

MINERALS INDUSTRY CAREERS. RICH IN DISCOVERY.

Professional Careers in the Minerals Industry
The Australasian Institute of
Mining and Metallurgy





Introduction – Careers In The Minerals Industry

Dear Career Seeker,

The minerals sector is one of the most diverse, stimulating and rewarding sectors in the world today. With a proud history built on achievement in a range of disciplines, the sector is experiencing unprecedented growth due to the increasing global demand for minerals commodities.

This growth is underpinned by innovative technologies and driven by professionals who seek exciting career and personal opportunities in a truly global industry. Minerals sector professionals enjoy not only financial rewards and professional advancement, but extensive travel, flexible working and living conditions and opportunities to work in remote, regional or international locations.

Depending on your interests and skills, you can gain experience in a variety of operations, including exploration, mining (extraction), processing, environmental sustainability, safety, community and indigenous relations, marketing, management and administration.

Graduate roles in the minerals sector are currently amongst the highest paid of all graduate jobs and provide the challenge necessary to utilise your skills and stretch your potential. Minerals sector professionals play a pivotal role in the development of sustainable business practices that meet our society's economic, social and environmental expectations.

If you want to make a difference and be valued for your contribution, then a career with the minerals sector may be a great option for you.

To plan a career with minerals, use this guide to explore the unique career paths and specialisations that are available across varied disciplines. We've included real stories from graduates who have built successful careers in the minerals sector – they're sure to inspire!

Regards

Michael Catchpole, MAusIMM
Chief Executive Officer
The Australasian Institute of Mining and Metallurgy



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Vacation Work, Graduate Employment, Salary and Course Information

Vacation Work

Vacation Work is an important part of your career development. Having vacation work often helps when it comes time to apply for jobs in the industry when you complete your tertiary studies. If you don't have it, it isn't the end of the world - but it is seriously recommended that you do.

In an industry with a workforce that is relatively small, getting your first (or only) vacation work position can be a competitive and daunting process. There are some things that you can do, that may make it easier not only to get vacation work but also your first job.

- 1. Learn about the industry** - Read industry journals and magazines. Subscribe to some of the email newsletters, read The AusIMM Bulletin and The AusIMM Week in Review. The more you know about the industry the easier it will be to talk to people who are working in it- ie; the people who may be able to help you find vacation work.
- 2. Think about what you would like to do in the industry** - Think about what you like about your studies and about where your strengths are technically and personally. Look at career paths, position descriptions and job advertisements on the internet and in newspapers. Then work out where the similarities are. It is OK to be interested in lots of different careers. The more you learn and the more understanding of the nature of the different opportunities you have may not help you decide what you want to do, but it will probably help you decide what you don't want to do.
- 3. Networking** - If you know about the industry and you have been thinking about how you could fit into it- it is much easier to talk to people about it. Tell people about yourself and what you are doing, be confident and be honest. Ask questions about what they do, ask who is the best person to talk to in their company. Sometimes asking to talk to someone with the aim of understanding more about what they do, and to talk about the options you have or are considering can help get your foot in the door or at least gets your resume recognised out of the 500 that are in the pile. Don't be afraid to ask for someone's business card and give them a call to have a chat. Go to AusIMM events, go to everything you can so that people start to know who you are and you know who they are.
- 4. Apply** - It might sound silly, but you have to be in it to win it. Ask someone to look at your resume that knows what employers are looking for. Ring the person coordinating the recruitment process and ask them questions about what the

work will involve, what you are interested in, etc. Learn about the companies and the work they do. Look for opportunities everywhere you can and put your hand up.

5. Be Proactive, Be Positive, Be Proud (not too proud) and Honest!

Looking for vacation work over the holidays? Get tips at <http://www.ausimm.com.au/Content/Default.aspx?ID=168>

Graduate Employment and Salary Information

For more information about the destinations and starting salaries for graduates in the minerals industry, visit the GradsOnline web resource, which can be found at: <http://www.gradsonline.edu.au>. GradsOnline provides state-by-state and gender breakdowns of industry activity, five year trends in graduate salaries and activities and salary comparisons with other fields of study.

You can also go to The Hays Salary Survey for a good indication of what salary you can expect to receive as a graduate in the minerals industry and what you can earn throughout your career – www.hays.com.au/salary/ and go to the Resources and Mining pdf file.

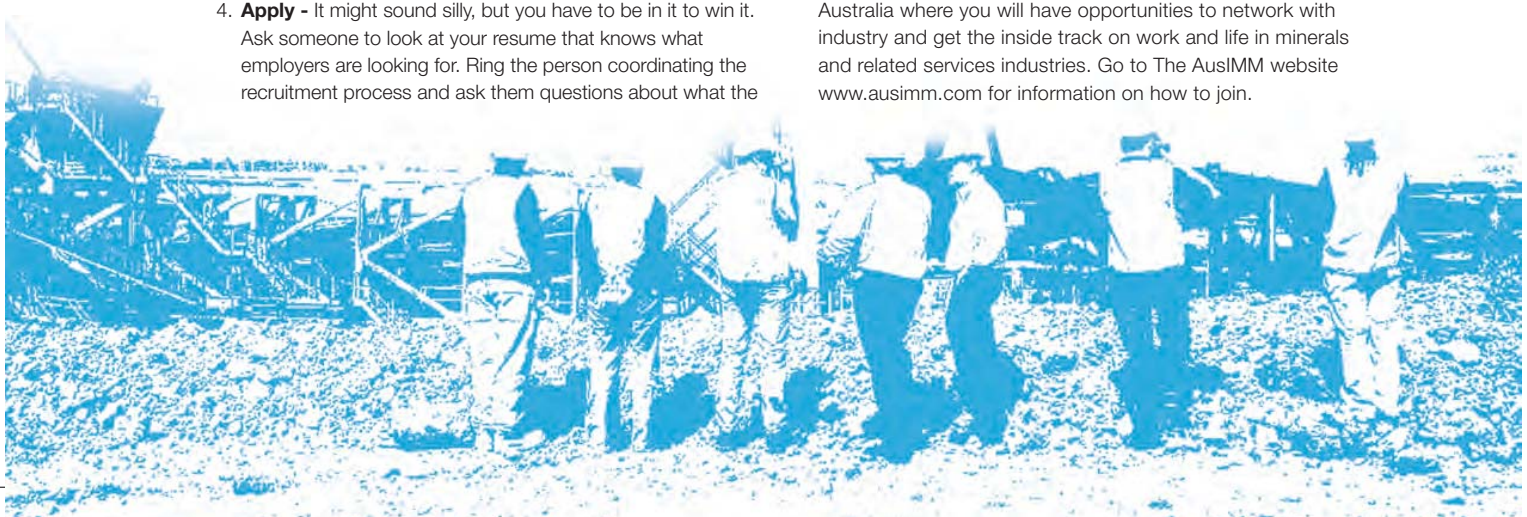
Minerals Industry Courses Offered in Australia

There are a myriad of programs and courses, from undergraduate level right through to Masters or PhD, that offer a range of skills applicable to the minerals sector. A list of undergraduate programs and courses related to the minerals industry and offered at Australian Universities, can be found on The AusIMM Careers webpage – link from www.ausimm.com

For a comprehensive list of all university programs, including honours, combined and double degrees and postgraduate programs, please visit the individual university school and department websites or www.myfuture.edu.au which allows prospective students to search for courses by Study Field, Industry, Attendance Mode, Entry Requirements, Education Level and Region.

The AusIMM Supporting Students

If you are a tertiary student and would like to know more about potential career paths in the Minerals sector, make sure you join The AusIMM as a student member. You will become part of a vibrant network of campus-based student chapters across Australia where you will have opportunities to network with industry and get the inside track on work and life in minerals and related services industries. Go to The AusIMM website www.ausimm.com for information on how to join.





Geoscientist

WHAT DO GEOSCIENTISTS DO?

Geoscientists study the nature, composition and structure of the earth to increase scientific knowledge, locate materials and minerals, and advise on the extraction of minerals, environmental protection and rehabilitation of land after mining. Geoscientists may specialise as a Field/Exploration Geologist, Geochemist/Mineralogist/Petrologist, Geomorphologist, Hydrogeologist/Hydrologist, Mathematical Geologist, Mine Geologist, Palaeontologist, Petroleum, Stratigrapher or a Structural Geologist.

Geoscientists may perform the following tasks:

- explore specific areas of the earth to work out its structure and the types of rocks or minerals that exist
- study rock cores, cuttings and samples
- study geostatistics and sampling theory
- study fossilised life forms and date rock strata
- study the nature and effects of natural events such as erosion, sedimentation, glaciation, earthquakes and volcanic hazards
- locate and manage ground water resources, investigate ground water contamination and land salinity
- undertake geochemical sampling of stream sediment and soils
- undertake ground magnetic and gravity surveys
- examine geological specimens in laboratories using optical, X-ray and electron microscope, chemical and mechanical techniques
- assist in determining the economics of extracting earth resources
- advise on the geological suitability of sites for structures such as tunnels, roads, coastal installations, bridges and water supply schemes
- contribute to environmental assessments such as land use, planning and rehabilitation, pollution studies and the seabed
- use computers to integrate and interpret data sets of geological information
- prepare geological models to describe processes and predict future situations
- prepare geological reports and maps.

Geoscientists work in laboratories, offices and in the field. They may work independently or as members of a mixed team of professional and non-professional staff. They may have contact with the public, especially if needing permission to go onto private land. Fieldwork can involve spending time in remote desert, tropical or Antarctic/arctic regions. The hours of work can be irregular and it may be necessary to spend long periods away from home.

WHAT ARE THE CAREER OPPORTUNITIES?

Geology is a rapidly expanding discipline, and geology graduates are now finding jobs in a variety of different areas. In addition to the traditional areas of mining and exploration, geoscientists are now employed in areas such as water quality, water resources, hazard and pollution monitoring, coastal zone management, urban and rural planning, and rehabilitation of mine sites.

Exploration Geologist

Field/Exploration Geologists carry out surveys and fieldwork to determine the geological structure, distribution and age of rocks; and can indicate where particular natural resources are likely to be found.

Mine Geologist - Open Pit

Open Pit Mine Geologists control the grade (or quality) of the ore mined and locate extensions to ore deposits, by deciding which areas of an ore body should be mined at a particular time in the open pit and defining the ore limits at the mine based on economic considerations. Open Pit mine geologists work above ground mapping, collecting and analysing samples.

Mine Geologist - Underground

Underground Mine Geologists control the grade (or quality) of the ore mined and locate extensions to ore deposits, by deciding which areas of an ore body should be mined at a particular time in underground developments defining the ore limits at the mine based on economic considerations. Underground mine geologists spend a lot of time mapping and collecting samples underground.

Computing/Mathematical Geologist

Computing/Mathematical Geologists predict the outcome of geological problems, by applying the most appropriate data and computer models to the geological information available.

Hydrogeologist

Hydrogeologists evaluate and manage the quality, quantity, reliability and sustainability of all aspects of water resources. Hydrogeologists are concerned with groundwater and the soil-moisture variation, amount, speed and direction of groundwater flow, extraction and replenishment of groundwater, water chemistry and pollution.

Geochemist/Mineralogist/Petrologist

Generally, geochemists are concerned with the distribution of elements in the earth with the aim of finding new mineral deposits (exploration application) or with the life cycles of elements. Geochemists study the mineral and chemical composition of rocks using equipment such as optical and electron microscopes, X-ray diffraction, atomic absorption and mass spectrometry. They may also be involved in examining the transport of pollutants through rock masses.



Academic/Research Geologist

Academic and Research geologists often work in universities or CRC's (cooperative research centres). Rather than looking primarily at the economic issues of how to mine most economically and locating the boundaries of ore deposits for this reason, academic and research geologists investigate why and how things behave the way they do or are the way they are.

Consulting Geologist

Consulting Geologists often work on many different projects and will probably be exposed to both underground and open pit mine geology. Consulting geologists are more likely to be based in urban centres and fly out to projects if necessary.

Geostatistician

Geostatisticians apply statistical methods to geological information to determine factors such as grade and mineral concentration in different volumes of rock mass. Geostatisticians tend to work in areas like resource estimation and reporting of resources and reserves. Geostatisticians are also involved with planning sampling programs.

Geophysicist

Geophysicists study physical aspects of the earth to determine its structure and composition, locate minerals, petroleum or ground water and to detect, monitor and forecast seismic, magnetic, electrical, thermal and oceanographic activity.

PROFILES

MARK NOPPÉ

BSc (Geol; Chem) BSc Hons (Geol) MSc (Exploration Geology) MAusIMM CPGeo Director, Regional Manager, Principal Consultant Geologist for Snowden Mining Industry Consultants Pty Limited

What have you enjoyed most about your profession(s)?

The challenge of problem solving and the satisfaction of scoping out and delivering a solution. These opportunities tend to be available in both operational and consulting roles, although the mix of routine and project-type work does differ. I also get satisfaction from sharing my experience in geology, geostatistics and resource estimation through training and mentoring assignments.

What are the negatives and low points in your career?

Very few. I can recall the frustration and uncertainty when I felt that I was not being sufficiently challenged or utilised, or could not see where my career was heading, but this is not unique to my profession.

For someone considering a career in your profession are there any words of wisdom to pass onto them?

It is important to gain solid practical experience before entering consulting because you will be engaged according to your ability, experience and track record. If you find yourself frustrated with where your career is going, try to find someone (a mentor?) in your organization who you can discuss your aspirations with. Keep your enthusiasm burning (it does show!) and pursue opportunities and appropriate new skills to get you where you want to be. Make your own luck!

