

Analysis of Processing Technology for Manganese Nodules Analysis of Processing Technology for Manganese Nodules. Buy this book Hardcover \$

The International Seabed Authority estimates that the total amount of nodules in the Clarion Clipperton Zone exceeds 21 billions of tons Bt , containing about 5. Growth and composition[edit] On the seabed the abundance of nodules varies and is likely controlled by the thickness and stability of a geochemically active layer that forms at the seabed. Nodule growth is one of the slowest of all known geological phenomena, on the order of a centimeter over several million years. Several of these processes may operate concurrently or they may follow one another during the formation of a nodule. A wide range of trace elements and trace minerals are found in nodules with many of these incorporated from the seabed sediment, which itself includes particles carried as dust from all over the planet before settling to the seabed. Almost half a billion dollars was invested in identifying potential deposits and in research and development of technology for mining and processing nodules. These initial undertakings were carried out primarily by four multinational consortia composed of companies from the United States , Canada , the United Kingdom , the Federal Republic of Germany , Belgium , the Netherlands , Italy , Japan and two groups of private companies and agencies from France and Japan. There were also three publicly sponsored entities from the Soviet Union , India and China. In the late-seventies, two of the international joint ventures succeeded in collecting several hundred ton quantities of manganese nodules from the abyssal plains 18, feet, 5. In the course of these projects, a number of ancillary developments evolved, including the use of near-bottom towed side-scan sonar array to assay the nodule population density on the abyssal silt whilst simultaneously performing a sub-bottom profile with a derived, vertically oriented, low-frequency acoustic beam. Sumitomo Metal Mining continues to maintain a small place-keeping organization in this field. On top of the environmental issues and the fact that the profits had to be shared, there was no cheap way to get the manganese nodules off the sea floor. There is also improved technology that could be used in mining including Pumps , tracked and screw drive rovers, rigid and flexible Drilling risers , and Ultra-high-molecular-weight polyethylene rope. Mining is considered to be similar to the potato harvest on land, which involves mining a field partitioned into long, narrow strips. The mining support vessel follows the mining route of the seafloor mining tools, picking up the about potato-sized nodules from the seafloor. Three factors were largely responsible: At this time, the commercial extraction of polymetallic nodules was not considered likely to occur during the next two decades. The International Seabed Authority has granted new exploration contracts and is progressing development of a Mining Code for The Area, with most interest being in the Clarion Clipperton Zone. Manganese nodules mining value chain[edit] Within the value chain concept of manganese nodules mining, seven main stages from prospecting to sales can be identified: Prospecting and application 3. Resource assessment, evaluation and mine planning Value is added in relation to resource classification â€” Pilot mining test â€” Intermediate phase â€” a phase where the value of the project actually starts. For mature terrestrial mining the value can start as early as prospecting and application. Extraction, lifting and surface operations 5. Offshore and onshore logistics, transport operations 6. Metallurgical processing stage 7. Distribution and sales Value is added basing on product processing The exact components and stages can be arranged individually for the particular deep-sea mining projects of various contractors. The current focus of deep sea mining projects is aimed at exploration where phases of mining, extraction, lifting and surface operation techniques are now in planning or are tested on a smaller scale. As presented in the list the main steps of manganese nodules project value chain can be differentiated using the criteria of the type of activities where the value is actually added. Whereas within prospecting, exploration and resource assessment phases the value is added to intangible assets, for the extraction, processing and distribution phases the value increases with relation to product processing. Exploration phase involves such operations as locating, sea bottom scanning and sampling using technologies such as

