

COBALT NEWS

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COBALT NEWS

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COMMENT

The CDI Annual Conference took place in Shanghai on 22/23 May and the one hundred and seventy or so delegates enjoyed a full and interesting programme. Though the global economy is still something of a challenge, it was encouraging to note that growth in cobalt consumption continues to increase and, according to the CRU, the annual growth rate will be >6% for the foreseeable future – largely driven by rechargeable batteries and superalloys for aerospace applications. In fact, in their presentation, Natureo Finance believed that if forecasts for large-format lithium systems turn out to be correct then cobalt demand will continue rapidly with growth in the sector. Couple this with very buoyant forecasts for growth in the aerospace sector, and future cobalt demand in its main two end-use sectors looked very promising indeed. The next Conference will be in Brussels on 21/22 May 2014 – don't miss it!

The mining industry in general acknowledges that conflict is an issue and has taken effective steps voluntarily to provide the transparency necessary to enable downstream users to have confidence that their products are conflict free. This was followed by the OECD initiatives and USA's Dodd-Frank Act. The EU is also now looking into the issue of 'conflict' surrounding raw materials, but the last thing the mining industry needs is yet another layer of unnecessary bureaucracy when so much exists both by statute and voluntarily applied through sustainability programmes. Our view is that it is far better to work within the existing framework, and this message has been conveyed to the EU.

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THE Cobalt Conference 2013

22/23 May – Shanghai, China

Against continued economic uncertainty and softening base metal prices, the great and the good of the cobalt industry got together for the 20th time under the auspices of the CDI for the annual Conference, this year in Shanghai, to interact with key people in the sector and hear topical and informative papers about developments in the cobalt market and other relevant topics such as sustainability and regulation. The Conference is an important opportunity in the cobalt calendar to network and exchange views whilst being briefed on key elements of the business – this is still the industry's only purely cobalt conference internationally.

Given the current market conditions and recognising that many mining companies had experienced a difficult period we were delighted that in spite of the prevailing market over 170 delegates from producers, fabricators, manufacturers, recyclers to traders, banks and financiers registered for the event – a good attendance representing a truly important cross-section of the cobalt market.

The meeting was opened by new Chairman David Elliott of Freeport MacMoran (majority shareholder and operator of Tenke Fungurume, DRC), who welcomed the delegates and summarised the developments of the previous year, emphasising that there were still challenging times ahead – not only from market forces but also international regulation which is already having a real impact on cobalt. He also recognised the work that the CDI was doing in this respect and underlined the CDI value proposition noting the cost savings that the Institute can bring to Members together with major successes it has achieved in defending market access for cobalt.

The CDI has been working ever more closely with the China National Non-Ferrous Industry Association in China (CNIA) given that country's importance to cobalt – it remains the largest cobalt refiner in the world – and to formalise this relationship the **Vice President of CNIA, Mr Pan Wenju**, and **CDI General Manager David Weight**, both signed a Memorandum of Understanding to increase the cooperation between our two organisations in matters relating to cobalt. Mr Pan Wenju then made a brief presentation about the CNIA in which he stressed the importance of China for the base metals sector and for cobalt in particular. He

also recognised the need for a sustainable industry and that to this end the cooperation with the CDI would be very important.

We then moved into the main programme and heard a keynote paper from **Mr Panos Kotseras of CRU** who presented "**The Medium-Term Outlook for Cobalt.**" He identified these trends as being represented by:

- Declining market prices
- Lower price volatility
- Industry restructuring
- Changes in raw materials
- Strong growth in batteries

He showed that cobalt demand continues to grow at an ever increasing rate year-on-year and CRU expects this growth to continue at over 6% per annum for the medium term. In conclusion Panos emphasised that the cobalt market was becoming an increasingly challenging and complex environment as a result of such factors as softening Cu/Ni/Co prices; industry restructuring; asymmetry between metal and raw material markets; the by-product nature of cobalt together with near to mid-term price uncertainty. The CRU report, as usual, was well researched, very informative and eagerly received by the delegates.