DAVID BUSHELL

B.Sc (Hons) Geology; MAusIMM Senior Exploration Geologist, Iluka Resources Ltd.

What formal qualifications do you have?

I graduated from LaTrobe University in Bundoora (Vic) in mid 1996 with a Bachelor of Science (Honours) degree. I had previously (1987) completed an apprenticeship and have a qualification as an Instrument Technician from the Royal Melbourne Institute of Technology.

Do I have any regrets about how your career has developed?

I am happy with my career development so far. Iluka has allowed me to continue my training and personal development and I have gained a Diploma in Frontline Management. With the Murray Basin evolving from an exploration play to a mining district, my role is also evolving, and Iluka is also expanding its exploration base across the country which provides further opportunity.

What have you enjoyed most about your profession(s)?

I have worked in places that people pay to go for their holidays. I have seen some great sights and met some beautiful people. Technically, was luck enough to come into the Murray Basin while it was still in its infancy and have had many commercial and technical successes. I have made an effort to personally train as many new graduates as I could given the resources available and take pleasure in seeing them move off with their careers.

What are the negatives and low points in your career?

Living away from my wife put a strain on our relationship. That was hard work. Also, as with any job, administration often gets in the way of the part I love, being the geology.

DONNA FRATER - SENIOR GEOLOGIST

Projects Development Group BMA Coal

What formal qualifications do you have?

I have an Applied Science (Geology) degree with Honours from the University of NSW, and a MBA from the University of New England.

Why did you choose your particular career?

I wanted a challenging job that was more outdoors than inside, I also wanted to travel with work and my preference was to live in regional Australia.

Why did you choose your particular career?

I have worked both as a Mine Geologist (Iron Ore in WA, Coal in QLD and NSW) and in Exploration. I have worked in small coal exploration consultant groups and large mining companies in open cut coal mines in NSW and QLD and then been involved with a short term coal feasibility study in Zimbabwe and also all facets of exploration from Greenfield to short term exploration in coal in QLD.

What have you enjoyed most about your profession?

Being a geologist has allowed me to work in some fantastic places, to contribute to real success in my workplace and has provided a fantastic lifestyle of travel and meeting good people.

For someone considering a career in your profession are there any words of wisdom to pass on to them?

Make sure you understand the lifestyle choices you are making. The isolated communities we work in can be magnificent if they are places you want to be and not just for 2 or 3 years, a career in mining means regional living or transient living for 10 – 15 years or more.

NEIL SCHOFIELD

BSc Hons(Geol), MSc (Applied Earth Sciences) MAusIMM, MAIG Principal of Hellman and Schofield P.L. – Technical Consultants to the Minerals Industry

Why did you choose your particular career(s)?

One of my high school teachers suggested a career in geology even though it was not available at the school. For someone with a general interest in science, geology has a lot to offer because the various avenues of enquiry in geology touch many other areas of scientific interest from cosmology to biology and botany. And for the numerically challenged, geology gives the appearance of requiring fewer quantitative skills compared to the various avenues available in engineering. Later, computing and geostatistics presented an interesting challenge when I was looking for a change of career and a move away from the nomadic life of exploration. Advances in spatial numerical modelling and computing will help to provide the basis for the successful development of mining projects into the future.

What have you done?

My years in mineral exploration were spent throughout Papua New Guinea, Australia and Indonesia ranging over geologic terrains of all ages, in wet and dry climates, and involving exploration for a variety of metals in different mineralization styles. The experience of this variety provides an important basis for a career in the minerals industry. One is also exposed to a wide range of views regarding mineralization and its formation. The connection to the second part of my career came when working with a team of geologists in Sulawesi on a number of copper-gold porphyries. At the completion of an advanced exploration program, my limitations in resource evaluation became apparent. It has been possible to continue to expand my geological experience while working in the more specialized field of resource modelling and geostatistics. Like mine geology, resource modelling is more concerned with the detailed geometry and structure of mineral deposits compared to the broader picture that is the focus of exploration. The tools of geostatistics have broad application from resource modelling to ore control, ore sequencing and stockpiling. It is a field of ongoing research where new and important methods of problem solving are continuously evolving.

What have you enjoyed most about your profession(s)?

The opportunity for travel and experience both a variety of human cultures, climates and geological terrains are the highlights of a career in exploration. Real success in exploration is an elusive experience for

many geologists but the variety of life and friendships is the obvious benefit.

Resource modelling and the development of new approaches to the efficient exploitation of mineral resources present an interesting challenge and another view of both the mining industry and the application of scientific methods. It lacks some of the cultural richness of the exploration life but appears to have other compensations.

What are the negatives and low points in your career?

That big discovery that most explorationists hunger for, can be a long time coming. Taking responsibility for errors in your work in any career can be a little depressing.

For someone considering a career in your profession are there any words of wisdom to pass on to them?

If you are really interested in rocks and travelling around, exploration has a lot to offer. Broad experience in mineralization and mineral deposits is a useful background for a career in resource modelling and ore control.

KIRSTY CULVER

BSc (Applied Geology) (Honours)
Exploration Geologist – Jubilee Mines

Why did I choose my particular career(s)?

I chose geology because I was interested in science and geography at school and I didn't want to be stuck in an office all day everyday, I enjoy working outdoors.

What I have done?

I completed my degree and honours at Curtin University in 2001. I was employed by BHP Billiton in February 2002 as a graduate mine geologist working at Mt Whaleback, Newman. I worked as a mine geo for about a year in production before moving into the Reserve Definition Group (RDG). I spent a lot of time on a reverse circulation rig drilling orebodies around the Newman area - Orebodies 18 & 25, Jimblebar and updating geology and structural models. In May 2005 I got a job with Jubilee Mines as an exploration geologist at their Cosmos Nickel Project. Here I supervise drilling and everything else that goes along with it. There's lots of planning, updating and logging core, we have 6 diamond drill rigs at Cosmos drilling to the south of the mine so it keeps us all pretty busy.

Do I have any regrets about how my career has developed?

Regrets? There's no point thinking about what could've been, I'm happy with where I'm at and where I'm going and that's all that matters really.

What I have enjoyed most about your profession(s)?

I'd have to say just getting out, seeing the countryside, and also going out to the drill rig in the morning and there is a nice massive sulphide intersection in the core trays, that's exciting.

For someone considering a career in your profession are there any words of wisdom to pass on to them?

Do as much hands on / varied work as you can when you start out, that way you'll get an idea of how you want your career to progress.

TIM BERRYMAN

BSc University of Western Australia,
MAusIMM, Senior Mine Geologist - Kalgoorlie Consolidated Gold Mines

Why did you choose your particular career?

I chose a career in mine geology as I enjoy the challenge of the day to day mining environment where I get to perform not only geology duties, but to have interactions with most aspects of the mining cycle from production to milling. There is a great exposure to geology as pits and underground mines progress, allowing an increasing knowledge about deposits as they are mined.

What have you done so far in your career?

So far I have spent most of my career in mine geology, but have also spent a couple of years in exploration and a year in mine planning. These have ranged from small operations where I was the only geologist, to my current job at KCGM where I am part of a team of 20 geologists on site.

The sites have included tantalum mines near Port Headland and Darwin, an exploration camp in Sumatra, and mines in Kalgoorlie with Barrick (formerly Placer Dome) and 6 years at KCGM at the Superpit and Mt Charlotte underground.

What have you enjoyed most about your profession?

The best part of the job is being able to work with a wide variety of professionals and to combine both an outdoors element of hands on geology with the indoors element of geological modelling and planning.

For someone considering a career in your profession, are there any words of wisdom to pass on to them?

Mine geology is a practical application of geology in the field, and will be rewarding to people who love getting outdoors and working as part of a team with other geologists, engineers and production people.



Geotechnical/Geological Engineering

WHAT DOES A GEOTECHNICAL/GEOLOGICAL ENGINEER DO?

Geological engineers identify and try to solve problems involving soil, rock and groundwater, and design structures in and below the ground, using the principles of earth science and engineering. Geological engineering includes a number of ground engineering specialities such as geotechnical engineering, land remediation, rock mechanics, groundwater hydrology and engineering geology.

Geological engineers may perform the following tasks:

- investigate the engineering feasibility of planned new developments involving soil, rock and groundwater
- plan and undertake site investigations for proposed major engineering works such as bridges, dams and tunnels
- design measures to correct land contamination and salination
- design major structures in rock such as tunnels, basements and shafts
- supervise construction and performance of major engineering works involving the ground
- work out strategies to control landslides and areas of potential instability
- coordinate of multi-disciplinary study teams
- perform computer analyses, use computer databases and generate computer-aided designs.

Geological engineers may work with other professionals including environmental scientists, geologists and hydrologists on solving land degradation, groundwater and salination problems; with civil engineers in the design and construction of better transportation links; or with mining engineers in designing open-cut and underground mines, and on rehabilitation works on completion of mining. Geological engineers typically spend up to half of their working hours on field investigations and supervising construction of their designs. Responsibilities of the role typically include ensuring geotechnical activities are conducted safely in order to provide a safe working environment for employees and contractors in accordance with company standards and government legislation.

Geologists and Engineers (usually civil or mining) can do postgraduate study to specialise and work as geological/geotechnical engineers. Postgraduate study is often more flexible than undergraduate study to fit in with full time work.

Geotechnical Engineer - Open Pit

Open Pit Geotechnical Engineers have responsibility for operational ground control issues in the open pit where open pit mining methods are used. They collect geotechnical data on the rock mass; monitoring of the performance of the excavation slopes and installed support systems. They are responsible for the design, installation, maintenance and use of geotechnical instrumentation to assess the response of the rock mass to

the mining activities; and for the interpretation and reporting of data collected. Typically they will deal with slope stability issues, erosion and the effects of weather conditions on the pit stability.

Geotechnical Engineer - Underground

Underground Geotechnical Engineers have responsibility for operational ground control issues underground where different underground mining methods are used. Underground geotechnical engineers collect geotechnical data on the rock mass; monitor the performance of the excavations and installed support systems; design, install, maintain and use of geotechnical instrumentation to assess the response of the rock mass to the mining activities; and interpretation and reporting of data collected. Underground geotechnical engineers spend time underground in the mine investigating and designing against rock bursts and failing of the development's walls.

Geotechnical Engineer - Civil

Civil geotechnical engineers often inspect proposed construction sites to work out soil and foundation conditions by conducting drilling and sampling programs. They oversee and participate in field and laboratory testing of soils, make sure that test equipment and machinery is properly set up, prepare reports of test results and make recommendations for the solution of engineering problems identified in test reports. They can also prepare specifications of soil mixtures for use in roads, embankments and other construction, calculate and advise on the required slope at cuttings and the thickness of soil dams and retaining walls.

Geotechnical Engineer - Consulting

Consulting geotechnical engineers will often be exposed to both underground and open pit projects depending on the company they work for and their area of expertise. Consulting geotechnical engineers will often be based in coastal capital cities and fly to their projects as necessary. Depending on the company they work for they may also be involved in civil engineering and/or construction projects.

Geotechnical Engineer - Computing/Modelling

Geotechnical Engineers who specialise in computing and modelling often design and apply computer programs and models to characterise and predict rock and ground behaviour. The models often look at stress regimes and rock strength by looking at the rock properties and then varying the situation parameters whether they be geometrical, material etc. to see how the model responds to the changes.

Geotechnical Engineer - Academic/Research

Academic and research geotechnical engineers investigate why and how things behave the way they do or are the way they are rather than looking primarily at the economic issues of how to mine most economically and locating the boundaries of ore deposits for this reason. Academic and Research geotechnical engineers often work in universities or CRC's (cooperative research centres).

MARNIE PASCOE

BSc Geology (Hons) and working on finishing MEngSc Workplace Trainer / AssessorMAusIMM (CP)

Why did you choose your particular career?

At the time WMC Kambalda were looking for a geologist with a structural geology background who wanted to learn new things. I worked with an experienced rock mechanics engineer and did a lot of learning on the job. Since then I've found the job very interesting and rewarding with good advancement opportunities and diversity.

What have you done so far in your career?

I worked for 3 years at Kambalda as the "sorcerer's apprentice" providing a geotechnical service to the 15 or so Nickel and Gold Mines in the region. I then joined BHP Minerals' Cannington Project as part of the feasibility team and helped set up the Cannington Mine. I was there for 4 years and saw the mine go from feasibility project to producing mine. I moved to AMC Consultants in Melbourne and worked there for 5 years doing all sorts of project work on existing mines and working on scoping and feasibility studies as well as training courses for miners and technical staff. RMIT University engaged AMC to teach their 4th yr rock mechanics unit which I did for 4 years. I rejoined WMC at Olympic Dam as the Geotechnical Superintendent and was there for 3 years as part of the team that stabilised mine production and improved mine design and technical practices. Following the BHPBilliton takeover of WMC I now work for Exploration and Mining Technology as a technical expert providing support to mining operations and identifying and implementing new technologies to mining operations.

What have you enjoyed most about your profession(s)?

Working with a wide variety of people across the operation. Being involved in more than one discipline. The job requires that you have a sound working knowledge of all aspects of the mining operation to be able to contribute effectively. Being part of the group that often leads change in the workplace.

For someone considering a career in your profession, are there any words of wisdom to pass on to them?

Move around every 3 yrs or so (you need about this length of time to become really familiar with most aspects of the ground behaviour at a site) to broaden your experience of mining methods and conditions. Be prepared to sometimes be last in line for praise ie sometimes letting people "claim" your improvements as a way of getting them to change. Try not to say "I told you so" too many times. Learn to communicate your ideas effectively, the engineering is the easy bit, getting someone to do something they may not want to is the hard bit. Be open to review of your ideas and find a

mentor that will give you this input "without fear or favour".

