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Message from the Managing Director

Reflections at the end of the Financial Year and on the future



Well we have just finished another financial year and I guess it's time to reflect on the past 12 months.

To take a leaf out of Queen Elizabeth's famous 1992 speech, and although a little worn it's fair to say that this past year can be described as *annus horribilis* for many and no doubt *annus mediocris* for the rest, however I concede that it may have been *annus mirabilis* for the very lucky few, although I have not come across any of these folk as yet.

Although difficult to generalise, many in the METS sector have been forced to slim down as a result of shrinkage of their order books, some as much as 50%. Junior explorers continue to face a brick wall in accessing financing. Despite some IPOs and deals reported over the last six months, the junior sector is still in poor shape. Also the availability of a plethora of traditional and alternative financing models such as private equity, metal streaming, off-take financing, royalty financing and equipment financing etc, has not yet made a big difference to the development of new mining projects. SNL's Pipeline Activity Index which measures overall activity reached an all time low in April.

The big end of town seems to be at the mercy of whatever bad news emanates from China. Bulk commodity prices have not improved, indeed the reverse. As to gold, rising costs continue to plague companies. The recent rally in price to over \$1300 may not be sustainable. Some think that the recent launch in Singapore of the exchange-traded gold kilobar contract may generate increased demand at least from Asia. There has been speculation of possible consolidation at the bigger end of town but nothing as yet. Copper continues to be a favoured target for many companies despite a dip in prices. Zinc has been showing promise.

Governments all over the world are feeling the squeeze because of reduced receipts. The mining boom, which resulted in unprecedented revenue, is now a thing of the past. Or is it?

In a new book, *Beyond the Boom*, the economist John Edwards, a board member of the Australian Reserve Bank, not only argues that the mining boom did not have as big an impact in Australia as people think but also that the end of the mining boom will herald a shift towards investment in natural gas.

The Australian Bureau of Resources and Energy Economics in their latest quarterly report say that commodity exports were the principle source of Australia's economic growth with commodity export earnings rising an estimated 11 per cent in the 2013-2014 financial year to a total \$196 billion. Apparently, this means nothing to the Australian Institute, who caused a furore recently by publishing a report that concluded that Australia's mining sector has received massive direct and indirect government subsidies despite its profitability. The implication being that the industry is robbing the Australian people. It is always a public relations disaster when one of Australia's largest miners is sensationally reported in the press to have paid almost no tax over the past three years. Regrettably this type of press is simply 'grist to the mill' for the anti-mining brigade.

The ill-wind of austerity is gripping Australia. The reduction in revenue, and some say also the profligate spending of the previous government, has forced the new government to introduce significant funding cuts across many areas including universities and CSIRO, more about this later.

In Chile, the new Bachelet government has approved legislation that would see a gradual increase of the corporate tax rate to 25% by 2017, from a current 20% rate, and the elimination of tax exemption for businesses that reinvest profits. Interestingly, the Chilean government is apparently planning to introduce free University education funded by the increase in taxes. In contrast, the Australia government is planning to deregulate university fees with the result that students may end up paying US level fees for a basic degree.

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So how has science and research fared in this environment? In Australia perhaps *annus horribilis* is the best descriptor. CSIRO, the Universities, and the Cooperative Research Centre (CRC) programme are feeling the pinch. CSIRO will lose over \$100 million over four years. Some \$80 million over four years has been removed out of the CRC programme resulting in the scrapping of the current round of funding for new CRCs, with only extension of existing CRCs being considered for funding. As if to balance these cuts in June the Australian Government committed some \$23.9m to establish seven new Industrial Transformation Research Hubs (ITR) targeting mining and resources, grain improvement, aquaculture and manufacturing. The funding has been provided through the Australian Research Council. Indeed four of the seven ITRs are mining related. In my view providing leverage funding to a consortium of companies whether through CRCs, ITRs or AMIRA style collaborative projects the economic benefits are likely to spread much more quickly and broadly.

In Chile, the government continues to invest in its International Centres of Excellence (ICE) programme, recently awarding the Sustainable Minerals Institute at University of Queensland a grant to form a new centre in partnership with University of Concepcion. This will be the second ICE in which a major Australian institution is involved; the other is led by CSIRO.

In South Africa, the government is investing heavily in innovation by supporting the creation of a number of centres of excellence. For example early this year the Department of Science and Technology announced five new centres of excellence. This included the creation of the Integrated Minerals and Energy Resource Analysis (CIMERA) hosted by the University of Johannesburg, and would see the collaboration of South African economic geology research units including the Palaeoproterozoic Mineralisation Centre, at the University of Johannesburg, and the Economic Geology Research Institute, at the University of the Witwatersrand.

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AMIRA signs two key MOUs

Agência para o Desenvolvimento Tecnológico da Indústria Mineral Brasileira

The Agência para o Desenvolvimento Tecnológico da Indústria Mineral Brasileira (ADIMB) is a not-for-profit member association www.adimb.com.br. Created in 1986, its mission is to promote scientific and technical development and training of human resources for the Brazilian minerals industry, through cooperative action among Government, businesses and research institutions. Currently ADIMB has 64 associate members ranging from large and small mining companies, METS suppliers, and four founding government agencies members.

The MOU was signed by ADIMB's incoming President, Mr Márcio Luis Silva Godoy (Codelco Brazil) and Mr Joe Cucuzza at the recent SimeXmin conference in Ouro Preto. The MOU will provide a framework around which AMIRA and ADIMB will cooperate in developing and managing collaborative projects focusing on Brazil.

