Special report

MARINE MINING

Seeking returns in uncharted waters

Despite obstacles, both countries and industry are keen to see deep-sea mining become a reality

Ruth Green

This time last year one of the most talked-about deep-sea mining projects seemed to be on the rocks as Nautilus Minerals was at loggerheads with the government of Papua New Guinea and its Solwara 1 gold, copper and silver project seemed but a lofty pipe dream.

By May the pair had resolved their differences and Nautilus confirmed that the Papua New Guinea (PNG) government had placed US$113 million into escrow, satisfying the conditions needed for the state to take a 15% stake in the polymetallic project off the coast of PNG.

Since then nothing, cyber attacks included, have really threatened to derail the project, which the company is hoping to bring on stream by early 2018. However, in February it was the turn of Chatham Rock Phosphate, which is looking to mine phosphate nodules on the Chatham Rise, some 400km east of Christchurch in New Zealand, to face disappointment when the country’s Environmental Protection Authority (EPA) rejected its marine-consent application on environmental grounds.

This was the second seabed-mining application to be rejected since New Zealand introduced a law restricting economic activity in New Zealand’s offshore Exclusive Economic Zone in July 2013. In June last year Trans-Tasman Resources’ proposal for its South Taranaki Bight iron-sands project was also rejected amid concerns over the project’s potential environmental impact.

Wylie Spicer, counsel at McInnes Cooper, recently spoke at the Deep-Sea Mining Summit in Aberdeen, and said the decision on Chatham Rock Phosphate really floored delegates there.

“The decision on Chatham Rock came on our last day in Aberdeen and I think the people that have been involved, whether as geologists or advisers, were shocked by the decision,” he told Mining Journal from his office in Calgary.

“The two decisions – Chatham and the one that came before, TTR… the industry in New Zealand is not happy with these results,” he said.

Chatham did not hold back in expressing its own disappointment, saying it was “aghast” at the EPA’s decision. However, Ian Coles, a partner at Mayer Brown, said New Zealand was not alone in flagging up environmental matters.

“New Zealand has a very strict approach to environmental issues, although other countries have expressed concern over disturbances to marine ecosystems caused by deep-sea mining,” he said.

“People thought back in 2011 that metal prices were only getting stronger, there would be no end to China’s development and it would hoard its rare-earth elements supply by 2020, Coles admitted the sheer expense is making some projects that were once alluring now seem less appealing.

“The equipment needed to access rare earths – or any other mineral on the sea bed – is expensive,” he said. “This is compounded by the fact that many of the reported rare-earth deposits on the sea bed are in very deep water, particularly those potentially rich deposits that lie off the continental shelf next to Japan. Given that several potentially large on-shore deposits are in the course of being developed – particularly in Africa – the comparative economics of developing a seabed project may not be so compelling.”

Jeff Ardron, a senior fellow at the Institute for Advanced Sustainability Studies (IASS), who also spoke at the Deep-Sea Mining Summit Aberdeen, agreed the economics behind the argument of exploring for REEs under the sea did not stand up.

“The idea that we need to go into the sea for REEs isn’t true, at least not now. It’s just not economically attractive,” he said.

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Although some estimates suggest marine mining could provide some 5% of total rare-earth elements supply by 2020, Coles admitted the sheer expense is making some projects that were once alluring now seem less appealing.

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Nautilus Minerals’ Solwara 1 project is set to come on stream by early 2018

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“People thought back in 2011 that metal prices were only getting stronger, there would be no end to China’s development and it would hoard its rare-earth elements. Therefore, deep-sea mining looked like a good idea. Four or five years later I don’t think we can make that same argument.”

Ardron said that although mining companies such as Nautilus and DeepGreen argued that deep-sea mining projects would benefit the economies of Small Island Developing States (SIDS), he said the longer-term economic impact of these types of projects had still been largely overlooked to date.

