



Legal and Technical Commission

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Evaluation of the annual reports submitted by contractors

Report and recommendations of the Legal and Technical Commission

I. Introduction

1. Pursuant to section 10 of annex 4 to the Regulations on Prospecting and Exploration for Polymetallic Nodules in the Area, all contractors are under the obligation to submit their annual activity reports by the end of March each year.

2. The contractors are: Yuzhmorgeologiya (Russian Federation); Interoceanmetal Joint Organization (Bulgaria, Cuba, Czech Republic, Poland, Russian Federation and Slovakia); the Government of the Republic of Korea; China Ocean Mineral Resources Research and Development Association (China); Deep Ocean Resources Development Co. Ltd. (Japan); Institut français de recherche pour l'exploitation de la mer (France); the Government of India; the Federal Institute for Geosciences and Natural Resources (Germany); and Nauru Ocean Resources Inc. As at 24 May 2012, annual reports had been received from all the contractors. The table below provides details of the annual reports for 2011 received.

Annual reports for 2011 received from contractors

| <i>Contractor</i> | <i>Date of receipt</i> | <i>Format</i> | <i>Original language(s)</i> | <i>Date of receipt of English translation</i> |
|--|--|--------------------------|-----------------------------|---|
| China Ocean Mineral Resources Research and Development Association | 27 March 2012 (copy) 11 April 2012 (original) | Hard copy and electronic | Chinese, English | |
| Yuzhmorgeologiya | 28 March 2012 | Hard copy and electronic | Russian | 7 June 2012 (translated by the United Nations Secretariat) |

* Reissued for technical reasons on 23 October 2012.



| <i>Contractor</i> | <i>Date of receipt</i> | <i>Format</i> | <i>Original language(s)</i> | <i>Date of receipt of English translation</i> |
|---|------------------------|--------------------------|-----------------------------|---|
| Nauru Ocean Resources Inc. | 30 March 2012 | Hard copy and electronic | English | |
| Interoceanmetal Joint Organization | 2 April 2012 | Hard copy and electronic | English | |
| Government of India | 3 April 2012 | Hard copy and electronic | English | |
| Government of the Republic of Korea | 5 April 2012 | Hard copy and electronic | English | |
| Federal Institute for Geosciences and Natural Resources (Germany) | 18 April 2012 | Hard copy | English | |
| Deep Ocean Resources Development Co. Ltd. | 11 May 2012 | Hard copy and electronic | English | |
| Institut français de recherche pour l'exploitation de la mer | 24 May 2012 | Hard copy and electronic | French | 11 June 2012 |

3. At its meeting during the seventeenth session, the Legal and Technical Commission made a number of comments and suggestions on the annual reports submitted for the year 2010. These comments are contained in document ISBA/17/LTC/8 and were conveyed in writing by the Secretary-General to the individual contractors on 4 and 5 October 2011, along with specific comments relevant to each contractor.

4. As a result of its analysis, the Commission herewith submits the following general observations and recommendations on the annual reports for 2011 to the Secretary-General.

II. General comments and recommendations

5. The following are general comments and recommendations related to the annual reports:

(a) Six out of the nine contractors failed to submit their annual activity reports in a timely manner. This compromises the ability of the organs of the International Seabed Authority to effectively carry out its functions;

(b) The majority of the reports follow in large part the general template prescribed by the Commission;

(c) Most contractors are in the final five-year phase of their contracts. It is to be expected that they will have identified a first-generation mine site, obtained good baseline environmental data, developed a mining system prototype and made arrangements for processing no later than the anticipated end of their respective contracts;

(d) The pace of work is not uniform among the contractors. Some of the contractors are still engaged in exploration or the environmental phase of their work, and some have not done any work on the technology for mining or processing;

(e) Results of fieldwork (especially with regard to the exploration work) are in many instances not reported in the required detail, and often not in digital format. This is of serious concern to the Commission. The lack of raw data in digital format hinders the Authority in its work as an effective repository of bathymetric, geophysical, geotechnical and chemical data to facilitate further exploration in the Area. In the future, the Commission will place great weight on how the contractors comply with the prescribed and recommended ways of reporting data when considering and recommending new licences;

Exploration work

(f) In general terms, exploration work proceeded slowly during the reporting period;

(g) The Commission expresses its concern that one contractor has not carried out any exploration activities during the first 10-year period under the contract. As the contractors enter the final five-year phase, the Commission finds this situation deeply troubling and invites the contractor to look into the matter;

(h) Some contractors reported no work at all under exploration, mining and metallurgy-related activity;

(i) As pointed out in earlier evaluations by the Commission, no uniformity exists in the classification of nodules based on morphology, shape or size. A standard needs to be developed at the earliest opportunity. The Authority should consider convening a meeting of contractors or a workshop for standardization, as noted in paragraph 96 of the annual report of the Secretary-General (ISBA/18/A/2);

(j) The Commission strongly recommends that the results of the exploration work be reported in digital format and include the following data:

- (i) Bathymetry (xyz files) (mandatory);
- (ii) Geophysical data (geo-referenced raw data) (requested);
- (iii) Nodule abundance (mandatory);
- (iv) Chemical analyses, including methods, analytical accuracy and precision estimates (mandatory);

Mining tests and proposed mining technology

(k) Progress remains to be made on technology-related issues, particularly with respect to the mining and metallurgical processing of nodules. A few contractors have not yet started to develop their technological capacity. It may therefore be beneficial if such contractors would make a concerted effort by pooling their resources;

(l) The contractors that are actively engaged in mining technology research and development should now concentrate on developing a combined mining system and testing their technology at greater depths;

(m) Few of the contractors have tested the mineral processing technology on a pilot scale. The extraction of rare earth elements and other metals from nodules will be of additional value and should be pursued;

Environmental monitoring and assessment

(n) The environmental work reported by contractors in 2011 was generally of better quality than that reported in previous years. In response to an appeal made during the meeting of contractors in January 2012, several contractors have provided some raw data which will go a long way in evaluating the potential impact on the marine environment and also in developing the regional environmental management plan for the Clarion-Clipperton Zone. These data will also help in developing the regional Environmental Management Plan for the Clarion-Clipperton Zone. As environmental data are unclassified, all contractors should provide the data to the Authority before the start of the nineteenth session of the Commission so that the central environmental database can be developed and strengthened by the Authority;

Financial

(o) Some contractors have still not provided detailed financial statements for 2009 and 2010 despite the Commission's repeated calls to do so. The Commission invites the Council to consider the matter accordingly;

(p) A positive development reported in 2011 was that many of the contractors have responded to the Commission's 2011 evaluation report (ISBA/17/LTC/8) and have made substantial progress towards compliance with the Commission's financial recommendations as contained in document ISBA/15/LTC/7. Contractors are encouraged to continue with improvements in financial reporting with a view to full compliance;

Other matters

(q) Only one contractor provided a list of research published in peer-reviewed journals during the reporting year. The Commission requests the secretariat to collate a list of publications from all contractors on polymetallic nodules and publish a booklet listing the publications;

(r) Few contractors have continued to analyse the market trends of demand, supply and prices of metals;

(s) In the detailed phase of exploration work, the contractors should consider the use of advanced techniques such as remotely operated vehicles and autonomous underwater vehicles for producing detailed bathymetric charts and estimating nodule abundances accurately.