echo-sounders, side scan sonars, deep-towed photography, ROVs , AUVs. The resource valuation incorporates the examination of data in the context of potential mining feasibility. A reliable mineral resources classification is a necessary condition for economic feasibility assessment. At first a sample of nodules is taken and it is processed in ship laboratories according to the specified technology in order to determine such quantities as nodules abundance and chemical content of the deposit. The spatial distribution of nodule ore abundance and metal content is processed in GIS computer systems. Eventually statistical analysis provides for the estimation of nodule tonnage and metals in the deposit, which are the subject of the report on mineral resources classification. Value chain based on product processing involves such operations as actual mining or extraction , vertical transport, storing, offloading, transport, metallurgical processing for final products. Unlike the exploration phase, the value increases after each operation on processed material eventually delivered to the metal market. This phase is also the subject of a taxation procedure. Logistics involves technologies analogous to those applied in land mines. This is also the case for the metallurgical processing, although rich and polymetallic mineral composition which distinguishes marine minerals from its land analogs requires special treatment of the deposit. Environmental monitoring and impact assessment analysis relate to the temporal and spatial discharges of the mining system if they occur, sediment plumes, disturbance to the benthic environment and the analysis of the regions affected by seafloor machines. This involves an examination of disturbances near the seafloor, as well as disturbances near the surface. Observations include baseline comparisons for the sake of quantitative impact assessments. After a certain reporting period feedback information is provided to improve the sustainability of the mining process. The first legislative achievement of this intergovernmental organization was the adoption of regulations for prospecting and exploration for polymetallic nodules, with special provisions to protect the marine environment from any adverse effects. The Authority followed this up by signing year contracts with seven private and public entities, giving them exclusive rights to explore for nodules in specified tracts of the seabed, each 75, square kilometers in size. The United States, whose companies were among the key actors in the earlier period of exploration, remains outside this compact as a non-party to the Law of the Sea Convention. To administer the mineral resources of the seabed in the Area; To enact rules, regulations and procedures relating to these resources; To promote and encourage marine scientific research and development in the Area; To protect and conserve the natural resources of the Area and prevent significant damage to the environment. The Mining Code includes exploration and draft exploitation regulations, an Environmental Management Plan for the Clarion Clipperton Zone, and recommendations for the guidance of Contractors in terms of reporting, environmental impact assessment, expenditure reporting and training for scientists and engineers from developing nations. In due course an intergovernmental conference would review and debate the recommendations of the PrepCom. Environmental issues and sensitivities[edit] Any future mining of nodules in The Area needs to be authorised by the International Seabed Authority and would need to quantify impact in advance via an Environmental impact statement and associated Environmental Management Plan. These assessments, monitoring plans and guidance controls would likely work at the scale of proposed operations. The International Seabed Authority already has an Environmental Management Plan that considers the entire Clarion Clipperton Zone and that includes reference areas that are not available for mining termed Areas of Particular Environmental Interest. Nodule regrowth takes decades to millions of years and that would make such mining an unsustainable and nonrenewable practice. Any prediction about the effects of mining is extremely uncertain. Thus, nodule mining could cause habitat alteration, direct mortality of benthic creatures, or suspension of sediment, which can smother filter feeders.

