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Exploration of polymetallic nodules in the Area: Reporting practices, data management and transparency

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☆The views expressed herein are solely those of the authors and do not necessarily reflect the views of the Legal and Technical Commission of the International Seabed Authority.

Abstract

The International Seabed Authority (ISA) regulates the activities related with the exploration and exploitation of seabed mineral resources in the Area, which are considered as the "common heritage of mankind" under the United Nations Convention on the Law of the Sea. The ISA has also the mandate to ensure the protection of the marine environment. The development of good practices for the annual reporting and data submission by Contractors is crucial for the ISA to comply with the sustainable development of the mineral marine resources. In 2015, the ISA issued a new template for reporting on exploration activities, which includes the definition of the format for all geophysical, geological and environmental data to be collected and analysed during exploration. The availability of reliable data contributes to improve the assessment of the ISA on the activities in the Area while promoting transparency, which is considered as a major principle of industry best practices.

Key words: International Seabed Authority; Polymetallic nodules exploration; Data reporting; Transparency

1. Introduction

The International Seabed Authority (ISA) is the organization through which States Parties to the 1982 United Nations Convention on the Law of the Sea (UNCLOS [1]) organize and control activities in the Area.[1] The ISA was created in 1994, upon the entry into force of the Convention and following the adoption of the so-called "1994 Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea" [2]. The set of activities in the Area are governed by the provisions settled in Part XI and Annex III of UNCLOS, particularly to administer the resources of the Area.[2] The Area is defined as "the seabed and the ocean floor and subsoil thereof, beyond the limits of national jurisdiction". Spatially, it is constrained by the outer limits of the continental shelf of coastal states as defined in Article 76 and Annex II of UNCLOS.

As can be read from a brochure issued by the ISA,[3] the aims of the international regime are threefold: to encourage the development of seabed resources, to safeguard the marine environment as it may be affected by such activities, and to ensure the equitable sharing of economic benefits between seabed miners and the international community. Therefore, the Authority acts as regulator of the activities related with the exploration and exploitation of seabed mineral resources on behalf of all its members. Moreover, these resources under the Area regime are considered as the "common heritage of mankind".[4] The latter classification coupled with the ISA's mandate to ensure the protection of the marine environment from the harmful effects of activities occurring in the Area poses a major challenge to the ISA whose role and decisions are and will be monitored and assessed by a greater number of stakeholders (Contractors, coastal States, environmental agencies, private companies, NGOs) and individuals from the civil society. This paper aims at contributing to the discussion on how this goal will be achieved and to review the actions already undertaken by the ISA to foster transparency on the development of seabed mineral resources in the Area. Particularly, these actions will be framed with the recommendations issued by the Legal and Technical Commission (LTC or the Commission) in accordance with its role defined by article 165 of UNCLOS. The Commission is a technical advisory organ of the Council, the latter being the executive organ of the ISA.[5]

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1 In accordance with Article 156 of the Convention on the Law of the Sea of 10 December 1982.

2 Article 157 of the Convention on the Law of the Sea.

3 http://www.isa.org.jm/files/documents/EN/Brochures/2014/ISAbrochure.pdf.

4 Article 136 of the Convention on the Law of the Sea.

5 The Council consists of 36 States, elected on a rotational basis, whilst the Commission is made up of elected experts, nominated by governments, who serve in their individual capacities.

2. Existing Regulations and contracts for exploration in the Area

In the Area, the most promising mineral resources for future exploitation are polymetallic nodules, polymetallic sulphides and ferromanganese crusts. Nodules can be found only on the floor of the deepest abyssal plains of the oceans (4000–6000 m water depth), sulphides precipitate near hydrothermal vents at the mid- ocean ridges and island arc volcanoes (1000–4000 m water depth) and crusts form on the steep flanks of seamounts from 600 to 2000 m water depth.