One of the first projects that both organisations are working on is the project development of a global laterite research project 'P1123 - Geochemical exploration in regolith-dominated terrains: A global perspective'. It is hoped that this will be one of many projects on which ADIMB and AMIRA will collaborate.



(from left to right)
Mr Marcus Gonzales (President ADIMB, Codelco),
Prof, Augusto Pires (Program Manager, ADIMB),
Mr Joe Cucuzza (MD, AMIRA),
Prof. Onildo Marini (Director, ADIMB)

Beijing Antaiko Information Development Co., Ltd

The China Nonferrous Metals Industry Association (CNIA) and AMIRA International have held discussions regarding an MOU that will provide a framework to enable sharing of information and also to develop and promote research projects in those areas that will support and improve the health of workers, communities and the environment, and the appropriate development of mining, metallurgy industry in China. CNIA is a government-backed industry organisation that represents the nonferrous metals mining industry in China (www.chinania.org.cn)

The MOU was signed with CNIA's subsidiary the Beijing Antaiko Information Development Co., Ltd (www.antaiko.com). Since being established in 1992, Antaiko has built a reputation for authoritative, strategic, and in-depth analysis of the Chinese metals industries and markets. It also provides news, trade and production data, prices and forecast. It works under the CNIA and directly oversees by the Information Centre of China National Nonferrous Metals Industry; Antaiko has become a key centre for information collection and delivery within China and across the world.



Welcome to New Members - BGRIMM

We are pleased to welcome The Beijing General Research Institute of Mining & Metallurgy (BGRIMM) as a member of AMIRA International. BGRIMM's core businesses includes; technical and engineering service in utilization of mineral resources; advanced material technology and products; and mining, mineral processing, metallurgy and secondary metal recycling.

BGRIMM is incorporated in China, and is a leading institute providing innovative technology, diversified products, and process-orientated engineering services in mineral and material industries worldwide. With ISO 9001 certification and a well established multi disciplinary organization, BGRIMM is a complete solution provider, integrating R&D, engineering and equipment manufacture tailored to customer requirements and serve the minerals industry with a full range of expertise from mining to mine closure.

Since its establishment in 1956, BGRIMM has been focusing on utilisation of mineral resources and has built up its reputation from complex ore processing in particular. Currently BGRIMM covers base metals, precious metal, rare-earth and non-metallic as well as iron ore resources, and is acting not only as a products and technology supplier in the areas of mining, industrial explosives & blasting, mineral processing, non-ferrous metallurgy, processing equipments and reagents, but also a service provider for resource evaluation, technical audits and diagnostics, due diligence, process development, EIA, feasibility study, engineering design and EP/ EPCM /EPC etc.

BGRIMM is headquartered in Beijing and has some 3000 employees. It has 11 divisions, two public companies and a number of holding companies.



Norton Goldfields

Norton Gold Fields Limited is one of Australia's largest domestic gold producers, with annual production of more than 170,000 ounces (www.nortongoldfields.com.au). The Company has a mining and processing complex in Western Australia's Kalgoorlie region, including a highly prospective tenement package surrounding the Paddington Mill.

The Paddington Operations have gold ore reserves of 1.07Moz and mineral resources of 6.94Moz and a mine life in excess of ten years, with considerable exploration upside from more than 80 known prospects across its tenement package. The Company is well positioned to grow its business through support from its major shareholder, Zijin Mining Group Co., Limited.

In August 2012, Norton's major shareholder, and China's largest gold producer, Zijin Mining Group Co., Limited increased its stake in Norton to 89% following a recommended takeover offer to shareholders. April 2013 saw the announcement of a friendly off-market takeover of neighbouring Kalgoorlie Mining Company whose key asset, the Bullant Gold Project, is just 28kms west of the Paddington Mill.

May 2013 marked the official opening of the new base-load Enterprise Mine, which when it reaches full ore production capacity, will supply the bulk of ore to the Paddington Mill and contribute greater than 100,000 oz pa to Norton's growing gold production.



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The good news for South Africa is that the platinum mines strike appears to be over; the bad news is that the country continues to be plagued by a chronic lack of energy to fire up business.

In Canada, the latest news was the award in January of C\$15 million over five years under the Business-led Networks of Centres of Excellence program to the Centre for Excellence in Mining Innovation for its Ultra-Deep Mining Network (UDMN) proposal. UDMN has also received a C\$31 million in leveraged cash and in-kind contributions. UDMN will build collaborative teams to solve critical challenges that impact resource extraction in ultra deep mining environments, as well as in deep, tight shale-hosted hydrocarbon reservoirs.

There is no doubt, that access to research funding has become much harder in the current climate. AMIRA International has certainly felt the consequences of this in this past year. This has regrettably resulted in some staff being let go. I strongly believe however, that companies will continue to support research, however it will require a compelling case and furthermore it must demonstrate value. It is true that funding long term research has for many companies taken a back seat. In *Mining Innovation State of Play 2013*, Virtual Consulting International reports that the majority of respondents to their survey focussed their efforts on a 0-3 year time horizon. The report indicates that mining companies allocated on average some 73% of their budget to incremental operational improvements. To achieve the later they generally partner with suppliers in one-on-one arrangements.