“If we’re going to do deep-sea mining and it’s a big if, because economically it’s not as attractive as it was initially thought to be, but if it’s going to be done it will have to be done carefully or it could cause more harm than good to the small island states,” he said.
“I think the discussion that we’ve seen so far focuses on environmental concerns, which are legitimate and a lot of researchers are looking at them. But almost no one is talking about the socio-economic impact and it’s almost like a blind spot. I’m really concerned that we’re going to repeat history and we’re sleepwalking into a socio-economic catastrophe. The only way that it can be averted is if we start talking about it and planning for it.”

He cited the example of the phosphate-rich state Nauru, which once boasted the highest per capita income enjoyed by any sovereign state in the world during the late 1960s and early 1970s, but now bore the environmental and economic scars of mining. After more than 80% of the island’s surface was strip mined and the phosphate reserves were exhausted, the island’s wealth plummeted.

“My fear is what we’ve seen happen already in Nauru is going to repeat itself unless we’re extremely careful,” he said, adding that the SIDS could learn from the example set by Norway, where prudent financial spending and employment policies in place have guaranteed the country’s ability to avoid the so-called dreaded ‘resource curse’.

“These governments are now saying that they’re going to do deep-sea mining and I wonder if they’re going to show the fortitude and the restraint that Norway has shown or if they will slip under the curse in the way that so many other countries have done.”

Approvals and licences
Under the UN’s Convention on the Law of the Sea, mining rights on the seafloor are controlled by the International Seabed Authority (ISA), which since 2001 has approved and signed 20 contracts to explore for polymetallic nodules, polymetallic sulphides and cobalt-rich ferromanganese crusts in the deep seabed.

The ISA has set aside concession areas as part of its ‘reserved area’ earmarked for developing nations, meaning that only developing nations are eligible to apply for licences there to conduct underwater exploration. Consequently, nations including the Cook Islands and Tonga have put themselves forward for the concession areas.

In January, the Republic of Kiribati, through state-owned Marawa Research Exploration, signed a 15-year contract with the ISA to explore for seafloor manganese nodules and conduct scientific studies in a section of the Clarion-Clipperton Zone (CCZ). The CCZ spans about 7,240km² and lies in the Pacific Ocean halfway between Hawaii and Mexico.

Spicer said this move by the ISA had benefited some unlikely contractors. “Singapore now has an application in and because Singapore – this is one of the oddities to me of the way the ISA defines things – is considered to be a developing nation and what that means is that it can apply to have a lease in one of these reserved areas,” he said.
In February, the ISA signed a 15-year contract with Singapore-listed Ocean Mineral Singapore (OMS) to explore for polymetallic nodules in the CCZ. OMS is owned by Singapore’s Keppel Corporation.

Perhaps more interesting still, UK Seabed Resources, a wholly owned subsidiary of Lockheed Martin, is a minority shareholder in the company. UK Seabed Resources has already signed its own exploration contract with the ISA that expires in 2028. Last July the ISA approved a second plan of work submitted by the company for exploring polymetallic nodules in a separate area.

And of some of the world’s other major economic powers are also getting in on the game.

In January 2014, JOGMEC signed a 15-year contract to prospect and explore for cobalt-rich ferromanganese crusts in Tokyo, while Russia has signed contracts to explore for cobalt-rich ferromanganese in the Magellan Mountains in the Pacific Ocean and polymetallic sulphides in the Mid-Atlantic Ridge.

Last August the ISA received an application from China Minmetals to explore for polymetallic nodules in the CCZ. Curiously, the IMF still considers China a developing country, which means it is also eligible to apply for licences to explore the area reserved for developing nations.

However, Ardron said China’s increasing dominance in the deep-sea mining sector could pose some problems ahead.

“Last year it was Singapore saying it was a developing country now China is doing the same, looking for its fourth lease in the high seas,” he said.

“This raises the question of whether one country can just continue to gobble up massive areas of the global seabed? How do we make the decision to set some areas aside for other countries? Or for future generations? Where and how do you draw the line?

The ISA, up until now, has more or less swept these kinds of difficult questions under the carpet, but I hope they don’t sweep this one away as it’s a legitimate question.”

Another issue mentioned by Spicer was the lack of transparency surrounding the approval process, presided over by the ISA’s Legal and Technical Commission.