Regulations for the prospecting and exploration of these re- sources in the Area were approved by the Council of the ISA and issued in 2000, 2010 and 2012, respectively, with amendments to the 2000 regulations issued in 2013 to bring all three sets of regulations into alignment. According to the regulations "Exploration" means the searching for deposits of polymetallic nodules, polymetallic sulphides or ferromanganese crusts in the Area with exclusive rights, the analysis of such deposits, the use and testing of recovery systems and equipment, processing facilities and transportation systems and the carrying out of studies of the environmental, technical, economic, commercial and other appropriate factors that must be taken into account in exploitation. The first contracts concerning exploration for polymetallic nodules were granted by the ISA in 2001 in the Clarion-Clipperton Zone (CCZ, Pacific Ocean, Fig. 1(A)). In 2002, the first contract for exploration of polymetallic nodules outside the CCZ was granted to the Government of India in the Indian Ocean. The first contracts contained the plan of work for exploration submitted by six Contractors (Table 1), corresponding to those initially registered as pioneer investors as the result of their investments and work in the CCZ before the Convention entered into force in 1994. Up to date, 27 contracts for exploration have been approved by the ISA covering the three types of seabed resources, which were granted to Contractors sponsored either by developed and developing countries.

According with the regulations (Annex to ISBA/19/C/17 [3]), the plan of work for exploration is approved for an initial period of 15 years. For the six contracts that started in 2001, this period expired between March and June of 2016, depending on the precise date of signature. Normally, upon expiration of a plan of work covering 15 years of exploration, it is expected that the Contractor would be able to proceed with a plan of work for exploitation. However, Contractors may apply for extensions for the plan of work of exploration for periods up to 5 years each. The six Contractors that have signed their contracts in 2001 have all made such applications. The decision on these requests will be taken by the Council of the ISA during the 22nd session in July 2016 based on the re-commendations by the LTC.

3. Polymetallic nodules exploration and exploitation

The initial total area allocated to a Contractor for polymetallic nodules exploration cannot exceed 150,000 km^2. During the first eight years from the date of the contract, the Contractor has to reduce the area by a series of relinquishments to a remaining maximum of 75,000 km^2. The mineral resource deposit is first of all characterized by the nodules abundance, metals grade and physical properties. But the seabed morphology is also a crucial information, since the roughness of the seafloor and the presence of obstacles will direct the design of the mining equipment. Therefore, the seabed morphology must be mapped in great detail. A reasonable resolution (higher than 150 m) of the seabed morphology of the exploration area can be achieved from a hull- mounted full-ocean multi-beam system. The full area of 150,000 km^2 can be completed within 30–50 days of dedicated ship time (excluding transit and downtime due to unfavourable marine conditions, considering a vessel velocity of 8 knots, a swath width up to 6 times the average water depth of 5 km and 30% overlap between adjacent lines) and consequently this is expected to be one of the main products delivered by Contractors during the first stages of exploration activities. However, in order to track the nodule abundance variation and the seabed morphology at a resolution capable of providing sufficient information for the development of a robust mining system, high-resolution multi-beam data must be acquired from a system mounted in remotely operated vehicles or autonomous underwater vehicles that can navigate closer to the seafloor. The gathering of these bathymetric data is much more time-consuming compared to hull-mounted systems and implies much higher costs for equipment purchase and maintenance. In addition, the Contractor needs to collect nodules and sediment for chemical and geotechnical analysis from an adequate number of sampling stations, as well as to acquire environment baseline data and develop monitoring programmes to assess the effects of the exploration activities on the marine environment. An exploration contract period of 15 years seems reasonable in order to comply with these commitments before proceeding to exploitation.

The exploitation of natural resources is the use of natural resources for economic growth. In the regulations adopted by the ISA on prospecting and exploration for polymetallic nodules in the Area, exploitation means the recovery for commercial purposes of polymetallic nodules in the Area and the extraction of minerals therefrom, including the construction and operation of mining, processing and transportation systems, for the production and marketing of metals. Nonetheless, the exploitation activity in the Area itself must be also economically sustainable in order to foster the development of a seabed mining industry, which is still absent. The acceptance of this principle poses a major challenge to all stakeholders of the seabed mining. Here we give a specific example applied to polymetallic nodules, but similar challenges (in terms of importance) will be faced by those involved in the future exploitation of polymetallic sulphides and ferromanganese crusts. As presented by most Contractors in the workshop on polymetallic nodule resource classification promoted by the ISA in