Yet without research focusing on the longer term it is hard to see how industry will be sustainable in the future. Recently Mark Cutifani, CEO of Anglo America, was reported as saying that "we need to do it differently. We need a better way. We need to innovate". He went on to say that "our industry is damned by the fact that our spending on innovation, research and development is one tenth that of the petroleum industry". Stirring words as long as we don't neglect the longer term research by focusing exclusively on the 3-years horizon as the VCI report suggests.

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A case in point is *in situ* mining. The future mine is not a mine as we know it. Although a glimpse of the future can be seen at the Beverley uranium mine in Australia.

Amongst the many attributes of the future mine will be that, for all intents and purposes, it will be invisible. By 2050 moving rock will be a thing of the past. Extraction will be through *in situ* recovery and then only of the valuable minerals and for 24/7. The ongoing developments in drilling, fracturing, groundwater management, online solution monitoring, and selective mineral leaching chemistry make this inevitable.

However to achieve this vision a greater understanding of the physical processes involved will be required and a lot of enabling technologies will need to be in place. As J.C. Argarwal said back in 1980 "*the eventual payoff is so great that the technology will be developed*", at least for copper. This may be so but is the industry in any shape to make this happen by osmosis? I contend that for this type of long term research a collaborative approach makes more sense than going alone. Some delegates attending the PwC Mine 2014 briefing in Melbourne recently even went so far as to suggest that the mining industry should outsource innovation. This could make sense in the context of longer term research that should best be tackled through collaboration.

But the question is how can one facilitate industry collaboration on a big ticket item such as *in situ* mining? Indeed will companies collaborate at all? Let's address the former first. Clearly the first thing that needs to be established is to specify what the future mine will look like, then identify what needs to be done, how, by whom and over what timelines. Some of the larger companies have independently done part of this in-house. However, I contend that an industry-wide view is critical and a technology roadmap is a good way of achieving this. It will require the collaboration of mining companies, METS suppliers, government agencies and research institutions to achieve this. AMIRA International is proposing the development of such a roadmap. If the initiative attracts broad stakeholder engagement it will provide a blueprint on how we may be able to achieve this truly transformative vision. Not all the research and development identified by the Roadmap need to be carried out via collaboration.

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From a presentation to the AMIRA International Board *In situ resource recovery search for the "invisible mine"* by Prof. B Hiskey, Uni. Arizona, 24 April 2013

Indeed I can foresee METS suppliers going alone in certain areas in which they have specialist know-how or embryonic technologies that they perceive will lead to early commercial advantage, they could even partner with a mining company to achieve this. I also envisage alliances coalescing around specific research & development topics identified by the Roadmap.

A few companies have signalled that they will go it alone in developing the relevant technologies because of the competitive advantage it will bestow. I believe that this is misguided and does not recognise that there will be a lot of fundamental work that will need to be done which on its own will provide limited if any advantage. Indeed I argue that this type of activity is ideal for collaboration, and is suitable in potentially attracting government leverage funding.

Some companies in the big end of town are basically chasing the same innovations, e.g. in automation by partnering with different METS suppliers.

The Fraser Institute in their recent report "*Benefits of Incremental Innovation*" suggest that the industry as a whole allocates resources inefficiently. They contend that there is simply too much "imitative" innovation and too little "breakthrough" or "disruptive" innovation. I think this is spot on. As an industry we need to consider how best to leverage each other's resources to address long-term technological challenges in a way that does not jeopardise individual competitiveness or contravenes anti-trust laws. There is a way, but it needs the companies that are prepared to lead to do something about it.

AMIRA International is prepared to assist with the first step. We propose to seek industry support for the development of a global Technology Roadmap focusing on In situ Mining. If support is secured we will consider an open tender process to engage the right people to assist in developing the Roadmap.

Joe Cucuzza

Final P1060 Sponsor Meeting

The final **P1060: Enhanced Geochemical Targeting in Magmatic-Hydrothermal Systems** sponsor review meeting was held in Hobart on the 4th June 2014. The meeting was well attended by representatives from 15 sponsor companies. Researchers from CODES-UTas, Imperial College and Lakehead University presented results from the three year project including a comprehensive dataset and an exploration toolkit. These have the potential to change the way exploration is undertaken within porphyry and epithermal mineral systems.

A project extension is currently in development following substantial interest from the current sponsor group. For more information please contact Adele Seymon.



P1060 sponsors and researcher team at CODES (Photo courtesy of Steve Calladine, UTas).

P1162: Unlocking Australia's hidden mineral potential - Stage 1:- The Roadmap

AMIRA International is proposing an industry funded project to develop a Roadmap to implement the UNCOVER vision as defined by industry for mineral exploration under cover in Australia.

The UNCOVER Executive is supporting AMIRA in this endeavour. The Roadmap will build on the work already done by the UNCOVER group.

The initiative will provide an opportunity for industry to contribute to a Roadmap which will provide the blueprint for addressing the challenges and gaps in knowledge, technology capability together with an assessment of the research capacity (human resources and infrastructure) required to improve the exploration success rate in areas of post mineral cover.

It is critical that this initiative has wide industry support. To ensure this we have structured a sponsorship model that is based on capacity to pay. Securing financial support is only one part of the equation however, the other critical part is engaging with the road mapping process.

