History Of Underwater Mining

Rodney Norman, Managing Director, Marine And Mineral Projects (Pty) Ltd, South Africa
Introduction

• ORIGIN.
• DIAMONDS.
• GOLD.
• HEAVY MINERAL SANDS.
• TIN.
• CONCLUSION.
Origin

- ORIGIN.
- DIAMONDS.
- GOLD.
- HEAVY MINERAL SANDS.
- TIN.
- CONCLUSION.
To trace the origin of underwater mining, we must look at the history of the dredging industry.

John B. Herbich in his “Handbook Of Dredging Engineering” notes:

- The art of dredging began along the Nile, Euphrates, Tigris and Indus Rivers many thousands of years ago.
- Dredging in Sumeria and Egypt about 4,000 B.C.
Origin

- Herbich goes on to say:
  - Early forms of dredging were primitive with buckets and spades.
  - Agitation dredging was also used in early times in the Indus River.
  - A scraper dredge (Krabbelaar) was first used in Zeeland in 1435 A.D.
  - The first known underwater mining operation was off the Essex coast in the late sixteenth century.
Diamonds

• ORIGIN.
• DIAMONDS.
• GOLD.
• HEAVY MINERAL SANDS.
• TIN.
• CONCLUSION.
Diamonds

- Diamonds were first discovered along the west coast in 1908 near Luderitz.
- By 1927, extensive deposits had been found both north and south of the Orange River mouth.
- By the 1950’s production was in excess of 2 million carats per annum.
Diamonds

- Few ventured into the sea off the west coasts of Namibia and RSA.
- The honour of recovering the first diamonds from the sea goes to a Texan, Sammy Collins on 15th November 1961.
Diamonds

- Sam’s interest in sea diamonds was sparked whilst tendering for an offshore pipeline at Oranjemund.
- He founded the MDC and obtain a large concession from the Orange River to Diaz Point, Luderitz.
Diamonds

- Sam’s sampling operations continued and by March 1962, a further 44 diamonds (12 crts) had been recovered.
- By May 1962 “Barge 77” had been commissioned and recovered 12,700 crts by Dec 1962.
Diamonds

- During a storm in June 1963 “Barge 77” was beached at Chameis Bay.
- A tank landing craft vessel was quickly converted the “diamantkus” and “Barge 111” converted to replace “Barge 77”.

Mine-Tech International Conference and Expo, 2-4 November 2009, Johannesburg, South Africa
Diamonds

• In 1965, another new barge “Colpontoon” was built and production peaked at 241,000 cts.

• In 1963 MDC was awarded further deep water concessions approx. to the end of the continental shelf.
Diamonds

• Financial problems, which started with the loss of “Barge 77”, continued at MDC and Sam invited De Beers to participate in the business.

• In 1965 De Beers became the majority shareholder in the MDC.
Diamonds

- Up to this point MDC had been mining the shallow waters (<30 m) from select high grade features with little pre-sampling.
- The new majority shareholders considered two options for the way forward in 1965:
  - Halt production and continue sampling operations; or
  - Continue operations to recoup investment.
Diamonds

- A compromise was reached and the production fleet was selectively phased out whilst survey and sampling continued.
- Production dropped from 241 000 crts in 1965 to 132 000 crts in 1967 as “Diamantkus”, “Barge 111” and “Colpontoon were withdrawn”.
- A new barge “Pomona” was commissioned in July 1967.
• Production from “Pomona” continued until 1971 with output peaking in 1970 at 239 898 crts from this one barge.

• However, due to the exhaustion of reserves, and the anticipated expense of refitting the “Pomona” after 3 years at sea, mining operations closed at the end of March 1971.
• Since the days of Sam Collins, shallow water (0 to 20 m) diamond mining, using diver based techniques, has continued to flourish along the west coast of South Africa and continues today.
Diamonds

- The MDC, now owned by De Beers in 1971, focused its efforts on developing an understanding of the marine diamond reserves.
- Geophysical surveys supplemented by vibrocoreing was carried out up to 1974 and between 1974 and 1977 3,297 samples were taken in 70 to 90 metres water depth.
- At the time the resource was estimated to contain no more than 0.5 million cts and too small to support the development of mining systems to operate at these depths.
In 1977 sampling operations moved further offshore and seemed to confirm a widespread low grade deposit in the 100 to 135 m water depth.

Sampling continued between 1977 and 1982 with 9,228 samples taken between the Orange River mouth and Diaz Point, Luderitz.
Diamonds

- By 1983, a deposit of large proportions had been identified and De Beers moved to the evaluation and ore reserve generation phase.
- In 1984 De Beers Marine was formed to develop the technology for mining in the deep water (80 to 200 m).
- Various mining systems were conceptualized between 1985 and 1988 while geological work was simultaneously being carried out to support the thinking for the mining tool design.
Diamonds

- By 1988 two approaches, the “horizontal” (remote controlled crawler vehicle) and “vertical” (drill technology) were proposed.
• In 1989, the first “horizontal” mining system, a remotely controlled underwater crawler was commissioned.
• This crawler mining vessel heralded the start of the production phase of De Beers Marine.
Diamonds

- And in 1991, the first “vertical” mining system, a large diameter drillship was commissioned.
- By the end of 1991 recoveries from the deep water concessions reached 159,000 cts.
Diamonds

- The success of the Coral Sea saw De Beers Marine follow with more large diameter drillships.
  - The “Grand Banks” commissioned in 1993.
Diamonds

• The development of deep water mining methods by De Beers in the 1980’s did not go unnoticed and by the early 1990’s a number of other players entered the offshore diamond mining industry, concentrating mainly on the mid water concession areas (20 to 80 m).

