

Recent Marine Scientific Research Activities in Korea Using Global Class Research Vessels

Sang-Mook Lee

School of Earth and Environmental Sciences

Seoul National University



SNU10-10 Initiative Planet A



**Center for
Deep-Surface
Coupling of Earth**

From all government-controlled to How it all started

- RV Onnuri (1450 ton, 68 m long, built in Norway **KIOST** 1992)
- RV Tamhae 2 (2500 ton, seismic vessel, built in Norway **KIGAM** 1995)
- RV Araon (7000 ton, icebreaking research vessel, **KOPRI** 2007)



SCIENCE/LEAH FREUD/REUTERS

at Johns Hopkins University in Baltimore, Maryland. The data have yielded new ways to classify tumours and pointed to previously unrecognized drug targets and carcinogens. But some researchers think that sequencing still has a lot to offer. In January, a statistical analysis of the mutation data for 21 cancers showed that sequencing still has the potential to find clinically useful mutations (M. S. Lawrence *et al.* *Nature* 505, 495-501; 2014).

On 2 December, Staudt announced that once TCGA is completed, the NCI will continue to intensively sequence tumours in three cancers: ovarian, colorectal and lung adenocarcinoma. It then plans to evaluate the fruits of this extra effort before deciding whether to add back more cancers.

EXPANDED SCOPE

But this time around, the studies will be able to incorporate detailed clinical information about the patient's health, treatment history and response to therapies. Because researchers can now use paraffin-embedded samples, they can tap into data from past clinical trials, and study how mutations affect a patient's prognosis and response to treatment. Staudt says that the NCI will be announcing a call for proposals to sequence samples taken during clinical trials using the methods and analysis pipelines established by the TCGA.

The rest of the International Cancer Gene Consortium, slated to release early plans for a second wave of projects in February, will probably take a similar tack, says co-founder Tom Hudson, president of the Ontario Institute for Cancer Research in Toronto, Canada. A focus on finding sequences that make a tumour responsive to therapy has already been embraced by government funders in several countries eager to rein in health-care costs, he says. "Cancer therapies are very expensive. It's a priority for us to address which patients would respond to an expensive drug."

The NCI is also backing the creation of a repository for data not only from its own projects, but also from international efforts. This is intended to bring data access and analysis tools to a wider swathe of researchers, says Staudt. At present, the cancer genomics data constitute about 20 petabytes (10¹⁵ bytes), and are so large and unwieldy that only institutions with significant computing power can access them. Even then, it can take four months just to download them.

Stimulus funding cannot be counted on to fuel these plans, acknowledges Staudt. But cheaper sequencing and the ability to use biobanked biopsies should bring down the cost, he says. "Genomics is at the centre of much of what we do in cancer research," he says. "Now we can ask questions in a more directed way." ■



Marine biologist Sang-Mook Lee has pushed for academic involvement in South Korea's research ships.

OCEANOGRAPHY

Korea opens up its ocean science

Ships used mainly for seabed surveys will expand in focus.

BY MARK ZASTROW

South Korea's ocean-going research programme is changing tack. For more than two decades, it has focused on discovery and exploitation of minerals on the sea floor, but now a move is afoot to expand the research agenda. A 5,900-tonne ship — the *Isabu* — is being built with the capability to launch autonomous underwater vehicles, perform sea-floor-penetrating seismic surveys and collect sediment cores up to 40 metres long.

The current flagship, the 1,422-tonne *Omnuri*, spends about three-fifths of its time scouring the sea floor for mineral deposits under the direction of the deep-sea minerals group at the Korean Institute of Ocean Science and Technology (KIOST) in Ansan. That heavy economic emphasis is set by the Ministry of Oceans and Fisheries, which oversees KIOST as well as the nation's ports and shipping.

The ministry's hold is so complete that in 22 years of operation, no academic researcher outside KIOST has ever led a cruise. "This is really scandalous," says marine geophysicist Sang-Mook Lee of Seoul National University. Although scientists at his university and elsewhere have been able to work aboard the ship, they have been frustrated by a near-complete lack of say in where the *Omnuri*

goes or what research questions it pursues. In March, that is set to change: KIOST will start to make *Omnuri's* upcoming cruise tracks public, and will invite outside researchers to propose projects that can be done along the way, says Gi-Hoon Hong, who became the institute's president in August and has supported broadening the constituency for its research vessels. Eventually, time on the ships, which currently costs up to US\$12,000 per day, will be awarded through a merit-based system.

