

Towards the Development of Mineral Resources on the Continental Shelf of Japan

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Int'l Seminar: 'Towards the development of resources on the continental shelf' 10 Jan. 2013,

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1. Non-fuel Marine Mineral Resources; Overview
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Recent submissions made by China and Korea to CLCS in East China Sea area

1. Two partial submissions were made recently by China (22 Dec 2012) and Korea (26 Dec 2012) both at East China Sea area.
2. These submissions claim an overlapping area in the northern Okinawa Trough within the 200 nautical mile EEZ of Japan.
3. Both China and Korea submitted Preliminary Information on 11 May 2009 in the area. However, China shifted its claim from southern Okinawa Trough to northern Okinawa Trough.
4. Korea expanded their claimed area from the southern boundary of Japan-Korea Joint Develop Zone to the limit of 12 nautical mile territorial sea of Japan.
5. China seems to change their position on Senkaku (Diaoyu in Chinese) Islands since 2009; ignored in Preliminary Information but regarded? as their territory in present Submission.

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Continental Shelf; criteria in the United Nations Convention on the Law of the Sea

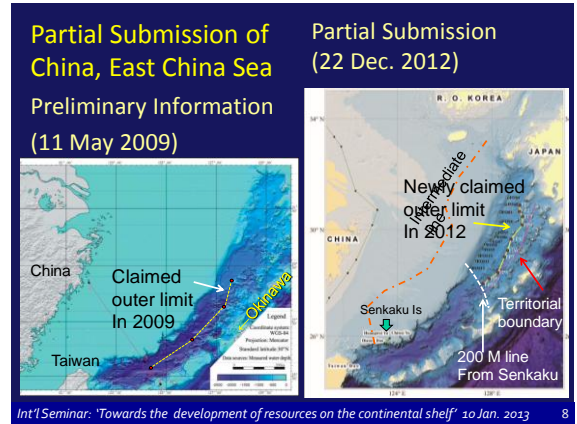
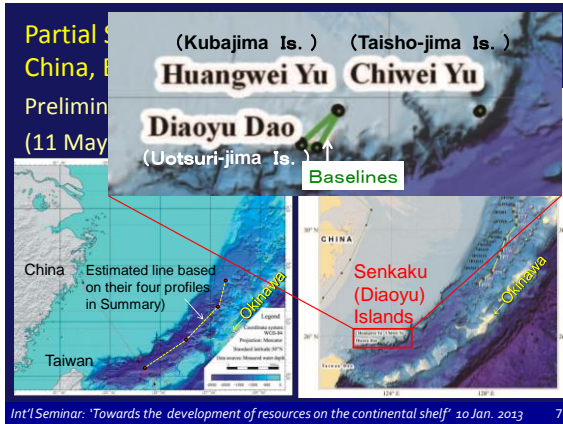
海洋法条約による大陸棚の定義

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Partial Submission of China, East China Sea Preliminary Information (11 May 2009)

Active rifting (stretching) and submarine volcanism are known within the Okinawa Trough.

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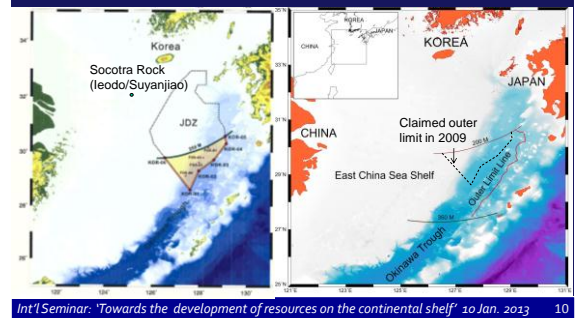
Excerpts from Executive Summary of China's Submission ...