An important development in the past three years has been the introduction of a cobalt contract on the London Metal Exchange. The Exchange itself is under new ownership having been bought by Hong Kong Exchanges and Clearing and we were pleased to welcome **Mr William Chin, Vice President of Business Development and Risk for the LME** who gave an instructive discourse on how to use the exchange for price risk management and explained the operations of a regulated metal exchange. He outlined how the LME could be used to manage price risk for miners/smelters; converters/manufacturers; traders/merchants and end-consumers. Many of the key questions were addressed such as volatility, consequences of speculative interest, effects of funds in the market and he concluded with an outline of the main focus areas for the medium term such as:

- Initial commercialisation factors (following takeover)

- The introduction of LME Clear (2014)
- Asian Benchmark Prices: changes for enhanced price discovery (2013)
- Warehousing – proactive approach to the global physical network

Our next speaker was **Mr Wouter Ghyoot, Commercial Director, Metal Carboxylates** with **Umicore**, who outlined the use of cobalt as driers in inks and coatings and as accelerators for curing unsaturated polyester resins (UPR) and the issue that ever increasing regulatory pressure focuses industry on looking for less hazardous products. Given the current classification of some inorganic cobalt salts Umicore was inspired to develop an innovative cobalt-based accelerator named Umicore® ECOS ND15 which is a non-hazardous alternative to traditional carboxylates. In this case the cobalt is embedded in a polymer structure and polymers are exempt from the REACH Regulation in the EU. In his presentation Wouter described the development of the new cobalt polymer and outlined the typical end-use of such a product. It was also very pleasing to note that Umicore had ranked as the **most sustainable company in the Global 100 Most Sustainable Corporations in the World index**.

A market that has had little exposure over the years is that of India, so the CDI Conference was pleased to welcome **Mr Gaurav K. Chopra, Managing Director of Zenith Metalik Alloys Ltd**. Gaurav explained that India was experiencing an economic slowdown which was exemplified by:

- Inconsistent Policies
- Loss of investor confidence
- Currency Devaluation
- Widening Trade Deficit

There is no domestic cobalt production in India and what there is comes from imported ores and concentrates together with any intermediate material. The Conference heard how cobalt production in India is actually declining currently, but that it is a diverse market where there is growth in minor metals consumption generally. It was emphasised that with a large population there is a strong driver for future growth – watch this space!

Sustainability is an issue of growing importance and one that our industry (along with all other industries) cannot afford to ignore, particularly as cobalt is essential for many ‘green’ processes and products and is vital to the innovation agenda which is key to future economic development. To bring the Conference up to date in this regard **Mr Guy Thiran, Director General**

of Eurometaux outlined the regulatory developments and growing market requirements (from an EU perspective) which call for ensuring that production and products demonstrate an acceptable sustainability footprint over their life-cycle. In particular he explained that there was considerable Regulatory pressure to reduce energy use and carbon emissions and a move from a substance/media based approach to a product functionality approach in order to meet the needs of value the chain. Eco-innovation would be rewarded in most of the emerging regulatory frameworks and that this should be seen as an opportunity by industry. Guy outlined the need to examine the whole supply chain from the standpoint of sustainability so that there was development of efficient production methods, innovation manufacturing, ‘smart’ products, minimum waste, maximum recycling and therefore reduced need for primary raw materials – the Eco-Smart approach to the supply chain. Here the Conference was introduced to the core values:

- Respect/care: for environment, people, workers, local communities and suppliers
- Integrity: meeting strong governance principles
- Accountability and transparency: accountable and open with stakeholders
- Innovation : creating added value and minimising impact
- Performance: striving for efficiency across the entire value chain

Guy also pointed out the need for proportionate regulation, particularly where non-ferrous metals are concerned as without them there would be:

- NO electric cars
- NO mobile phones
- NO building functions
- NO airplanes would fly
- NO solar cells operate
- NO Wind generator moves

This was a pretty compelling presentation from the head of Eurometaux.

As the global marketplace is moving more and more to the internet as a means of communicating and concluding business, Metal-Lynx has been considering if there is there a future for trading physical metals over the internet? **Mr Nigel Tunna, the Managing Director of Metal –Pages Ltd and Metal-Lynx** gave a detailed explanation of how the physical trading platform would operate and gave some examples of how trades take place.