III. Evaluation of annual reports and recommendations

A. Deep Ocean Resources Development Co. Ltd.

General

6. The contractor submitted its annual report for 2011 in English on 11 May 2012. Under the standard conditions of the contract (section 10 of annex 4 to the Regulations), the contractor is under an obligation to submit its annual activity report within 90 days of the end of the calendar year. The contractor should make every effort to submit the reports in a timely manner in order to allow the organs of the International Seabed Authority to effectively carry out its functions. The report was submitted both in hard copy and in electronic format. The report included details of exploration activities, environmental studies, mining tests and training programmes and a financial statement. The report was structured in line with the headings and content list recommended by the Commission in the annex to document ISBA/8/LTC/2.

Exploration work

7. The annual report for 2011 indicated that in 2010 Deep Ocean Resources Development Co. Ltd. (DORD) carried out field activities for the first time in the contract period. A research cruise was conducted in December 2011. Laboratory analyses on material collected on the cruise will be presented in the annual report for 2012. The main objective of the cruise was to carry out resource evaluation in the SA24 block of the west area and an environmental survey in the Japan deep-sea impact experiment (JET) area in BA 201 of the west area. The survey cruise lasted 32 days, of which 24 days were spent on-site for resource evaluation and the JET environmental study.

8. During the second five-year phase of the contract (2006-2011), DORD carried out a study to assess the overall viability of deep-sea commercial mining operations. This included a study of the current status of mining technology, smelting and refining nodules, an environment assessment related to nodule exploitation operations, and the value of the metals in the nodules.

9. The report provided details of the research vessel, RV *Hakureimaru No. 2*, and the survey equipment used. General maps of the resource evaluation block and the JET environmental survey block were presented in the report. Bathymetric surveys, seafloor observations using a deep-sea camera, and sampling by box coring and large gravity coring were carried out. Manganese nodules were collected in dredges. Owing to bad weather conditions, DORD was unable to carry out the planned high-resolution side scan sonar survey aimed at obtaining information on microtopographic features in an area with dense aggregations of polymetallic nodules. A similar side scan sonar survey will be included in the 2012 cruise by deploying an autonomous underwater vehicle. The report listed the number of survey lines carried out by the different survey and sampling methods. Previous sampling and bathymetric surveys were not as detailed or accurate. Work undertaken during the December 2011 cruise provided more detailed bathymetry charts in part of the application area and used finer-resolution grid sampling, side scan sonar and camera surveys.

10. The report provided some preliminary results from the survey work. A bathymetric chart and nodule abundance map were presented. Three survey lines using a deep-sea camera were used to estimate nodule abundance. The start and finish of the survey lines were tabulated, and a general description of the area was provided. Similarly, information was provided about coring locations and other details. Six dredges were deployed to collect nodules. The maximum weight of nodules collected on one dredge was 120 kg. All data were archived in the DORD geographical information system (GIS). A resource evaluation was carried out using ArcGIS. A copy of the spatially referenced data was provided to the Authority. The chemical analyses and the photo image transect processing is ongoing and will be presented in the 2012 annual report.

11. With regard to progress with the plan of work, the contractor should be congratulated on having commenced direct exploration, as it is noted that none was carried out for the period between 2001 and 2010.

Mining tests and proposed mining technologies

12. No mining tests were conducted during the reporting period. However, DORD collected and reviewed information for the establishment of trends to guide further research and development in mining.

13. An explanation was provided on the development of a nodule collector system and an ore lifting system (pump lift method and air lift method) in the period between 1981 and 1997. The contractor also attempted to develop a handling system and assessment of the operational systems. Verification experiments were carried out until 1997, but the contractor then discontinued its research and development activities.

14. DORD did not carry out any metallurgical tests during the reporting period. Previous information on metallurgy was reviewed to establish trends in processing technology. The report provides a brief description of metallurgical work carried out between 1989 and 1995.

Training

15. Training obligations as defined in the contract have been completed. In accordance with the programme of activities under the contract, no training programme was carried out.

Environmental monitoring and assessment

16. The contractor stated that the environmental work performed in 2011 consisted of a 32-day environmental research cruise. Maps of the study area were presented, and information about the samples collected and the methodology used was provided. Brief descriptions of the samples were provided. Temperature and salinity profiles were presented graphically. The contractor stated that the analyses were ongoing and that the results would be presented in the annual report for 2012. The contractor also stated that all archived data had been collated into a geo-referenced database.

17. The revisiting of the JET impact disturbance experiment site is noted as a vital step in assessing the long-term environmental impact of mining and rates of recolonization. However, owing to the low number of individuals in core samples, an assessment should be made as to whether the sampling programme will produce statistically robust data. Photographic transects should be used to evaluate the

intensity of seabed disturbance and related to the probability of box cores landing in areas impacted by the disturbance tracks. Sampling by remotely operated vehicles should be used to provide better control of sampling sites relative to the disturbed areas. The recolonization processes at the JET site need to be followed up regularly. The five-year plan for the final phase of the contract period is comprehensive and is to be commended.

18. For macrofauna, Authority guidelines require that a 250-um sieve be used. This study used 300 um.

19. Data from 1975 to 1996 should be provided to the secretariat in electronic format.

Financial statement

20. For the period from 1 January to 31 December 2011, the contractor reported a total expenditure of \$2,011,340 (¥160,907,223), which was reported in detail against five headings as recommended by the Commission. Each heading is now compliant with the recommended headings in ISBA/15/LTC/7. The financial statement also included details of vessel-related costs and staff expenditure in relation to the cruise. The contractor indicated that no single item of the capital expenditure in 2011 exceeded \$100,000. No expenditure was reported for research and development of mining technology and metallurgical process, because those activities took place after the reporting period. The financial statement was certified by certified public accountants. The financial statement was dated 21 May 2012. The contractor requested that the submission of the certificate be postponed until the end of May, because the fiscal year runs from 1 April to 31 March.

Proposed adjustment to the programme of activities

21. The contractor did not propose any changes to the programme of activities. The contractor responded to the comments made on the 2010 annual report in document ISBA/17/LTC/8 in a manner that greatly facilitates the consideration of the reports submitted by the Commission.

22. The Commission is deeply troubled that no exploration activities were carried out during the first 10-year period under the contract and invites the contractor to consider this matter accordingly. The Commission looks forward to the commissioning of a new research vessel, which is under construction.

Comments

23. For the first time during the contractual period, fieldwork was carried out and significant progress was made in environmental and resource evaluation studies. However, for mining and metallurgy, the annual report mentioned only work carried out in previous years. The maps and tables presented are of good quality. All positional data were provided. DORD is planning another 50-day cruise during 2012.

B. Federal Institute for Geosciences and Natural Resources

General

24. The contractor submitted its annual report for 2011 in English on 18 April 2012. Under the standard conditions of the contract (section 10 of annex 4 to the Regulations), the contractor is under an obligation to submit its annual activity report within 90 days of the end of the calendar year. The contractor should make every effort to submit the reports in a timely manner in order to allow the organs of the International Seabed Authority to effectively carry out its functions. The report was submitted in hard copy only. Reports must be provided in electronic format. The report contains information on exploration, mining tests and environmental activities, as well as a financial statement. The report was broadly structured in line with the headings and content list recommended by the Commission in the annex to document ISBA/8/LTC/2.

Exploration work

25. During the reporting period, the contractor conducted no research cruise (none was planned). However, analyses of the data collected during the previous cruises continued.

26. A detailed bathymetric map (multibeam data) and a backscatter map of the prospective mining area were presented in the report. A backscatter map with a resolution of 120 m by 120 m was produced for the entire area. Sidescan tracks (two lines) and video tracks (five lines) were analysed. Over 5,000 photographs were converted to grey scale for a threshold-based and learning algorithm approach. Video transects, still photo transects, backscatter images and sidescan surveys were used in a high-resolution study of nodule distribution and abundance.