- The determination of the outer envelope of 60 nautical miles from FOS according to article 76 (4)(a) (ii) of the Convention confirms that ECS's continental shelf has naturally prolonged to the Okinawa Trough's axis. Considering the geographical conditions and based on the topographical change of the seafloor. The outer limits of ECS's continental shelf beyond 200 nautical miles limit is defined as the line connecting of the maximum water depth points on the axial area of the profile which is vertical to the trend of the Okinawa Trough (hereinafter referred to as the "maximum water depth points")

(要旨) 沖縄トラフまでは大陸の延長とし、その最深点を結んでいる。

Submission by Republic of Korea

Preliminary Information (May 2009) Partial Submission (26 Dec. 2012)
JDZ: J/K Joint Development Zone. Extended to territorial sea of Japan



Excerpts from Executive Summary of Korea

- Korea has made efforts in good faith to assure its neighboring States that the present Partial Submission is made without prejudice to the questions of delimitation of the continental shelf in the East China Sea. The Government of Korea has consulted with the Government of the People's Republic of China, and has also made efforts to consult with the Government of Japan concerning Korea's submission.
 - The final outer limits of the continental shelf beyond 200 M from the baselines of Korea are derived from the outer envelopes of 60 M from the FOS, but adjusted so as not to impinge on the territorial sea of Japan in the East China Sea.
 - The fixed points comprising the line of the outer limits of the continental shelf do not exceed 350 M from the baselines from which the breadth of the territorial sea is measured.
- (要旨) 韓国は日本の領海外縁まで延長。350Mで切った。

China's justification for the Submission

- "The Chinese Government hereby informs the Commission that China, the Republic of Korea and Japan are yet to complete the delimitation of the continental shelf in the area involved in this Submission. According to article 76(10) of the Convention, recommendation of the Commission with regard to this Submission will not prejudice future delimitation of the continental shelf between China and the states concerned."

(要旨) 申請海域の境界画定は終わって居ないため、CLCSが勧告を出しても隣国の将来の境界画定に損害を与えないと説明している。

- Personal Comments on these submissions:*

Probably, these are the first Submission ever made to try to extend the outer limit of their Continental Shelf to/along the boundary of the territorial sea of the neighboring or opposing state.

Note Verbale of Japan on 23 July 2009

The distance between the opposite coasts of Japan and the People's Republic of China in the area with regard to which the People's Republic of China has submitted preliminary information is less than 400 nautical miles. The delimitation of the continental shelf in this area shall be effected by agreement between the two States in accordance with Article 83 of the United Nations Convention on the Law of the Sea (hereinafter referred to as "the Convention"). It is indisputable that the establishment of the outer limits of the continental shelf beyond 200 nautical miles in an area comprising less than 400 nautical miles and subject to the delimitation of the continental shelf between the States concerned cannot be accomplished under the provisions of the Convention.

(要旨) 日中間の間隔は400マイル以下であり、関連する国々の間で大陸棚の境界が決定される海域であることから、海洋法の規定により大陸棚の境界を画定することはできないことは議論の余地がない。

Note Verbale of Japan on 28 Dec 2012

Paragraph 5 (a) of the Annex 1 of the Rules of Procedure of the Commission on the Limits of the Continental Shelf provides that "In cases where a land or maritime dispute exists, the Commission shall not consider and qualify a submission made by any of the States concerned in the dispute. However, the Commission may consider one or more submissions in the areas under dispute with prior consent given by all States that are parties to such a dispute." In the area, which is the area which is the subject of the submission, the delimitation of the continental shelf is yet to be determined. The Government of Japan does not give such prior consent to the consideration of the submission by the Commission.

The submission contains references to the Senkaku Islands including their "baselines" that the People's Republic of China argues. These "baselines" have no legal ground under international law. Such references to the Senkaku Islands including their "baselines" are categorically unacceptable for the Government of Japan in light of the reasons mentioned above;

(要旨) CLCSは紛争海域の勧告をしてはならない。尖閣は日本領土。

Specialist's view (B. Kwiatkowska, 2012) on China's 2009 Preliminary Information

However, as these areas are within 200-mile zone of neighbouring Japan, para.11 of China's Preliminary Submission specified in accordance with UNCLOS Articles 74/83 that:

11. Following its consistent position, China will, through peaceful negotiation, delimit the continental shelf with States with opposite or adjacent coasts by agreement on the basis of international law and the equitable principles.