Sponsors, whether companies, government agencies or industry bodies will:

- Have input into the development of a powerful industry-wide position, vision and view of current and future exploration needs and priorities in areas of cover and an agreed plan on how to develop solutions,
- Contribute to a plan that aims to stimulate R&D to deliver new knowledge, knowhow and technologies that will open up new exploration frontiers, significantly improve risk management and increase exploration effectiveness in areas of cover in Australia,
- Help to build and optimise research capacity (human resources and infrastructure) to address Australian exploration challenges,
- Assist in ensuring that the research community understands where they should focus their endeavours and align with industry needs if they wish to engage with industry,
- Help to guide government agencies and influence on both type and location of new critical geoscientific data needs and delivery formats required by industry, and
- Help to build a powerful document that could be used to lobby federal and state governments to invest in this critical area.

Mr Robbie Rowe, NextGen Geological Pty Ltd, has been working with AMIRA to develop the prospectus. Robbie will be engaged by AMIRA as part of the AMIRA team tasked to deliver the Roadmap.

We plan to commence the workshop activities in the road mapping process in September subject to receiving the necessary support.

Those interested in receiving the prospectus are asked to contact:

Robbie Rowe
NextGen Geological Pty Ltd
+61 419 899 095
rjrgeo@iinet.net.au

Adele Seymon
AMIRA International
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adele.seymon@amirainternational.com

Acknowledging Dr Ravi Anand

AMIRA International would like to congratulate Dr Ravi Anand, Chief Research Scientist - CSIRO Earth Science & Resource Engineering on being the recipient of the Gibb Maitland Medal for 2014.



Dr Anand is a world leader in the field of weathering, regolith geoscience and geochemical exploration. His research focuses on developing new and improved methods for mineral exploration in areas of sedimentary cover. He has been a major contributor to the success of mineral exploration research in CSIRO. He has worked with AMIRA International for many years and has led many successful projects the last of which is the recently completed *P778A: Predictive Geochemistry in Areas of Transported Overburden II*.

We are pleased to continue to work with Dr Anand in the new initiative *P1123: Geochemical exploration in regolith-dominated terrains: A global perspective*. This project is currently in circulation seeking sponsorship.

For more information, please contact Adele Seymon +61 3 8636 9978
adele.seymon@amirainternational.com



GEOLOGICAL SOCIETY OF AUSTRALIA
WESTERN AUSTRALIAN DIVISION

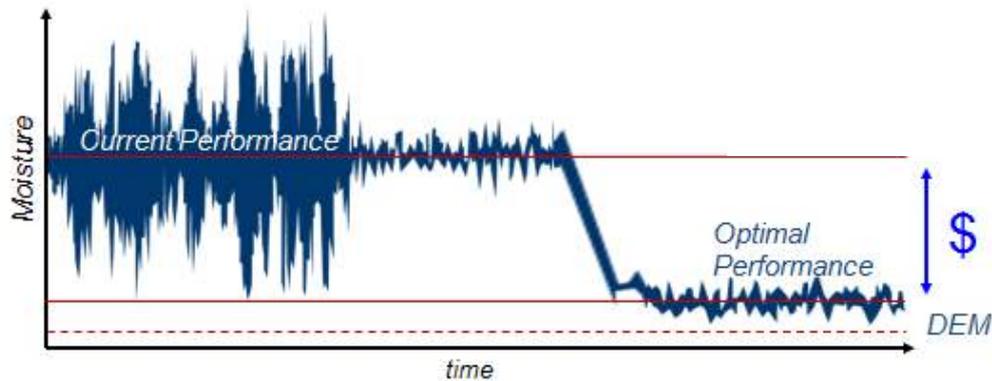


Gibb Maitland Medal

Awarded for substantial contributions to geoscience in Western Australia, with particular consideration given to contributions that relate to the occurrence or discovery of mineral resources

P1097 Systematic Evaluation of Transportable Moisture Limit (TML) Measurement Methods for Iron Ore Fines Bulk Cargoes

During AMIRA International's project **P1097: Systematic Evaluation of Transportable Moisture Limit (TML) Measurement Methods for Iron Ore Fines Bulk Cargoes**, it became apparent that opportunities existed to improve moisture measurement and control for the iron ore industry, and that economic moisture reduction may also be possible due to moisture migration on conveyors. Moisture must be high enough in iron ore processing to suppress dust, yet low enough to ensure material handling issues do not occur, ensure any TML requirement is not exceeded, and to avoid unnecessary freight costs. Water reduction capability is particularly relevant for ores that are mined below the water table, wet processed, or just mined in a high rainfall area. In addition, the ability to further reduce water content in the ore has economic advantages throughout the transport chain where a one percent reduction in moisture content can equate to multi-million dollar transport cost savings.



P1150 Moisture Measurement and Control for Iron Ore Conveyor Systems

A new 2-year collaborative **AMIRA project P1150: Moisture Measurement and Control for Iron Ore Conveyor Systems** is currently being developed to address the above issues. It will be conducted by two well-respected research providers: TUNRA Bulk Solids Handling and Scantech, under the leadership of Dr Tom Honeyands. AMIRA International, represented by Program Manager Olga Verezub, will have overall responsibility for the development of the project and subsequent management/oversight once sufficient industry support is secured to start the project.