STEVE WEBBER

Geotechnical Engineer, Consolidated Minerals, Beta Hunt Mine

What formal qualifications do you have?

B.Sc., (Physics), B.Sc. (hons), M.Sc. Both Geophysics all from Victoria University of Wellington, New Zealand, M.Sc. (dist) Mining Geophysics from University of the Witwatersrand, South Africa, Ph.D. (Geological Engineering) University of Oklahoma, U.S.A.

What have you enjoyed most about your profession(s)?

Being exposed to things relatively few people get to see. Not having to dress formally to go to work. Being exposed to different conditions and problems every day – the job/profession is never the same on any two consecutive days.

What are the negatives and low points in your career?

I suppose being retrenched twice would normally be considered to be career low points. However, each time I was retrenched my career changed direction and life got a lot more interesting so getting retrenched was brilliant.

For someone considering a career in your profession are there any words of wisdom to pass on to them?

Do what you enjoy doing. Chase the fun not the dollar. Just be aware of the consequences of your decisions. Choosing a niche field is great but it can limit your career options at times. Don't be scared to change career directions and start at the bottom again. Take advantage of any opportunities to go on courses, go to conferences, receive training or to broaden your knowledge. Ask questions all the time.

BRUCE HEBBLEWHITE

BE(Mining, Hons 1) PhD Dip(AICD) MAusIMM Head of School & Research Director, Professor of Rock Mechanics – School of Mining Engineering, The University of NSW.

What formal qualifications do you have?

I did my first degree in Mining Engineering at UNSW, graduating in 1974. I travelled to England to do a PhD in rock mechanics at the University of Newcastle upon Tyne, whilst working for Cleveland Potash Ltd. After returning to Australia, I undertook a Diploma offered by the University of New England, run by the Australian Institute of Company Directors.

Why did you choose your particular career(s)?

Having completed my undergraduate degree, I chose to pursue a PhD in rock mechanics, my interest in the field having been captured by the topic itself, but also by a very capable and inspiring lecturer. I did not want to just sit and contemplate theoretical concepts, but

was taken by the practical applications of rock mechanics in mining. The opportunity arose to study for my PhD at the internationally famous centre of mining geomechanics at the University of Newcastle-upon-Tyne in the UK. There was the added bonus of working for Cleveland Potash Limited at their Boulby Mine, on a range of geotechnical issues associated with mining potash at 1,100m deep, under the North Sea – the deepest mine in Europe at the time. This time spent in the UK was an extremely rewarding experience – not just academically, but as a life experience, studying and living in a different part of the world.

What have you done?

During my undergraduate degree, I had three periods of industry industrial training – all very different – spent in WA at Mt Newman, at Broken Hill, working in the old South Mine, and in Tasmania with Aberfoyle Ltd, working in the north-east, and also at Cleveland Tin on the west coast at Luina. After completing my PhD in 1977, I returned to Australia and joined the Australian Coal Industry research Laboratories Ltd (ACIRL) in Sydney. I spent 17 years with ACIRL, during which I saw many changes across the coal industry. For the last 10 years I headed ACIRL's Mining Division and had the opportunity to work on a large range of mining projects – both applied research and consulting – in many parts of Australia and around the world. In 1995 the opportunity arose to join academia at UNSW as a Professor of Rock Mechanics and Research Director. This was an industry-funded position which ensured I would be able to maintain my close involvement with the industry, as well as entering the new field of teaching and university research. I took over at UNSW as Head of School in 2003, moving back into a management role, but still active in teaching, research and industry consulting.

Do you have any regrets about how your career has developed?

None whatsoever. I would never have contemplated the move to academia, but having done it at the stage of my career that I did, I have absolutely no regrets.

What have you enjoyed most about your profession(s)?

The exposure to so many different parts of the industry and the people in them – in all parts of the world. It is a big industry, but in many ways it is very small and close, in terms of people and the contacts you make. I have also really enjoyed being able to make a difference – both through technical project work, and now education.



Metallurgy and Mineral Processing

WHAT DOES A METALLURGIST DO?

Within the minerals industry, metallurgists work at mine sites in concentrators and metal recovery operations, in smelters, metal refineries, foundries, and research and development laboratories. They use their knowledge of chemistry and physics, mineralogy, underlying process fundamentals and process engineering to control and improve the processes that separate, concentrate and recover minerals and their valuable metals from the natural ores. Depending on the mineral and metal, the process stages can include mineral processing that upgrades or concentrates the mined ore, and extraction of a metal or intermediate product. This extractive or primary metallurgy can include wet or hydrometallurgical process stages, high-temperature or pyrometallurgical process stages, and electro-metallurgical process stages. Sometimes, crude metals can go through complex refining processes. The metal products can be subject to further processing, termed secondary metallurgy or physical metallurgy, that includes process such as alloying, casting in foundries, rolling, and extrusion.

Some of the many roles that a metallurgist can take are:

- application of physical and chemical methods to concentrate valuable minerals from their ores; processes can involve methods such as magnetic, electrostatic, gravity, and flotation processes;
- application of a combination of processes involving hydrometallurgy, electrometallurgy and pyrometallurgy to produce crude or refined product metal for market;
- management of the technical aspects metallurgical operations using tools such as on-line process monitoring, sampling, chemical analysis, data analysis and process modelling;
- management and supervision of production staff in metallurgical operations;
- design of mineral processing and extractive metallurgical plant;
- study and application of the fundamentals of metallurgical processes to both aid control and improve their physical and economic operation;
- undertake or manage research and development studies to improve existing processes, or to apply existing or possible processes to new ores or concentrates;
- improve environmental performance of metallurgical operations and ensure all environmental standards are met;
- prepare reports on metallurgical operations and projects;
- liaise with a wide variety of people on the job such as operators, maintenance and engineering staff, geologists, mining engineers, and supporting specialists in process control, computing, technology provision and research.

WHAT DOES A MINERAL PROCESS ENGINEER DO?

Minerals process engineers transform the ores found in nature to value-added products. These ores can be high-grade materials taken directly into metal extraction, such as iron ore into production of iron and steel. For most other metals (and for some iron ores) it is necessary to upgrade or concentrate the ore into an intermediate product that is then subject to extractive processes for metal recovery. Further refining of the metal may be necessary. Ores typically contain many waste and undesirable elements, and their treatment can involve surprisingly complex and difficult process technology. The continuing variation in feed requires a high level of metallurgical process understanding and control.

A mineral process engineer may perform the following tasks:

- process design and development;
- process control and management;
- application of chemical, metallurgical and process engineering fundamentals to production processes;
- management of process data collection and analysis;
- metallurgical problem solving with application of modified or addition unit processes;
- application of economic analysis of production processes to effect optimal performance;
- planning of production, budgets, operational and management reporting;
- human resource management of both professional and operational staff.

Metallurgist - Extractive/General

Extractive Metallurgists study and apply metallurgical techniques for extracting and refining metallic materials from their ores or concentrates. They research, develop, control and provide advice on processes used in extracting metals from their ores and the washing, crushing and grading of ore or refining metals. They coordinate the analysis of samples taken from metallurgical process streams to ensure safe and economic operation and they advise operations personnel on process changes required to obtain desired products, processes and quality control.

Mineral Processing Engineer

Minerals process engineers transform low value impure minerals, recycled materials and by-products of other processing operations into commercially valuable products. The main sources of these raw materials are low grade minerals, by-products of other processing operations and recycled materials. Minerals process engineers are employed in all stages of raw materials processing

Hydrometallurgist

Hydrometallurgists are involved in the treatment of ores through low temperature refining and wet processes such as leaching. Hydrometallurgists study the nature and properties of different metals and materials and remove insoluble and toxic materials from metal using water-based solutions to find a more pure form of ore. They may use electrolytic refining and processes.

Pyrometallurgist

Pyrometallurgists design and develop high temperature heat-based processes and equipment to concentrate, extract, refine and process metals and other materials. They extract and obtain pure metals and ore through various extractive processes such as refining, welding, fusing and smelting metals. They control temperature adjustments, change mixtures and other variables in operations such as blast-furnaces and steel-melting furnaces to obtain materials such as pig iron and steel of specified metallurgical characteristics and qualities.

Metallurgy/Mineral Processing - Consulting

Consulting Metallurgists and Mineral Processing Engineers often work on a variety of processes, plants and ores. They will typically be based in coastal cities and fly out to projects as necessary.

Consultants can and do specialise in certain processes or metals/minerals and therefore act to provide certain specific technical information to companies and operations.

Metallurgy/Mineral Processing - Research

Academic and Research metallurgists/mineral processors often work in universities or CRC's (cooperative research centres). Rather than looking primarily at the economic issues of how to extract metals and minerals from ore, they investigate why and how things behave the way they do or are the way they are.

Chemical Engineer

Chemical Engineers design, develop and operate processes for converting and refining raw materials into products. A chemical engineer may improve/develop new processes and materials; design/ improve methods and equipment for extraction, filtration, distillation; prepare reports and detailed costing of changes/improvements; design/operate pilot plants; design plants and specify equipment/processes and layout; test the quality of the process/product; find faults in plant equipment and take corrective action to ensure safe operation.

Materials Engineer

Materials engineers investigate the properties of metals, ceramics, polymers and other materials and develop and assess their commercial and engineering applications. Materials engineers may study the structure and properties of metals and other materials, investigate methods for shaping and fabricating materials, and study methods for joining materials, improving existing materials and evaluating new ones. They participate in the design of products using advanced materials, investigate material failures and study ways to extend the life of materials.

MATHEW REVELL

BEng(Minerals Processing, Hons), Postgraduate Diploma Finance and Investment, MAusIMM Senior Paste Engineer, Revell Resources

What formal qualifications do I have?

I completed a 4 year Minerals Processing Engineering degree at the University of Queensland. I graduated in 1997. I also completed a Postgraduate Diploma in Finance and Investment by correspondence through the Securities Institute. I completed the diploma in 2003.

Why did I choose my particular career(s)?

In the first year at University of Queensland it is a general engineering course. At the end of first year I heard about vacation jobs, that paid good money, were available in the coal mines. I worked for three months at a Bowen Basin coal mine and really enjoyed it. As a result I decided to choose Minerals Processing Engineering.

What have I enjoyed most about my profession(s)?

More than anything I have enjoyed the variety of challenges that the mining industry offers. At most mine sites there is always something going on, and there are more than enough

challenges if you put your hand up. The industry also offers you the chance to travel. Lastly there is also a great variety of characters you meet. It is also a very small industry and you tend to keep in touch with a large range of people.

For someone considering a career in your profession are there any words of wisdom to pass on to them?

I must say that vacation work was a huge bonus for me. I really didn't have any clear idea of what I wanted to do. By doing vacation work you get a clear idea of the industry, the culture and the type of work you will be doing. I also found having mentors in my early years was very important. For my job at Cannington, one of the driving factors for accepting the job was the strong metallurgical team and the experience I could gain from them. Lastly the mining industry is a small industry, so always put in 100% and you may be surprised by the opportunities that arise down the track.

MIRIAM LYONS-STANBOROUGH
BE (Chem, Hons) BA (Hons) MSc (Mineral Economics) MAusIMM MIEAust
Clarification Area Supervisor, Pinjarra Refinery, Alcoa of Australia

What formal qualifications do I have?

I initially completed a double degree in Arts and Engineering at Monash University, deferring along the way to complete an honours year in Arts – my major was Japanese language. In 2001 I graduated from WASM with a Masters degree in Mineral Economics – I completed this degree via intensive coursework sessions over two years while working full time for WMC Resources Ltd.

Why did I choose my particular career(s)?

I did well at school and particularly liked Chemistry and Japanese. Not wanting to abandon either field of study, I investigated combined degrees. Initially I was heading towards an Arts/Science degree, but a friend's boyfriend who was studying first year engineering at the time convinced me that, for an extra year of study, I would be more employable with an engineering degree than a science degree upon graduation. So I settled on Engineering/Arts. During Year 11 at school I participated in what was then known as the CRA National Science Summer School in Canberra.



PROFILES

It was a fantastic experience, and after returning the following year as a staff member, I kept up contact with CRA which eventually led to me getting vacation work with one of their subsidiaries, Argyle Diamonds, at the end of first year at uni. And that's when I realised that the mining industry was for me.

What do I enjoy about my role?

The opportunity to work in both technical and line-management roles. All the roles I have performed have required a high level of communication skills. I love working with people, rather than in isolation.

For someone considering a career in your profession are there any words of wisdom to pass on to them?

Find out as much as you can about the profession and industry while you're still studying – vacation work in particular is so valuable. Start your career planning early – I stalled for a few years, waiting for someone to offer me opportunities, until I realised that I had to get out there and tell people where I wanted to go and what I could do.

MEGAN KROPP

BEng (Minerals Process) GAusIMM
Process Engineer, BHP Billiton Mitsubishi
Alliance Central Qld. Office

What formal qualifications do you have?

Minerals Processing Engineering at the University of Queensland, after high school in Mt Isa.

Why did you choose your particular career(s)?