Japan's Note Verbale of 23 July 2009 was prompt in reserving its right to make additional comments on China's position in the future and in meanwhile stressing that:

It is indisputable that the establishment of the outer limits of the continental shelf beyond 200 miles in an area comprising less than 400 miles and subject to the delimitation of the continental shelf between the States concerned cannot be accomplished under the provisions of the UNCLOS.

This passage implies that were China to proceed with Partial (East China Sea) Submission, Japan would request the CLCS to refrain from making Recommendations on such Submission.

China also plans;

- The fact that in para.10 of its 2009 Preliminary Partial (East China Sea) Submission:

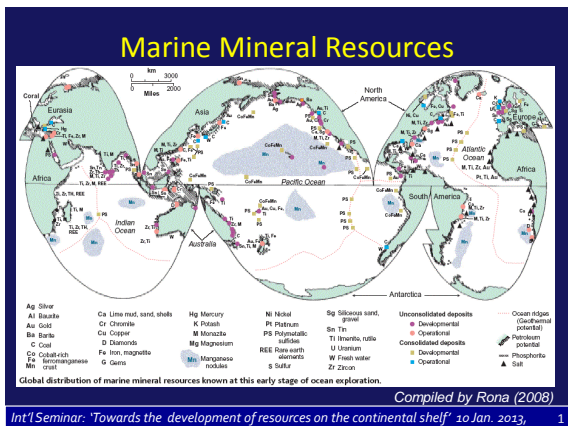
10. China reserves its right to make Submissions on the outer limits of the continental shelf that extends beyond 200 miles in the East China Sea and in other sea areas (emphasis added),

can be construed as presaging another China's Partial (South China Sea) Submission. Such a Submission, however, seems for the time being to be unlikely given China's notorious U-shaped line claim with a view to indicating its ownership of Spratly/Nansha (Truong Sa/Kalayaan), Paracel/Xisha (Hoang Sa) and Scarborough/Huangyan Dao within this U-line and given that South China Sea disputes are long-standing, multi-state, and involve valuable resources in addition to other strategic

Prof. Barbara Kwiatkowska (Former Deputy Director, NILOS) (Farewell Lecture on 9 Dec. 2011): <http://www.uu.nl/nilos/onlinepapers>

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Rona ('08) on non-fuel marine minerals

- "Prior to the advent of plate tectonics, we viewed the ocean basins as passive sinks for particulate and dissolved material eroded from land."
 - Marine placer deposits (Au, Sn, REE, and diamond),
 - Aggregates (sand and gravel), and
 - Precipitates (phosphorites and manganese nodules).
- "With the advent of plate tectonics, plate boundaries are recognized as active sources of mineralization"
 - hydrothermal massive sulfide deposits, inferred
 - magmatic Ni-Cu sulfide, chromite and PGE deposits

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Seafloor is not passive but active!



Drilling into 308°C hydrothermal reservoir at Suiyo Seamount, Izu Arc (Archean Park Project, Japan)

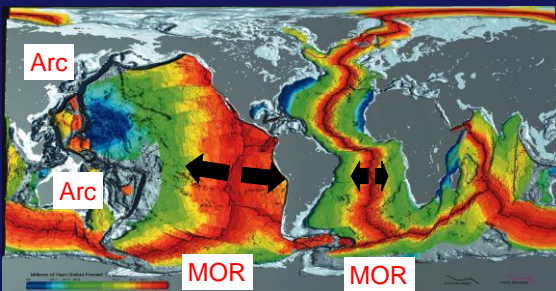


Observed volcanic eruption at NW Rota Seamount, Mariana Arc (Courtesy of NOAA Vent program)

水曜海山の海底熱水活動

北西ロタ海山の海底噴火²⁰

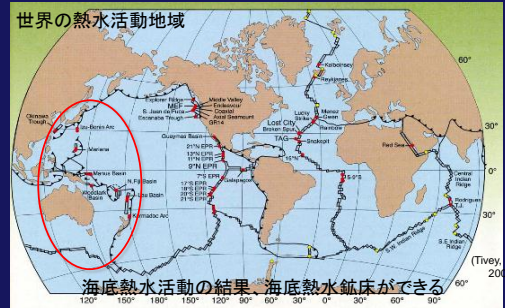
Age of Seafloor: Seafloor is generated along Mid-Ocean Ridge (中央海嶺) and subducts beneath Arc (島弧)



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Distribution of hydrothermal sites in the world

There are about 340 known and inferred sites. Among them, 83% are on mid-ocean ridges and the rest are in arc-backarcs.