The project proposes to address the following two critical areas:

- Develop an effective means of automatic calibration and monitoring of moisture through the ore on high speed conveyor belts for a range of iron ore mineral types, using a low frequency microwave sensor combined with a mineralogy detection device. This unique system will provide automatic moisture detection throughout the whole depth of the iron ore on the belt, rather than just at the surface.
- Exploit the tendency for moisture migration due to dynamic belt oscillation on high speed conveyors to develop conceptual moisture reduction system designs for moisture liberation from an iron ore stream.



Figure 2: Conveyor belt system

Sponsors for this project will benefit by having the ability to measure iron ore moisture content online and in real-time for a range of ore mineralogies via a global calibration matrix. Sponsors will gain exclusive access to this solution for the period to be agreed after the completion of the project. Sponsors will also benefit from understanding the mode of moisture migration (to the top or bottom of the belt), and the rate of moisture migration through the definition of dynamic moisture migration characterisation curves specific to their ore and handling system. This design information will be used to identify or create economic moisture reduction systems where liberated water and/or a wet portion of the ore stream can be separated. It is envisaged that this separation would ideally occur at a conveyor transfer and any entrained ore re-processed and returned to the belt.

The project is planned to commence in October 2014. For further information please contact:

Olga Verezub
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AMIRA International involved in Australia 3.0 Forum 2014

Australia 3.0 is a Forum for informed debate and for developing new opportunities on the digital transformation that is already causing massive structural impact in many industries, most notably evident in some sectors such as banking and finance, media, retailing and music distribution. These are not one-offs. All industries will be affected and many significantly transformed. Information and communications technologies (ICT) have changed the way we work, learn and live, making this one of the most strategic shifts in the modern economy.

The Australian mining industry faces some significant challenges over productivity and sustainability (social licence to operate). Decreasing ore grades, deeper mines, higher input costs and complex regulation have all contributed to declining productivity and hence reducing our global competitive advantage. The mining industry also needs to maintain the confidence of the communities in which they operate in regards to health, safety and environmental management.

A number of mining companies are conducting major initiatives to reinvent the way operational processes are carried out to achieve a step change in performance. These initiatives are underpinned by the digital transformation and are aimed at shifting operations from a relatively static and disparate set of functions, to a digitally aware, dynamic, automated, integrated and interactive environment, with increased agility, lower operating costs, higher productivity and improved safety and environmental outcomes.

Australia 3.0 committee, formed as a joint initiative of the ICT industry associations* in partnership with CSIRO and NICTA, is reaching out to industry associations in a number of industries including mining to engage their membership in this unique opportunity to engage in informed and action-oriented debate.

Invitees can participate in the on-line discussions leading up to a two-day conference in Melbourne on 28th - 29th August 2014. In addition to the mining industry, the other industries engaged in this activity include: Health Services, Transport Infrastructure and Government Services.

The goals of the Mining stream in Australia 3.0 in 2014 are broadly as follows:

- Bringing thought leaders in these vertical sectors together with their peers in the ICT sector
- Identifying the major obstacles to improving productivity and sustainability outcomes
- Showcasing ideas and solutions that show early promise to have a significant impact in the mining industry
- Developing proposals for collaborative effort to progress identified opportunities

AMIRA International is actively involved in organising the Mining Stream and will be assisting in the review and selection of the best ideas from this event with a view to be seeding new collaborative innovation projects for the mining industry.

Members of AMIRA International are encouraged to join the mining stream and help pro-actively drive the Australia 3.0 debate. The discussions will commence this month and will run through mid August using 'Yammer' as the social media tool for facilitating the debate. The results of the on-line discussions will be debated in workshops during the two-day conference at the end of August.

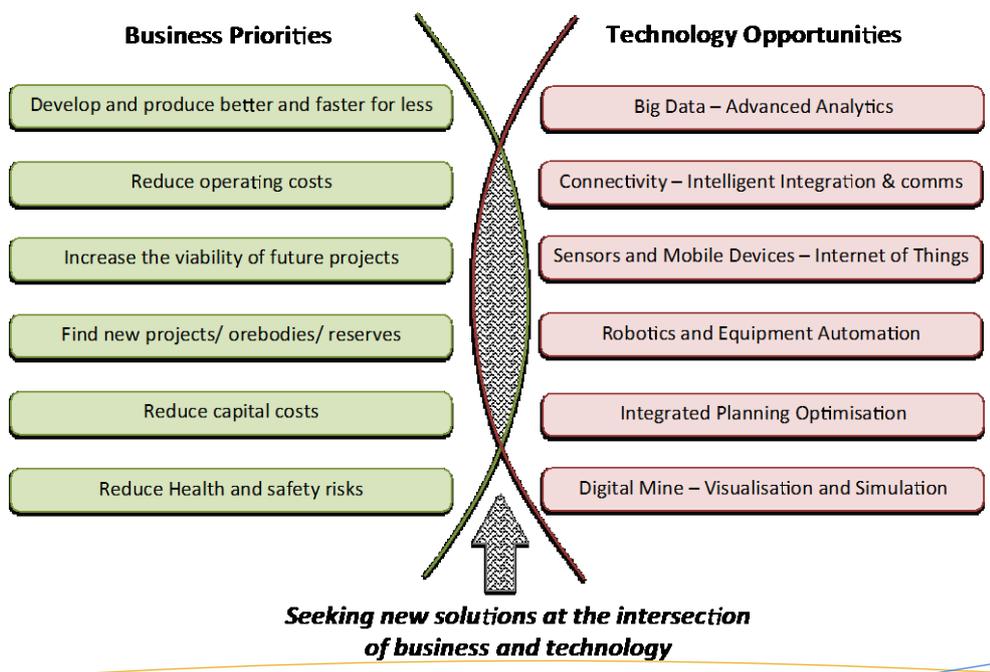
These discussions will be centred on the intersection of mining industry drivers for innovation and technology enablers as illustrated in the graphic on the right.