I always enjoyed and excelled in Maths and Science at high school, and when I had to pick what I wanted to do at Uni; Engineering seemed like a natural choice. Despite growing up in Mount Isa I didn't know much (if anything) about careers in the mining industry apart from apprenticeships, but I did know Chemical Engineering could lead into a variety of fields, including mining. As part of preparation for a scholarship interview, I organised to visit a Chemical Engineer working at the Copper Concentrator in Mt Isa and learnt a little about what she did, and what options were generally available for Chemical Engineers. Once at Uni, while completing the generic first year of Eng, I attended all the information sessions held by the different Eng departments to learn a bit more about each field. During these sessions, I became aware of a program to give 1st year Eng students Vacation Work in metallurgical roles. After spending summer at Osborne in NW Qld, learning about the plant, doing surveys and experiencing the FIFO lifestyle, I decided to take the plunge and chose the specialised option of Minerals Processing Engineering (rather than general Chem Eng)

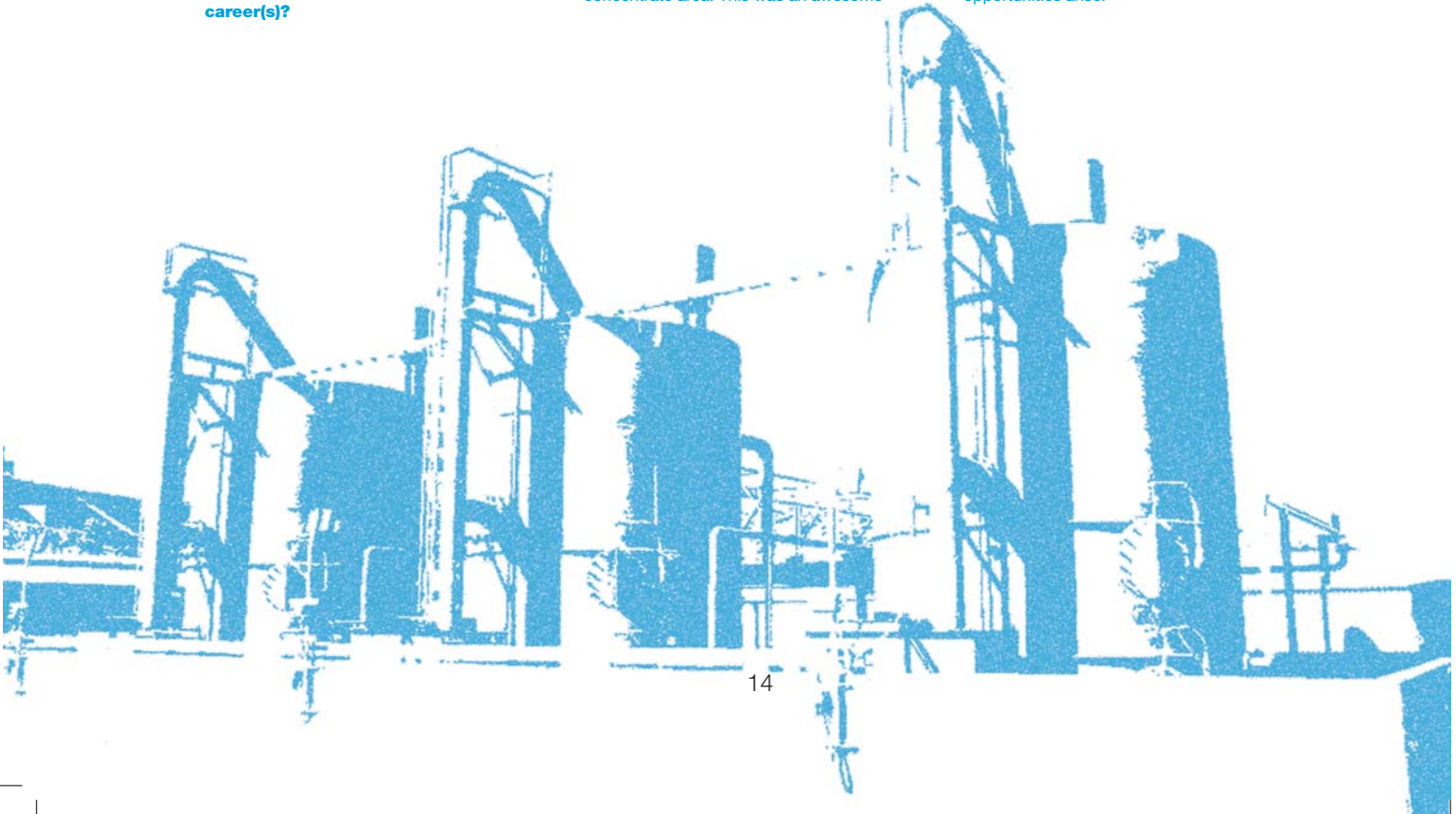
What have you done?

I was very fortunate to have three sets of vacation work while at Uni - Osborne, Mt Gordon and Ernest Henry. The first two were spent working in a metallurgical role, conducting plant surveys at Osborne, and developing lab tests to model the process at Mt Gordon. My vac work working as an operator at Ernest Henry was very interesting, mainly looking after the thickeners and concentrate area. This was an awesome

experience - I believe that to truly understand the process, (esp. as a young engineer) you have to get right into it and the best way to do this is be involved in the operations team. After Uni I was offered a position in the WMC Graduate Program at its Phosphate Hill Operation. I spent 6 months moving around the different plants interacting and being a part of production crews. I also did 6 weeks in Mt Isa at the WMC Acid Plant working on optimising their sampling regime. Phosphate Hill was more a chemical plant than a traditional base metals concentrator, but the plant I started working in as a Process Engineer was basic Minerals Processing with crushing and screening. I was involved in a screen optimisation study and also developing some Metallurgical Accounting systems. As part of the Graduate Program I was offered the opportunity to move to WA and work at WMC's Mt Keith Operations, which is a more complicated Nickel concentrator. I spent time on shift learning the day to day operations of the plant, then acted in the Production Planning Metallurgist role, then spent 12 months as a Plant Metallurgist.

Do you have any regrets about how your career has developed?

My career is still developing; only four years out of Uni and at this stage, everything I do whether right or wrong gets chalked up to experience, and you soon learn not to repeat stupid mistakes. I am still aiming towards a career more in the production, day to day running of the plant, and getting my hands dirty, but will keep an open mind as opportunities arise.



DAVID READETT

BEng(Metallurgical Engineering)
Group Manager Project Development -
Minara Resources Ltd

Why did you choose your particular career(s)?

I was always inclined towards the sciences. I attended a University Careers day and liked what I saw in Metallurgy. I also found out that the entry criteria were less competitive than other engineering based degrees so felt I had a better chance of gaining entry.

What have you done?

I am Chartered Professional Metallurgical Engineer (FAusIMM CPMet) with over 15 years experience in the Mining and Minerals Industry, employed in a variety of professional roles including Group Manager Processing and Engineering with Straits Resources, Technical Services Manager with Cobre Las Cruces (on secondment from Straits Resources), Business Development Manager and Senior Process Engineer with CMPS&F as well as roles with Mount Isa Mines Limited, Pasminco Metals and the South Australian Institute of Technology. I have been involved in test work, process flowsheet development, design, commissioning, optimisation, operation and management of numerous metallurgical projects specialising in base metal hydrometallurgy and biohydrometallurgy, coal and gold. I have been involved with a number of the Australian Copper Leach SX-EW projects and operations and have also had extensive overseas experience in the Americas, Europe and South East Asia.

I have developed an international reputation, in my chosen field of hydrometallurgy, as a result of industrial and consulting experience and extensive publication of technical papers. In 1987 I was the inaugural winner of the AusIMM G.B O'Malley Medal and was also part of the team that was awarded the 1999 AusIMM Mineral Industry Operating Technique Award. I headed the Process/Metallurgical/Engineering team within Straits, a small Australian resource companies, for the past 7 years. During this time I have overseen the development and optimisation of several significant successful projects including Girilambone Copper Operation, Nifty Copper Operation, Browns Creek Gold Operation and Sebuk Coal Mine. I took on site based management roles as well as corporate and operational technical management role. David has also headed the development teams for a number of Feasibility studies including Tritton Copper Project, Whim Creek Copper Project, and Maroochydore Copper project. I have also headed up Straits

technical Due Diligence teams which has investigated numerous base metal, cobalt/nickel, gold and coal projects/prospects.

Through my career I have been intimately involved in the development and establishment of new technologies including Isa Process, Jameson Cells, heap Bioleaching/aeration and SX coalescing systems as well as being involved in a number of innovative design/engineering developments.

PS and had a lot of fun along the way

Do you have any regrets about how your career has developed?

No, I have worked hard, had fun and achieved beyond what my early goals were.

What have you enjoyed most about your profession(s)?

I have enjoyed the variety of challenges that the mining industry offers along with the chance to travel. It's a small industry which attracts like minded people. Along the way I have made many close enduring friendships.

ADAM LONERGAN

BE (Metallurgical Engineering) (Hons)
BBus (Business Administration), MAusIMM
Metallurgical Engineer, Rio Tinto Technical
Services

Why did you choose your particular career?

Whilst completing high school I was interested in Chemistry and Physics and wanted a career that would combine these disciplines and be "hands on". In addition to 'the sciences' I'd also had an interest in business management (topping my class), so when applying to university I decided to aim for a dual Engineering/Business degree. As nothing like this was available locally I was forced to look to Melbourne, and was offered a place at RMIT to study Metallurgical Engineering and Business Administration concurrently as a double degree. A double degree is more difficult to get into and means an increased workload, but it allowed me to obtain two degrees within five years rather than seven (4 year Engineering, 3 years Business Administration). Doing a double degree has certainly made me more rounded and I am quite sure that it was a strong contributing factor to securing both vacation work every year and my graduate position.

I was lucky enough to also be offered a residential place at Ridley College, which was a great place to live after moving out of home and down to Melbourne.

Living at college is an excellent experience and a great place to meet friends; it's close to campus and most things are taken care of for you so you can concentrate on studying and socialising. If you can justify the costs I recommend it to everybody.

What have you done so far in your career?

At completion of first year university I landed my first vacation job with Newcrest at Cadia (Copper/Gold flotation) in NSW. I was quite 'green' when I commenced shift work as a plant operator that summer, but gained a great deal of knowledge that helped me at university and earned enough money to pay a good portion of my expenses for the following year. Each year afterwards I completed vacation work with a different company in a different commodity (MIM, Mount Isa (Lead/Zinc flotation); AngloGold, Pine Creek (Gold CIL); Rio Tinto, Bundoora (Iron/Titanium Pyrometallurgy R&D) which gave me a good perspective of the industry and different career options. Rio Tinto then supported my final year research project and paid my expenses (including a trip to Perth to present the findings).

In my final year I successfully applied to Rio Tinto for a graduate position and was interviewed by my research project supervisor and manager. Having over 12 months industry experience and my work being known to them undoubtedly helped my application.

Day one of my full time employment saw me in the Pilbara working at an iron ore mine, where I stayed for 5 months; followed by a 2 month stint in Perth before spending my first day at my desk back in Melbourne (7 months after starting). Since then I've worked at ERA (Ranger, Uranium), a number of Coal operations in Queensland and NSW and nearly a year overseas in Richards Bay, South Africa, but that's another story...I don't know of any other graduates in any industry that have had these kind of opportunities!

What have you enjoyed most about your profession?

I really enjoy the diversity of the work I do as a Metallurgical Engineer. In the past year I've been involved in pilot plant construction, equipment decommissioning, mine site energy reviews, high temperature molten metal test work, numerous plant and laboratory trials, advanced computer modelling and technical desktop studies. I've travelled extensively interstate and worked overseas in a number of different commodities and roles.



Mining Engineering

WHAT DOES A MINING ENGINEER DO?

Mining engineers plan and direct the various engineering aspects of extracting minerals from the earth. They prepare initial plans for the type, size, location and construction of open pit or underground mines.

The sorts of things that a mining engineer oversees at a mine might include:

- conduct investigations of mineral deposits and undertake evaluations in collaboration with geologists, other earth scientists and economists to determine whether the mineral deposits can be mined profitably
- prepare plans for mines, including tunnels and shafts for underground operations, and pits and haulage roads for open-cut operations, using computer-aided design packages
- prepare the layout of the mine development and the way the minerals are to be mined
- plan and coordinate the employment of mining staff and equipment with regard to efficiency, safety and environmental conditions
- consult with geologists and other engineers about the design, selection and provision of machines, facilities and systems for mining, as well as infrastructure such as access roads, water and power supplies
- operate computers to assist with calculations, prepare estimates on the cost of the operation and control expenditure when mines come into production
- oversee the construction of the mine and the installation of plant and equipment
- make sure that mining regulations are observed, including the proper use and care of explosives, and the correct ventilation to allow the removal of dust and gases
- conduct research aimed at improving efficiency and safety in mines
- establish first aid and emergency services facilities at the mines.

MINING ENGINEERING CAREER OPPORTUNITIES?

Mining engineers have a wide variety of career options including becoming mine planners and designers, consultants for tunneling operations (for road, rail, hydro-electric, water supply or sewerage works), operations managers, technical specialists (eg. rock mechanics, drilling and blasting, mine machinery or ventilation), investment analysts and advisers, researchers, or general managers and mine managers.

To prepare for such a career, students studying mining engineering cover a broad range of subjects such as mining technology, rock mechanics, ventilation, geology, metallurgy, surveying, economics and finance, management, health and safety, environmental principles and computer applications.

Mining Engineer - Open Pit

Mining Engineers working in open pits are involved with both long and short term open pit mine planning, mine design scheduling and budgeting, strategic planning, supervision of technical and operating staff, mine management. They are also involved with feasibility studies, drilling and blasting supervision, operation of mining systems, evaluation of open pit mining equipment, mining contract development.

Mining Engineer - Underground

Underground Mining Engineers can be involved with coordinating mining activities, maintenance scheduling for all equipment, short/long term mine planning, scheduling and design. They supervise staff and are involved with feasibility studies, mining contract development, design operation and maintenance of underground mining equipment.