27. The report contained maps of medium backscatter values with nodule abundance of at least 10 kg/m². Coherent maps with medium backscatter and slopes of less than 3° account for about 37 per cent of the area.

28. Major and trace element geochemistry of manganese nodules (200 samples) using X-ray fluorescence (XRF), inductively coupled plasma-optical emission spectrometry (ICP-OCES) and mass spectroscopy (MS) techniques were provided, including information on analytical accuracy. A table in the report provided statistics of the analysis (mean, maximum minimum and standard deviations of concentrations). Several maps were presented of the concentrations of major metals, minor metals and trace elements. Metals from the nodules in the German licence area were divided into two groups. Type 1 metals included cerium, neodymium, titanium, cobalt, niobium, zirconium, rare earth elements plus yttrium and high field strength elements, which are inversely correlated with manganese/iron. Type 2 metals included copper, nickel, molybdenum, lithium, rubidium and caesium, which are correlated directly with the manganese/iron ratio.

29. A map showing metal distributions in the eastern German licence area was developed on the basis of the average metal concentration for each station, as calculated from individual nodule compositions. Total metal content and manganese/iron ratio maps were presented in the report. Similarly, maps of molybdenum and rare earth element concentration were produced. The geochemistry section included a list of publications produced by the Federal Institute group over the years.

30. A detailed note was included on the mineralogy of nodules studied by X-ray diffraction and on the growth rates of nodules.

31. As in the 2010 report, an exploration strategy for the next 10 years was provided. The contractor intends to perform five cruises within the next nine years. Two exploration cruises will be conducted during the third five-year period, in addition to the environmental and technical studies. The contractor should undertake a study on the economic prospects of polymetallic nodule exploitation. The contractor intends to purchase a video sledge, television grab and XRF analyser during the coming year.

Mining tests and proposed mining technologies

32. In accordance with the programme of work, no mining test or mining technology-related work was carried out during 2011.

Training

33. Training obligations under the contract have been completed. In accordance with the programme of activities under the contract, no training programme was carried out.

Environmental monitoring and assessment

34. All environmental aims declared in the annual report for 2011 were completed. The contractor stated that in 2011, in accordance with the programme of work, no additional baseline data were collected, but analyses of data collected during the 2010 cruise were continued. The analyses concerned the physical properties of the sediment (dry bulk density and sedimentation), sediment geochemistry (elemental composition and organic carbon analysis), and microbiology and biodiversity of the claim area. Full methodology and sample locations were presented for each analysis. The results of the bulk density investigations were presented by showing density values on a map of the claim area and by vertical profiles. Graphs and descriptive analyses of sedimentation rates were presented. Vertical profiles were presented for the elemental composition and total organic carbon content of sediments. Geographic variation in total organic carbon was discussed. Information on the microbial communities associated with different areas of manganese nodules (and control environments) were presented graphically and discussed in relation to the vertical profiles of microbial activity. The contractor stated that biodiversity studies were ongoing. Molecular analyses of the meiofauna and macrofauna included detailed protocols and phylogenetic and ecological studies. The contractor noted the limitations of the analysis and presented a future strategy.

35. The contractor stated that the raw data associated with samples collected between 2008 and 2010 will be supplied once the format for delivering metadata and actual environmental data had been provided by the Authority. The formats have now been provided, and data are expected to be forthcoming. Exceptions are data on pore water chemistry (annual report of 2010), solid phase element analysis, biodiversity and microbiology, as these are being generated by research projects funded by third parties and will be submitted to the Authority within the next two years, after publication in scientific journals. The contractor also stated that it is collaborating with the French contractor to obtain additional data.

36. The Commission notes the increasing use of new technology by the Federal Institute in its work. The Commission recommends that the data generated from high-resolution bathymetry, sidescan sonar and photographic transects be correlated with the coring work on sediment characteristics, geochemistry and biodiversity. It would be useful if all subsections of the environmental work, for example, on microbiology, began with a few (three to four) bullet points listing the main results as they relate to mining and environmental baseline issues. There was a good opening summary in the biodiversity section. Some of the data are excellent. The conclusions drawn on the relevance of the high diversity in meiobenthos to mining impacts will need to be considered with caution when the results are published. It is clear that the level of biological sampling in the Clarion-Clipperton Zone needs to be improved by several orders of magnitude in order to understand the biological significance of so many singleton species in one sample. A plan for addressing the gaps in environmental data identified in the five-year review should be presented.

Financial statement

37. In response to the previous year's evaluation report, the contractor explained that the Federal Institute, as a governmental institution, acts on behalf of the Government of Germany. The contractor also indicated that financial statements are signed by the head of section, who assumes responsibility and liability for all budgetary aspects of the contractor's activities; as such, he has the capacity to sign the summary of exploration expenditures under the contract with the Authority. Furthermore, the budget is controlled by law by the Budget Committee of the German Parliament. The budget is also independently examined by the supreme German authority in charge of screening federal financial management under the German Constitution.

38. For the period from 1 January to 31 December 2011, the contractor stated a total expenditure of €2,845,546, which is reported against five headings (resource evaluation, environmental monitoring, mining technology development, metallurgical process development and other activities), as recommended by the Commission in document ISBA/15/LTC/7. The financial statement is indicated as being certified by Franck Lichtenberg, Chief Financial Officer; however, there was no signature. The contractor needs to ensure that the financial statement is signed in the future. The contractor also stated that some environmental costs were not appropriately itemized in financial statements submitted in the annual reports for 2008, 2009 and 2010. The contractor estimated that 30 per cent of expenditure for those years should be attributed to environmental activities. The total expenditure for environmental exploration for those years would then amount to €2,870,000. The contractor indicated that no environmental work was carried out in 2006 and 2007.

Proposed adjustments to the programme of activities

39. The contractor had promised to implement the GIS-based database during 2011. However, this had not been implemented. The task has been rescheduled for 2012/13. The purchase of a conductivity, temperature and depth (CTD) profiler and an Acoustic Doppler Current Profiler (ADCP) has been rescheduled for 2013.

Comments

40. The annual report followed the established template and provided all relevant information, including analysis and, in some cases, raw data. No work on mining and mineral processing technology was planned during the year.

41. The contractor responded to the comments made on the 2010 annual report in document ISBA/17/LTC/8 in a manner that greatly facilitates the consideration of the reports submitted by the Commission.

42. Regarding the provision of digital data, as requested by the Commission last year, the contractor has stated that the data will be provided during 2012. Regarding analysis of ADCP data, the contractor had said that a detailed analysis would be provided in the annual report for 2011. However, this was not done, and the report stated that the final report would be provided in the 2012 annual report.

C. Government of India**General**

43. The Government of India submitted its annual report on 3 April 2012 in English. Under section 10 of annex 4 to the Regulations, the contractor is under an obligation to submit its annual activity report within 90 days of the end of the calendar year. The contractor should make every effort to submit the reports in a timely manner in order to allow the organs of the International Seabed Authority to effectively carry out its functions. The report contained information on survey and exploration work, an environmental impact assessment and mining and extractive metallurgy technologies, and included a financial statement. The report was structured in line with the headings and content list recommended by the Commission in the annex to document ISBA/8/LTC/2.

Exploration work

44. The exploration activities are concentrated on a first-generation mine site that had been reported previously. The main thrust of the exploration activities was the completion of multibeam bathymetric surveys to map microtopographic features. No exploration cruises were launched during the reporting period. Processing of the bathymetry data was carried out during the reporting period.

