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# Deep Sea Mining Technologies, Equipment and Mineral Targets

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## Abstracts

**REPORT SCOPE:**

For the purpose of this report, deep sea mining is defined as a mineral retrieval process (mining) that takes place on the ocean floor. Deep sea mining is also alternatively known as ocean floor mining, ocean bed mining, sea floor mining or seabed mining. However, deep sea mining is different from shallow sea mining. Since deep water mining is a relatively new industry, there is no standard definition that segregates deep sea mining from shallow sea mining. However, various stakeholders in the industry as well as others active in the market generally agree that deep sea mining is the removal of minerals from sea beds deeper than 500 meters.

Based on types of deposits at sea floor, deep sea mining can be categorized into three types-

Cobalt rich crusts (CRC).

Manganese nodules.

Seafloor massive sulphides (SMS).

Cobalt rich crusts, also known as cobalt crusts or cobalt rich ferromanganese crust, are rock-hard, metallic layers that form on the flanks of submarine volcanoes, called seamounts. It is estimated that slightly more than 55% of sea floor cobalt crusts are located in the Pacific Ocean. Cobalt crusts also represent a very large metal resource in the sea and contain a relatively large amount of cobalt compared to deposits on land

and to manganese nodules. The largest share of metals in the cobalt crusts, however, consists of manganese and iron. Cobalt crusts are also called as cobalt rich ferromanganese crusts. On an average, most promising cobalt crusts lie at water depths of 800 to 2,500 meters.

Manganese nodules, also known as polymetallic nodules (PMN or PN), contain mainly manganese, along with other minerals such as iron, nickel, copper, titanium and cobalt. Manganese nodules are mainly present in the Pacific and Indian Oceans, in the wide deep-sea basins at depths of 3,500 to 6,500 meters.

Seafloor massive sulphides, also known as sulphide deposits, originate at hydrothermal vents in the ocean where sulphide-enriched water flows out of the seabed. Massive sulphide deposits are expected to contain valuable metals such as copper, gold and silver. However, high temperatures around the hydrothermal vents make it is nearly impossible to carry out mining activities near the active vents; high temperatures would damage machinery and mining vehicles. SMS deposits typically occur at depths of 500 to 4,000 meters. Currently, the focus is on depth within 500 to 2,500 meters range as that is considered economical and profitable.

The scope of this report includes various types of equipment used in the deep sea mining market. The market is broken down by major equipment, minerals, mining stages, and regions. The market has not yet started on a commercial scale and the first commercial exploration is expected to start in 2019. Therefore, the revenue forecast period is from 2020 through 2030. The revenue forecast includes manufacturers' total revenue and is categorized by major equipment as well as by mining stages.

## DETAILED INCLUSIONS

For the purpose of this report, deep sea mining is defined as the mining of minerals and metals from sea floor at a depth of more than 500 meters.

The report covers the following stakeholders in the global market for deep sea mining-

Core deep sea mining companies (e.g. Nautilus Minerals and Neptune Minerals).

Companies and institutions, including government bodies, that are not yet active in the deep sea mining market but have applied for a license

and have shown interest in deep sea mining.

Manufacturers of deep sea mining equipment.

For manufacturers of deep sea mining equipment, revenue includes both product/ manufacturing revenue and services revenue.

Revenue forecasts from 2020 to 2030 are given for the overall market and regional market with estimated values derived from manufacturers' and deep sea mining operators' total revenues.

Deep sea mining has the following phases: Exploration, evaluation, extraction and mining, mineral lifting (to support vessel), surface operations, and transfer of mineral to shore.

However, in this report, for purpose of market revenue calculation, only the stages that are directly linked to mining activity are considered. Hence, only extraction and mining, mineral lifting, and surface operations phases are considered; these stages are together known as exploitation stage.

For company profiles, the report has considered players/companies from the above three categories, depending on their importance in the global market only.

Companies considered for profiling are based on a number of criteria such as number of licenses, geographic presence, current activity in deep sea mining, innovation capability, revenue, etc.

The report considers mining licenses granted (approved) as well as applied for (yet to be approved) by both ISA and individual countries (where the mining area falls under a particular country's territory or exclusive economic zone (EEZ).

For deep sea mining in a country's territory (EEZ), the report only considers license information that is publicly available through trusted sources.

## DETAILED EXCLUSIONS

The report has not considered 2017 and 2018 revenue as although the active companies are spending significant amount, the mines are not yet operational and hence are not considered.

Any mining activity at a depth of less than 500 meters is considered as shallow sea mining and is excluded from the scope of this report.

Evaluation and exploration stages of deep sea mining are not considered as exploration and evaluation does not necessarily indicate mining. There is often a huge time gap between the exploration and evaluation phase and start of actual deep sea mining process.

Equipment and systems such as vessels that are used to transport mineral to shore, vessels used for exploration, mineral cleaning systems, etc. are excluded from the scope of this report.

The report also excludes any post sales service providers who are into consulting, education, support, etc.

The report also excludes any revenue or expenditure out of environmental impact assessment.

**REPORT INCLUDES:**

38 tables

An overview of the global markets for deep sea mining technologies, marine, equipment and mineral targets

Analyses of global market trends, with estimated data from 2020 and 2024, and projections of compound annual growth rates (CAGRs) through 2030

An overview of historical developments of deep-sea mining equipment and technologies and assessment of its impact at a global level

Briefing about International Seabed Authority (ISA) and exclusive economic zone (EEZ) and discussion of their role in regulation of deep-sea mining activities in order to protect the marine environment

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Company profiles of the top players in the industry, including Eramet Group (Eramet S.A.), Hydril Pressure Control (GE Hydril), Nordic Ocean Resources AS (Nora), Teledyne Technologies, Inc., and UK Seabed Resources (Lockheed Martin UK Ltd.)

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2H OFFSHORE ENGINEERING LTD.
ACTEON GROUP LTD.
BAUER MASCHINEN GMBH
BOSCH REXROTH AG
CALEY OCEAN SYSTEMS LTD.
CELLULA ROBOTICS LTD.
DAEWOO SHIPBUILDING & MARINE ENGINEERING CO. LTD.
DEEP REACH TECHNOLOGY, INC.
DEEPGREEN METALS, INC.
DREDGING ENVIRONMENTAL & MARINE ENGINEERING NV
ECA GROUP
ERAMET GROUP (ERAMET S.A.)
HYDRIL PRESSURE CONTROL (GE HYDRIL)
GMC LTD.
HYDRO-LEK LTD.
KEPPEL OFFSHORE & MARINE LTD.
KONGSBERG MARITIME AS
MHWIRTH AS
NAUTILUS MINERALS, INC.
NEPTUNE MINERALS, INC.
NORDIC OCEAN RESOURCES AS (NORA)
ODYSSEY MARINE EXPLORATION, INC.
ROYAL IHC LTD.
SEAS (SUBMERSIBLE EQUIPMENT & SERVICES) OFFSHORE PTY LTD.
SEATECH SOLUTIONS INTERNATIONAL (S) PTE LTD.
SOIL MACHINE DYNAMICS LTD.
TECHNIPFMC PLC
TELEDYNE TECHNOLOGIES, INC.
TRITECH INTERNATIONAL LTD.
UK SEABED RESOURCES (LOCKHEED MARTIN UK LTD.)

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