1 SUMMARY

The report is based on the currently available knowledge on the geology deposits of polymetallic nodule (PN) as well as on the mining and processing technology. The report contains information about the physical, geological, environmental and technical aspects of the deep sea mineral exploration and extraction of polymetallic nodules in the Clarion-Clipperton Zone (CCZ).

The key documents used in the elaboration are as follow: Technical Report on the Interoceanmetal Joint Organization polymetallic nodules project in the Pacific Ocean Clarion-Clipperton Fracture Zone (Szamałek et al., 2016), Report on Selection of the configuration and determination of the parameters of the collection unit for the conditions of the IOM exploration area (Kostyuk et. al, 2013), Processing Technology of Polymetallic Nodules Pre-Feasibility Study (Miyares, 2016) and Market Study (Lewicka et al., 2018).

The report includes a detailed description of IOM's activities within the CCZ related to polymetallic nodule exploration, which started from 1987. It discusses climatic and environmental characteristic, geological setting of the CCZ, geological aspects of nodules formation, deposit and nodule characteristics, research methods, estimates of the mineral resources, mining and processing technology, as well as legal issues.

Resources and reserves summary

The mineral resource estimate at the abundance cut-off of 10 wet kg/m^2 is the selected base case scenario for future mining operation. The effective date for the estimate is June 2016. No mineral reserves were estimated at this stage of the project development.

According to the CRIRSCO directives (CRIRSCO, 2013), the resources of polymetallic nodules can be categorized as „inferred" in the B1 and B2 exploration areas and as „indicated" in the H11 and H22 exploration blocks. Such categorization is justified by different mean sampling intervals within the exploration areas and exploration blocks. In the B1 and B2 exploration areas, the mean sampling intervals are 11 and 15 km, respectively. On the contrary, in the H11 and H22 exploration blocks, the mean sampling interval is about 7 km each. Within the whole exploration area and both of the blocks, the accuracy of nodule resource estimation is high, with the relative (kriging) standard error of the estimate of 3–8%. The accuracy of Cu, Co, Mn and Ni grade estimates is highly satisfying in areas of any size due to low variability of metal contents, resulting from stable chemical composition of polymetallic nodules.

Mineral Resource estimate for the IOM Exploration Area (nodule abundance cut-off 10 kg/m^2)

Mineral Resource Classification	Abundance (wet kg/m^2)	Mn (%)	Ni (%)	Cu (%)	Co (%)	Polymetallic Nodules (million tons)*
Measured	-	-	-	-	-	-
Indicated (H11 exploration block)	14.6	31.74	1.31	1.29	0.16	41.4
Indicated (H22 exploration block)	14.1	31.04	1.30	1.29	0.17	31.9
Indicated total						**73.3**
Inferred (B1 exploration sector)	13.4	27.84	1.21	0.90	0.21	62.6
Inferred (B2 exploration sector)	13.1	31.53	1.32	1.24	0.18	242.9
Inferred total						**305.5**

Economic analysis summary

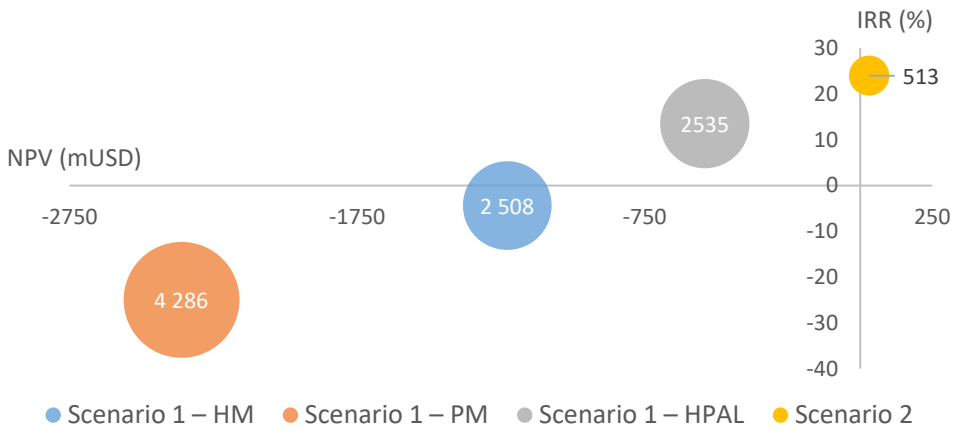
Economic modelling for 2 scenarios (4 different variants) was carried out. Scenario 1 is a variant of the project which assumes extraction and processing of 4.5 million tons of wet polymetallic nodules. The processing part of the business case takes into consideration 3 technological options, which could be used to process nodules. Scenario 2 is a variant limited to the mining and sale of raw ore. This option does not take into account the construction costs of the metal processing plant and operating costs of the process. In this scenario, all the mined PN volume would be sold to any buyer. The basic factor of profitability of such a scenario is the price and sales volume of raw ore.

The economic evaluation includes basic sensitivity analyses and stress testing. Analysis of the options for alternative project implementation indicates that the project requires optimization of the business concept. For scenarios that include a combination of a mining and processing part, the project results are negative regardless the chosen technology. This results both from high plant construction costs (CAPEX) as well as operating costs (OPEX). Use of existing processing capacities or ordering the processing of metals as external service seems to be a better solution. This requires reconsideration of the optimal capacity of polymetallic nodules production and the sales structure. This will be subject for analysis in the Pre-Feasibility Study. Developing detailed knowledge of mining technology (Pilot Mining Test) is necessary to ensure profitable sales of raw ore.

Comparison of alternative project implementation scenarios

	Mining output (wet PN ktons)	Processing input (dry PN ktons)	Total CAPEX (mUSD)	Average annual OPEX (mUSD)	NPV (mUSD) WACC 20,5%	IRR (%)
Scenario 1 – HM	4 500	3 000	2 508	1 293	-1 228	-4,36
Scenario 1 – PM	4 500	3 000	4 286	1 814	-2 361	-30
Scenario 1 – HPAL	4 500	3 000	2 535	751	-541	13,49
Scenario 2	1 500	-	513	110	31	23,99

HM- hydrometallurgy, PM – pyrometallurgy, HPAL – high pressure acid leaching



The presented economic results are based on limited information sources and conservative assumptions. Current stage of the project evaluation does not allow for making investment decisions. However, the results are promising and they justify the continuation of analytical work and technological studies. The purpose of future actions is to choose the optimal investment scenario and to obtain precise data, enabling comprehensive economic assessment.