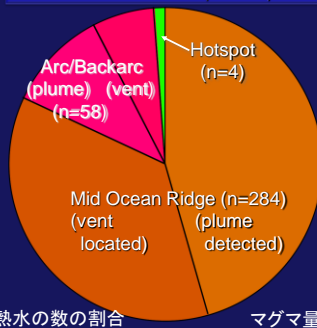


世界の熱水活動地域

(Tivey, 2001)

海底熱水活動の結果、海底熱水鉱床ができる

Hydrothermal sites in the world compiled by E. Baker

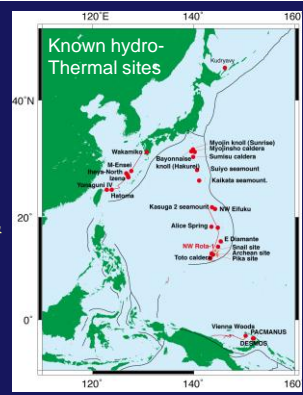


- >340 hydrothermal sites are detected either by plume survey or by camera/ROV/submersible.
- Those in arc/backarc setting consist of 16%; consistent with the fraction of arc magma to MORB.
- Hot spot (like Hawaii Island) is not fertile setting for hydrothermal activity.

Merits of Arc/Backarc Deposits

- Shallower water depth (<1600m) compared to Mid-Ocean Ridge (2500-3500m)
- Larger tonnage than that of MOR (Max. 5 million tons)
- Higher ore grade (rich in Au & Ag).
- Closer to shore and located within EEZ / territorial sea of coastal states.

Modified after Ishibashi & Urabe (1985)

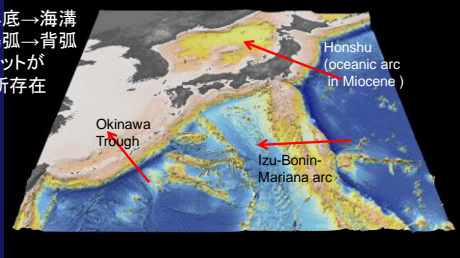


Known hydro-thermal sites

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Three sets of "trench-arc-backarc systems" around Japanese islands

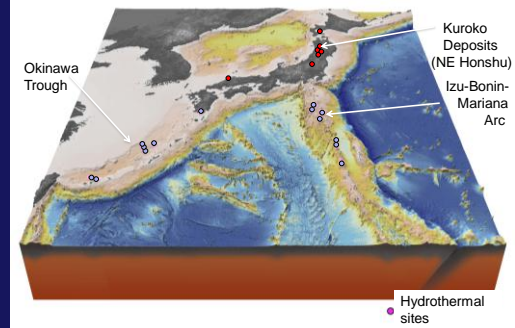
海洋底→海溝
→島弧→背弧
のセットが
3カ所存在



- ◆ Izu-Bonin and Okinawa arcs are typical oceanic arcs.
- ◆ Honshu (NE Japan) arc was an oceanic arc during Miocene age and Kuroko deposits were formed in the arc.

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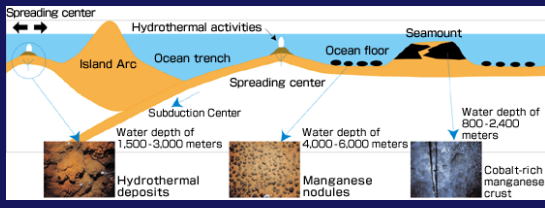
Seafloor Hydrothermal sites around Japan - Present and Past (Kuroko Deposits) -



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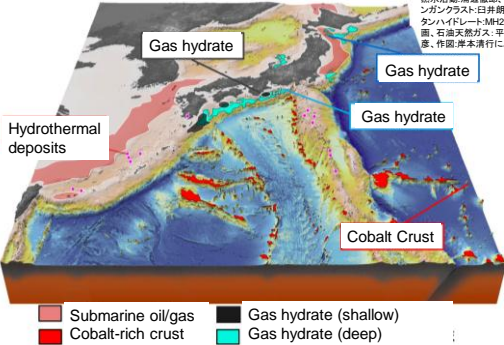


