A Classification Society’s Experience with Subsea Mining

Marco Figoni
ABS Brazil Offshore Technology
Rio de Janeiro, Brazil

Sudheer Chand
ABS Offshore Technology
Houston, US

ABSTRACT
Growing interest in deep water minerals resources is providing opportunities for both the mining and oil industries. Exploration and production of ocean minerals require synergies between different technologies. In this context appropriate standards are needed to cover both new equipment and existing equipment that may be subject to changed service conditions. This paper covers ABS’ experience with related equipment such as deep sea oil and gas, certification of equipment as per existing API requirements, manufacturer’s Specifications and Coastal Administration’s requirements.

KEY WORDS: Deep-sea mining, Certification, Classification, Risk Assessment, Novel Concept.

NOMENCLATURE
ABS American Bureau of Shipping
DP Dynamic Position
FAT Factory Acceptance Test
FMECA Failure Mode, Effects and Criticality Analysis
HAZID Hazard Identification Study
HAZOP Hazard and Operability Study
HV High Voltage
ISA International Seabed Authority
JIP Joint Industry Project
LV Low Voltage
NDE Nondestructive Examination
P&ID Piping and Instrumentation Diagram
PQR Procedure Qualification Record
REEs Rare Earth Elements
SCFU Subsea Chushing and Feeding Unit
SEPS Subsea Electrical Power Standardization
SMS Seafloor Massive Sulphides
SS Seabed Systems
TS Topside Systems
UTS Underwater Transportation Systems
WPS Welding Procedures Specifications

INTRODUCTION
The most critical challenges with regard to the recovery of ocean bed mineral resources, especially in deep water, are related to the production operations, including the deep-sea excavation process, the transport to the surface of large slurry volumes, slurry abrasiveness, power supply management and the subsea equipment handling. While the mining industry has taken the lead with respect to the dredging and processing part of the system, the oil industry is contributing through the adaptation of exploration techniques and the development of ore lifting technology based on existing subsea knowledge. The areas of interest for deep sea mining are:

- Mid ocean ridges, volcanic arcs and back arc spreading systems where active and extinct hydrothermal vents create sulphide deposit commonly called Seafloor Sulphide Deposits (SMS) and located between 1500 m and 5000 m below sea level.
- Seafloor of ocean basins between 4000m and 6000 m where it can be found polymetallic nodules deposits rich in rare earth elements (REEs).
- Seamounts and around flanks of volcanic islands between 400 m and 4000 m where it possible to find polymetallic crusts.

Several exploration techniques and offshore production systems have already been designed and assessed, all of them with apparently positive results. While the exploration phase is well advanced, and subject to continuous expansion, resulting in the discovery of an increasing inventory of different mineral resources in the world’s oceans, production can be considered to be still at an early stage. Subsea operations associated with offshore mining require close cooperation between international and local authorities to preserve the environment and leave a small footprint yet there are still many uncertainties in this regard. Additionally, all the exploration processes must be carefully evaluated if subsea mining is to be allowed to develop in a sustainable manner. From a purely technical standpoint, mining at the seabed has already been successfully demonstrated. The process is based on three main components (fig. 1), namely Seabed Systems (SS), Underwater Transportation Systems (UTS) and Topside Systems (TS). This layout is based on the concept that ore, or other