• These companies employed a different technology for mining the sea bed.
Diamonds

• The wire line dredging system was considered lower technology and therefore cheaper than the De Beers Marine approach.
Diamonds

- Companies that employed wire line dredging systems included:
  - Ocean Diamond Mining.
  - Benguella Concessions.
  - Transhex.
  - Galmarine.
  - Diamond Field Resources.
• Around the mid 1990’s another new player NAMCO entered the industry.
• They favoured the high technology approach and after an initial period of sampling commissioned the Kowambo in 1997 employing a new generation of sub sea remote controlled mining crawler.
Diamonds

• With the Kowambo reporting the recovery of 400,000 crts in 1998, the industry now turned to remote controlled crawler technology.
  • De Beers commissioned the “!Gariep” in 1999, and
  • NAMCO commissioned the “Ya Toivo” in 2000.
Diamond mining technologies deployed along the west coasts of South Africa & Namibia.
Diamonds

- NAMCO went into liquidation in 2002/2003 and their assets were purchased by SAMICOR with the exception of the "Ya Toivo" which was acquired by De Beers Marine.
- De Beers Marine scrapped their crawler vessel, the "!Gariep" in 2002 and reconverted it to a drillship in 2003. The Debeers fleet now consisted of 4 drillships and 1 crawler vessel, the Ya Toivo.
Today few players remain in the offshore diamond mining industry.
  - Benguella Concessions ceased operations in the late 1990’s.
  - Ocean Diamond Mining was bought by NAMCO in 1999.
  - Galmarine ceased operations in the early 2000’s.
  - Diamond Field Resources, SAMICOR and Transhex have recently suspended operations.
Diamonds

- Total diamond production from De Beers’ marine mining activities reached close to 1 million crts in 2006.
- 2005 marked a historic milestone as marine production surpassed land production in Namibia for the first time ever.
Diamonds

- De Beers marine continues to operate and recently (2007) commissioned another remote controlled crawler mining vessel, the “Peace In Africa” to mine their South African concessions.
Diamonds

- In 2001, De Beers Marine was split into two companies, De Beers Marine SA and De Beers Marine Namibia.
- De Beers Marine Namibia, until recently owned and operated 5 production vessels.
- De Beers Marine SA owns and operates two sampling and one production vessel. In addition they own 2 survey class autonomous underwater vehicles and a survey towfish.
Diamonds

• The demise of so many players in the marine diamond industry and even MDC before them highlight the risks of underestimating the sea and the critical necessity of well defined mineral reserves and mining technology.

• Not to mention the capital to carry exploration overheads and the occasional mishaps at sea.
Diamonds

- Other sources of marine diamonds have been sought over the years. Prospecting has taken place in the Joseph Bonaparte Gulf in northern Australia (early 1980’s to 1994) with seemingly little success.
Diamonds

- Today the mining of diamonds from rivers and streams continues in countries such as Angola, Congo and Sierra Leone and from kimberlites below the lakes in Canada.
Gold

- ORIGIN.
- DIAMONDS.
- GOLD.
- HEAVY MINERAL SANDS.
- TIN.
- CONCLUSION.
Gold

• Like diamonds, the allure of gold has seen the panning of gold from streams and rivers for decades.
• As dredger technology developed the mining of gold from rivers and streams was carried out on a larger scale.
Gold

- Alaska has been the source of gold from the rivers since the Klondike Gold Rush of the late 1890’s.
- Of all the gold ever mined 1 to 2% (more than 33 million ounces) has come from Alaska. Of this 72% was mined from rivers and streams.
Gold

• In the mid 1980’s attempts were made to mine gold from the sea off Nome.
• These attempts were abandoned in the early 1990’s.
Gold

• Today the mining of gold from rivers and streams continues from Zimbabwe to America and New Zealand, and continues in Alaska.
Heavy Mineral Sands

- ORIGIN.
- DIAMONDS.
- GOLD.
- HEAVY MINERAL SANDS.
- TIN.
- CONCLUSION.
Heavy Mineral Sands

- Underwater mining does not only occur in rivers and the sea.
- Since 1976 RBM has been mining heavy mineral sands from the coastal dunes just north of Richards Bay in KwaZulu-Natal.
• ORIGIN.
• DIAMONDS.
• GOLD.
• HEAVY MINERAL SANDS.
• TIN.
• CONCLUSION.
Tin mining in Malaysia dates back to the 1600’s with dredgers commonly being used.

During the heyday 40 dredgers were operated in Perak with a record of 105 in 1929.
• In the late 1970’s, Malaysia had more than 1,000 tin mines producing an average of over 70,000 tpa.

• The industry collapsed in 1985 coinciding with the economic crisis and the collapse in the tin price.

• Today Malaysia produces 5,000 tpa.
Conclusion

- ORIGIN.
- DIAMONDS.
- GOLD.
- HEAVY MINERAL SANDS.
- TIN.
- CONCLUSION.
Conclusion

• Throughout history many instances of underwater mining occur and are still being carried out today. Both in water bodies on land and at sea.

• As the Industry matures and more deposits are discovered on the sea beds of the oceans, underwater mining techniques will be developed and improved and, like the oil industry, will move into the ultra deep water depths of 3,000 m and beyond.
History of Underwater Mining

Thank You
References:

- Dickin E.P., A History Of Brightlingsea.
- Williams R., King of Sea Diamonds : The Saga of Sam Collins.
- Richardson K., A Perspective of Marine Mining Within De Beers.