Mining Engineer - Coal

Coal mines can be open pit or underground and tend to use different mining methods. Coal mines can be prone to gas and fire problems. Coal Mining Engineers can be involved with coordinating mining activities, maintenance scheduling for all equipment, short/long term mine planning, scheduling and design. They supervise staff and are involved with feasibility studies, mining contract development, design operation and maintenance of mining equipment.

Mining Engineer - Consulting

Mining Engineers who work as consultants are often involved in a wide variety of projects, mining methods and different technical areas. They use computer programs to model the mining process and design and can work on both open pit and underground developments. Consulting mining engineers will typically be based in coastal cities and fly out to projects and mines as required.

Mining Engineer - Academic/Research

Academic and Research mining engineers often work in universities or CRC's (cooperative research centres). Rather than looking primarily at the economic issues of how to mine most economically and locating the boundaries of ore deposits for this reason, academic and research engineers investigate why and how things behave the way they do or are the way they are. They experiment with different mining methods, designs and equipment.

KATE SOMMERVILLE

MBA, Grad.Dip (Mining), B.Eng (Geological) RMIT, 1st Class Mine Managers Certificate of Competency (WA,Qld), UG Supervisors Certificate of Competency (WA). MAusIMM. Principal Mining Engineer-Iron Ore, BHP Billiton

What formal qualifications do you have?

After RMIT in Melbourne I did a distance-mining course at Ballarat. I then concentrated on getting my statutory tickets. After a break I realised that I was unbalanced on the business side so I did an MBA - Distance through Edinburgh Business School. I also did Spanish and Six Sigma Business Improvement.

Why did you choose your particular career(s)?

I put all my likes together: earth science, physics, chemistry, maths, outdoors and adventure. I wanted to do something useful: mining was on the radar by year 11 and in my final year of school we did 'minerals to metals in chemistry' and suddenly from an average student I shot to the top of the class for this subject. I knew it was the industry for me. I picked Geological Engineering and I was lucky enough to get a Women in Engineering Cadetship from Melbourne Water after 1st year. I was very grateful for that experience.

What have you done?

I have 14 years experience and have worked all around Australia and also did some work at mines in Sth America, Nth America and Sth Africa. I have done a mix of residential and FIFO arrangements. I started off in underground mines but have been exposed to many types of commodities and operations. Roles include: production, planning, supervision, contracting, foreman, shift bossing and underground operator. I had a dream job in Business Improvement where I was responsible for networking, running workshops and conferences, benchmarking, educating and encourage sharing of technical expertise over all the BHP Billiton sites in the world. I assisted with the integration of Olympic Dam to BHP Billiton. Now I have decided to learn about open cut so I am working at Iron Ore in long term planning.

Do you have any regrets about how your career has developed?

I finally got the dream job so, in spite of everything and doubts at many points it has worked out. My initial approach was to get broad experience in production, planning, corporate and contract. I thought that if I was solid then I could pick anything and be more robust. I could not say that I planned each job – but I have ended up with some great roles.

I have seen some others who have set out to get a solid technical portfolio and ended up in consulting by 30 – I admire their foresight. I have changed companies and sites quite a bit – it can get frustrating changing so much – you have to keep proving yourself each time.

What have you enjoyed most about your profession(s)?

Mining has such a cross section of people and I enjoy seeing different perspectives. People spend years in 'wanderlust' trying to get the people/country experience that you can get in mining. The people are passionate, friendly, encouraging and like me, enjoy a good drop of red wine!

What are the negatives and low points in your career?

On my first day of work – part of the operation was closed down and many people lost their jobs. From this day I have always ensured that I never commit too much financially – as there is a chance I may lose my job. The past decade has been tough in mining – and I am seeing for the first time what it is like to be in boom time. Mining is a lifestyle job and my husband is in mining also. It takes quite a bit of juggling to ensure we end up in the same location and roster. It would be good if more mines could accommodate senior professional couples on the same site. I am encouraged to see more women balancing a rewarding career and family at mines – but still think we have a long way to go.

For someone considering a career in your profession are there any words of wisdom to pass on to them?

Get site and hands on experience before you do anything else. Get exposure to both production and planning. Work out where and how you want to live and get experience which suits your end game. Always leave a job in a better state than you found it - work is about giving and receiving. There is always a win-win solution out there for work issues or your career – the fun bit is finding that solution – it feels good when both parties win. Keep learning, laughing and be positive.

GRAEME FULTON

BSc. (Hons) Mining & Petroleum Engineering, MAusIMM, Mining Engineering Consultant - Terra Mining Consultants Ltd.

What formal qualifications do you have?

After completing a pre-university year with Anglo-American in South Africa, as part of their scholarship programme, I returned to Scotland to complete my degree at the University of Strathclyde, with a few vacation employment stints along the way.

Why did you choose your particular career?

I have always been interested in the Earth Sciences and coupled with a careers assessment that fitted me into the engineering category I looked at mining engineering. This coupled with the opportunity of a scholarship and pre-university year overseas with Anglo-American set me on the road.

What have you done?

Since graduation I have worked for French-Kier on their Benbain Opencast coal mine (UK); Anglo American Corporation at Vaal Reefs Gold Mine, Premier Diamond Mine and Springbok Colliery; and as Senior Mining Engineer for Avgold on the development of a new deep-level gold mine, Target (South Africa). I also spent part of my career in the mining information systems field, having worked at Andersen Consulting, Intertech Systems and Datamine on mining, petroleum and manufacturing projects, as well as mining software development, training and support, GIS and mapping. I am, and have been, involved in number of mining and quarrying consultancy projects over a wide range of minerals and deposits both locally (New Zealand) and internationally (Southern Africa, Papua New Guinea, Canada and Malaysia).

Do you have any regrets about how your career has developed?

None, I have had many varied and diverse experiences, some good and some not so pleasant, all building up to the fulfilling work I currently undertake.

What have you enjoyed most about your profession?

Like minded people, experiences few people encounter, and many interesting challenges.

For someone considering a career in your profession are there any words of wisdom to pass on to them?

The profession offers many challenges, varying career opportunities in many parts of the world. Mining engineers are few and far between and are always in demand. Put your heart into it and you will get a lot out.

**PETER CUNNINGHAM**

BE mining (Honours), Member AusIMM
Principal Mining Engineer, AMC Consultants

What formal qualifications do you have?

I completed a six-year part-time mining engineering degree at the WS & LB Robinson College (part of the University of NSW) in Broken Hill, graduating with Honours in 1983. After completing my degree and gaining the necessary operational experience, I then sat for and obtained my NSW Below Ground Mine Managers Certificate.

Why did you choose your particular career(s)?

I grew up in a mining town, where the mining companies offered cadetships, which allowed you to study part-time whilst working full-time at the mine, gaining valuable hands-on experience in your chosen field of study. The prospect of getting paid what was considered a good wage, whilst completing my university studies was very appealing. The first thing I had to do when I was offered a mining engineering cadetship, was find out just what a mining engineer did. Even though I grew up in a town steeped in mining history, I had no idea what role a mining engineer played in it all.

What have you done?

After completing my studies, I spent the next 13 years working in both technical and production roles at the operating mines in Broken Hill. I then moved to Melbourne and worked in a head office/corporate environment for a couple of years, gaining an appreciation of the functions/departments outside of mining, that were part of an integrated mining and smelting company. I was then offered

an opportunity to move to Perth as part of a technical services group, whose role was to provide support to the mines operated by that company. This role became redundant after about 1 year following a restructure. At this time I took up an opportunity to join a major mining consultant group.

Do you have any regrets about how your career has developed?

There have been short periods during my career when I have wondered just where I was heading, however, looking back, I feel that my time in Broken Hill gave me some of the broadest operational training you could hope to get, as a mining engineer. In Melbourne I gained an insight into how the corporate side ticked, then moving to Perth in both in-house and external consulting roles I have had the opportunity to grow and apply the knowledge I had gained in my previous positions.

What have you enjoyed most about your Profession?

In my current role as a mining consultant I do work for many different mining companies, both throughout Australia and overseas, which allows me to visit many mine sites and meet with a lot of interesting people, as well as bumping into many old colleagues.

JOHN NAJOR

BE (Mining Engineering) UNSW, GAusIMM
Graduate Mining Engineer – Pilbara Iron

Why did you choose your particular career?

I recognised Australia was rich in mineral resources with plenty of opportunities for mining professionals. I also knew a lot of people in the industry who had great jobs and really enjoyed their work.

What have you done so far in your career?

During uni I was fortunate to work at the end of every year at a different operation. At the end of 1st year, I worked for Wambo Coal at Singleton NSW, gaining valuable experience in open cut coal mining. In 2nd year I worked for Centennial Coal at their Springvale & Angus Place operations at Lithgow NSW where I was exposed to underground coal mining. And in 3rd year I worked for Pilbara Iron at Tom Price WA, at an open cut iron ore mine.

When I finished uni, I was fortunate to be able to come back to Tom Price as a graduate where I am currently working as part of the Production Planning team, responsible for mine planning across several of Pilbara Iron's mines in the northwest of WA. I am currently working as an engineer but look forward to getting some pit experience driving a haul truck and on the blast crew later in the year.

What have you enjoyed most about your profession?

The people you meet are great right across the board - whether it is an operator on the hill or the mine manager. It's also been



great living in a remote town in the Pilbara being part of many community activities and sporting events. I have also enjoyed the opportunities and responsibilities that arise at work.

For someone considering a career in your profession, are there any words of wisdom to pass on to them?

Enrol in the course, work hard and look forward to an exciting career!

CLINT JENKINS

BEngSc (Mining Engineering), GAusIMM
Graduate Mining Engineer – Rio Tinto Hunter Valley Operations

I completed my studies at the University of Ballarat, Victoria in 2004 under the new three year Bachelor of Engineering/Science degree which was the first time it had been adopted by an Australian University. It was designed to meet the needs of the Australian mining industry – get trained professionals into the workforce fast! It gave me the key understandings of the mining industry in a theoretical and practical environment.

Why did you choose your career?

The main factor contributing to my decision to enter the mining industry was the fact that my father has always been a desk-bound accountant and I decided at an early age that I wanted something a bit more “interesting”, with more options - no offence to accountants! Trawling through career papers, I discovered mining and I set that as my goal.

What have you done so far in your career?

So far throughout my graduate program, I have experienced a number of interesting and worthwhile roles ranging from planning engineer to shottirer and truck operator. I have had a good balance between office based and in-pit based jobs which is a great help when communicating with others. The best part of being on a graduate program is the exposure to a number of roles and training courses which gives you the necessary tools to go forward in the industry.

What have you enjoyed most about your profession?

Perhaps the most enjoyable aspect of my profession is seeing a job completed on time with no safety issues and knowing that I had been a part of it.

For someone considering a career in your profession, are there any words of wisdom to pass on to them?

Coming from a small country town in Victoria I had never experienced the mining industry, nor had anyone I knew. For anyone in a similar situation, I would strongly recommend getting as much information as you can and giving it a go ... It is a big world out there and it needs mining professionals





Environment

WHAT DOES AN ENVIRONMENTAL PROFESSIONAL DO?

Environmental engineers are concerned with assessing and managing the effects of human and other activity on the natural and built environment. They apply their engineering knowledge and skills to such things as environmental impact assessment, natural resources management and pollution control. Environmental scientists measure and record features of the environment, study, assess and develop methods of controlling or minimising the harmful effects of human activity on the environment, and develop conservation plans.

Environmental professionals can be involved in many different tasks:

- Developing ways of minimising the impact of processes on the environment, based on the study and assessment of these processes, environmental legislation and physical, biological, social and cultural environments
- Undertaking laboratory work; analysing pollutants, identifying their sources and assessing their effects
- Monitoring and evaluating the environmental and social impacts of engineering projects and development activities
- Rehabilitating land, water and air affected by mining, etc, conducting research and preparing proposals to lessen the impact of developments on the environment
- Researching matters of immediate and long-term importance to governments and the communities such as the impact of land clearing on native animals and the impact of waste products on waterways
- Negotiating with and assisting in the development of policies, strategies and codes of practice on environmental management and conducting environmental audits with industry, government departments and the public
- Researching and developing new technologies and techniques to improve the environmental acceptability of engineering projects
- Designing and operating processes to treat wastes to a standard acceptable for discharge and/or recycling, e.g. waste water treatment or waste solidification
- Working with occupational health experts to ensure a hazard-free working environment
- Preparing reports and studies on the best approach to environmental management in new and existing engineering projects, taking into account environmentally sustainable economic activity and legal, environmental and industrial factors
- Effectively communicating relevant issues to other technical staff, managers, regulatory authorities, public interest groups and the public.

WHAT ARE THE CAREER OPPORTUNITIES?

Just as safety and health are becoming more and more important in the minerals industry so are the environmental professions. There are very good career opportunities in the environmental

professions and many occupations now combine environmental work with another technical discipline.

Environmental Engineer

Environmental engineers are concerned with assessing and managing the effects of human and other activity on the natural and built environment. They apply their engineering knowledge and skills to such things as environmental impact assessment, natural resources management, and pollution control.

Environmental Scientist

Environmental scientists measure and record features of the environment and study, assess and develop methods of controlling or minimising the harmful effects of human activity on the environment. Environmental scientists usually work with a range of other professional and technical staff. The amount of indoor and outdoor work they do depends on the individual job.

Environmental scientists may specialise as an Environmental Officer who makes sure that sound management practices which support plant and animal life are in place.