The event is by invitation only and there is no cost to participants, other than the optional iAwards Gala Dinner held in the Melbourne Convention and Exhibition Centre on the evening of Friday August 29th.

Registration of interest to participate in Australia 3.0 can be made through completion of the 'Get Involved' form <http://australia30.com.au/get-involved>

For further information about the Australia 3.0 forum visit www.australia30.com.au or contact the convener of the mining stream: Colin.Farrelly@IndagoPartners.com

* Australia 3.0 is a joint initiative of The Australian Information Industry Association, The Australian Computer Society and The Pearcey Foundation.



AMIRA P260F Student Clement Owusu shows way for increased Copper and Gold Recoveries

The work of AMIRA P260F student Clement Owusu's has led to remarkable increases of both copper and gold recovery in the post-regrind cleaning stages at one of the AMIRA P260F sponsor's operations. Clement has been supervised by Dr Max Zanin from the Ian Wark Research Institute at the University of South Australia where Clement has undertaken his PhD research studies.

In the flotation of copper ores, fine regrinding of the rougher concentrate is often required for liberation of the copper minerals from pyrite. However, after regrinding, reduced copper recovery is often experienced in plants, due to electro-chemical reactions between the copper minerals and pyrite in the pulp.

Clement Owusu just submitted his PhD thesis, titled "Effect of aeration in the separation of Chalcopyrite from Pyrite after Regrinding with an IsaMill", in which he investigated the effect of post-regrind aeration on the selective flotation of copper minerals from pyrite. Clement's work highlighted the positive effect of aerating the slurry after fine regrinding. After aeration of chalcopyrite/pyrite mixtures ground in an IsaMill, increased Cu recovery and grade were observed in subsequent cleaning flotation. At the same time, more pyrite was rejected after aeration, due to surface oxidation of the latter. In particular, Clement found correlation between the chalcopyrite/pyrite ratio in the pulp and the amount of air needed for optimum copper recovery and selective rejection of pyrite.

Clement also developed a tool to assist plant operators designing a post-regrind aeration stage and adjusting the air supply according to the pulp composition and particle size. The approach has been tested in one of the project sponsors' operations, resulting in a remarkable increase of both copper and gold recovery in the post-regrind cleaning stages.



AMIRA Board Director retires



**Dave Bentley,
Anglo American**

We wish to farewell Mr Dave Bentley who stepped down as Director of AMIRA International after he retired from Anglo American. As Group Head of Technology Development he was responsible for the development of future technologies for use in the mining environment. Dave worked for Anglo American for 30 years and joined immediately after completing a Chemical Engineering degree at the University of the Witwatersrand. Dave worked in a variety of roles including mining operations and corporate centre functions, including running a global business improvement initiative for the Base Metal division. The Board and staff of AMIRA would like to thank Dave for his service and dedication to AMIRA. We wish Dave well particularly in his pursuit of several charity based NGOs in South Africa.

New Board Director co-opted



**Gavin Yeates,
BHP Billiton**

We would also like to take this opportunity to welcome Mr Gavin Yeates. Gavin has been co-opted to the Board awaiting election at the next AGM. Gavin currently is Vice President – Mine Optimisation at BHP Billiton. He has had a 33 year career with BHP and BHP Billiton covering mining operations, resources evaluation, study management, project management and execution, asset development and leadership, merger and acquisition, corporate planning and strategy, corporate governance and business improvement, and executive leadership.

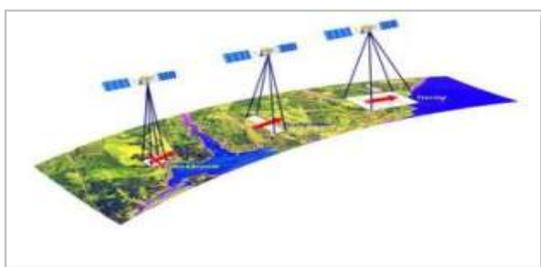
Recently Gavin headed the Group Resource and Business Optimisation global function, responsible for Geoscience, Resource Planning and Development, Operating capability, technology development and group wide implementation, production, maintenance and technical governance for BHP Billiton Group.

P1147 Space-borne hyperspectral sensor briefing sessions

As reported in the March 2014 newsletter, AMIRA International is working with HySpecIQ and the Boeing Company to develop a program that will deliver unprecedented high quality space-borne hyperspectral sensor information products for mineral applications.

The project team is currently planning regional briefing sessions. These sessions are intended to provide interested companies with an opportunity to investigate the applicability of the technology to their business.

Companies interested in understanding the unique application of this technology to their exploration and mining processes, please contact Adele Seymon:



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AMIRA International supports the bid for a CRC ORE II

AMIRA International is supporting the bid for an extension of the Cooperative Research Centre for Optimisation of Resource Extraction (CRC ORE I).

CRC ORE is seeking to build on its success with a bid for a further six year funding term. The theme of CRC ORE II will be "Transforming Mining into an Advanced Manufacturing Industry", with a focus on developing and embedding innovative manufacturing business systems in traditional mining operations.