South Korea's focus on mineral exploration dates back to the founding of KIOST in the early 1970s, when the nation was in the middle of a decades-long economic boom. At the time, polymetallic nodules — balls of manganese and other metals such as iron, nickel and cobalt that accumulate on the sea floor — seemed a valuable potential resource. Although international interest in the minerals waned over subsequent decades, the South Korean government continued to fund research on the nodules and other sea-floor mineral deposits.

Securing marine mineral resources is "considered very important to the Korean people, because of the scarcity of land-based natural resources," says Jai-Woon Moon, the head of KIOST's deep-sea mineral research group. And rising prices for metals have renewed the world's interest: Nautilus Minerals of

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닥터 조흥근의 당뇨·혈관 이야기

동서남북 2

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이정환 선임2부 과학담당

지난 8일 국제학술지 '네이처'에 "한국에서 올 3월부터 대학 연구자들도 해양과학조사선을 활용할 수 있게 됐다"는 기사가 실렸다. 국내 과학계에서 박사급 연구자의 80% 이상이 대학에 있다. 왜 그동안 대학 연구자들은 조사선을 활용하지 못하고 소외됐던 것일까.

1992년 취역한 1422급 해양과학조사선 '온누리'호(號)는 해수수산부 산하 한국해양과학기술원이 운영한다. 미국·영국·일본 등 해양과학 선진국에서는 국가기관과 대학 등 민간 연구자들이 공동으로 해양과학조사선을 활용하고 있다. 하지만 우리나라는 지난 23년간 민간 연구자가 온누리호 탐사를 지휘한 적은 한 번도 없다.

문제는 정부의 그릇된 경제 논리였다. 온누리호는 운항 시간의 5분의 3을 해양과학기술원의 심해저(深海底) 광물 탐사에 썼다. 대학에서 온누리호를 쓰려고 해도 하루에 수천만원씩 사용료를 내야 해서 엄두를 내지 못했다. 반면 해양과학기술원은 해수부로부터 해저 광물 탐사 명목으로 1년에 몇십억원씩 해양조사선 사용료를 따로 받았다.

그러나 네이처지는 "해저 광물 채굴에 대해서는 회의론이 널리 퍼져 있다"고 전했다. 해수부 관계자도 "현재로서는 해저 광물을 채굴하는 것이 육상 광물 채굴보다 경제성이 낮은 게 사실"이라고 인정했다. 이상목 서울대 지구환경과학부 교수는 "정부가 계속 해저 광물의 경제적 가치를 말하면 국민에게 거짓 말하는 것"이라고 했다.

그런데도 정부는 또다시 예전 방식을 고집했다. 그러자 이상목 교수는 작년 해수부 국정감사에 증인으로 나와 "새로 건조하는 5900급 대형 해양과학조사선 '이사부'호의 소유권이 당초 계획과 달리 다시 해양과학기술원에 돌아갔다"고 폭로했다. 2008년 한국개발연구원(KDI)은 이사부호에 대한 예비타당성 평가에서 "사업성이 떨어진다"며 탈락시켰고, 2차 평가에서는 '대학과 선박을 공유해야 한다'는 조건을 달아 승인했다. 해수부가 이를 어긴 것이다. 이 교수의 폭로가 나온 뒤 해수부는 이사부호를 민간도 활용할 수 있게 하겠다고 약속했다.



이정환 8
산원부 차장
E-mail: yjlee@chosun.com
종학생도 이해할 만큼 쉽게 과학기사를
쓰려고 요구하는 데스크들에게. <디브리>

> 오피니언 모든 콘텐츠

- 김대중 컬럼
- 강진석 컬럼
- 송희영 컬럼
- 한상희 컬럼
- 양성준 컬럼
- 강창권 컬럼
- 최보식 컬럼
- 박두식 컬럼

오늘의 인기 프리미엄조선



어느날 날추번에도 정동구 회장, 덕분 없이 이라적 특종 신년사
각본 없이 발표한 신년..