2014 and held in Goa, India, an economic exploitation of this re- source is foreseen to be primarily dependent on the capacity of the mining system to retrieve a minimum of 2–3 Mton of dry nodules per year to the surface [4,5]. The latter represent the extraction of 231–347 ton/hour or 5.6–8.3 thousand ton of dry nodules per day. The final technology and collector to be used to comply with these figures are still under development by all Contractors, but the same technology must also avoid causing serious harm to the marine environment, following article 145 of UNCLOS. This concern is mostly related with the compaction of the first meters of the sediment layer during mining, as well as with the creation of sediment plumes that could spread over large areas outside the mined ones and the increase in the content of toxic metals in the water column (by the nodule collector itself and/or the water discharge from the surface vessel). However, in order to untangle some radicalism pointing to the massive destruction of the marine environment resulting from seabed mining, it must be said that an area of about 8500 km^2 (11% of the exploration area of 75,000 km^2) is sufficient to support 20 years of nodule harvesting from the seafloor (considering the extraction of 3 Mton of dry nodules per year and a nodule abundance of 7 kg/m^2). Notwithstanding the fact that this value should be regarded as under- estimated in order to consider the possible losses from the integrated mining system, an area of 8500 km^2 in the CCZ represents only ~ 21% of the core of each area of particular environment interest (APEI, 200 x 200 km core area, Fig. 1(A) and (B)) or ~ 5% of the APEI area considering the buffer zone of 100 km around the core. Presently, there are nine APEI in the CCZ under protection (Fig. 1(A)), each with a core area considered large enough to maintain minimum viable population sizes for species potentially restricted to a sub-region of the CCZ, and to capture the full range of habitat variability and biodiversity within a sub-region (see ISBA/17/LTC/7 [6]).

4. Annual reporting of the exploration work plan

According to Section 10 of the Annex IV of the Regulations, the Contractor must submit an annual report to the Secretary-General covering the programme of activities in the exploration area and in a format recommended by the LTC that may be periodically revised. Following the Regulations, two main documents were issued by the LTC in 2002: recommendations for the guidance of the Contractors for the assessment of the possible environmental impacts arising from exploration for polymetallic nodules in the Area (ISBA/7/LTC/1/Rev.1 [7]) and the format and structure of annual reports included as an Annex of the Evaluation of the annual reports submitted by Contractors (ISBA/8/LTC/2 [8]). In the latter document, for what concerns the mineral resources and not the environmental data, only results and descriptive information should be delivered to the Authority and no raw data are required. Regarding the environmental studies performed by the Contractor, the same document states that: "Results, data and their graphic representation should be published by the

Contractor or made available on open file". The former document prescribe that in order to report the work on the marine environment the Contractor should provide the Authority with all relevant data, data standards and inventories.[6] However, despite the reasonable subjectivity in the interpretation of what should be considered relevant data, no data format has been defined in order to comply with this task.

Regulation 36, paragraph 2, of the Regulations on Prospecting and Exploration for Polymetallic Nodules in the Area [3], provides that "Data and information that is necessary for the formulation by the Authority of rules, regulations and procedures concerning protection and preservation of the marine environment and safety, other than proprietary equipment design data, shall not be deemed confidential". However, in the recommendations issued by the LTC in ISBA/7/LTC/1/Rev.1 [7] and according to the paragraph 19, in section D of part V, only data related to the protection and preservation of the marine environment resulting from mining tests are considered to be freely available for scientific analysis and research. The same limitation is still found in the new document (ISBA/19/LTC/8 [9]) issued in 2013, which resulted from the LTC review of the previous Recommendations for the guidance of Contractors for the assessment of the possible environmental impacts arising from exploration activities [7].

However, a significant progress (in addition to the elaboration of a standard sampling protocol, acquisition of more and better baseline data and information on the impacts of exploration activities on the marine environment) was introduced in this review by stating that the Contractor should provide the Authority with raw environmental data in the format agreed with the Authority. This step allowed the Authority to internally develop a vision towards the implementation of a data management programme and strategy.