Nigel highlighted the main enabling elements of Metal-Lynx:

- MPAT – Mutually Pre-approved Anonymous Trading
- Binding listings – Standard General Terms
- Flexibility on Specific Contract Terms
- Narrowcasting
- Network expansion
- A Safe and Secure Environment
- Low Cost

The Metal-Lynx system was able to simplify the business process and we wait to see if this could be the future for physical trading.

As we all are aware the Chinese market has been through a major expansion phase but to ensure that the continued expansion is sustainable then there will need to be considerable focus on efficiency within the supply chain. **Mr Frank Jiang the Group Operations Director and Deputy General Manager** explained how Shenzhen GEM is a forward thinking company who adhere to the development concept of “Limited Resources, Unlimited Recycling” which is particularly relevant for metals as these are used in a process but not consumed. For example GEM has launched the largest used-battery recycling activities in the world, which covers 100 town & cities with 30,000 collection points, and covering 100,000km² and 70 million people. Not only are GEM involved in recycling metals but they also recycle electrical/electronic items, waste plastic and agricultural waste. The Company was founded by Mr Xu Kaihua back in 2001 and it appears well on track to achieve its goals and lead sustainable development in China and help China move significantly up the global league tables of sustainability.

Continuing on the theme of sustainability the Conference next heard from the **Ms Brigitte Amoruso**, who is the **CDI Advocacy and PR Manager**, and she presented a key-note paper on developments related to global regulation. This is a very important subject and one which will affect everyone involved within the cobalt supply chain (that is, any metal, product or article...). She explained that more and more Chemical Regulations are appearing around the world as countries become aware of the need for sound chemical management – this is a compelling argument because we as citizens should be able to make our own choice of the chemicals we use and consume, and therefore we should demand more transparency and involvement in chemical management decision-making. However, this comes at potentially significant costs in both monetary terms and resources so it is imperative that Regulators and Legislators apply regulation in an appropriate and proportional way. Sustainability in the supply chain is key and through its own experiences and expertise the

CDI is able to guide and support the cobalt industry in this respect. She emphasised the key CDI successes for cobalt over the past two years and encouraged stakeholders to join the CDI, leverage its expertise and benefit from the CDI value proposition.

The DRC holds over 50% of the global reserves of cobalt and close to 50% of the world's mined cobalt units come from this mineral rich country. **Mr Jack Bedder, a Senior Analyst at Roskil Information Services** provided a detailed resume of cobalt production dynamics in the DRC and emphasised how complicated this could be, particularly with the mix of public and private companies – with significant Chinese interest. The DRC Government has sought to exercise better control on the sector through legislation and re-structuring. Jack explained how the DRC had a reputation as a hard place to do business, but that this had continued to improve in recent times with numerous large companies investing in the country. It is not without its problems and the Conference was told how shortages of power, limitations of infrastructure, political risk and conflict (in the Kivu region) all impacted negatively. However he showed some interesting statistics demonstrating how DRC continues to increase its output of mined, refined and intermediate cobalt production and that export of ores and concentrate is anticipated to fall as that of intermediate and refined products increases. The presentation provided detailed information and statistics which was a considerable help to delegates in getting a much greater appreciation of the DRC in respect to resources.

Next to present was **Dr Fu Shuhong** from the **Beijing Institute of Aeronautical Materials** who presented a paper on superalloys. China currently has a small production of these important alloys, but the Chinese Government is supporting efforts for China to develop its own range of superalloys. Dr Fu went through the basics of superalloys before going into the applications in detail and there is a broad range:

- **Aircraft/industrial gas turbine components:**
Blades, disks, combustors, shafts, cases, combustions, bolts
- **Steam turbine power plant components:**
Bolts, blades, stack-gas reheaters
- **Space Vehicles**
Rocket motors, Aerodynamically heated skins
- **Nuclear Power Systems**
Control-rod drive mechanisms, Springs, Ducting
- **Chemical and petrochemical industries**
Bolts, Valves, Reaction vessels, Pumps
- **Heat treating and Metal processing equipment:**

Trays, Fixtures, Conveyor belts; Hot work tools and dies, Casting dies

- **Medical components and Selected automotive components:**

Dentistry, Prosthetic devices; Turbochargers, Exhaust valves

Dr Fu emphasised that applications requiring higher temperature strength and resistance typically require superalloys with higher cobalt contents. She concluded by providing a very upbeat assessment of the potential growth in aerospace applications for superalloys.