“One of the problems, and it was raised quite directly in Aberdeen, is essentially the work of the Legal and Technical Commission, which is really the heart of the whole seabed-mining piece, is secret,”

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Marine mining projects

**Atlantic 1**
- **Commodity:** Diamonds
- **Ownership:** Debmear Namibia, a wholly owned subsidiary of Namdeb Holdings, which is a 50:50 joint venture between the Namibian government and De Beers.
- **Project team:** Chief executive Otto Shikongo
- **Location:** Off the southwest coast of Namibia
- **Geology:** Mining takes place on the ocean floor at water depths ranging from 70m-140m. Diamonds are recovered in a completely sealed environment with no human interaction. The company operates five diamond mining vessels – MV Debmar Atlantic, MV Debmar Pacific, MV Igarie, MV Grand Banks and MV Mafuta.
- **Status:** Preliminary results suggest Debmear Namibia produced 1.3Mt in 2014, which was largely in line with 2013 levels. Despite a 19-day strike in the September quarter, production was boosted by strong operational performance by the new MV Mafuta vessel.
- **Latest:** Namdeb Holdings owns 100% of Debmear Namibia’s sea licences, which originally expired in 2020. However, Anglo American revealed recently that the company has received a 15-year licence extension for both land and sea operations to 2035. Debmear Namibia is due to acquire a new exploration vessel from Norway in June 2016.

**Chatham Rock Phosphate**
- **Commodity:** Phosphate
- **Ownership:** Chatham Rock Phosphate
- **Project team:** Managing director Chris Castle
- **Location:** The permit area spans 820km², 450km east of Christchurch and at 400m water depths on the Chatham Rise
- **Geology:** The deposit is originally discovered by New Zealand scientists in 1952. The best sampled area of 380km² has an identified resource of 25Mt. The total area to be mined each year is about 30km² and over 15 years will amount to 450km², or approximately 0.5% of Chatham Rise. A recent study by RSC Consulting revealed an inferred resource of 80 million m³ of phosphorite at an average grade of 290kg/m³, an estimated 23.4Mt of phosphorite.
- **Status:** At the end of March 2014 the company submitted a draft marine consent application to the Environmental Protection Authority (EPA) to mine phosphorite nodules on the Chatham Rise. On February 11, 2015, the EPA said it had refused the application, finding: “The destructive effects of the extraction process, coupled with the potentially significant impact of the deposition of sediment on areas adjacent to the mining blocks and on the wider marine ecosystem, could not be mitigated by any set of conditions or adaptive management regime that might be reasonably imposed.”
- **Latest:** Chatham Rock has said it is continuing to develop strategies to progress the project and is considering re-submitting its marine consent application.

**Solwara 1**
- **Commodity:** Copper, gold and silver
- **Ownership:** Nautilus Minerals (75%) and Papua New Guinea government (15%).
- **Project team:** Chief executive Mike Johnston, vice-president for projects Kevin Cain, vice-president for PNG operations Adam Wright, and PNG country manager Mel Togolo
- **Location:** Territorial waters of Papua New Guinea
- **Geology:** The Solwara 1 deposit is located on the seafloor at a water depth of 1,600m.

The project has an indicated mineral resource of 1.04Mt, grading 7.2% of copper, 5.0g/t of gold, 23g/t of silver and 0.4% of zinc and an inferred mineral resource of 1.54Mt, grading 8.1% of copper, 6.4g/t of gold, 34g/t of silver and 0.9% of zinc.

**Status:** Nautilus was granted the first mining lease for the project in January 2011 and in April 2014 it signed an agreement with the PNG government, which paved the way for the project to move into production. As per the agreement, in exchange for the government’s 15% stake in the project, in December Nautilus received the previously escrowed US$113 million from the PNG government.

**Latest:** The company has announced the commissioning and factory acceptance testing of its third and final seafloor production tool (SPT), the auxiliary cutter, which deals with rough terrain and creates benches for the other SPTs to work.