Environmental Consultant

Environmental Consultants can be either environmental engineers or scientists. They often work on a wide variety of projects and tasks. Environmental Consultants are often based in capital cities and travel to the project they are working on at the time. Because much work is done by computers now a consultant may only travel to the project site to take samples, etc.

Environmental Research

Environmental Researchers can work from tertiary institutions like universities where they may be involved in research and teaching students. Environmental researchers also work within companies in researching different aspects of products, processes, situations and their environmental effects

Environmental Chemist

Environmental Chemists monitor pollutants, their products and natural chemicals, determine ways to reduce the bad effects of chemicals released into the environment and devise industrial processes which are environmentally friendly.

Environmental Economist

Environmental Economists study the environmental impacts of projects and subsequently advise industry and government on environmental and natural resource management regulations. They also advise on the government's responsibilities in terms of international agreements and treaties about the environment.

Environmental Geologist

Environmental geologists study the nature of ground and surface waters; soil movement, erosion and degradation; salinisation and coastal erosion; the effects of pollution and human activity on rivers; and the environmental effects of mining, nuclear energy and waste disposal.

LAURA MCILWAINE

BEng (Hons 1) – Environmental, MAusIMM
Senior Environmental Engineer, BHP Billiton
Olympic Dam

Why did you choose your particular career?

Up until Year 12 I wasn't sure what I wanted to study. I loved mathematics, science and geography and had a deep love for the outdoors and the environment. I'd considered careers in marine biology and even music, but it wasn't until a friend handed me the RMIT University Environmental Engineering degree brochure that I realised this was the course, and indeed career, for me. I found the fact that it was a relatively new discipline exciting and was thrilled at the prospect of using my math and science skills to benefit the environment.

What have you done?

Throughout secondary school and university I was heavily involved in extra curricular activities associated with music, netball and student clubs. I helped establish the first AusIMM student chapter at RMIT, held positions on the Environmental Engineering Students Association and was an active speaker in the RMIT Women in Engineering School Speakers Program.

Being a country student, I was required to work long hours in my part time waitressing jobs on top of 30-something university contact hours a week, in order to make ends meet with rent, bills, car and entertainment money. I remember finishing work at 1am the night before a morning exam and thinking "this is mad!" but I don't think it did me any harm. In fact, the communication, teamwork and organisational skills I developed in my part time work and extra curricular activities at university prepared me well for the "real world" where you need to juggle life and long working hours.

I was fortunate in my second year at university to obtain a scholarship with Pasminco Limited (now Zinifex Limited) which involved two summers of vacation work. So at the age of 19, I worked in my first mine – the Pasminco

Rosebery Mine on the west coast of Tasmania. The position opened my eyes to the challenges associated with minesite environmental management, and in particular, acid rock drainage (ARD) management. I returned to Tasmania the following summer working at the Pasminco Hobart Smelter and returned again a year later as a graduate in Hobart for nine months prior to relocating to the Century Mine in North West Queensland.

I worked at the Century Mine for over four years as an Environmental Advisor, during which time I commenced my Masters of Science (Environmental Geochemistry) in ARD prediction techniques. I left Pasminco in January 2004 after accepting a position with Maunsell as Environmental Engineer in their Townsville office. Despite enjoying the variety and challenging work of environmental consulting, I accepted a position as Senior Environmental Engineer at Olympic Dam in early 2005 to live and work in the same town as my partner who is a Metallurgist. In early 2006 I will complete my Masters thesis which will be the result of four years part time study, an achievement that will put a huge smile on my face!

What are the negatives and low points in your career?

The long hours and commute nature of working a remote fly-in-fly-out position for over four years took a lot out of me and I now understand what it is to be truly exhausted. Saying that, remote sites really develop your sense of self and I am a much more independent person as a result from working in such challenging circumstances.

BRONWYN SMART

BSc (Conservation Biology and Environmental Restoration) Murdoch University. Environmental Scientist - Newcrest Mining Limited, Telfer Gold Mine.

Why did you choose your career?

I grew up in a country town, close to a bauxite mine which provided numerous jobs for those

living there. After completing some work experience there during year 12, and spending time with people from various professions, I decided that getting into the environmental field was something that appealed to me. I have always been passionate about the environment, and loved biology, geography and science in general, so choosing to be an Environmental Scientist seemed only natural.

What have you done so far in your career?

Upon completion of my degree I was offered a position in the Newcrest Graduate Program, which I commenced in February 2005. The Newcrest Graduate Program consists of a 2 year program, with elements such as a professional development plan, mentoring program and site rotations. My initial site placement has been at Telfer Gold Mine in Western Australia. Later in the year I will be completing my second placement at Cadia Valley Operations in New South Wales.

What have you enjoyed most about your profession?

I have most enjoyed working away out in the bush – most people in Australia never even visit a place as remote as Telfer, let alone live and work out here! There are some beautiful landscapes, plants, animals and weather to experience in the desert, which I probably would never have had the opportunity to experience had I not been working here. I have also had the opportunity to meet a lot of great people in the mining industry too.

For someone considering a career in your profession, are there any words of wisdom to pass on to them?

If you choose to enter the environmental field, try to get as much hands on experience whilst you are completing your degree as you can. Volunteer work, work experience and vacation work are good ways to do this, and will aid you in getting employment later on. Graduate positions in mining companies are a great way to start out – keep an eye out early in your last year of university, as this is generally when these positions are advertised.





Safety and Health

WHAT DO SAFETY AND HEALTH PROFESSIONALS DO?

Safety and health professionals develop and coordinate safety and health systems and strategy in an organization, identify hazards and assess risks to safety and health, put appropriate safety controls in place, and provide advice on accident prevention and occupational health to management and employees. Increasingly Safety and Health Professionals are also responsible for many of the environmental aspects of their workplace. As this profession matures there is an increased emphasis on risk management strategy and on workplace culture.

Safety and health professionals may perform the following tasks:

- Promote occupational health and safety within the organization and develop safer and healthier ways of working
- Make sure that the organization is aware of, and complies with, all legislation in relation to the use of its plant, equipment and substances, as well as in all workplace activities
- Help supervise the investigation of accidents and unsafe working conditions, study possible causes and recommend remedial action
- Develop and implement training sessions for management, supervisors and workers on health and safety practices and legislation
- Coordinate emergency procedures, mine rescues, fire fighting and first aid crews
- Communicate frequently with management to report on the status of the health and safety strategy and risk management strategy
- Develop occupational health and safety strategies and systems, including policies, procedures and manuals

WHAT ARE THE CAREER OPPORTUNITIES?

The minerals industry has made a very strong commitment to a vision of the industry free of injury, fatality and disease. Without Safety and Health Professionals this vision cannot be achieved. Many professionals from other technical areas move into Safety and Health roles.

Occupational Health and Safety Officer

Occupational Health and Safety Officers inspect and test machinery and equipment, such as lifting devices, machine shields and scaffolding, to make sure they meet appropriate safety regulations and make sure that personal protective equipment are being used in workplaces according to regulations and that dangerous materials are correctly stored. They are often required to conduct training sessions for management and employees, identify and test work areas for potential accident and health hazards, such as toxic fumes and explosive gas-air mixtures, as well as implement appropriate control measures.

OH&S Auditor

An OHS Auditor can be an external consultant position or an internal staff position in larger companies. It requires formal qualifications in OHS or equivalent industrial experience, and formal training in auditing. It is different from an inspector in that the audit process requires gathering of evidence and proof that procedures are being implemented, rather than just inspecting for hazards or risks. A professional auditor will normally be a member of an audit professional association. Auditors may be employed by consultancies or run their own business.

Hygienist

Hygienists identify and investigate problems of occupational/ industrial hygiene (chemical, physical and biological hazards) in the workplace. They use scientific equipment to measure and control hazardous substances and the effects on workers health of physical impacts such as noise.

Risk Manager

Risk Managers understand certain critical management issues of fundamental importance to the mining industry. They are concerned with advanced applications in risk management, in particular the human behavioural side of risk taking, making errors, accident occurrence ergonomics, as well as application of risk management to some of the major hazards in the mining industry. They apply the fundamentals of risk management; the adoption of risk management tools in the regulatory environment; risk management in specific mining-related processes; environmental risk management; mining and other disasters and the application of risk management techniques; emergency preparedness in the mining industry.

Mines Inspector

Mine inspectors primarily conduct on-site inspections or investigations of mines, mills and quarries in search of conditions that are potentially hazardous to the safety and health of workers. They inspect to ensure that equipment is properly maintained and used, and that mining practices are carried out in accordance with safety and health laws and regulations. They investigate accidents and disasters, and may help direct rescue and fire fighting operations when fires or explosions occur. Mines Inspectors work to identify the causes of accidents to determine whether laws and regulations have been violated. Inspectors discuss findings directly with mine management and issue citations describing violations and hazards that must be corrected. They have the authority to close a mining operation if they encounter a work situation that presents an imminent danger to workers. They may also be called upon by mine personnel to provide technical advice and assistance.

AMIE HAYNES

BSc (Health and Environment) Murdoch University, Graduate Health Officer - Northparkes Mines, NSW

Why did you choose your particular career?

1. As I had an interest in health and safety, mining was the logical choice as the industry deals with some of the most potentially dangerous and unhealthy conditions. Working in the mining industry gives me the opportunity to make the biggest difference and be exposed to and learn the most about a wider variety of Occupational Safety and Health issues.
2. I care about people's health and want them to return home after a days work unaffected by work processes. I also want them to go into their later years not having been negatively affected by their past occupations.
3. Great pay, conditions and opportunities (training, career development, travel etc)

the biggest, most profitable companies (e.g. mining) are in a position to look after you the most in regards to these things and I like working in a big team.

What have you done so far in your career?

I am on a graduate program whereby my development is structured and I do a lot of courses to do with my field and other fields, such as HR etc. My basic role includes working within the Environmental Health and Safety Management system where I carry-out Health surveillance and Health monitoring and I'm also developing Health Management Plans and Training packages.

What have you enjoyed most about your profession?

The opportunity to be involved in a range of different tasks. In EHS you get to work with a lot of different people which I enjoy, but what I've enjoyed the most is being able to provide advice on Occupational Health related

matters, that may enhance or maybe even save someone's life....and also having the opportunity to promote Safety's neglected cousin 'Health'.

For someone considering a career in your profession, are there any words of wisdom to pass on to them?

Try to gain employment as a graduate, on a graduate program with the right company. I recommend mining - they are able to foster your development and provide you with the skills and abilities to do what ever it is you want to do. If you care about the Health and Safety of workers and want to make a positive difference to people's lives, mining is the way to go, you will find the company's values are in line with your own so you will be supported, not constantly blocked when trying to improve safety and health conditions. The people are also great - down to earth, friendly, supportive and very, very team focused.





Other Engineering

Mechanical Engineering

Mechanical engineers apply engineering principles in the employment of energy, machinery, equipment and materials. They design machines and mechanical installations and evaluate installed machinery, processes and products. Mechanical engineers in the minerals and energy industry may undertake the design and construction of resource development projects (eg gas platforms, mining facilities etc), design new machines, equipment or systems taking into account costs, material suitability and life, carry out research in areas such as use and application of different fuels and energy, materials, heating, handling, storage and pumping of liquids. Mechanical Engineers use CAD (Computer Aided Design) to design plants. They supervise and manage the working of production plants (eg coal handling, power stations) and set up work control systems.

Electrical Engineering

Electrical engineers apply scientific and engineering principles in the research, design, manufacture, operation and maintenance of electrical and electronic equipment, machine systems and components. Electrical engineers in the minerals and energy industry may plan and supervise generating equipment; supervise construction plans and specifications; and supervise operating and maintenance staff. They use CAD to assist in the design and drawing of complex electrical systems; decide on the type and arrangement of circuits, transformers etc; make or improve electrical products such as motors, equipment etc; and they write, interpret specifications and regulations about electric power equipment and its use.

Software Engineering

Software engineers develop specialised programs for all aspects of the industry processes. Software engineers in the minerals and energy industry develop software specifications for a proposed

process, compile programs from approved specifications which a computer can understand. Software Engineers maintain and upgrade technology to keep abreast of change, develop software solutions and investigate and develop tool and ideas to support the production of software programs.

Surveying/Geomatic Engineering

Surveyors assemble and assess land and geographic information which is used for planning and regulation of the land, the sea and related structures. Mine Surveyors measure underground and open-cut mine workings in full detail. Their measurements enable new mine works to avoid older and possibly flooded ones, and allow connections to be made between different underground passages. Mine surveyors also establish the boundaries of mining claims in some states and territories. Surveyors may spend a lot of time working outdoors. They also work in offices, analysing data and preparing plans and reports.

Civil Engineering

Civil engineers plan, design and supervise the construction, operation and maintenance of roads, bridges, dams, ports, docks, building structures and other facilities required by the minerals and energy industry. Civil engineers in the minerals and energy industry may investigate sites to determine suitable foundations, research and advise of best engineering solutions on site; and produce detailed designs and documentation for construction of a project. They may also organise delivery of materials, plant and equipment to site; establish detailed programs for the coordination of site activities; prepare engineering calculations required for project design; and supervise the testing and commissioning of completed works. Civil Engineers analyse and interpret reports on loadings, materials etc; analyse risks associated with natural phenomena (eg earthquake, flood etc); and arrange for geological and geophysical investigations.

PROFILES

BRIAN N'DRELAN

BEng (Mechanical) MSc (Industrial Management) MAusIMM, MIEPNG Senior Mill Mechanical Engineer – OTML Production Maintenance Department

What formal qualifications do you have?