Further recommendations for the guidance of Contractors for the reporting of exploration expenditures and of their obligatory training programmes were issued by the LTC in 2009 and 2014, respectively. Both recommendations were made to meet accountability and transparency towards an objective evaluation of the Contractors' compliance with their plans of work. However, the lack of raw georeferenced geological data still precludes the ISA to fully administer the exploration activities in the Area. That also represents a strong limitation to the development of a successful strategy for the management and protection of the marine environment.

5. Current available data and data management strategy

In 2000, the Secretariat of the Authority decided to establish a central data repository (CDR).

[6] Paragraph 17 of Section B – Data archival and retrieval scheme, Part V.

According to the document ISBA/9/ LTC/3 [10] prepared by the Secretariat the objective of the CDR was to collect and centralize all public and private data and information on marine mineral resources. This should have allowed for the creation of uniform data formats and useful summaries in a central location, readily accessible to users and include, inter alia, quantitative mineral assessments. The latter is quite important because Contractors will mine only the economically mineable part of a mineral deposit defined as mineral reserves [11]. In the report of the Chairman of the LTC to the Council of the 9th Session (ISBA/9/ C/4 [12]) it was acknowledged that, as users of the repository, LTC members could usefully contribute to the future elaboration of the database by making suggestions for improvements to the structure and usability of the database.

During the 13th ISA session in 2006, one LTC member presented to the Commission a proposal for the development of a mineral resource/reserve classification system for the Area. As stated in ISBA/12/C/8 [13], such a classification system is useful to evaluate the resource for management purposes, both in terms of exploration and economics. Despite the agreement to retain this proposal for further discussion, the Council did not request its implementation. The same document also pointed out that the Commission had on several occasions requested actual raw data to be provided by Contractors wherever possible, but reporting of such data was still lacking from most of the Contractors. In 2009, the Commission expressed once more its concern over the lack of raw data associated with resource assessment and environmental baseline studies (ISBA/15/C/5 [14]). It noted that the lack of such data was an impediment to the assessment of activities in the Area by the Authority, such as the creation of a regional environmental management plan. In the Annex I (Data Management Protocol) of the summary report of the Chairman of the LTC to the Council in 2011, the Commission stated that there was an urgent and timely need for the Authority to update its data management requirements with regard to acceptable data format(s) for submission to the Secretariat of scientific and technical data collected by Contractors (ISBA/17/C/13 [15]). This applies equally to resource assessment activities as well as environmental baseline studies. Moreover, it noted that while the recommendations for the guidance of Contractors for the assessment of the possible environmental impacts arising from exploration for polymetallic nodules in the Area were reviewed in 2010 (ISBA/16/LTC/7 [16]), they did not make reference to the format by which data should be submitted and did not contribute to improve the regulations in this specific domain. The Commission expressed a general concern that the scientific and technical data as presented in the annual reports were not in a format suitable for input into a centralized metadata and data management system that the Secretariat of the Authority is tasked to hold and maintain.

The same concern was again expressed in 2012 and in order to improve the data delivery in useful and standard formats, the Commission recommended that the results of the exploration work be

reported in digital format and include bathymetry (xyz files), geophysical data (geo-referenced raw data), nodule abundance and chemical analyses (including methods, analytical accuracy and precision estimates) (ISBA/18/C/20 [17]).

According to the Commission and the 2013 report: "the management, assembly, display and availability of data, information and knowledge is fundamental to the credibility of the Authority and its ability to cooperate broadly with other agencies. The re- view of annual reports has highlighted that current arrangements within the Authority for collecting and managing data are likely to jeopardize future data access and use. Data-handling obligations will increase with the involvement of more Contractors and requirements for sharing and mapping data layers. Without a clear data management strategy, the argument for Contractors to collect data in the first place is significantly reduced". It was also high- lighted by the Commission that the evaluation of the progress made by the Contractors is largely a subjective exercise, and no formal criteria are available against which to judge the accept- ability of the Contractors' reports or to measure their progress. Therefore, the Commission recommended that a series of key "Contractor milestones" with an appropriate threshold level, be devised in each activity area, by which progress can be measured (ISBA/19/C/14 [18]).