사장 명의로 1년 35억 원씩 버는 신격호 회장 장녀 신영자
신격호(94) 롯데그룹..

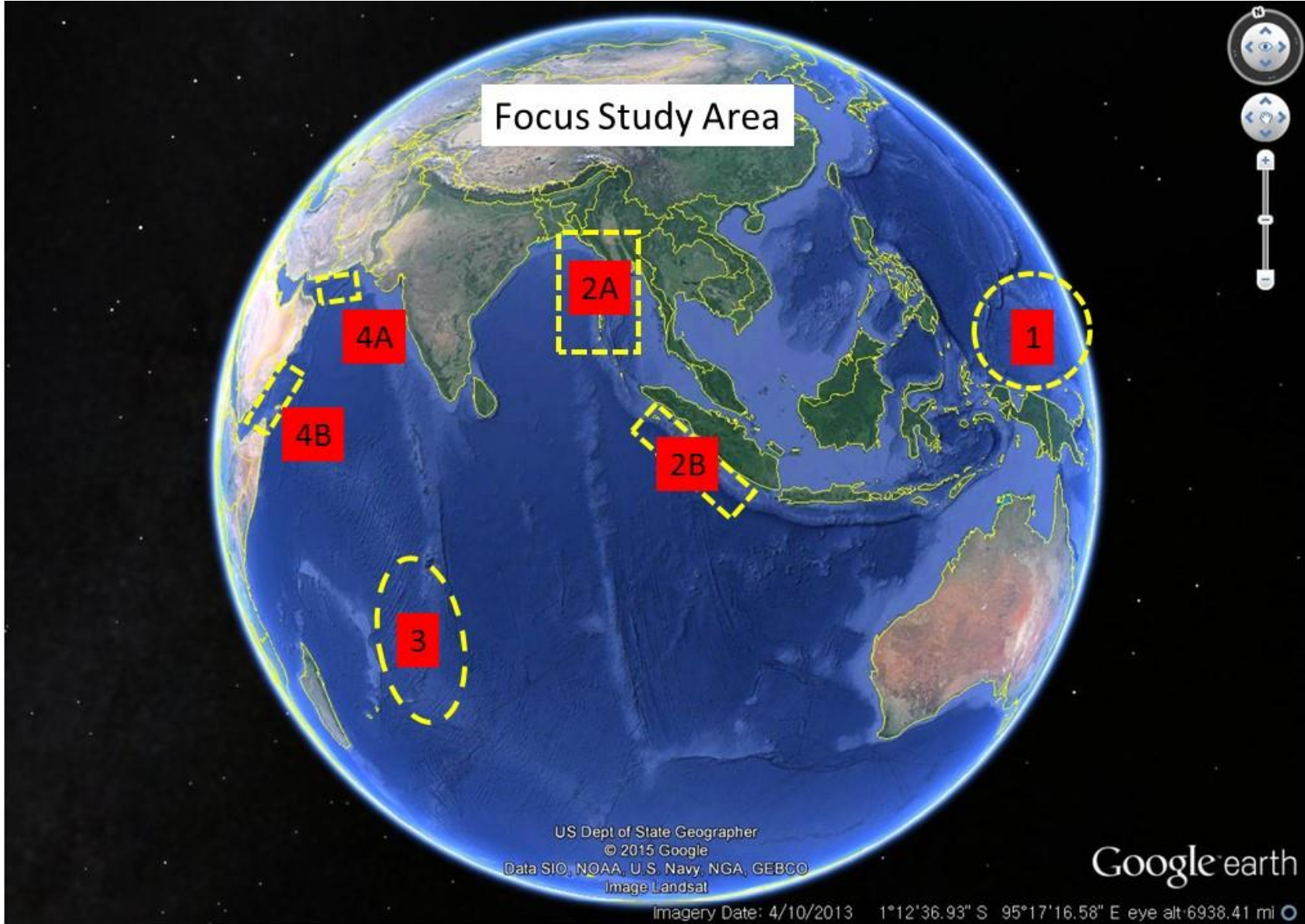
37년간 당해 피우다 금연 신년한 문형보 복지부 장관, 금단현상유?

