These comments will be kept strictly confidential by AGC. The comments will not be attributed to you or your institution. The comments will only be used to help form a general overview of the sector and emerging issues.

Additional comments:

Additional comments (ctd):

Appendix 3: ERA rankings for the 2-digit and 4-digit earth science FOR codes for all Australian Universities in the 2018 ERA assessment.

Institution	04 Earth Sciences	0401 Atmospheric Sciences	0402 Geochemistry	0403 Geology	0404 Geophysics	0405 Oceanography	0406 Physical Geography & Environmental Geosci.
University of Adelaide	5		5	5	4		
Australian National University	5	5	5	5	5	4	5
University of Melbourne	5	5	5	5			5
Southern Cross University	5		5			5	
University of New South Wales	5	5		5		5	5
University of Tasmania	5		4	5	5	5	4
Curtin University Tech	4		5	5	3	4	4
James Cook University	4		4	5			4
Macquarie University	4	5	4	4	4		4
Monash University	4	5	5	4			4
University of Newcastle	4			4			5
University of Queensland	4		5	4			5
Queensland University Tech	4	4		5			
University of Sydney	4			5	5		4
University of New England	4			5			
University of Western Australia	4		4	5	4	5	4
University of Wollongong	4	5	4	5			4
Flinders University	3						4
Griffith University	3						4

5 Well above world standard
4 Above world standard
3 At world standard