In 2014, the Commission noted that there was a need to review the recommended template for annual reports. Following the reviewing process, the Commission in 2015 adopted the draft recommendations as contained in document ISBA/21/LTC/15 [19]. The recommendations now include specific guidance for reporting on the exploration activities under contract for each category of mineral resources. It is requested to the Contractor to present the short-term (1-year), medium-term (5 years) and long-term (10–15 years) objectives. Annexes I to III specify the data types to be re- ported to the Authority and the respective formats. Annex IV comprises a list of templates for reporting standardized environmental and geological data in order to be included in the CDR. Annex V of the recommendations includes the standard for reporting of mineral exploration results assessments, mineral re- sources and mineral reserves. Those are derived from the inter- national reporting template of the Committee for Mineral Reserves International Reporting Standards (CRIRSCO), based on the results arising from the ISA workshop held in Goa, India, in October 2014 [5].

With regard to the reporting of geology and resources, the Goa workshop was of utmost importance to the Contractors in the final stage of their 15 years contracts for exploration. All Contractors having contracts granted by the ISA since 2001, made a resource assessment of priority areas. Applying the principles listed in the CRIRSCO classification system, most Contractors were able to classify their nodule deposits in those areas as inferred or indicated resources. However, it was also recognized that none of them set out and/or had tested mining technology on nodule deposits in real conditions, which

precludes the development of a pre-feasibility study and a realistic evaluation of the economic viability of the project.

The new template for reporting also specifies the environmental baseline data to be collected in the development of programmes for monitoring and assessment the environmental impacts that might arise from the exploration activities. Particularly, it stimulates the comparison with results and data from other studies, the acquisition of information on ecosystem functioning and the comparison of different sampling and analysis methods and an evaluation on their performance. The latter follows from the recommendations issued from the ISA workshops on taxonomic standardization of the benthic fauna inhabiting the CCZ. Such standardization is an essential guidance to Contractors assessing environmental impacts and to ensure the sustainable development of the mineral resources in the Area [20].

6. Transparency

As referred in the introduction, the LTC is a technical advisory organ of the Council, which in its turn is the executive organ of the Authority. In the current state of affairs, where neither the Enterprise or the Economic Planning Commission are yet established, the LTC is the major body tasked to prepare and forward matters for the Council. These matters all concern resource management and, as such, the LTC is an important part of the ISA governance process.

According to [21,22] transparency and accountability are fundamental components of good governance applied to the management of natural resources. Transparency in this respect may be referred to two different issues: insight into the working procedure of the Authority, and insight into the data and information submitted by the Contractors to the Authority. Some authors (e.g. [23]) have recently argued that there is a need for the ISA to in- crease transparency in order to improve the access to information and civil society participation. In this respect, the LTC is frequently referred to as the main body to adopt better transparency principles. Up to date, transparency with regard to the working procedures of the LTC is duly taken care of by the comprehensive report of the Chairman of the Commission to the Council annual sessions, which always take place in open meetings. Transparency, concerning to the information and data reported by the Contractors, is a different matter. In this regard, it is frequently suggested that Contractors' reports, as well as those on Contractors' compliance submitted annually by the LTC to the ISA should be made available to the public. Similar comments have been made by civil society groups in their responses to the Stakeholder Survey Questionnaire launched by the ISA in March 2014, aimed at soliciting contributions for the development of a regulatory framework for the exploitation of marine minerals in the Area. However, Contractors' reports contain elements that are defined as confidential in Part

VI of the Regulations [3]. These include information that is crucial for the Authority to administer mineral resources in the Area such as business models, patent specifications, and evaluation of mineral reserves.

Civil society groups have also addressed the need for disclosing environmental data acquired by Contractors' following the activities for exploration. According to the Regulations [3], and as suggested in the Rio Declaration and the Aarhus Convention, environmental data are a kind of information that has to be made available to the public domain and do not implicate confidentiality issues in themselves.