CRC ORE II's research is structured around the following four integrated programs:

- Program 1: Improved feed quality
- Program 2: Enabling mass separation
- Program 3: Increasing extraction efficiency
- Program 4: Integrated system value and operational control

Part of AMIRA International's commitment to CRC ORE II is the roll in of the P420 Gold Project and future extensions of the P9 Modelling and Simulation Project. AMIRA International looks forward to a deeper engagement with CRC ORE II.



University of Tasmania secures \$17.4m Industrial Transformation Research Hub

The University of Tasmania was successful at securing a \$17.4m research hub, one of seven announced by the Australian Government. The funding includes a \$4 million research grant from the Australian Research Council's (ARC) Industrial Transformation Research Hub scheme, \$9.6m in industry support, and the remainder from other government block funds.

The University's research centre, CODES (ARC Centre of Excellence in Ore Deposits), has partnered with the Australian minerals industry to establish a unique research hub for Transforming the Mining Value Chain (TMVC). The mining value chain extends from exploration and discovery through mining and processing to waste disposal. CODES Deputy Director Professor David Cooke will be the Hub Director and will be joined by a team of researchers from the University including the Director at CODES, Professor Bruce Gemmell.

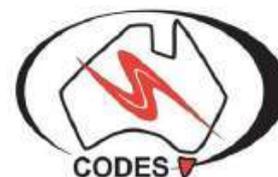
The hub will bring together a team of world-class researchers from the University of Tasmania, the University of Exeter and Australia's Information Communications Technology Research Centre of Excellence (NICTA) to work with partner organisations Newcrest Mining Ltd, BHP-Billiton, Corescan Pty Ltd, Laurin Technic Pty Ltd and a consortium of national and international companies coordinated by AMIRA International.

The TMVC is an example of AMIRA's continued support of building research capacity and infrastructure that will ultimately benefit our members. Another recent example of this is AMIRA's support of a bid by the University of Concepcion in Chile to establish a Laser Ablation Mass Spectrometry laboratory for interdisciplinary application to mineral chemistry and related materials.

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AMIRA International Santiago Seminar and Cocktail Function

On the 20th May AMIRA International hosted a seminar on projects of relevance to our South America member organisations. The seminar was well attended with interest in projects across the various portfolios. The seminar was followed by cocktails at Hotel El Bosque.



AIG Seminar: Mineral Systems Advances from traditional ore deposit

The Western Australian branch of the Australian Institute of Geoscientists is holding a one day seminar on *Mineral Systems: Advances from traditional ore deposit models*. The seminar will be held on Monday 11th August 2014 at the Burswood on Swan, 1 Camfield Drive, Perth (www.aig.org.au)

Three keynote presentations will cover the mineral systems concept, application to Archean gold deposits, and advances in using pyrite for basin fertility and vectoring. The programme includes presentations from well know academics and industry representatives covering the application of minerals systems to gold, nickel, copper, REE and iron ore. Mr Robbie Rowe will give a presentation on AMIRA's UNCOVER Roadmap initiative. The seminar will conclude with a panel discussion.



AMIRA International Board meeting in Cape Town

In May of this year the following distinguished speakers presented to the AMIRA International Board in Cape Town:

- Dr Gordon Smith, Executive Head:Technical, Anglo Platinum: "*Fast tracking the uptake of new technologies*"
- Prof Magnus Nyden, Director - Ian Wark Research Institute: "*A systems approach with big analytics, data fusion and machine learning for optimising processing performance*"
- Prof Francis Petersen, Dean, Engineering & Build Environment, University of Cape Town: "*Global challenges influencing current research thinking and practices*"
- Dr Peter Craven, General Manager Business Development, Mintek: "*Mintek's views on disruptive technology trends*"
- Dr Luiz Mello, Director of Technology & Innovation Vale: "*State of minerals research activity in Brazil and in what Areas and how AMIRA could promote collaboration*"
- Mr Alan Muir, Vice President Metallurgy, AngloGold Ashanti: "*Pathway to new technology implementation in deep mining at AGA - lessons learnt and early wins*"
- Prof Cyril O'Connor, President of the International Mineral Processing Council, "*The supply and demand of Minerals Engineers: A Global Survey*"
- Dr Jim Porter, Director, University of the Witwatersrand: "*Deep Mining Status & Future Direction in South Africa*"
- Prof Ronny Webber-Youngman, Head of Department, Department of Mining Engineering, University of Pretoria: "*Future opportunities and practical implementation of Virtual reality (VR) mine design and planning for the Minerals Industry*"
- Mr Rodney Jones, Specialist Consultant: Process Modelling, Mintek: "*Pyrometallurgy Key Challenges Current Developments and Future Directions*"
- Prof Phillip de Vaal, Head of Department- Chemical Engineering, University of Pretoria: "*Key Challenges, the Status and Future Directions in Process Control*"
- Prof Pieter van Heyningen, Programme Manager, Stellenbosch Innovation District, Uni. of Stellenbosch: "*Co-development of SMART CITY business principles and implementation for the mining community -post mining economically- self sustainable communities*"
- Prof Alison Emslie Lewis, Crystallisation and Precipitation Research Unit University of Cape Town, "*Modern Alchemy: Turning Toxins into Treasure*"
- Dr Craig Sheridan, University of the Witwatersrand: "*Towards water efficiency in the mineral industry - AMIRA P1084 Project*"



Sharing the Benefits

P705C Improving Base Metal Electrowinning - Webinars winning sponsor approval

AMIRA **P705C: Improving Base Metal Electrowinning** commenced this year and is led by Professor Michael Moats from Missouri S&T. The research team also involves research groups at Murdoch University, the University of Utah and the Universidad Federal de Minas Gerais in Brazil.