45. The first-generation mine site is divided into 42 blocks of equal size. Standard statistical methods, abundance and grades have been calculated for the blocks. Abundance varies from 5.14 to 15.3 kg/m². Nodule grade (total metal, nickel + copper + cobalt) varies between 2.15 per cent and 2.54 per cent of nodule weight. The bathymetry data were used to produce contour interval maps, slope angle maps and three-dimensional images of the first-generation mine site. Examples of such maps and images were provided. However, neither the raw nor the processed data were provided in digital format.

46. Research and development activities under the exploration programme continued during the reporting period. A special portable and reusable core liner was developed. Geochemistry and mineralogy of nodule, crusts and associated deep-sea sediments continued during the year. Studies on intercalated volcanic ash layers in two sediment cores from the Central Indian Ocean Basin indicated that the source

was in situ suboceanic volcanism, the age of which could be correlated with global climatic cooling events. Fifty buried nodules at different depth intervals were recovered in 12 sediment cores from the Basin. The buried nodules were compared with those from the Atlantic Ocean and Peru Basin. However, with regard to geochemical data from nodules and sediments, no information was provided in digital format. Also, references to the analytical methods, accuracy and precision were absent. Other areas of basic research included the study of drift pumice in the Basin, relationships between the chemical composition and magnetic susceptibility in sediment cores and petrology. Future work will focus on the first-generation mine site and will involve use of remotely operated vehicles (also reported in the 2010 annual report).

Mining tests and proposed mining technologies

47. As in previous annual reports, the first section of the mining report dwelt on the historical aspect of the work performed by the contractor. During 2011 the remotely operable in situ soil tester was tested at a depth of 5,462 m in the first-generation mine site area. The technical specifications of the soil tester along with the vane tester and cone tester were tabulated in the report. Photographs of the launch of the system were also provided. The subsea slurry pump was tested at a depth of 1,032 m. This is an important unit of the underwater mining system and needs to be developed and tested for deep-sea mining.

48. The flexible riser system, systems for remote operation from the mother vessel and launch and recovery systems are all progressing well and will form part of the mining system. The integrated deep-sea mining system, system configuration design, detailed design of major subsystems, design of various subsystems such as undercarriage systems, mechanical collectors and pick-up devices, cleated belt conveyors, crushers, solids-pumping systems and hydraulic systems are being developed. In addition, the development of a new undercarriage with track belts or chain drives is under way.

49. Experimental sinkage studies and pull-out tests are being undertaken at the National Institute of Ocean Technology. Finalization of the configuration of the solids pump based on results from the tests at a depth of 500 m is being carried out. A remotely operated submersible (ROSUB 6000) is being developed jointly with the Experimental Design Bureau of Oceanological Engineering in the Russian Federation. A brief description of the system was provided in the report.

50. The report stated that about 48 engineers and scientists were engaged in technology development work. The future work will include development studies and performance demonstrations of various subsystems of the deep-sea mining system at greater depths, preliminary design of an integrated mining system, execution of joint research and development projects and realization of ship-based systems for handling 6,000-m mining systems.

51. With respect to technology development (metallurgy), the major areas of work were improvement of the existing flow sheet, generation of value-added products from exit process streams, utilization of waste and development of novel flow sheets for better techno-economics. To eliminate gaps pertaining to hydrometallurgical processes, the contractor was exploring reduction smelting, matte formation, ammoniacal pressure leaching and hydrothermal reduction processes to recover copper, cobalt, nickel and manganese from the nodules. The report provided details

of the work carried out in pilot-scale direct reduction smelting of nodules. The effect of the holding time on the production of iron-silicon-manganese from the slag generated from nodule smelting was presented in a table. A total of 20 experiments manipulating various parameters had been carried out, and the results were tabulated. Parameters included coke, quartz, dolomite and time. Stripping studies, high-pressure acid leaching of manganese nodules and autoclave leaching were the new experiments attempted during the reporting period. The effect of varying the percentage of starch and temperature and pulp density was documented.

52. A total of 30 scientists were engaged in metallurgical technology development work. Future activities include extraction by acid pressure leaching, alternative processing of nodules, preparation of manganese metal and electrolytic manganese dioxide, recovery of rare earth elements, safe disposal of nodule residue, process upscaling and process appraisal.

Training

53. Training obligations under the contract had been completed in previous years. In accordance with the programme of activities under the contract, no training programme was carried out.

Environmental monitoring and assessment

54. There was a good introduction to the environmental work carried out by the Government of India in 2011. It consisted of analysis of grain size and clay mineral distribution, monitoring of the sedimentary carbon in an artificially disturbed deep-sea sedimentary environment, analysis of biogenic silica and characterization of the microbial communities. The results of the grain size and clay mineral distribution were provided descriptively and the vertical profiles of clay minerals presented. The sedimentary carbon analysis was presented descriptively with graphs and maps. Biogenic silica analysis was presented descriptively without any explanation of its relevance to nodule activities. Microbial investigations were described with no data or graphs to support the description. Overall, the environmental work of the contractor was descriptive and contained no raw data and a limited number of graphs. The relevance of the results of the studies to nodule exploration is unclear.

55. Data presented in relation to the variation of organic carbon in surface sediments before and after disturbance from the benthic impact experiment need to take into account local variation between cores at each site. All data provided to the Authority must include standard deviations from multiple replicate samples to be valid. No coordinates were provided for sediment samples.

Financial statement

56. Financial statements for 2009 and 2010 compliant with document ISBA/15/LTC/7 have not been provided, as recommended in last year's evaluation report.

57. For the period from 1 January to 31 December 2011, the contractor reported a total expenditure of \$6,930,000, which is reported against four headings (survey exploration, environmental impact assessment, technology development (mining) and technology development (metallurgy)) as recommended in document ISBA/15/LTC/7, together with a partial breakdown. The contractor stated that the reported

expenditure did not include non-technical and administrative manpower. Under the Commission's financial recommendations, the reported expenditure should also, as far as possible, be broken into operational expenditure, capital expenditure, staffing and personnel costs and overhead costs. The financial statement was certified by the Secretary of the Ministry of Earth Sciences. The contractor should be requested to ensure full compliance with the recommended format in future years.

Proposed adjustment to the programme of activities

58. The contractor did not propose any change to the programme of activities.

Comments

59. The bulk of the work carried out by this contractor in 2011 consisted of research and development activities for nodule collection and processing. The exploration work involved mainly reprocessing of the bathymetry data and generation of geomorphic and slope angle maps. A substantial amount of detail was given on mining technology and metallurgy, but that appeared to be a continuation of the work already reported in previous years. No raw data or analyses were provided for the environmental work carried out during the reporting period. Environmental work from previous years was also repeated in this report.

60. The Commission reiterates its concern about the work done so far in environmental issues as described in the progress reports, which continues to be very poor and disappointing.

D. Interoceanmetal Joint Organization

General

61. The Interoceanmetal Joint Organization (IOM) submitted its annual report on 2 April 2012 in English. Under the standard conditions of the contract (section 10 of annex 4 to the Regulations), the contractor is under an obligation to submit its annual activity report within 90 days of the end of the calendar year. The contractor should make every effort to submit the reports in a timely manner in order to allow the organs of the International Seabed Authority to effectively carry out its functions. The report contained information on contract-related activities, geological exploration, environmental research and mining and processing technologies and a financial statement. The report was structured in line with the headings and content list recommended by the Commission in the annex to document ISBA/8/LTC/2.