The criticism made by the civil groups seems to presume that a certain degree of the information that is not classified as confidential is held back intentionally by the Authority. We argue that this is not the case. Modern electronic reporting and data formats have developed very fast in recent years and, as a consequence, the templates for standard reporting of exploration results and data, which have been formulated for the first exploration con- tracts, are no more adequate. As described in the previous section on data management, this has hampered an efficient reporting of such data by the Contractors to the Authority.

The Chairman of the Commission has indeed reported to the Council on several issues related to the lack of information and raw data, which impedes the Authority from properly developing an efficient CDR that could serve the geological and environmental data management. Moreover, the Commission also alerted the Council about the lack of data format specifications in the regulation on prospecting and exploration for polymetallic nodules. As referred above, at the 21st ISA session in 2015, the LTC issued a new, comprehensive template for the annual reporting, including the types and formats of data to be submitted to the Authority [19]. The template also includes a standard for reporting on mineral exploration results assessments, mineral resources and mineral reserves in agreement with industry best practices. From now on, it is expected that it will be easier and more straightforward for the Authority to make data and information available to the public in accordance with its confidentiality regulations and to assess compliance of plans of work for exploration submitted by Contractors. This is of utmost importance because the first con- tracts for exploration of polymetallic sulphides and ferromanganese crusts are still within their first five-year period and their evaluation from the Commission will eventually benefit from the new reporting.

Similarly to the formulation of recommendations for the guidance of Contractors for the assessment of the possible environ- mental impacts arising from exploration, the contents of the new templates for geology and resources were based on the conclusions derived from the Goa workshop with experts in the field of mineral resources classification. Some stakeholders still highlight issues related with data confidentiality, but these are related with the standard clauses of the contracts for exploration, as

well as provisions of the regulations and/or UNCLOS that establish the framework for the LTC to operate. Conversely, it should be stressed that all outcomes, decisions and recommendations taken by the organs of the Authority or stemming from seminars and work- shops are duly posted in the open website of the ISA (www.isa.org.jm).

7. Conclusion

The development of seabed mineral resources while protecting the marine environment is a major challenge faced by the ISA. Some Contractors are now ending their first 15-year period for the exploration of polymetallic nodules in the Area (inside the CCZ) and have submitted applications for the extension of the contracts for five more years. The development of good practices for the annual reporting and data submission by Contractors is crucial for the assessment of the role of the Authority as a regulator of the activities occurring in the Area and its responsibility to ensure the protection of the marine environment. The availability of reliable data will enable the Secretariat and the LTC to carry out independent assessments of the environmental implications of activities in the Area (according the Article 165 of UNCLOS), as well as to validate the work done by Contractors. The new templates for reporting will contribute to achieve this objective while promoting transparency, which is considered as a major principle of industry best practices.

The development of transparency principles is also assisting the ISA in the development of the regulation for exploitation of marine minerals in the Area. In 2014, the Authority launched a public survey with the aim of starting a process of stakeholder engagement and consultation for the formulation of the mining code. Notwithstanding, the drafting of regulations for exploitation of marine minerals in the Area had already started and, although the fact that the interaction with all stakeholders is considered a priority, the framework for the decision-making process will always rely on UNCLOS.