The largest end-use for cobalt is in rechargeable batteries and more than 30% of cobalt currently finds its way into these applications. Therefore information about the dynamics and developments in this sector are vital to understanding the cobalt market and **Mr Olivier Vallee a Senior Analyst and Partner at Natureo Finance** was able to provide a comprehensive discourse in this respect. Significantly, Natureo forecast continued strong growth for lithium systems as it displaces other battery technologies in traditional markets and enables new applications and noted that production costs were falling and performance was rising. Olivier presented a detailed report, explaining the macro and small scale developments and significant changes, noting that cobalt content in many applications had reduced, but that the market is growing significantly and that there was strong growth potential for cobalt in numerous battery applications. The delegates learned that battery compositions had moved from cobalt, nickel or manganese oxides to various combinations and whereas cobalt concentrations had been falling in battery chemistry as cathode use has changed, the market was only really at the early stages of development and growth. It was explained that large-format batteries, especially for xEV, could bring massive growth potential. An excellent report backed up with interesting discussion which demonstrated the expertise of Olivier and Natureo in this sector.

Fleur Ritzema, Deputy Non-Ferrous Metals Editor of Metal Bulletin made a presentation on the tools that are available from Metal Bulletin to help with crucial business decisions, emphasising that CRU information services can significantly improve transparency in the marketplace. Fleur explained that the Metal Bulletin was first launched in 1913 and its mission is to provide must-have timely information, including price indications, for the global non-ferrous metals and steel markets. Metal Bulletin has produced independent assessments of non-ferrous metal prices, steel prices and scrap prices since it was established. These non-ferrous and ferrous metal prices and scrap prices are used widely. Producers, consumers and trading companies often take Metal Bulletin prices as the basis to settle contracts with their counterparties.

Companies and banks employ them to value inventories or ores, and to evaluate projects and opportunities. Governments consider them when they calculate royalties and tariffs. Fleur outlined the Metal Bulletin system of price discovery and emphasised that the company provides a comprehensive set of tools to help make important decisions in the cobalt and non-ferrous metals business.

To close the Conference we were honoured to have **Mr Wu Jun, Vice President of Jinchuan Group Ltd and President of the CNIA (Cobalt Division)** give his assessment of the Chinese Cobalt Market.

He gave an optimistic outlook for cobalt but cautioned that the Chinese economy would grow a little slower than before. Mr Wu Jun explained that Jinchuan Group Co., Ltd. is a large mining group engaged in mining, concentrating, metallurgy and chemical engineering and deep processing, which vertically integrates the mining industry and metals. Through the green development, clean production and comprehensive utilization in the whole world, limited resources will be converted to products and services required by customers to the greatest extent, thus promoting the economic prosperity and the common progress of the enterprise, staff and society. The headquarters of Jinchuan is located in Jinchang City of Gansu Province in northwest China producing nickel, cobalt, copper and chemicals.

General Manager of the CDI, Mr David Weight, thanked Mr Wu Jun for bringing the conference to a successful end and then summarised some of the main themes that had come out of the two days of Conference:

- The CNIA noted how important China is on the demand side of base metals and the CDI/CNIA had signed a MoU to work more closely together
- The CRU considered that long-term cobalt demand would be strong but that an asymmetry was developing between metal and the cobalt raw material market
- On several levels we saw how Metal Lynx, Metal Bulletin and the LME could provide comprehensive services to help trade cobalt and manage price risk effectively.
- A recurring and developing theme is that of 'Sustainability' and the Conference saw how the supply chain should address this imperative through recycling, ecosmart approaches, innovative systems or innovation in product design.
- The impact of global Chemical Management Regulation was emphasised and stakeholders were advised to be aware of these developments because there were potential unintended consequences that could adversely affect business and innovation.