Exploration work

62. The contractor carried out the data processing and analysis of samples collected during a cruise in 2009. No field work was carried out during the reporting period. The analysis of data from the 2009 cruise included an interpretation of geoacoustic profiles (only one profile was provided). In the cross section of the IOM application area, four geotechnical complexes have been identified (details presented in the annex to the annual report). The first one is over 80 per cent sediment, the second is radiolarian ooze, the third is calcareous and calcareous clayey sediment, and the fourth geotechnical complex is made up of basaltic basement.

63. The development of an optimal and effective method for the reliable assessment of metal resources in nodule deposits and definition of relevant criteria was also carried out by the contractor. IOM presented two papers and information from the International Society of Offshore and Polar Engineers Ocean Mining Symposium on the exploration work.

Mining tests and proposed mining technologies

64. With respect to technology for mining and transport, IOM worked on the following issues:

(a) An updated analysis of the status of mining technology up to 2011 to assess the parameters of a mining system adapted for operating in the IOM area;

(b) Research and development projects on mining collector development, buffer subsystem design, computer modelling of mining ships, and integrated mining and mining subsystems.

65. All aspects are still in the preparatory stage. The objective during the reporting period was to study the dynamics of the system and finalize several issues important for the next stage of design. A three-dimensional model of the mining ship was created to study the forces acting on the ship and the vertical transport pipe. The results of this model study were presented in the report.

66. To carry out a techno-economic analysis of the most suitable nodule processing technology, IOM carried out a detailed review of nodule processing technologies. The techno-economic evaluation identified three processing scenarios: hydrometallurgical, pyro-hydrometallurgical and hydrometallurgical with autoclave. IOM has continued to study variations in mineral prices and worldwide demand for nickel, copper, cobalt, manganese, zinc, molybdenum and iron from open sources.

Training

67. Training obligations under the contract have been completed. In accordance with the programme of activities under the contract, no training programme was carried out.

Environmental monitoring and assessment

68. The environmental work performed by IOM in 2011 consisted of the analysis of sediment and pore water properties, biological communities (megafauna, macrofauna and nodule fauna) and bioturbation processes using samples collected during a cruise in 2009. The report stated that data on and analyses of the sediment properties, pore water and megafauna, including a photographic catalogue of species, were presented to the Secretary-General of the Authority in December 2011 along with raw data. The report contained no other information on these studies. For the macrofaunal and nodule fauna studies, the report presented the methodology used, a map of sampling locations, raw data, graphs and a description of the results. Bioturbation studies were described with graphs and some representative photographs of biogenic structures.

69. Metadata for macrofauna and nodule fauna provided by IOM in its annual report were reasonably in line with the format agreed at the meeting between the Authority and contractors in January 2012. Given the short period of time between

the agreement on the templates and the submission of the report, this is encouraging. However, it is preferred that in future reports the contractor provide the metadata in the exact format. A plan for the coming year and a timeline for filling in gaps in the data required should be given.

Financial statement

70. In response to last year's evaluation report with respect to the relevant authority for the certification of the financial statements, the contractor explained that a State auditing commission consisting of plenipotentiaries from the States sponsoring IOM reviews and approves the financial statements before their approval by the IOM Council.

71. For the period from 1 January to 31 December 2011, the contractor reported a total expenditure of \$838,065.28, which was reported against four headings (geological exploration, environmental research, technology of nodule mining and transport, and technology of polymetallic nodule processing) and was partially compliant with the relevant recommendation made by the Commission in document ISBA/15/LTC/7. Under the Commission's financial recommendations, the reported expenditure under each heading should also, as far as possible, be broken into operational expenditure, capital expenditure, staffing and personnel costs and overhead costs. The contractor reported that the IOM auditing commission had reviewed and approved the expenditure during a meeting held from 26 to 30 March 2012.

Proposed adjustment to the programme of activities

72. The contractor did not propose any changes to the programme of activities.

Comments

73. IOM carried out its activities in accordance with the programme of activities under the contract. As no field work was carried out during the reporting period, the work involved mainly analysis of data from previous years. Desk research was conducted on geotechnical studies and mining technology. Under the processing heading, IOM carried out a detailed review of the existing processes. It provided metadata on environmental work, but data should be provided in line with the template agreed at the January 2012 meeting.

E. Government of the Republic of Korea

General

74. The contractor submitted its annual report on 5 April 2012 in English. Under section 10 of annex 4 to the Regulations, the contractor is under an obligation to submit its annual activity report within 90 days of the end of the calendar year. The contractor should make every effort to submit the reports in a timely manner in order to allow the organs of the International Seabed Authority to effectively carry out its functions. The report contained details of exploration work, environmental studies, mining technology work, training and other activities and a detailed financial statement. A summary was also provided at the beginning of the report. The report was structured in line with the headings and content list recommended by

the Commission in the annex to document ISBA/8/LTC/2. Relevant figures and tables were included in the report.

Exploration work

75. The contractor carried out 36 days of field survey on board RV *Kamikai-o-Kanaloa* during the reporting period as part of its exploration and environmental work. The main objective was to carry out a detailed bathymetric survey for future mining and to document the chemical, biological and sediment properties of the water column and bottom sediments. Five water column profiles and six sediment core samples were collected during the cruise. To monitor temporal variations in sediment flux and deep-sea currents for a one-year period, two moorings were recovered and redeployed with the addition of two new moorings (four moorings in total). The report provided details of the research vessel and equipment used for the survey. A location map was included in the report. Details of sidescan and sampling sites were also presented.

76. The results of the deep-tow survey in the KR5 block were presented in the report in the form of two maps illustrating sidescan data and colour-coded bathymetry. However, the maps were not provided in digital format.

77. Manganese nodule distribution was studied by means of nodule sampling at five stations. The objective was to make a precise assessment of the mining potential of the allocated area. Nodules were classified on the basis of their surface texture, morphology and size. A total of 3.5 kg of nodules were collected. No estimates of nodule abundance were provided.

Mining tests and proposed mining technology

78. In accordance with the programme of activities under the contract, no mining tests were carried out during the reporting period. However, the contractor continued working on the mining robot and integrated mining operation technology. The programme is developing a self-propelled miner model that sweeps polymetallic nodules from the seafloor and disposes of them through a flexible pipe into a buffer station for lifting, as well as the creation of the methodology required to perform at-sea mining operations. The results of the work during the reporting period were contained in sections as follows:

- Detailed design of a pilot mining robot based on the sea test of *MineRo*
- Design of the machinery and structure of the mining robot
- Design of a hydraulic system
- Design of electrical and electronic systems
- Modified design of mining robot systems
- Development of core design technology for an integrated mining system
- Development of deep ocean lifting technology

79. The contractor conducted scaled-up testing (200 kg/day) of the reduction smelting-leaching process to recover copper, nickel, cobalt, manganese and molybdenum. Further work concentrated on:

- The scale-up test (capacity: 200 kg/day of manganese nodules)
- A thermodynamic study on production of silicon-manganese from slag
- A basic and conceptual engineering design for construction of a production plant with a 10 ton/day capacity
- Recovery of rare earth elements

Figures of all the processes were appended to the report.

Training

80. Training obligations under the contract have been completed. In accordance with the programme of activities under the contract, no training programme was carried out.