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Three major deep-sea mineral resources

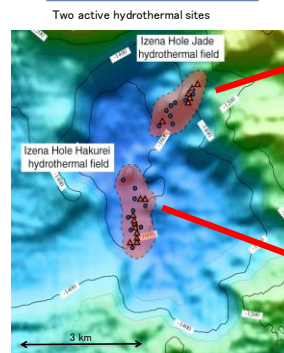
Name	Ferromanganese Nodule	Cobalt-rich Ferromanganese crust	Seafloor Massive sulfide (SMS)
Shape	Sphere (1-10 cm φ)	Coating (1-10 cm)	Chimney, mound
Major components	MnO ₂ +Fe-hydroxide	MnO ₂ +Fe-hydroxide	Sulfides + sulfates
Metals of interest	Cu, Ni, Co, Mn, REE	Co, Cu, Ni, REE, Pt	Cu, Zn, Au, Ag, Pb
Water depth	3500 - 6000 m	1000 - 3000 m	700 - 3500 m
Resources	5 x 10 ¹¹ ton (?)	5 x 10 ¹⁰ ton (?)	10 ⁸ ton (?)
Geology	Sediment hiatus of deep-sea floor	Bare rock area of seamount & plateau	On volcanic center of MOR and arc
Age	< 80 Ma	< 120 Ma	< 0.1 Ma
Ore genesis	Chemical precipitates from seawater	Chemical precipitates from seawater	Precipitates from high-temp fluid
Mining Technology	Developed and tested	Not yet tried	Seriously planned

Distribution of Known/Estimated Seafloor Resources around Japan



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Izena Cauldron



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Izena Cauldron, Okinawa Trough

(Data after T. Ura)

1. Extraordinary clear image of seafloor was obtained.
2. Most of the mounds are proven to be sulfide edifices by ROV survey.
3. Intensive drillings have been conducted by JOGMEC using BMS (Benthic Multi-coring System)

Side-scan Image
↓
Interferometry map

(After JOGMEC, 2009)



Drilled Cores from Izena Cauldron

- The Seafloor Massive Sulfide (SMS) in the Izena Cauldron is the largest known in the world, except those in Red Sea.
- Due to the limitation of BMS drilling (<15 meters), it is difficult to estimate the reserves accurately.
- We need more investigation to calculate ore reserves and to know the genetic mechanism of SMS.

Au: 0.42-20.7ppm(3.62ppm),
Ag: 0.17-2900ppm(237ppm),
Cu: 0.1-5.1%(0.4%),
Pb: 0.1-20%(2.74%),
Zn: 0.1-30%(7.14%)
():Average value

Estimated Ore Reserve
= 5,000,000 ton

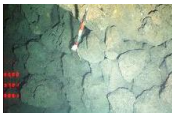
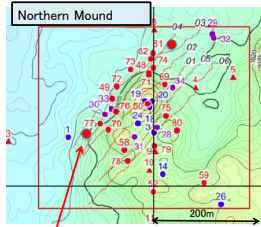


(After JOGMEC 2009)

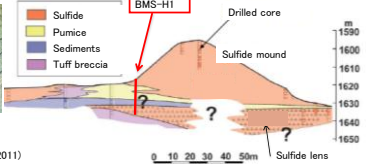
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Exploration in Izena Caldera

- JOGMEC conducted BMS drillings at Izena caldera in three years as the national exploration program for SMS (seafloor massive sulfide).
- No of holes: 82
- Total drilled depth=796m
- Total core length=396 m



Surface of sulfide mound.



After JOGMEC's Interim Report (2011)

New Exploration Vessel "Hakurei" (has replaced "Hakurei-maru No.2" in 2012)



"Dream vessel" for rock-sampling \$ 375 million US (including equip.) built by Mitsubishi Heavy Industry

Research Gears

Everything we need..