2: Manganese nodule | Revolv

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Manganese nodule Save Polymetallic nodules, also called manganese nodules, are rock concretions on the sea bottom formed of concentric layers of iron and manganese hydroxides around a core. The core may be microscopically small and is sometimes completely transformed into manganese minerals by crystallization. When visible to the naked eye, it can be a small test shell of a microfossil radiolarian or foraminifer, a phosphatized shark tooth, basalt debris or even fragments of earlier nodules. As nodules can be found in vast quantities, and contain valuable metals, deposits were identified as having economic interest in the s by John Mero. Their surface textures vary from smooth to rough. They frequently have botryoidal mammilated or knobby texture and vary from spherical in shape to typically oblate, sometimes prolate, or are otherwise irregular. The bottom surface, buried in sediment, is generally rougher than the top due to a different type of growth. The total amount of polymetallic nodules on the sea floor was estimated at billion tons by Alan A. Archer of the London Geological Museum in Polymetallic nodules are found in both shallow e. During the scientific expeditions of the HMS Challenger " , they were found to occur in most oceans of the world. Penrhyn Basin near within the Cook Islands. The International Seabed Authority estimates that the total amount of nodules in the Clarion Clipperton Zone exceeds 21 billions of tons Bt, containing about 5. Growth and composition On the seabed the abundance of nodules varies and is likely controlled by the thickness and stability of a geochemically active layer that forms at the seabed. Nodule growth is one of the slowest of all known geological phenomena, on the order of a centimeter over several million years. Several of these processes may operate concurrently or they may follow one another during the formation of a nodule. A wide range of trace elements and trace minerals are found in nodules with many of these incorporated from the seabed sediment, which itself includes particles carried as dust from all over the planet before settling to the seabed. Almost half a billion dollars was invested in identifying potential deposits and in research and development of technology for mining and processing nodules. These initial undertakings were carried out primarily by four multinational consortia composed of companies from the United States, Canada, the United Kingdom, the Federal Republic of Germany, Belgium, the Netherlands, Italy, Japan and two groups of private companies and agencies from France and Japan. There were also three publicly sponsored entities from the Soviet Union, India and China. In the late-seventies, two of the international joint ventures succeeded in collecting several hundred ton quantities of manganese nodules from the abyssal plains 18, feet, 5. In the course of these projects, a number of ancillary developments evolved, including the use of near-bottom towed side-scan sonar array to assay the nodule population density on the abyssal silt whilst simultaneously performing a sub-bottom profile with a derived, vertically oriented, low-frequency acoustic beam. The technology and experience developed during the course of this project were never commercialized because the last two decades of the 20th century saw an excess of nickel production. Sumitomo Metal Mining continues to maintain a small place-keeping organization in this field. Kennecott Copper had explored the potential profits in manganese nodule mining and found that it was not worth the cost. On top of the environmental issues and the fact that the profits had to be shared, there was no cheap way to get the manganese nodules off the sea floor. Since the late s, deep sea technology has improved significantly: There is also improved technology that could be used in mining including Pumps, tracked and screw drive rovers, rigid and flexible Drilling risers, and Ultra-high-molecular-weight polyethylene rope. Mining is considered to be similar to the potato harvest on land, which involves mining a field partitioned into long, narrow strips. The mining support vessel follows the mining route of the seafloor mining tools, picking up the about potato-sized nodules from the seafloor. Three factors were largely responsible: Difficulty and expense of developing and operating mining technology

that could economically remove the nodules from depths of five or six kilometers and transport them to the ocean surface. High taxes the international community would charge for the mining, and Continuing availability of the key minerals from land-based sources at market prices. At this time, the commercial extraction of polymetallic nodules was not considered likely to occur during the next two decades. In recent times, nickel and other metal supply has needed to turn to higher cost deposits in order to meet increased demand, and commercial interest in nodules has revived. The International Seabed Authority has granted new exploration contracts and is progressing development of a Mining Code for The Area, with most interest being in the Clarion Clipperton Zone. Manganese nodules mining value chain Within the value chain concept of manganese nodules mining, seven main stages from prospecting to sales can be identified: Prospecting and application 3. 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At first a sample of nodules is taken and it is processed in ship laboratories according to the specified technology in order to determine such quantities as nodules abundance and chemical content of the deposit. The spatial distribution of nodule ore abundance and metal content is processed in GIS computer systems. Eventually statistical analysis provides for the estimation of nodule tonnage and metals in the deposit, which are the subject of the report on mineral resources classification. Value chain based on product processing involves such operations as actual mining or extraction , vertical transport, storing, offloading, transport, metallurgical processing for final products. Unlike the exploration phase, the value increases after each operation on processed material eventually delivered to the metal market. This phase is also the subject of a taxation procedure. Logistics involves technologies analogous to those applied in land mines. 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The first legislative achievement of this intergovernmental organization was the adoption of regulations for prospecting and exploration for polymetallic nodules, with special provisions to protect the marine environment from any adverse effects. The Authority followed this up by signing year contracts with seven private and public entities, giving them exclusive rights to explore for nodules in specified tracts of the seabed, each 75, square kilometers in size. The United States, whose companies were among the key actors in the earlier period of exploration, remains outside this compact as a non-party to the Law of the Sea Convention. To administer the mineral resources of the seabed in the Area; To enact rules, regulations and