Environmental monitoring and assessment

81. In 2011, the Government of the Republic of Korea carried out a research cruise to investigate physical, chemical and biological oceanography and an evaluation of sediment characteristics within its claim area. The physical assessment involved CTD profiles and current measurements, including an evaluation of seasonal variability in currents and regional simulations from modelling. The chemical assessment consisted of collecting water samples from the CTD castings to determine vertical profiles of inorganic nutrients, organic carbon and nitrogen. Graphs were presented to show inter-annual variations of temperature, dissolved oxygen and inorganic nutrients at a long-term study site within the claim area from 1995 to 2011. Biological studies consisted of an analysis of meiofauna (species composition and abundance), macrofauna (species composition, abundance and biomass) and microbiology of the water column (biomass and production). Studies of sediment characteristics consisted of an analysis of the water content of cores, a description of the core profiles in the contractor's preservation and benthic impact experiment sites, an assessment of sediment flux to the seabed using time-series sediment traps at two locations, and an analysis of carbon (organic and inorganic) and nitrogen within sediment cores. The analysis included inter-annual variability and differences between preservation and impact reference sites.

82. All results were presented graphically and descriptively, with maps as appropriate. It is especially encouraging that the contractor provided electronic raw data for meiofauna, macrofauna, sediment analysis, water analysis and CTD profiles in the format agreed at the meeting between the Authority and contractors in January 2012, given the short period of time between the agreement on the templates and the submission of the report. The exceptionally low abundances of macrofauna in the box core samples, even of polychaetes, is interesting and appears to indicate that macrofauna do not play a critical role in ecosystem functioning. However, box cores may not be suitable for studying the macrofauna at the densities in which they occur. It is recommended that a suitable sampling device be used, such as the Brencke epibenthic sledge used by the University of Hawaii and the University of Hamburg.

Financial statement

83. For the period from 1 January to 31 December 2011, the contractor reported a total expenditure of \$10,783,400 which was reported against five headings (resource evaluation, environmental monitoring programme, mining technology development and metallurgical process development, and other activities) as recommended by the Commission in document ISBA/15/LTC/7. Each heading was divided into research and analysis, equipment and instruments, staffing and personnel costs and overhead costs, as recommended by the Commission. The breakdown of expenditure also included details on the actual day rate for ship time, also as recommended by the Commission. The financial statement was certified by the Director of the Marine Territory and Development Division of the Ministry of Land, Transport and Maritime Affairs.

84. The contractor also submitted certificates of expenditure for 2009 and 2010 which were structured in the same way as the certificate for 2011. The contractor should be congratulated on being fully compliant with the recommended reporting format.

Proposed adjustment to the programme of activities

85. The contractor did not foresee any changes in the near future and did not propose any changes in the programme of activities. The activities under the exploration and environmental section will continue, and research under mining and mineral processing will also be pursued in the coming years.

86. The contractor held a joint workshop with the Government of China. Results from exploration and environmental studies were discussed in relation to manganese nodules and massive sulphide deposits.

Comments

87. The quality of the data presentation in the form of tables and figures is good. The report contained over 12 tables and 50 figures. The organization of the report was neat and all relevant information was provided, but not all in digital format. No estimates of nodule abundances were provided. All this information should be reported in digital format.

88. The report contained a detailed section on environmental studies. During the year, water column characteristics and the geotechnical properties of the sediments were also carried out. All the relevant sampling locations were provided in the form of tables.

89. The Commission observes with satisfaction that the contractor consistently includes raw environmental data in digital format.

F. China Ocean Mineral Resources Research and Development Association**General**

90. The China Ocean Mineral Resources Research and Development Association submitted its annual report for 2011 on 27 March 2012 in Chinese and English. The report contained information on exploration work, environmental baseline studies,

research and development of deep-sea mining systems and metallurgical processing technologies, other activities, training, the workplan for 2011 and a financial statement. The report was structured in line with the headings and content list recommended by the Commission in the annex to document ISBA/8/LTC/2.

Exploration work

91. The Association conducted three field survey cruises during 2011. One of the cruises was exclusively for environmental data collection. A schematic diagram of stations surveyed during the cruise was included in the report, as well as pictures of the research ships. Surface sediments at 15 box core stations were sampled. A table detailing the type, abundance and coverage of nodules was included. However, there was no information on the location of the samples. Water content, wet bulk density, penetration resistance and vane shear strength were measured. The mean nodule abundance was 10.3 kg/m². The nodules were classified according to their morphology. The metal content of nodules was presented as mean, minimum and maximum concentrations. However, no geochemical data were provided in digital format. Also, the analytical accuracy and precision were not reported. Sea trials of the manned submersible *Jiaolong* were conducted in August 2011 for 5,000 m in the Association's contract areas. Seven dives were made during the trials, and data on fine topography and relief measurement were recorded with deep-sea cameras. The figures of the survey were presented in the report.

Mining tests and proposed mining technologies

92. In 2011 the Association carried out research and development on mining technology to develop a prototype of an excavating and crushing device. The device was designed to adjust its movements to changing terrain so that the device is always parallel to the seabed to achieve high collection efficiency. Computer simulations of flow distributions when operating the capture system were carried out and were presented in the report.

93. The Association continued its metallurgy experiments and shifted its focus to recovering rare earth elements in metallurgical processing. The distribution of rare earth elements in ammonia leaching residues of nodules was examined, and a study exploring the possibility of recovering rare earth elements from ammonia leaching was initiated. About 80 per cent of the rare earth elements could be recovered using these methods. Results of the experiment were presented in tables.

Training

94. Training obligations under the contract have been completed. In accordance with the programme of activities under the contract, no training programme was carried out.

Environmental monitoring and assessment

95. The environmental work carried out by the contractor in 2011 consisted of the analysis of data and samples collected during three cruises to the exploration area. The contractor noted that analyses of samples collected on the third cruise were ongoing. The contractor stated that the parameters sampled were physical oceanography (temperature, salinity, water depth and current), chemical oceanography of surface waters (pH, dissolved oxygen, oxygen saturation, phosphate, silicate,

nitrate, nitrite and ammonium salt) and biology (chlorophyll-a, size fraction of chlorophyll-a, plankton, meiofauna, macrofauna and megafauna). Physical and chemical oceanographic properties were presented as vertical profile graphs and a description of the results, as were the chlorophyll-a results. Each section of the environmental report should begin with bullet points or a short paragraph stating the relevance of the results presented and whether the data offer any new insights into work presented in previous annual reports. For instance, do the data relating to salinity, temperature, pH, nutrients and chlorophyll plots of the water column advance knowledge with respect to data presented in previous years? Changes with time (e.g., inter-annual or seasonal variability) should be highlighted. It would be useful for the oxygen data to delineate the depth of the bottom of the oxygen minimum zone.

96. The megafaunal results consisted of seven images taken during sea trials of the manned submersible. The requirement for submitting megafaunal data to the Authority still needs to be fulfilled.

97. The contractor provided raw data at the meeting between the Authority and contractors in January 2012. Additional raw data were included with the annual report. The contractor also presented the geotechnical properties of the surface sediments (water content, bulk density, penetration resistance and shear strength) graphically with a brief summary in the exploration section of the report. It was proposed in the 2011 annual report that the Association undertake research on and an evaluation of problems concerning environmental protection and impact by conducting a mining system test in 2011/12, but this has not been completed. A plan for addressing the gaps in environmental data identified in the five-year review should be presented. Positional data for environmental data were not provided in the report. There was a location map but no coordinates on the map.

Financial statement

98. No detailed financial statement for 2009, as requested by the Commission in last year's evaluation report, has been provided.