- The importance of batteries and superalloys was once again underlined as being the two major end-uses for cobalt and in both sectors the Conference heard that the potential for growth was high. Lithium batteries were only at the early stages of development and much higher future growth was anticipated. In superalloys cobalt still plays a major role in high temperature alloys and future growth in the aerospace sector looks strong.
- Cobalt supply is dominated by the DRC and we saw how that country is attempting to deal with the many problems it has to face but it will remain a challenge for the foreseeable future
- To draw the Conference to a close we heard from Mr Wu Jun of Jinchaun that China remains the largest refined cobalt producer and is an important driver of the cobalt market.

In conclusion David Weight commented on the versatility of cobalt given that it was contained within something so essential and subtle as Vitamin B12, and that it was also at the forefront in supporting technology such as superalloys, rechargable batteries, biotech applications, catalysts and many many more important sectors of industry. Cobalt was also underpinning the innovation platforms of many nations and supporting the technology that will lead to a greener future. After considering everything that was seen and heard at Conference the CDI remained confident cobalt has a bright future, but cautioned that the market should be aware of existing and emerging

issues, most notably Regulation. This, it was said, would affect everyone in the cobalt supply chain and though industry supports sensible, risk based chemical management, Regulators and Legislators must develop and implement Regulations in a fair and proportionate way and in this respect the CDI is representing the interests of the cobalt industry and working hard to protect market access for cobalt. Over the past two years the CDI has had notable successes in this respect: demonstrating that Authorisation of cobalt salts under the REACH Regulation in the EU was not proportionate; demonstrated that cobalt was not a conflict mineral and with other metal associations successfully fended off an initiative by the USA's ASTM to try and implement a specification for 'Resource Depletion' – something that was wholly unsuitable for metals. The Institute provides real value for money by being able to represent the collective best interests of the cobalt industry in front of global Regulators and Legislators – our success in managing the Cobalt REACH Consortium in the EU is a key performance indicator, where we continue to meet all objectives within time and underbudget.

To close the Conference formally, our new **Chairman Mr David Elliott of FreeportMacMoran** thanked the speakers and looked forward to seeing the delegates again at the next CDI Cobalt Conference which will be on the **21-22 May 2014 in Brussels**.

***THE* Cobalt Conference**

***Radisson Blu Royal Hotel Brussels
21/22 May 2014***

The Cobalt Development Institute will hold its annual Cobalt Conference in Brussels, Belgium in May 2014.

The programme hasn't been finalised yet but papers will include:

- *Detailed cobalt market reviews*
- *Review of global cobalt trade flows*
- *Regulatory matters and updates*
- *Supply chain sustainability*
- *Presentations on major cobalt related projects and mining operations*
- *Latest on sector developments and applications such as GTL, Superalloys, Batteries, Chemicals*

If you have a paper which you feel would be of interest, there is still time to include it in the programme. Please contact David Weight at the CDI.

Cobalt discovery replaces precious metals as industrial catalyst

Novel cobalt system supports less expensive hydrogenation and the creation of everyday products

Cobalt holds promise as an industrial catalyst with potential applications in such energy-related technologies such as production of biofuels and reduction of carbon dioxide.

HIGHLIGHTS

- Cobalt may substitute as industrial catalyst for energy-related technologies
- Catalysts are integral to thousands of industrial, synthetic, and renewable energy processes
- Common cobalt may replace pricier, rare metal relatives
- Potential applications: biofuel production, carbon dioxide reduction, basic necessary chemistry

LOS ALAMOS, N.M., November 26, 2012—Cobalt, a common metal, holds promise as an industrial catalyst with potential applications in such energy-related technologies such as the production of biofuels and the reduction of carbon dioxide. That is, provided the cobalt is captured in a complex molecule so it mimics the precious metals that normally serve this industrial role.