I completed a 1st degree in BEng Mechanical at PNG University of Technology 1978, 2nd degree in BEng Mechanical & Manufacturing at QUT 1989, and 3rd degree a Master of Science in Industrial Management at the Institute of Technology Bandung – Indonesia 1997.

Why did you choose your particular career(s)?

Bougainville Copper Limited (BCL) sponsored me at the PNG University of Technology to study Mechanical Engineering. BCL was the second largest copper mine at that time, so naturally I went to work at Bougainville after graduation in 1978. I was impressed with the

hugeness of the mining equipment and what they were capable of doing. I started working as a Graduate Engineer at the Pit Maintenance Department, which maintained various mining equipment including blast-hole drills, electric rope shovels, haul trucks, dewatering pumps. I also spend eight months with Zinc Corporation Ltd, in Broken Hill NSW. There I had exposure to underground mining equipment such as Skips, Cage, Load-Haul-Dump equipment, winders, milling & flotation plant, trains & rail lines. My interest in mining process has kept me more or less working in one mine or another. The other mines where I had spent time with include Hamersley Iron Pty Ltd in Western Australia, Porgera Joint Venture in PNG, PT Timah- a tin company in Indonesia. I was an academic at the PNG University of Technology, before I joined Ok Tedi Mining Ltd in March 1999.

What have you done?

Some roles I have played include being supervisor on maintenance teams, Major shutdown planning coordinator, senior engineer in engineering sections, carry out condition monitoring on equipment, and also being an academic for six years at PNG University of Technology. Reading has helped me a lot to broaden my engineering base.

What have you enjoyed most about your profession(s)?

The involvement on major projects with other professionals and trades people has brought much joy. People express how much your contribution has meant to the outcome of the project. The wide range of skills employed including man management, maintenance planning, imparting information, research for information, analysing data, and sourcing of resources. I enjoyed helping others improve their knowledge base.



Human Resources

Human Resources

Human Resource professionals provide employment and personnel administration services within an organisation. Human Resource professionals assist in organisational changes in culture and take part in strategic management. They conduct analyses to determine the number of employees, the type of skills required to meet the organisation's objectives, and they analyse the requirements of jobs and develop job descriptions and duty statements. Human Resource professionals advertise vacancies, assess/interview applicants and make recommendations to management about staff appointments. They maintain personnel records of all employees and arrange for staff training. Human Resource professionals provide advice and information to management and employees on HR, personnel policies and procedures, etc. and organise employee welfare services such as canteens, first aid, superannuation and social activities. In small organisations, human resources officers are usually responsible for all staffing matters. In large organisations they may specialise in a particular area, such as recruitment, wages and entitlements or staff training.

Recruitment

Recruitment consultants interview applicants to determine their job requirements and suitability for particular jobs, assess their training needs and help employers to find suitable staff. They record relevant personal and work details, receive and record job vacancy information from employers, including details such as duties involved, working conditions, hours, pay, any experience needed and training that is available and they organise advertising, interviewing and selection processes for recruitment campaigns. Following interviews they prepare shortlists of candidates for referral to prospective employers, provide applicants with further information, check references and suitability of applicants

before referral to employers for interview, conduct and analyse psychometric tests and advise job applicants of the success or failure of their application. Recruitment professionals assist with sales and marketing duties designed to increase the client base, including visiting employers to discuss consultancy service and fees, and assess working conditions. Recruitment consultants may specialise in particular areas.

Industrial Relations

Industrial relations officers manage employment conditions and related issues. They aim to encourage employees and employers to work towards the development of effective organisational practices. They may represent industrial, commercial, union, employer or other organisations in industrial negotiations. They undertake negotiations on rates of pay and conditions of employment for employees and employers, develop and administer policies on different employee classifications, wage structures etc; and maintain good relationships between employer and employee. They examine and attempt to resolve industrial disputes and they study and interpret relevant industrial legislation. They advise others on appropriate procedures for carrying out negotiations; can appear as a representative of an industrial group before a tribunal and take part in enterprise bargaining talks where employees, management and unions discuss the development of specific work arrangements and conditions (for example, pay and hours of work). Those industrial relations officers working for organisations with a large workforce seek to minimise industrial disputes by acting as a communications link between management and employees. Those working for employer associations or trade unions aim to protect the interests and maximise the benefits of the group they are representing.

PROFILES

KARIN BAXTER

BSc Hons Geology, GCM (HRM), MAusIMM
Practice Leader - Resourcing, BHP Billiton
Mitsubishi Alliance

What formal qualifications do you have?

I have a degree in Geology from Flinders University in Adelaide, and Honours in Geology at the University of Adelaide. I have also completed the Graduate Certificate in Management in Human Resource Management at the University of Queensland.

Why did you choose your particular career(s)?

I studied Geology in my final year of High School and went into University studying a Bachelor of Science with a double major in Geology and Psychology. Geology was of interest because it appeared almost a creative science. The field work component also appealed, as did the factual base. At the time of graduation I felt too naive to move into the Psychology field, as my life experience was somewhat slim, so Geology it was. I worked

in this field for around 7 years at which time I moved in the Human Resources sector for several reasons, the main being that I felt I had reached my goals as far as Geology was concerned. HR is such a broad field in which you can utilise both life experiences and factual knowledge to make a difference.

What have you enjoyed most about your profession(s)?

Mostly the people that I have met and the experiences I have had on my travels, mostly in remote locations. The rapport and camaraderie that is built from being in an isolated place, is a reason in itself to remain in the Mining Industry.

I believe that when I have children and grandchildren one day, they will be amazed at the stories I have to tell.

What are the negatives and low points in your career?

I don't feel that I have had any 'low points' as such in my career but a few negatives from

the career I chose would be the long commute periods and strains that this can put on your personal life. I have found that there is a time in your life where you work a fly in and out roster, and there is a time when you work in a residential role. You are the only one that can make that decision when the time comes.

For someone considering a career in your profession are there any words of wisdom to pass on to them?

Listen to your mentors and act on the advice they give you. Keep in mind the future and where you are heading so that your career can flow rather than change abruptly. Roll with the punches, as these are the times when you are more likely to learn a valuable lesson. Always remain open-minded and don't be afraid to voice your opinion and ask questions when you don't know the answers. On a final note, join the AusIMM as it will assist in creating new opportunities through networking.



Management

Mine Manager

A mine manager is responsible for the overall management of the mine including planning, budgeting, staffing, cost containment, and profitability. Mine Managers oversee and analyse operations, making recommendations when necessary to ensure production quotas and procedures are met. They prepare production reports for review by senior management, confer with other managers to set production quotas, to plan extraction sites and to develop policies for the removal of raw materials and they evaluate efficiency of production sites to determine adequacy of personnel, equipment and technologies used, making changes to work schedules or equipment when necessary. Mine Managers typically hold Mine Managers certificates, statutory certificates and have many levels of responsibility. From a legal and ethical standpoint, the first duty of a mine manager is to provide and maintain a safe and healthy work environment. Similarly, a mine manager is responsible for ensuring compliance with applicable environmental regulations. A mine manager accomplishes most of his or her work through the efforts of others. The ability to select, train, develop, and utilise the skills of supervisors, professionals, miners and support staff is the key to success in this job. In most instances, a mine manager also represents the company in the community. A mine manager is expected to meet with landowners, public officials, and other parties to resolve property issues and community issues related to mining activities. Different states will have different statutory/legal requirements.

Mill/Plant Manager

A plant manager is responsible for the overall management of the mill or plant including planning, budgeting, staffing, cost containment, and profitability. Mill/Plant managers have many levels of responsibility. They oversee and analyse operations,

making recommendations when necessary to ensure production quotas and procedures are met. From a legal and ethical standpoint, the first duty of a mill/plant manager is to provide and maintain a safe and healthy work environment. Similarly, a mill/plant manager is responsible for ensuring compliance with applicable environmental regulations. Mill/Plant managers accomplish most of their work through their employees. The ability to select, train, develop, and utilise the skills of supervisors, technical professionals, operators and support staff is the key to success in this job. In most instances, a mill/plant manager also represents the company in the community. A mill/plant manager is expected to meet with landowners, public officials, and other parties to resolve property issues and community issues related to processing activities.

Chief Executive Officer

Chief Executive Officers (CEOs) plan, organize, direct and control, through their managers and employees. They formulate policies which establish the direction to be taken by their company, either alone or in conjunction with other members of a board of directors. They establish objectives for the company and formulate or approve policies and programs. They authorise and organise the establishment of major departments and associated senior staff positions, allocate funds to implement company policies and programs; establish financial and administrative controls; formulate and approve promotion campaigns; and approve overall personnel planning. CEOs select or approve the selection of middle managers, directors or other executive staff and coordinate the work of regions, divisions or departments. They represent the company or delegate representatives to act on behalf of the company in negotiations or other official functions.

PROFILES

FRAN BURGESS

BSc Tech (Mineral Processing), Masters Qualifying, B Applied Economics, B Applied Sc (Environmental Management) FAusIMM, Grad T IEAust, General Manager Zinfex Rosebery Mine

What formal qualifications do you have?

Originally from Broken Hill in NSW, I completed a Bachelor Science (Technology) in 1982, majoring in Minerals Processing, and completing Master's Qualifying in 1984. In 1995 I completed a Bachelor of Applied Economics with the University of South Australia and in 2000 obtained a Bachelor of Applied Science majoring in Environmental Management with Murdoch University. The first degree was completed part-time while working as a Cadet Metallurgist in Broken Hill and the other two were completed via distance education, whilst working in the mining industry. Currently enrolled in an MBA with Deakin University.

Why did you choose your particular career(s)?

I was attracted to employment in the resources sector at a young age and was able to fulfill my dream by being accepted as the first female cadet in Broken Hill in February 1978.

What you have done?

I have worked for North Broken Hill Ltd, Normandy Ltd, Pasmenco Ltd and now Zinfex Ltd, during a career spanning 28 years. I have held technical and management positions in Metallurgy with both Normandy and Pasmenco, the most recent at the 5mtpa Pasmenco Century Mine, where I was the Manager Metallurgy. I was promoted to General Manager at Zinfex Rosebery Mine, Tasmania in September 2003. I have a passion for safety; the environment and ensuring personnel make the most of their time at work. I love mineral processing, in particular flotation, however grinding and gravity separation are high on my list as well.

Do you have any regrets about how your career has developed?

I have not had time to do my Master's in Flotation and then a PhD. It is still on my list of objectives for the future.

What you have enjoyed most about your profession(s)?

Working with people of all different walks of life and enjoyed the differences and challenges.

My most favorite time is commissioning new plant and working with people to get the project up and working well.

What are the negatives and low points in your career?

I haven't had many low points, I have always felt privileged to be in the industry – people who put me on at North Broken Hill had to make a paradigm shift and I have always been grateful for that. I was retrenched in 1982 due to a down turn in the industry and no guarantee of a job when you complete a cadetship – I could have taken longer to do my course and the retrenchment would not have occurred. However, I would not be the person I am today.

For someone considering a career in your profession are there any words of wisdom to pass on to them?

Always do your best and only expect from others what you yourself would do, i.e. do not ask others to do something you would not do yourself. Treat people with respect and the way you wish to be treated and you should not have any issues. Have a balance between work and home. Enjoy every minute as time goes very fast.



Law and Finance

Lawyer

Lawyers provide advice to clients on a variety of matters and may write and submit documents on their behalf as well as represent them in court or at tribunal hearings. A lawyer employed in the minerals and energy industry may prepare contracts for joint venture partnerships and contractors; oversee legal requirements of the company and advise in areas of worker compensation, native title and environmental responsibility. They may ensure legal requirement of tenement and lease management is adhered to and ensure appropriate liability insurances are in place.

Finance Professionals - Accounting

Financial Professionals analyse, report and give advice on the financial dealings of organisations and individuals, and advise on associated record-keeping and compliance requirements. Many technical professionals in the minerals industry do further studies in finance to work in financial fields within the minerals industry. Finance Professionals can specialise in a number of areas some of which are listed below:

Finance Manager who prepares reports for management, summarising the business' financial position in areas of income, expenses, capital usage and cash flows, and assists with the preparation of strategic plans, budgets and financial forecasts. Finance managers also work out funds requirements and strategies to invest surpluses. They also develop accounting and management policies and procedures.

Investment Analyst who evaluates the worth of companies for potential buyers and investors, and investigates businesses being sold, bought or merged.

Treasurers plan short and long-term finance for organisations and advise on the financial consequences of internal and external decisions. They design and manage investment portfolios to manage financial risk for organisations by acquiring, looking after and investing funds.

Finance Professionals - Dealing And Broking

Financial dealers and brokers may obtain information on securities, market conditions, government regulations and financial circumstances of clients, deal in the marketplace on behalf of clients and provide financial advice. They may record and give 'buy' and 'sell' orders, calculate and record costs of transactions, develop lists of appropriate investments for clients and plan buying and selling activities. Finance Professionals can specialise in a number of areas some of which are listed below:

Commodities Trader who brings together buyers and sellers of commodities to negotiate private sales and arrange sales through established marketplaces.

Financial Market Dealer who buys and sells securities within the financial market and trades and distributes financial securities on behalf of financial institutions.

Stockbrokers buy and sell stocks and bonds on behalf of clients. With experience and perhaps further training, a financial dealer and broker may progress to become a

Merchant Banker, who offers financial products and services, handles large financial transactions and operates as an intermediary in the professional and commercial sectors of the finance industry. They are also involved in the money market, corporate lending activities and investment banking.

PROFILES

CHRISTIAN ZEROVICH

BSc(Geology) BCom (Economics and Finance) MAusIMM. Advisor, Euroz Securities Ltd.

What have you done in your career(s)?