99. For the period from 1 January to 31 December 2011, the contractor reported a total expenditure of RMB 45,114,600 (approximately \$7,160,000) which was reported against six headings (exploration cruises, resources and environment assessment, development of mining technology, development of metallurgical technology, samples management, and data and information management) with a partial breakdown. The financial report was partially compliant with the recommended format under the Commission's recommendations in document ISBA/15/LTC/7. The reported expenditure under each heading should, as far as possible, be broken down into operational expenditure, capital expenditure, staffing and personnel costs and overhead costs. No breakdown was provided by cruise; for each cruise, the actual day rates for ship time and for any large item of equipment used should be specified. The contractor submitted a certification by the Financial Department of the State Oceanic Administration. The certification indicated that it had been established in accordance with Chinese national standards and that proper books of account had been kept. The contractor should be requested to ensure full compliance with the recommended format in future years.

Proposed adjustment to the programme of activities

100. The contractor did not propose any changes to the programme of activities.

Other activities

101. The contractor undertook a study on the economic prospects of polymetallic nodule exploitation, which included an exhaustive market survey for copper, nickel, cobalt and manganese. Data were provided on land-based mining production levels, consumption, projected production and price fluctuations over the past five years for each of the metals. The survey indicated that land-based resources of nickel, cobalt, copper and manganese were quite abundant at present and would meet demand for the next 50 years. It is the rare earth elements contained in the polymetallic nodules and cobalt-rich crusts that may become the new driver for the development of seabed resources. Global demand for rare earth elements is likely to continue to increase in the future. The main factors that affect the economic benefits of nodule mining are the quality of the resources, the scale of the mining, the level of fixed-asset investment, operational costs, metal prices and interest rates. The economic analysis showed that exploitation of nodules requires high investment and risk. A similar survey was presented in the 2010 annual report.

102. The Association continued working on the development and operation of an ocean information system. This included managing China's ocean sample repository and updating the ocean sample information system. China and the Republic of Korea continued to collaborate within the framework of international cooperation agreements on deep-sea mineral resource development (also reported in 2010).

Comments

103. The Association provided an informative report. The work was carried out according to the programme of activities set out in its contract. The figures and maps in the report were generally good. However, the positional data of sampling stations were not provided. Geological analyses were not provided in digital format. The contractor is making steady progress in mining and processing technologies. The analysis on the economic potential of nodule mining, although not part of its contractual mandate, is very useful.

G. Institut français de recherche pour l'exploitation de la mer**General**

104. The contractor submitted its annual report for 2011 on 24 May 2012 in French. The official English translation of the report was received on 11 June 2012. Under section 10 of annex 4 to the Regulations, the contractor is under an obligation to submit its annual activity report within 90 days of the end of the calendar year. The contractor should make every effort to submit the reports in a timely manner in order to allow the organs of the International Seabed Authority to effectively carry out its functions. The report contained information on environmental monitoring and other matters and a financial statement. The report was broadly structured in line with the headings and content list recommended by the Commission in the annex to document ISBA/8/LTC/2.

Exploration work

105. The Institut français de recherche pour l'exploitation de la mer (IFREMER) did not carry out an oceanographic campaign during the reporting year and did not report any exploration activity.

Mining tests and proposed mining technologies

106. In accordance with the programme of activities under the contract, no work was carried out.

Training

107. Training obligations under the contract have been completed. In accordance with the programme of activities under the contract, no training programme was carried out.

Environmental monitoring and assessment

108. The environmental work performed by IFREMER in 2011 consisted of further analysis of data collected during the *Nodinaut* cruise and organization and preparation of the *Bionod* cruise. The contractor listed four scientific publications that resulted from the *Nodinaut* cruise and included abstracts from the papers. Faunal data had been incorporated into the Biocean database. The report states that the *Bionod* cruise will be the flagship activity undertaken by IFREMER during the last five years of the exploration contract with the Authority. It will be organized jointly by IFREMER and the German Federal Institute for Geosciences and Natural Resources. The cruise was scheduled to take place from 28 March to 11 May 2012. The contractor stated that all the metadata from the cruise would be archived and freely accessible over the Internet within one year of the end of the cruise. Data from the cruise will be forwarded to the Authority after scientific validation.

109. Overall, the report was very short and generally unacceptable. Each year an overview should be provided of how far the environmental work has progressed, referencing previous reports if necessary, identifying gaps and addressing how and when the gaps will be addressed over the next five years. The papers highlighted should be set in the context of what they mean for assessing environmental baselines and future impacts of deep-sea mining.

110. The report stated that faunal data from the *Nodinaut* cruise, archived in the Biocean database, were appended to the report, but this does not appear to have been done. A separate letter provided a response to the comments on the submission of data on the environmental biological issues made in 2011 by the Commission. The responses to the comments on the work in progress and its delivery in 2012 were informative.

Other matters

111. Development of the GIS nodule using an ArcView system and its Oracle database continued during the reporting period. The GIS data were used in planning the biological sampling programme on the *Bionod* cruise. The contractor reported that a study on the potential for the exploitation of deep-sea mineral resources had been published in 2011. This publication was not attached to the report.

Financial statement

112. In response to last year's evaluation report, the contractor explained that the expenditure that corresponded to structure and staffing costs directly associated with a scientific activity amounted to 63 per cent of the total expenditure. No detailed financial statement for 2009 was provided.

113. For the period from 1 January to 31 December 2011, the contractor stated a total expenditure of €62,977, which was broken down into operations, equipment, staff and general expenses. This was only partially compliant with the recommended format in document ISBA/15/LTC/7. The financial statement of expenditure, certified by the senior accounting officer, was attached to the annual report. It provided details on expenditure without including the value added tax and expenditure for staff paid in accordance with a partnership arrangement that had been approved by the board of directors of IFREMER. The contractor should be requested to ensure full compliance with the recommended format in future years.

Proposed adjustment to the programme of activities

114. The contractor did not propose any changes to the programme of activities.

Comments

115. The report was extremely brief. There has been no work in the last 10 years on resource estimation, mining technology or processing methods. While the format of the report was structured according to the recommended template, it contained no maps, figures or tables. In the annual report for 2012, the contractor is requested to provide details of the work carried out in the study on the potential for the exploitation of deep-sea mineral resources referred to above.

116. The report on environmental research continued to be very disappointing. In its evaluation of the 2010 report, the Commission had asked for full copies of the scientific publications cited, as well as the raw data and/or access to the Biocean database. Receipt of such documentation is still pending, as again this year the required documentation was not included with the 2011 report. The Commission insists that the contractor fulfil its reporting obligation in accordance with the Regulations.

117. The contractor is again requested to provide a detailed financial statement for 2009, as recommended in document ISBA/15/LTC/7.

H. Yuzhmorgeologiya**General**

118. Yuzhmorgeologiya submitted its annual report for 2011 in Russian on 28 March 2012. The report was translated by the United Nations translation services, and the translation was received on 7 June 2012. The report contained an introduction and a financial statement, and sections relating to exploration work, environmental studies, research activities, mining tests and a personnel training programme. The report also included a brief description of the work programme for 2010. The report was structured in line with the headings and content list recommended by the Commission in the annex to document ISBA/8/LTC/2.

Exploration work

119. The exploration work during the reporting period was confined mainly to the eastern polygon of the Russian area. Exploration activities concentrated on a detailed study of nodule distribution and the delineation of nodule-free areas. During 2011, investigations were carried out at two sites of 3,670 km² and 4,240 km² respectively, located in the western part of the eastern polygon of the Russian area. The contractor conducted three cruises on board RV *Gelendzik* during the reporting period. Coordinates and maps of the two study blocks were provided in the report. In the smaller block a video line photographic survey and video profiling of the seabed were carried out along with some sampling; seven lines covering 265 km and 11,950 photographs were collected from 95 stations. In the other block, acoustic profiling along 13 lines and video profiling along 17 lines were completed during the year. Coordinates of the sampling stations were tabulated. The contractor completed processing of the data for the smaller block. A geological map with a scale of 1:200,000 had been prepared. Various geomorphic features, physiographic features and the depth distribution in the block were presented. A distribution scheme of sediments and rocks was constructed on the basis of an analysis of the sampling data. A geochemical analysis of rocks and sediments was carried out. The distribution of density values and different types of clays was studied and presented in the report. However, no raw data or maps were provided in digital format.