procedures relating to these resources; To promote and encourage marine scientific research and development in the Area; To protect and conserve the natural resources of the Area and prevent significant damage to the environment. The Mining Code includes exploration and draft exploitation regulations, an Environmental Management Plan for the Clarion Clipperton Zone, and recommendations for the guidance of Contractors in terms of reporting, environmental impact assessment, expenditure reporting and training for scientists and engineers from developing nations. In due course an intergovernmental conference would review and debate the recommendations of the PrepCom. Environmental issues and sensitivities Any future mining of nodules in The Area needs to be authorised by the International Seabed Authority and would need to quantify impact in advance via an Environmental impact statement and associated Environmental Management Plan. These assessments, monitoring plans and guidance controls would likely work at the scale of proposed operations. The International Seabed Authority already has an Environmental Management Plan that considers the entire Clarion Clipperton Zone and that includes reference areas that are not available for mining termed Areas of Particular Environmental Interest. Nodule regrowth takes decades to millions of years and that would make such mining an unsustainable and nonrenewable practice. Any prediction about the effects of mining is extremely uncertain. Thus, nodule mining could cause habitat alteration, direct mortality of benthic creatures, or suspension of sediment, which can smother filter feeders.

3: manganese nodule | eBay

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Effect of Leached Residue: The alloy obtained from heat nos. This is due to the increased MnO availability in the slag for reduction with higher amount of Mn ore addition in the charge. This is perhaps due to more fluidity of molten bath at lower basicity. The higher yield and metallic recovery at charge basicity 0. Chemical composition of obtained at different residue: Optimizing Quartz Addition Silica in the charge mix has dual role, first as source of silicon and second as fluxing agent. In present work, silica addition in the charge mix is maintained by quartzite addition in the charge mix. The charge mixes of heat no. The chemical compositions of alloys obtained at various quartzite additions are given in Fig. However, required Si content in the alloy was obtained in the entire range of quartz addition. Effect of leached residue: Mn ore ratio on Mn recovery Figure 6. Mn ore ratio on Mn recovery Figure 7. Mn ore ratio on metallic yield The effects of quartz addition on manganese recovery, silicon recovery and metallic yield are given in Figure 9, 10 and 11, respectively. The addition of quartz in the charge mix was found to be associated with decreased metallic yield. The decrease in metallic yield was due to decreasing Mn recovery with the addition of quartz. Although, there was increase in Si recovery but not enough to compensate the losses due to decreased Mn recovery. Chemical composition obtained at different quartz addition Heat no. Effect of quartz addition on Mn recovery Figure Effect of quartz addition on Si recovery In a melt, reduction of manganese and silicon mainly takes place from their combined oxides as shown below, which is rather difficult than reduction from their free oxides[8]. Effect of quartz addition on metallic yield Presence of basic oxides such as CaO and MgO form stabler silicates and generate free MnO available for reduction by carbon. However, with the addition of silica in slag, MnO. Thus, an increase in silica addition resulted in increased silicon content and decrease in manganese recovery. Addition of silica also increases the slag liquidus, which intern lead to higher bath temperature favorable for Si recovery. Conclusions The low manganese containing leached manganese nodule residue can be utilized for silicomanganese production by blending with high grade manganese ore. It is found that charge mix should contain leached manganese nodules residue: Mn ore of 1: Utilisation of leach residue for silicomanganese production will not only ensure its bulk utilisation but also minimize the environmental problem and economics of the manganese nodules processing will also be improved. Bureau of Indian Standards, New Delhi,

4: Manganese Nodules Residue: Potential Raw Material for FeSiMn Production

Eventually statistical analysis provides for the estimation of nodule tonnage and metals in the deposit, which are the subject of the report on mineral resources classification. Value chain based on product processing involves such operations as actual mining (or extraction), vertical transport, storing, offloading, transport, metallurgical processing for final products.

5: Manganese nodule - Wikipedia

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