I worked in the Western Australian gold industry for about 5 years. My resources experience spanned from mine geology and resource definition at the Wiluna and Jundee mine sites, to gold exploration in the Laverton Belt.

I have been working in the stockbroking industry for 5 years, with the last 3 years at Euroz Securities. Euroz Securities specialises in Western Australian-based mid-cap resource and industrial companies.

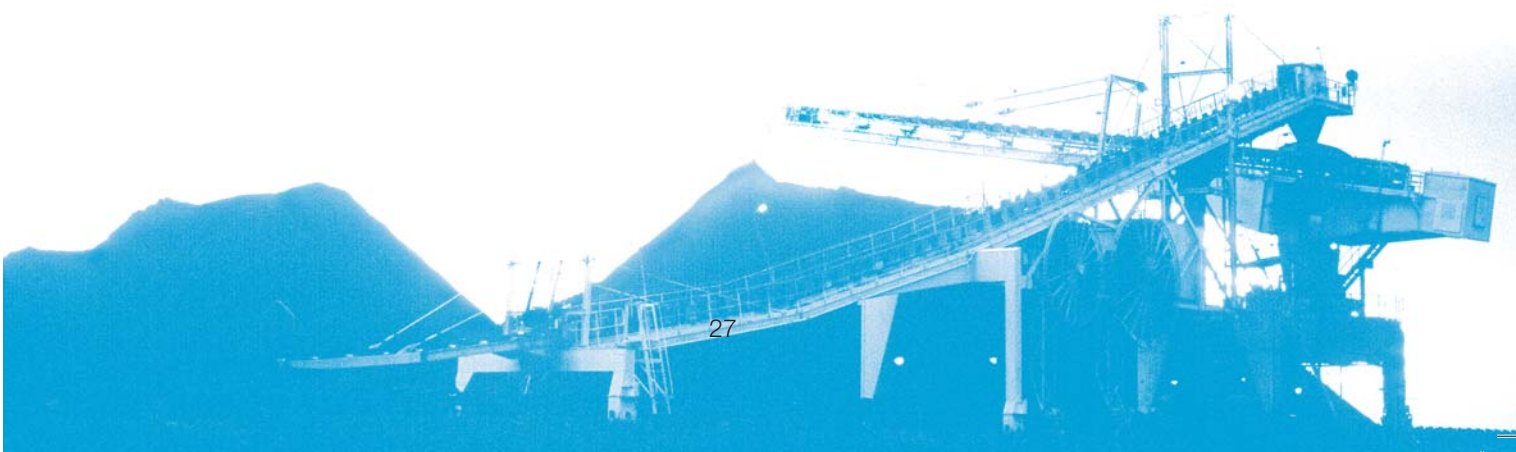
What have you enjoyed most about your career(s)?

The dynamic environment of the stockmarket and investment industry has made my career very enjoyable. Each day provides opportunities to research new companies and commodities, and provide up to date investment ideas to clients.

For someone considering a career in your profession, are there any words of wisdom to pass on to them?

People looking for a career in stockbroking should have a strong grounding in a technical field, such as geology, mining, metallurgy, accounting, etc. These skills will be transferable to company research and idea generation.

A wide network of people from the mining industry also provides a source for company and project information, and contacts.





Liaison/Communication

Community Liaison/Relations

Community Liaison/Relations professionals encourage and assist communities to assess the requirements of their community and liaise with industry and governments to establish harmonious and productive relationships. Community Relations and Liaison professionals in the minerals and energy industry prepare submissions and reports, monitor, evaluate and recommend changes to community programs, policies and practices and encourage community participation in development of strategies for dealing with environmental, heritage and health issues. They also organise and chair community meetings.

Industry Liaison - Policy And Advocacy

People working in industry liaison roles confer and consult with individuals, groups, and committees to determine needs, plan, implement, and extend programs and services based on the consultation process. Industry liaison professionals establish and maintain relationships with other agencies and organisations in industry to meet and not duplicate needs and services. They can assign duties to staff, members or volunteers and plan, direct, and prepare public relations materials. Research and analysis of member, industry and community is conducted as basis for strategic development and participation in various activities is undertaken to serve clients of the organisation. Industry liaison professionals review and analyse legislation, laws, and public policy and recommend change to promote and support interests of industry and specific groups. They deliver speeches, write articles, and present information for their organisations at meetings or conventions to promote services, exchange ideas, and accomplish objectives and they consult with staff and others in government, business, and private organisations to discuss issues, coordinate activities, and resolve problems. They evaluate findings of investigations, surveys, and studies to formulate policies and techniques and recommend improvements for personnel actions, programs, or business services.

They may also direct and conduct studies and research, prepare reports and other publications relating to industry trends, program objectives and accomplishments.

Anthropology

Anthropologists study the origin, development and functioning of human societies and cultures, as they exist now, or have existed throughout history. Anthropologists are concerned with the total complexities of social and cultural life, including religion and rituals, family and kinship systems, languages, art and music, symbolism and economic and political systems. Anthropologists' main research method is fieldwork, living with the people being studied and learning by participation in activities. Applied anthropologists may work in areas such as social policy and planning, social impact assessments, conservation, advocacy, community development, women and development, cultural resource management, land claims and social justice. In collecting information about a society, Anthropologists may have to learn a language and spend some time undertaking field work in remote areas and often under difficult conditions. Anthropologists in the minerals and energy industry may work in different communities to gather and analyse information on social and cultural behaviour, artefacts, language and biology of the groups and societies which they are studying. They collect, identify, date, protect and preserve indigenous artefacts, material possessions and other objects of anthropological interest.

Anthropologists may specialise as in areas such as Applied Anthropology working in areas such as social policy and planning, social impact assessments, conservation, advocacy, community development, women and development, cultural resource management, land claims and social justice. They may also specialize as a Social/Cultural Anthropologist who conducts ethnographic research on small communities, cities and nations, and makes comparative studies of different cultures.

PROFILES

SAM RIGG

BA MA (International Studies)
Community Liaison Officer - Minara
Resources Pty. Ltd. Murrin Murrin Operations

Why did you choose your particular career?

I like to believe that, apart from simple arithmetic, there is no 'one-answer' to any problem. So, if industry is serious, mutually beneficial solutions can be reached with all external stakeholders. For anyone motivated by community issues or inequalities, often more can be achieved by working with industry than against it.

What have you enjoyed most about your profession?

Every day is different. There are crises, short and long-term projects and time in-and-out of the office. You get the chance to interact with all departments within your organisation and a wide variety of external stakeholders which provides continual learning experiences and personal development.

For someone considering a career in your profession are there any words of wisdom to pass on to them?

Everything in community engagement takes time. If someone raises a concern with your organisation don't dismiss it or bombard him or her with facts, figures and 'expert opinions' it is not going to help. 90% of the people who raise issues do so with benevolent intentions and you need to listen and really figure out why they are distressed. Although, dealing with the other 10% is more entertaining!

MONIKA SARDER

Senior Policy and Research Coordinator,
The AuslMM

What formal qualifications do you have?

BA/LLB (Honours) from Melbourne University.

What have you done?

I have written submissions to a raft of Government enquiries as well as press releases and articles on issues such as

uranium policy, exploration and education for major newspapers. I have attended a number of strategy sessions in which future policy directions were discussed, and undertaken a number of projects, such as a series of profiles on women mining professionals who successfully balanced work and motherhood.

What have you enjoyed most about your profession?

The chance to synthesise secondary research with on the ground opinions from members. You are constantly learning new things from people.

For someone considering a career in your profession are there any words of wisdom to pass on to them?

People are often the best resource you have. You need to be ready to listen to others and constantly amend your argument.



Technology Services and Application

Technology Application

Technology application professionals promote and enable the transfer and commercialisation of technologies. Technology application professionals implement various and relevant programs and projects in different areas and divisions such as planning and management, technology packaging and promotion, enterprise development, consultancy services, applied communication and technology commercialisation. They prepare pre-feasibility studies, feasibility studies and business plans for selected technologies to establish not only the economic viability of adopting/using the technology but perhaps more importantly to guide scientists in their R&D efforts to further improve the technology. They look at ways of shortening the lag time between development and utilisation of available technologies and inventions and provide technical assistance for the establishment and operation of pilot plants prior to full commercialisation. Technology application professionals aim to establish the economic and technical viability

of selected technologies under field conditions, thus, enhancing the technologies ability to be commercialised. Often they will bring together government and private technology generators, investors, financial institutions and technology adopters interested in starting or improving technology-based ventures.

Technology application is particularly important to the Minerals Industry in Australia which has placed significant emphasis and recognition on the Minerals Technology Services Sector. Technology application and services professionals come from a range of technical backgrounds and tend to have entrepreneurial and innovative strengths. Some will start their own companies, others will work in large corporations and some will work in research and academic institutions such as CRC's. Many will take pure research and have the insight to be able to match the results with an industry need, and then develop them so that the technology can be made commercially successful.

PROFILES

DR ALAN MONAGHAN

PhD B.Sc. (Hons) MAusIMM Research & Development Manager, Hatch Associates

What have you done?

I have programmed fluid dynamics and thermal modelling software (CSIRO), developed mine planning and survey software, commercialised software and mining technologies (including managing licensing negotiations), managed IP portfolios, supervised the project management for technology based equipment manufacture (MIM), developed and managed R&D programs and the R&D Tax concession, consulted on R&D and IP strategy including IP identification, valuation and commercialisation (Hatch).

Do you have any regrets about how your career has developed?

Not really, everything is about being flexible enough to come up with or recognise opportunities (which mostly occur in your current organisation, as you know it best), and to have a genuine interest in taking on assignments that will benefit your organisation. You cannot guarantee that you will succeed at everything you try, but you can have some great successes along the way. I would have to admit that I have no idea what I will be doing in three years time, only that I will be doing something I am interested in that adds significant value to my employer.

What have you enjoyed most about your profession(s)?

The variety, and the opportunity to experiment with new things, whether they be working with new or improved technologies, or creating new business models.

What are the negatives and low points in your career?

I have had to spend considerable time away from home and family, and when you are trying new things you do not always have support and success from day one. You have to stick by what you believe in to get past the knockers and doubters, but still be prepared to listen to them to make sure that you are not off the track.

For someone considering a career in your profession are there any words of wisdom to pass on to them?

Remember that the idea you are championing may be fantastic, but it might not be the right time or climate for it to succeed. Learn to accept temporary setbacks to work with your organisation's bigger agenda, but don't stop believing in great ideas. One day the time might be right.





Career Links

AUSTRALIAN JOB SEARCH

www.jobsearch.gov.au

Contains:

Australian Training-Get the Training for the Job or Career you want - Search to find courses by occupation, by region, or by institution. Has details on courses, education and training providers including universities, TAFE and registered training organisations.

Australian Careers - Has Job Outlook (Find out about job prospects, weekly earnings, type of work and other useful occupational information), Career Quiz (a fast online assistance tool, helping to inform about career interest areas and providing links to local career information services), and Job Explorer.

CHAMBER OF MINES AND ENERGY WESTERN AUSTRALIA

<http://www.cmewa.com.au>

Has an excellent careers section and multimedia material with tips for looking for vacation work and employment. Also goes through just about all of the career and employment opportunities in the minerals industries. Also has a Human Resources section.

GRADUATE CAREERS AUSTRALIA

<http://www.graduatecareers.com.au>

Graduate Careers Australia is a peak body with representatives from employers, universities and government. Their website is a user-friendly, central source of information about graduate careers and employment, which has been created for students and graduates of Australian universities, as well as employers, researchers and careers professionals.

UNIVERSITY CAREERS SERVICES

If you are a current tertiary student or recent graduate find links to your University Careers Service at:

<http://www.graduatecareers.com.au/content/view/full/1749>

JOB GUIDE

<http://jobguide.dest.gov.au>

A site by the Department of Education, Science and Training that lists hundreds of occupational profiles and information on courses. You can look at an occupation and see related occupations, an occupation profile and all the training and course providers.

MY FUTURE

<http://www.myfuture.edu.au>

This site provides the opportunity to search all courses and programs, as well as other careers/employment information. A joint initiative by the Commonwealth, State and Territory Governments.

MINERALS COUNCIL OF AUSTRALIA (MCA)

www.miningcareers.com

A careers web site from the Minerals Council of Australia featuring profiles and multimedia - must see viewing!

NEW SOUTH WALES MINERALS COUNCIL

www.nswmin.com.au/campus

A comprehensive education website, including career profiles and pathways.

QUEENSLAND RESOURCES COUNCIL (QRC)

www.qrc.org.au/school/index.htm

Has a careers guide and provides information for career advisers, teachers and students on possible career options in the minerals industry.

APESMA- ASSOCIATION OF PROFESSIONAL ENGINEERS, SCIENTISTS AND MANAGERS, AUSTRALIA

www.apesma.asn.au

APESMA has a wide range of career, student and graduate services. They have an active career management area and also a dedicated students and graduates section. Well worth a look!

AUSIMM STUDENT CHAPTERS & MEMBERSHIP

Student Members play a vital role in ensuring The AusIMM connects with tomorrow's professionals. Student membership is \$11 and offers a fantastic range of benefits including:

- Access to Scholarships
- Discounted Conference Registrations and Industry Publications
- Networking and Mentoring
- AusIMM Student Chapters and;
- FREE Access to Conference Papers Online.

The AusIMM runs a network of Student Chapters at university campuses where minerals related programs are offered. Student Chapters organise social, technical, industry networking and careers events and provide a unique opportunity for personal and professional development.

For more information on AusIMM Student Membership and Student Chapters, visit: www.ausimm.com/careers or call: (toll free) 1800 657 985