In work published Nov. 26 in the international edition of the chemistry journal *Angewandte Chemie*, Los Alamos National Laboratory scientists report the possibility of replacing the normally used noble metal catalysts with cobalt. (<http://onlinelibrary.wiley.com/doi/10.1002/anie.201208739/full>)

Efficient and reusable catalysts essential elements for commodity chemicals

Catalysts are the parallel of the Philosopher's Stone for chemistry. They cannot change lead to gold, but they do transform one chemical substance into another while remaining unchanged themselves. Perhaps the most familiar example of catalysis comes from automobile exhaust systems that change toxic fumes into more benign gases, but catalysts are also integral to thousands of industrial, synthetic, and renewable energy processes where they accelerate or optimize a mind-boggling array of chemical reactions. It's not an exaggeration to say that without catalysts, there would be no modern industry.

But a drawback to catalysts is that the most effective ones tend to be literally precious. They are the noble metal elements such as platinum, palladium, rhodium, and ruthenium, which are a prohibitively

expensive resource when required in large quantities. In the absence of a genuine Philosopher's Stone, they could also become increasingly expensive as industrial applications increase worldwide. A push in sustainable chemistry has been to develop alternatives to the precious metal catalysts by using relatively inexpensive, earth-abundant metals. The chemical complexities of the more common metals have made this research a challenge, but the Los Alamos paper holds out hope that the earth-abundant metal cobalt can serve in place of its pricier relatives.

Highly effective yet tolerant and earth-abundant catalyst discovered

Cobalt, like iron and other transition metals in the Periodic Table, is cheap and relatively abundant, but it has a propensity to undergo irreversible reactions rather than emerging unchanged from chemical reactions as is required of an effective catalyst. The breakthrough by the Los Alamos team was to capture the cobalt atom in a complex molecule in such a way that it can mimic the reactivity of precious metal catalysts, and do so in a wide range of circumstances.

The findings of the Los Alamos team have major ramifications and suggest that cobalt complexes are rich with possibility for future catalyst development. Due to the high performance and low cost of the metal, the cobalt catalyst has potential applications in energy-related technologies such as the production of biofuels, and the reduction of carbon dioxide. It also has implications for organic chemistry, where hydrogenation is a commonly practiced catalytic reaction that produces important industrial chemical precursors.

The research was funded by the LANL Laboratory Directed Research and Development Early Career program. "Mild and Homogeneous Cobalt-Catalyzed Hydrogenation of C=C, C=O, and C=N Bonds." *Angewandte Chemie International Edition*. DOI: 10.1022/anie.201206051. Guoqi Zhang, Brian L. Scott, and Susan K. Hanson* Guoqi Zhang, Kalyan Vasudevan.

First posted on <http://www.lanl.gov> in November 2012 (<http://www.lanl.gov/newsroom/news-releases/2012/November/11.26-hanson-catalysis.php>).

Cobalt News

Honda's starts recycling program to extract 80% of rare earths from used hybrid batteries

Just Means reports 386 Honda hybrid vehicles damaged beyond repair in the March 2011 earthquake and tsunami in Japan prompted the vehicle manufacturer to institute a new process at Japan Metals & Chemicals (JMC) of extracting oxides containing rare earth metals from used nickel-metal hydride batteries.

The new process makes it possible to extract more than 80% of the rare earth metals which include neodymium, cerium, lanthanum and praseodymium at 99% purity, similar to mined rare earths. Honda is not stopping at the damaged vehicles, but plans to commercialize the process:

Starting early March, the extracted rare earth metals are being supplied from JMC to a battery manufacturer, which will reuse them as negative-electrode materials for nickel-metal hydride batteries for hybrid vehicles. This first batch came from the vehicles rendered useless by the earthquake.

The plans go further. As soon as a sufficient volume is secured, Honda said it will begin applying the same process and recycle rare earth metals extracted from used nickel-metal hydride batteries collected by Honda dealers through battery replacement.

After a slow start hybrid and all-electric vehicles sales rose rapidly around the globe last year and is set to reach 3.8 million units annually by the end of the decade.