**UK Seabed Resources**
- **Commodity:** Polymetallic nodules
- **Ownership:** UK Seabed Resources, a wholly owned subsidiary of Lockheed Martin UK Holdings (LMUK)
- **Project team:** Stephen Ball, chief executive of Lockheed Martin UK and UK Seabed Resources
- **Location:** Pacific Ocean
- **Geology:** The application area covers a total surface area of approximately 58,000km² in the eastern part of geological submarine fracture zone known as the Clarion-Clipperton Zone.
- **Status:** The exploration licence for the project was approved by the ISA in March 2013.
- **Latest:** In July 2014 the ISA approved a second plan of work submitted by UK Seabed Resources for exploring polymetallic nodules in a separate area.
Nautilus Minerals: Solwara 1 Project Vessel Update

PRODUCTION SUPPORT VESSEL

Vessel Charter signed with MAC*
- Low Nautilus capital contribution
- 5 year charter @US$200K/day
- Option to extend or acquire the PSV
- PSV being built by experienced Chinese yard
- Delivery of PSV by end 2017

*Marine Assets Corporation (MAC), a marine solutions company based in Dubai which specialises in the delivery of new build support vessels for the offshore industry

To find out more, visit us at: www.nautilusminerals.com
he said. "All you know about it is that such and such a country has made an application for such and such a space, and at the end of it you get a result of a recommendation but you’ve no idea what’s going on in the meetings."

“The people that know are the people that make the application as they go and make a presentation, but then the Legal and Technical Committee just goes away and makes up its mind and at least publicly you don’t see anything other than a report of what they’re recommending. And you would think that once the industry starts to take of that that just isn’t going to hold water.”

Ardron agreed more needed to be done to make relevant scientific information more available and the overall bidding process much more transparent.

“Right now the ISA’s Legal and Technical Commission is a closed door process. They do not attribute decisions at the end, they do not say if they voted on things or who voted on what. Although they have conflict of interest guidelines, they have no reporting on them, so we don’t know how well these rules are being followed.”

In mid-March the ISA issued a report containing a draft framework for regulating exploitation activities in the reserved area. The report is available to download from the ISA’s website and the authority’s members and stakeholders are invited to submit comments on the draft framework by May 15.

Deep-sea technology
Developing suitable technology, let alone at a cost comparable to that used in land-based mines, continues to be an ongoing challenge for the marine mining sector. However, Spicer pointed to two companies – Krypton Ocean Group and Marshall Hydrothermal – which could offer two interesting alternatives.

“Krypton Ocean Group’s proposed method of mining doesn’t rely at all on what I would call the traditional oil and gas model – which really is what Nautilus is doing – but has a remotely operated vehicle that does everything at the bottom of the ocean and then brings it up to the surface.

“Also, what Marshall Hydrothermal is proposing to do is not to take the minerals from the vents, but to take the steam and turn it into electricity, which is quite interesting. Certainly in the case of Marshall you wouldn’t think it would run into the same environmental problems if all they’re doing is sucking steam up from the top of the vent.”

There has been progress elsewhere. The European Union recently launched a 42-month research and development programme to design and build a robotic, underwater mining prototype with associated launch and recovery equipment to perform field tests at four mine sites across the EU.

The Viable Alternative Mine Operating System project will cost approximately €12.6 million (US$13.38 million) and involves a consortium of 17 project partners led by engineering group BMT Group and Soil Machine Dynamics.

Although there have been some developments even in REEs, Mayer Brown’s Coles said commodity-price volatility would continue to weigh heavily on investor sentiment.

“There are a couple of projects utilising seabed mining, so over time there will be less concern over the reliability of the technology and less time needed for testing etc. Much also depends on the price of rare earths – still a difficult factor to predict given continued Chinese domination of global production.”

Although the jury may still be out on marine mining, Spicer said for now at least, companies and countries still had a vested interest in seeing deep-sea mining projects come to fruition. “Often when I start to talk to people about seabed mining they start to glaze over, but 20 years ago they were glazing over when we were talking about drilling for oil in deep water 300 miles off the coast,” he said.

“We’re there because we have to be and to some extent I think that’s what’s obviously driving this industry, particularly because of the minerals available, which are all very important for the 21st century.”