AMIRA P705C is the 4th iteration of the successful P705 projects that has supported many base metal electrowinning operations globally and be a driver for innovation in EW for the past 10 years. The AMIRA P705C project has been formulated to address a number of key issues currently confronting electrowinning in the copper, zinc and nickel industries is focusing on the key challenges raised by the industry sponsors by undertaking targeted collaborative research on topics that have the aims of:

- reducing energy consumption
- improving capital utilisation
- reducing harmful and damaging acid mist; and
- quickly transferring technology and innovation to the EW operations.

A project initiative that has been designed to deliver on the last dot point has been the introduction of "sponsor only webinars" and after the first two of these sessions have been presented they are being acclaimed widely within the sponsor organisations.

Mike Moats has already delivered webinars on the following topics:

- Copper Electrowinning Tankhouse Operating Data
- Impurity Effects at the Cathode in Zinc Electrowinning

These webinars were presented by Professor Moats from his base in Rolla and had sponsors representatives on various continents participating without leaving their own offices and meeting rooms. The ability for the Project Leader to reach a more diverse audience within our sponsor group in a shorter timeframe has been seen as a great step forward in achieving the technology transfer outcomes AMIRA International is continually seeking to deliver. Also, by utilising web conferencing accessible by personal computers these interactions are achievable without incurring any travel costs for either sponsors and researchers and thus making this innovation a very cost effective and efficient mode for technology to be transferred to sponsor operations in a timely manner.

The list of forthcoming webinar topics is now being developed in consultation with the sponsor group with the control of Acid Mist in Electrowinning being the likely theme for the next sessions.



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P420E Gold Processing

The AMIRA **P420E: Gold Processing** Sponsor Review Meeting was held in Perth on the 23rd of May 2014. The meeting was well attended by sponsors from Anglo Gold Ashanti, Barrick, Newcrest, Newmont, St. Barbara, Norton Goldfields, Magotteaux, Gekko and Tenova.

The researchers from Curtin University presented the results of the most recent fundamental research and related plant surveys conducted in West Africa, Australia and South Africa. The detailed plant surveys resulted in a number of key recommendations for plant improvements and increased metallurgical value recovery from gold processing plants.

Discussions are being held with two companies who are interested in joining this very successful project.

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DM The Global Encyclopaedia of Ore Deposits

A major collection by the late Rod Kirkham in Vancouver has been offered to Data Metallogenica, and subsequently arrived in Australia recently. Rod was a well known consultant on major copper and molybdenum deposits from around the world. The collection comprises over 7,000 documented samples from many deposits that are not already in DM (particularly from outside Canada), and will supplement the 70,000 samples already held in the physical collection. These samples will be used to produce and add new Lithotheque plates to the new DM website (www.dmgeode.com).

The collection also contained thousands of colour transparencies from deposits around the world, dating from the 1960s. These are being progressively scanned and added as photo galleries to many deposits. As well as many representing a view of deposits from many years ago, many of these also have ceased mining and are flooded or otherwise inaccessible. Examples of the latter already on the website include Island Copper and Granisle in Canada.

The new website now contains unique or hard-to-find technical information on over 4,000 deposits of all types from around the world, making it very valuable for training and education for young geologists, especially when coupled with the translation potential of the website and most files (over 80 languages). It is also important as a quick reference for experienced geologists on global deposits they may never visit.



P1025 Achieving Interoperability across the Minerals Value Chain

Data Interoperability - State of the Art Study

AMIRA International members are currently supporting up to in excess of 300 software applications across their operations. The gains in productivity and operational quality that could be realised by increasing the capability of these packages to freely exchange data or to interoperate cannot be underestimated.

The realisation of the opportunity to improve our processes has led to there being a large number of initiatives to set standards for data storage and exchange all around the world.

AMIRA project **P1025: Achieving Interoperability across the Minerals Value Chain**, will investigate the current status of these initiatives while seeking to identify the gaps and missed opportunities relating to the systems in use today. The proposed study will also consider the strategies developed in other sectors including agriculture and oil and gas depending on sponsor support.

Participation by your company in this collaborative effort will ensure increased awareness of current and past interoperability initiatives and ensure gaps that are critical to your business are considered and addressed. Improved data transparency, integrity and exchange will lead to improved decision making across the minerals value chain (from rock to metal). Please contact:

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AMIRA Staff Changes during the year

During the year we bid farewell to the following personnel:

- Ms Donna Copolov. Donna was with AMIRA for four years and served as Project Support officer.
- Dr Bernard Xu. Bernard served in several roles including Assistant Program Manager.
- Ms Katie Legge. Katie was with AMIRA for six years and served as Executive Assistant to three CEOs.
- Mr Matthew Dalziel. Matthew was one of the longest serving Program Managers having joined AMIRA in 1995. During this time Matthew had oversight over the mining portfolio and was responsible for some very successful projects.

AMIRA thanks them all for their contribution over the years and wishes them the very best in future endeavours.



From left to right:
Donna Copolov, Bernard Xu, Katie Legge, Matthew Dalziel



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