Lithium-ion batteries used by among others Ford in the US also cut the need for rare earths dramatically. With more than 95% production centred in China, Japan's high tech industry has been working hard to decrease its reliance on rare earths used in a variety of industries including green technology, defence systems and consumer electronics.

China's monopoly position – only now being challenged by miners Molycorp in the US and Australia's Lynas – has not stopped the sharp declines in the value of the 17 elements.

While mid-2012 prices looked as if it will begin to stabilize, values continue to soften and most REEs

are down more than 80% since hitting a peak in 2011.

Frik Els | March 10, 2013, <http://www.mining.com>

COBALT - Sulphuric acid boosts cobalt project options

A detailed scoping study for the production of a sulphuric acid bi-product from Broken Hill Prospecting's world-class Broken Hill Cobalt Project in the far west of New South Wales has highlighted significant potential for a long-term operation with a low capital start-up and staged development. The study enhances project flexibility for development of a cobalt operation.

The study confirmed that pyrite from the company's Pyrite Hill, Big Hill and Railway cobalt deposits could yield valuable sulphuric acid bi-product. Currently sulphuric acid is in strong demand in fertilizer production, mineral processing and other industries. Pyrite treatment would also provide significant cobalt and iron recovery.

Five fast-track, low-cost development options have been identified in the study at nominal annual processing rates of 1.5 million to 7.5 million tonnes. All of the known cobaltiferous pyrite mineralization is located near-surface within an exploration licence and two mining leases, and can be mined by open cut methods.

Broken Hill Prospecting's managing director Ian Pringle says, "This first step towards development of the cobalt project is important because it shows that production of pyrite to produce sulphuric acid could be a valuable revenue stream to support cobalt sales. This outcome gives us tremendous flexibility in developing this large project, including how mining should be undertaken and what the end product should be.

"Next we need to undertake resource definition, metallurgical studies, mine planning, infrastructure and transport needs, and also evaluate the best marketing approach. These project studies will be invaluable in determining how to deliver the best value," he adds.

A recent resource evaluation estimated the combined inferred resources of the three deposits as 35.7 million tonnes of pyrite mineralization with an

average grade of 1.85 pounds/tonne of cobalt. In addition, 'potential' for between 37 million and 59 million tonnes of pyrite mineralization of similar cobalt grade was estimated.

Broken Hill Prospecting is a mining and exploration company seeking to develop significant cobalt deposits near Thackaringa, 25km southwest of the world famous mining centre of Broken Hill.

The deposits are geologically unusual because they do not occur as a bi-product with richer copper or nickel deposits, as is the case in nearly every other mine around the globe. Cobalt, therefore, would be the main focus of any mining development.

The deposits exist near surface and recent drilling has defined a footprint which is at least 4km in length that is open at width, depth and length. The mineralization can be simply processed to a cobalt-pyrite concentrate, which, because of the excellent location, could be transported by rail/road/sea for processing to produce cobalt, sulphuric acid and iron ore products.

www.bhpl.biz

UK Seabed Resources joins deep-ocean mineral-mining rush

A new and controversial frontier in mining is opening up as a British firm joins a growing rush to exploit minerals in the depths of the oceans.

UK Seabed Resources is a subsidiary of the British arm of Lockheed Martin.

It has plans for a major prospecting operation in the Pacific.

The company says surveys have revealed huge numbers of so-called nodules - small lumps of rock rich in valuable metals - lying on the ocean floor south of Hawaii and west of Mexico.

The exact value of these resources is impossible to calculate reliably, but a leading UN official described the scale of mineral deposits in the world's oceans as "staggering" with "several hundred years' worth of cobalt and nickel".

An expedition to assess the potential environmental impact of extracting the nodules will be launched this summer amid concerns that massive "vacuuming" operations to harvest the nodules might cause lasting damage to ecosystems.

With the support of the British government, UK Seabed Resources has secured a licence from the United Nations to explore an area of seabed twice the size of Wales and 4,000m deep.

Under the UN's Convention on the Law of the Sea, mining rights on the ocean floor are controlled by a

little-known body, the International Seabed Authority, which since 2001 has issued 13 licences - with another six in prospect.