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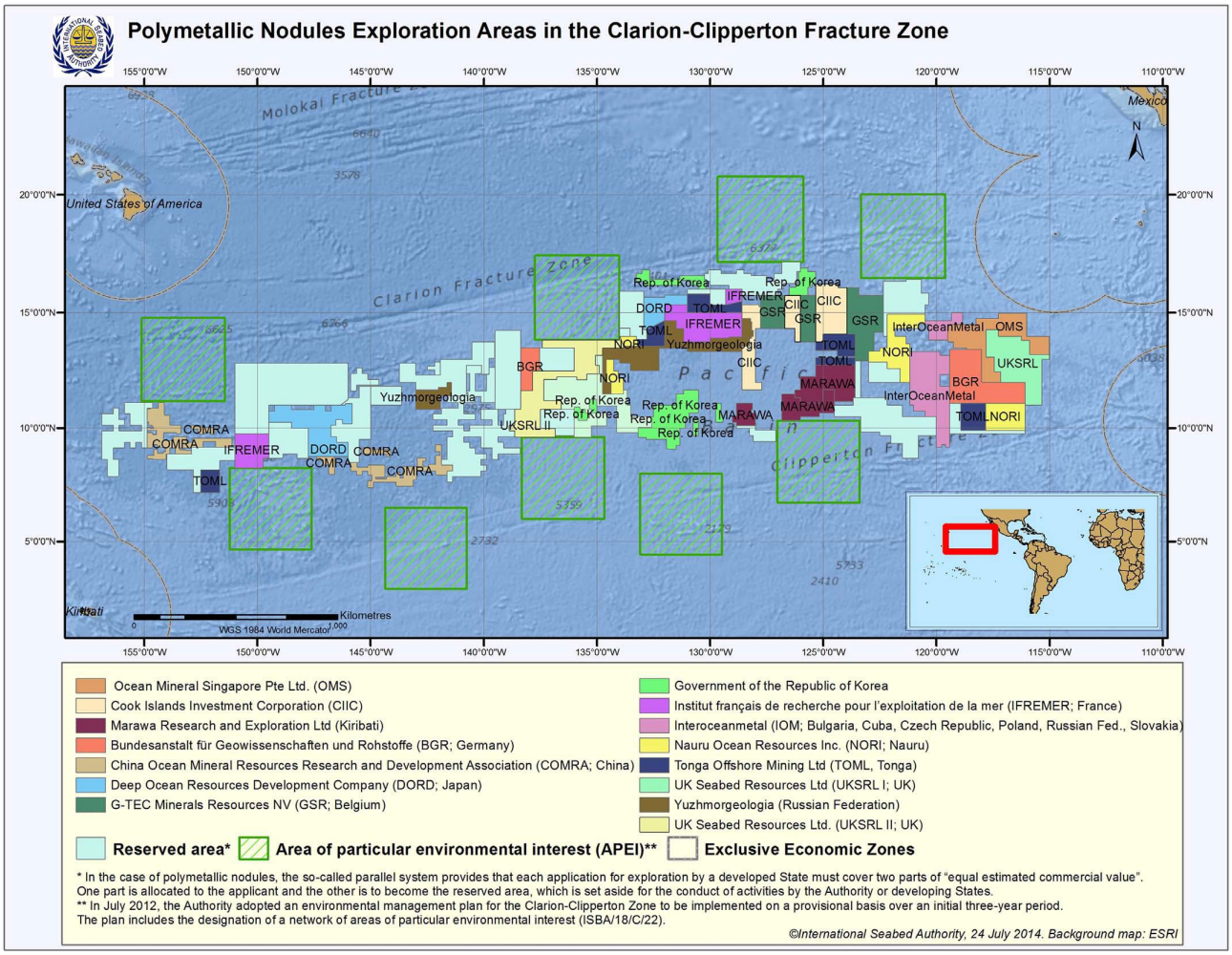
A



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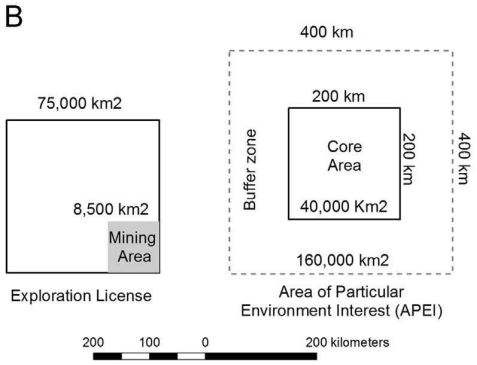

Fig. 1. (A) Location and spatial distribution of the exploration areas under contracts with the ISA, as well as the Areas of Particular Environmental Interest (APEI) (source: ISA). (B) Size comparison between a license exploration area, a possible mining area (production over 20 years) and an APEI.