120. Manganese nodules were recovered from 85 stations (a total of 327.8 kg); buried nodules were also reported at 19 stations. The size of the nodules varied from 1 to 14 cm. Different morphologies of the nodules were tabulated in the report. The average chemical composition of the major elements was provided. However, the individual geochemical analyses were not presented. In addition, references to the analytical methods, accuracy and precision were absent. No data were reported in digital format. A total of 38 ore bodies were identified with an area of 1,850 km², which is 50 per cent of the total study area of 3,670 km².

Mining tests and proposed mining technologies

121. In accordance with the programme of activities, no mining activity or metallurgical processing activity was scheduled for 2011.

Training

122. Training obligations under the contract have been completed. In accordance with the programme of activities under the contract, no training programme was carried out.

Environmental monitoring and assessment

123. In its annual report the contractor stated that the environmental work performed in 2011 consisted of a research cruise and laboratory analysis of samples collected in 2010 and 2011. Studies consisted of seabed analyses (physico-chemical properties of the sediment), biological analyses (mega-, macro- and meiofauna and fauna associated with nodules) and meteorological observations. The report stated that the methodology used had been described in the report submitted in 2008; a brief summary was nevertheless provided in the annual report for 2011. Megafauna studies consisted of assessing the abundance of each taxonomic group identified from the study area with ecological descriptions and photographs provided. In

addition, maps showing the photographic tracks from which species were identified and the distribution of key megafaunal groups were presented. Similar information was provided for other biological groups with the addition of specific sampling locations. For the main macrofauna and meiofauna taxonomic groups an analysis of vertical distribution within the sediment was provided. Meteorological studies consisted of a descriptive and graphical analysis of air temperature, temperature of the water surface layer, atmospheric pressure, general weather conditions, wind direction and speed, sea state and visibility. In addition, the contractor carried out studies to investigate the transmission of sound through the water column (locations presented on a map) and, as a result, the contractor also obtained water temperature profiles at the study sites to accompany the vertical profiles of sound velocity.

124. The contractor provided raw data on the macrofauna and meiofauna studied in 2011 but not in the format agreed at the meeting between the Authority and contractors in January 2012. However, this is understandable given the short period of time between the agreement on the templates and the submission of the annual report for 2011. It is hoped that the agreed format will be used in future reports.

125. The environmental studies are comprehensive and progressing well. Detailed seafloor mapping and co-location of major faunal groups will allow good planning for the future in resource exploitation and the conservation of biodiversity. The Commission recommends that the data generated from high-resolution bathymetry, sidescan sonar and resource assessments be correlated with both the photographic transect and the coring data on sediment characteristics, geochemistry and biodiversity. Analyses of the data could use better statistics.

Financial statement

126. Detailed financial statements for 2009 and 2010, as requested in last year's evaluation report, have not yet been provided.

127. For the period from 1 January to 31 December 2011, the contractor reported a total expenditure of \$6,794,328 against four headings (exploration activities for resource assessment, environmental studies, mining technology and metallurgical process development), as recommended in document ISBA/15/LTC/7, with a breakdown in the format recommended by the Commission. The expenditure was also broken down into operational costs, capital costs, personnel costs and overhead costs as also recommended by the Commission. However, the actual day rates for ship time and for any large items of equipment used during each of the three cruises were not specified. In addition, capital expenditures on items exceeding \$100,000 were not itemized. The contractor indicated that the Director-General of Yuzhmorgeologiya, Arthur Pronkin, had approved the expenditure; this was confirmed by the Chief of the Department of Continental Shelf and Oceanic Mineral Resources of the Federal Subsoil Agency of the Russian Ministry of Natural Resources, V. Bedenko. However, the financial statement was not signed.

Proposed adjustment to the programme of activities

128. The contractor did not propose any changes to the programme of activities.

Comments

129. The annual report was quite exhaustive, with several maps and tables and figures. The activities were conducted in accordance with the approved plan of work. Under exploration, the emphasis was on geoacoustic profiling and seabed sampling. The contractor has now identified two prime areas for first-generation mining. The surveys were concentrated in these blocks. Details of acoustic survey lines were provided, but without the coordinates of sampling stations. The raw data as well as all maps should be submitted in digital format.

130. The Commission observes that detailed expenditure statements for 2009 and 2010, as requested in last year's evaluation report, are still pending, and urges the contractor to provide them in an expeditious manner.

131. In order to facilitate the work of the Commission, the contractor is again requested to provide an English translation of the report in future.

I. Nauru Ocean Resources Inc.**General**

132. Nauru Ocean Resources Inc. (NORI) is the newest contractor; the exploration contract was signed after the application was approved at the seventeenth session of the Commission. NORI submitted its annual report for 2011 in English on 30 March 2012. The report contained an introduction and a financial statement and sections relating to exploration work, environmental studies, mining tests and a personnel training programme. The report was structured in line with the headings and content list recommended by the Commission in the annex to document ISBA/8/LTC/2.

Exploration work

133. In accordance with the plan of work, no exploration activities were conducted in 2011. The report listed the main objectives of the exploration programme, which comprises detailed bathymetry and nodule sampling during the initial years followed by a medium- and long-term exploration programme. The proposed tasks listed in the report included design of nodule mining equipment, selection of first-generation mine sites, a pre-feasibility study to analyse the technical and economic viability of a collector system, design and construction of trial mining equipment, mine plan design, testing of mining equipment, complete environmental impact assessment studies and, finally, the full feasibility study.

134. NORI was awaiting construction of a new deep-towed sonar system, which will be a key piece of equipment in acoustic surveys. Details of this equipment were provided in the report. NORI proposed to undertake initial multibeam bathymetric surveys followed by deep-towed sonar high-resolution imagery surveys during the proposed cruise in 2012. Nodules will also be collected during the cruise, and geotechnical studies will be carried out on the sediments.

Mining tests and proposed mining technologies

135. In accordance with the programme of activities, no mining activity or metallurgical processing activity was scheduled. NORI engaged various international offshore engineers and consulting groups to carry out a technical review of the

project to identify and rank the key engineering areas requiring the longest development, in order to determine where future work should be concentrated.

Training

136. NORI has submitted a comprehensive training document for training two scientists from developing countries. If approved, this programme will be implemented during 2012. In addition, NORI commenced a training programme in Nauru, funding two Nauruan students to complete undergraduate, postgraduate and trade certificate courses in deep-sea mining-related fields and environmental science. Two fellowships were provided in 2011/12.

Environmental monitoring and assessment

137. In its annual report NORI stated that it had carried out a detailed review of publicly available environmental data pertaining to the Clarion-Clipperton Zone, including environmental data published by the International Seabed Authority, in order to plan its environmental programme. The report noted that the environmental baseline studies will begin in 2012 during the exploration cruise and the results submitted in the annual report for 2012.

Financial statement

138. The contractor reported that no expenditure directly related to exploration was incurred during the reporting period.

Comments

139. The annual report was very brief, as it covered only the first few months following the signing of the contract with the Authority. The report provided the objectives of the exploration and environmental work and the proposal to carry out its first research cruise during 2012. The contractor should submit a more detailed account of the activities carried out in the report for 2012.