These licences, valid for 15 years, have been bought for \$500,000 each by government organisations, state-owned corporations and private companies from countries including China, India, Russia, Japan and South Korea.

The high prices fetched for copper, gold and rare-earth minerals are leading to a surge in interest in mining the ocean floor. The idea first surfaced in the 1970s but was dropped because the costs were too high and the technology could not cope.

The nodules are known to contain up to 28% metal - 10 times the proportion found on land.

A similarly high metal content is found in another target for seabed mining: hydrothermal vents, chimneys formed by extremely hot water, rich in minerals. We reported on the discovery of the world's deepest vents last month.

Stephen Ball, chief executive officer of Lockheed Martin UK, owner of UK Seabed Resources, says the engineering experience of offshore oil and gas operations and the trend to rising mineral prices have now combined to make seabed mining feasible.

"It's another source of minerals - there's a shortage and there's difficulty getting access, so there's strategic value for the UK government in getting an opportunity to get these minerals," he told the BBC.

China's domination of the global production of rare-earth minerals in particular has fuelled the search for other sources of materials essential for everything from electronics to wind turbines.

But many marine scientists and conservationists have warned that the implications of this deep-sea gold rush are not yet understood - and that mining nodules or hydrothermal vents could prove catastrophic for seabed ecology.

Mr Ball said exploration over the next three years would establish whether a system to vacuum up the nodules could be designed to cause minimal impact. The nodules typically lie in a shallow layer of silt.

He said he believed it would be "perfectly feasible to create a benign method to extract these minerals from extreme depths without disturbing the seabed."

"But until we've demonstrated that, there will be a debate around that."

One risk is that the mining operations could generate huge plumes of sediment that could drift through the sea - choking any marine life that feeds by ingesting water and filtering out its food sources.

Michael Lodge, general counsel for the International Seabed Authority, told me that the authority's aim

was to encourage a new mining industry to exploit seabed minerals but within strict environmental controls.

"The nodules are generally lying in sediment that is between 2-6in (5-15cm) thick that's been there undisturbed for millions of years. We simply don't know the recovery times or the distribution of species - there are lots of uncertainties."

He described mining hydrothermal vents as "more invasive" because it would involve breaking up the uppermost metre of the sea floor and piping the rock fragments to the surface.

Cold War heritage

A Canadian company, Nautilus Minerals, is hoping to be the pioneer of vent mining with plans for operations off the coast of Papua New Guinea. However, work is currently delayed because of a legal dispute. The concern is for the impact mining could have on ecosystems.

Nautilus would use massive robotic machines, which are being built in Wallsend, near Newcastle-upon-Tyne, by a firm with long experience of marine engineering, Soil Machine Dynamics.

Nautilus says that it is devising strategies for minimising the environmental impact, by trying to contain any disturbed sediment and leaving parts of the seabed untouched so the mined area can be recolonised by marine life.

A leading biologist, Professor Cindy Van Dover of Duke University in North Carolina, has carried out research for Nautilus and says life might recover after a single mining event but that no-one can be sure.

"How do we do this so a hundred years from now somebody doesn't look back at us - at me - and say 'Oh my God, I can't believe they were so stupid and let this happen in a particular way'.

"So how do we do it right? How do we do it sustainably?"

Michael Lodge has also said questions will remain about profitability while the final terms of mining licences are settled.

The authority was set up to encourage and manage this new sector but any future business, such as the Lockheed Martin subsidiary UK Seabed Resources, will have to pay royalties to the authority to be distributed to developing countries. The exact details have still to be negotiated.

Research into seabed minerals has a long and slightly conspiratorial history, starting in the Cold War with the United States and the Soviet Union

surveying the oceans ahead of possible future conflict.

Surveys of seabed nodules in 1970s were also used as a cover by the US for the secret retrieval of a lost Soviet submarine.

Now, the legacy of all that research and exploration is the growing likelihood of large-scale mining operations, fuelled by rising mineral prices, in many parts of the ocean in the coming decades.

David Schukman, 14 March 2013,
<http://www.bbc.co.uk/news/science-environment-21774447>