[Acoustic]

- Multi-Narrow-Beam Echo Sounder (MBES)
- Side-scan Sonar (SSS)
- Sub-Bottom Profiler
- Doppler Current Profiler (ADCP)

[Observation & Sampling]

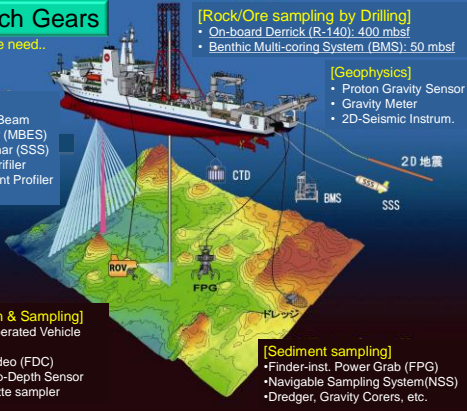
- Remotely Operated Vehicle (ROV)
- Deep-tow Video (FDC)
- Salinity-Temp-Depth Sensor (CTD) - Rosette sampler

[Rock/Ore sampling by Drilling]

- On-board Derrick (R-140): 400 mbsf
- Benthic Multi-coring System (BMS): 50 mbsf

[Geophysics]

- Proton Gravity Sensor
- Gravity Meter
- 2D-Seismic Instrum.



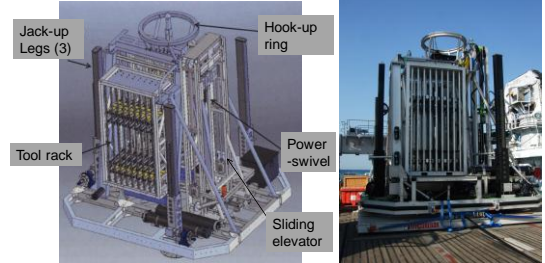
[Sediment sampling]

- Finder-inst. Power Grab (FPG)
- Navigable Sampling System(NSS)
- Dredger, Gravity Corers, etc.

BMS - 5 0 M (Tethered Benthic Multi-coring System)

Max. Drilling Depth = 50 mbsf
Drilling System: Power-swivel Rotary Coring
Core Φ= 63.5 mm (HQ), Wireline Method

Max. Water Depth = 3000 m
H=6.8m, L=5.7m, W=5.2m
Weight (in air) =15 ton



Williamson & Assoc. + NGK Ocean

Conclusion 1

- "The trend of modern international law in terms of the peaceful settlement of disputes tailored to meet the needs of present-day international society" (Nelson, 2009) should be reflected also on the submission to CLCS (König & Pesch, 2012).
- Para.8 of Article 76 of UNCLOS requests coastal state that the submission shall be done "on the basis of equitable geographical representation".
- However, recent submissions made by China and Korea in the area of East China Sea is a sign of retarded and non-productive international relations in East Asia.
- Article 83 of UNCLOS: "The delimitation of the continental shelf between States with opposite or adjacent coasts shall be effected by agreement on the basis of international law."
- China once assured in PI in 2009, to "delimit continental shelf" "through peaceful negotiation" with opposite coast.

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Conclusion 2

- Japan has vast unexplored seafloor (territorial sea + EEZ + extended Continental shelf = 451 km²) which is equivalent to India (330 km²) or Australia (770 km²) if it exists on land.
- We must continue (i) monitoring, (ii) mapping, (iii) sampling, and (iv) modelling of the ocean and its floor to meet societal (e.g. disaster, fishery), scientific (e.g. environmental, biodiversity) and management (e.g. maritime safety) purposes.
- Exploration and development of seafloor resources may take a lead to open this frontier area not only for Japan but also for global society. High resources potential around Japan may promote such activity.
- Japan should take a lead, in collaboration with ISA (International Seabed Authority), for the sustainable use of marine resources.

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Platforms used for research

ROV Hyper Dolphin



AUV Urashima



AUV r2D4



Drill Ship Chikyu



BMS (tethered marine rock-drill)



HORV Shinkai 6500



Images after JAMSTEC.
BMS after JOGMEC.
r2D4: Ura Laboratory,
Univ. of Tokyo.

AUV = Autonomous Undersea Vehicle

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