가진제품 전생에서 참 곁 거논 윤문보 삼성전자 사칭기 조성진 LG전지 사칭

3형제 분란 속 아버지 조석려 회장의 눈물겨운 장남 사망
효성그룹 조석려 최침이 끝없는 '장남' 사랑들 보려고 있다. 첫째 아들..

프리미엄 기획 · 특집



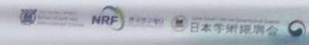




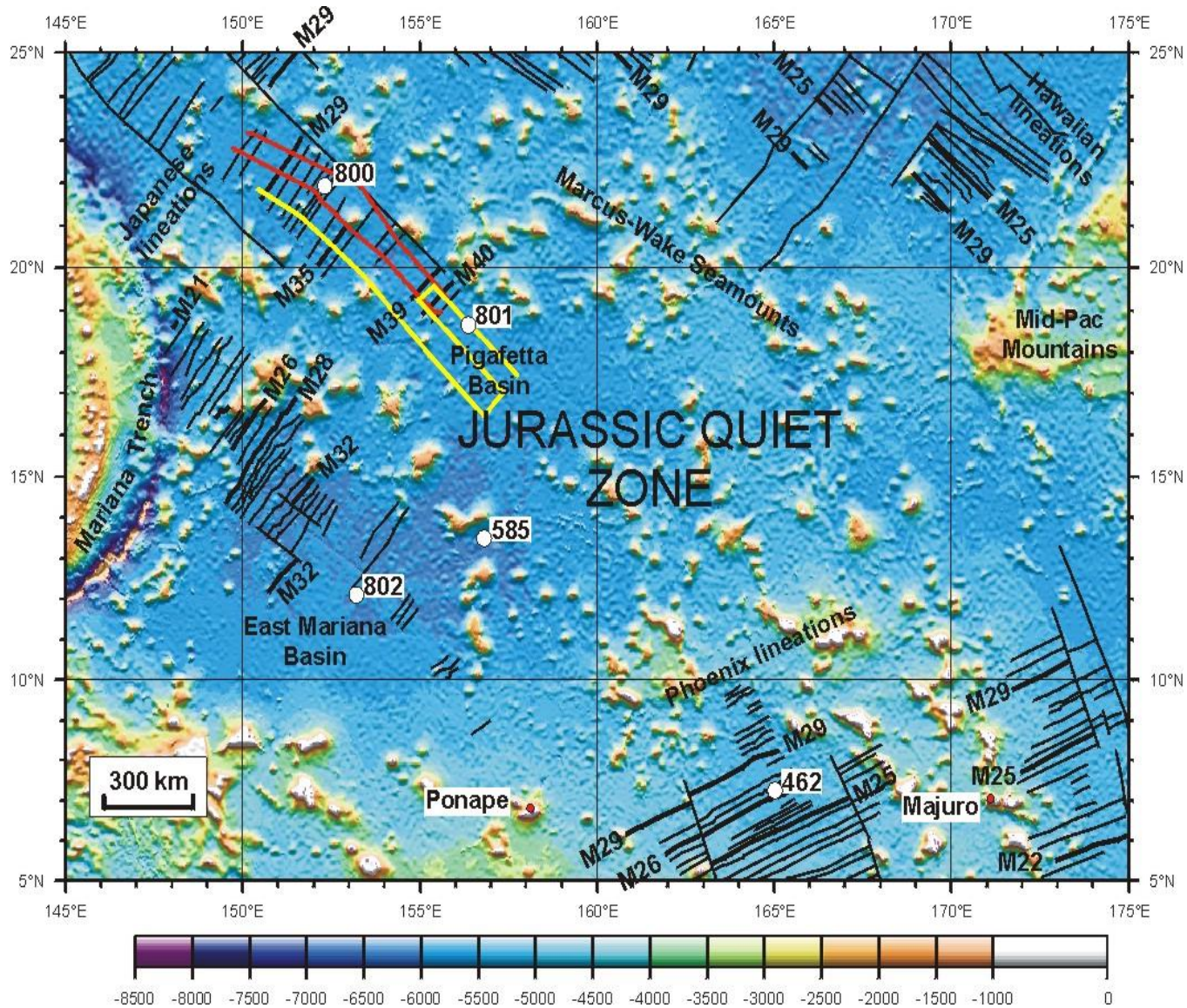
5900 ton

 Collaborative Research
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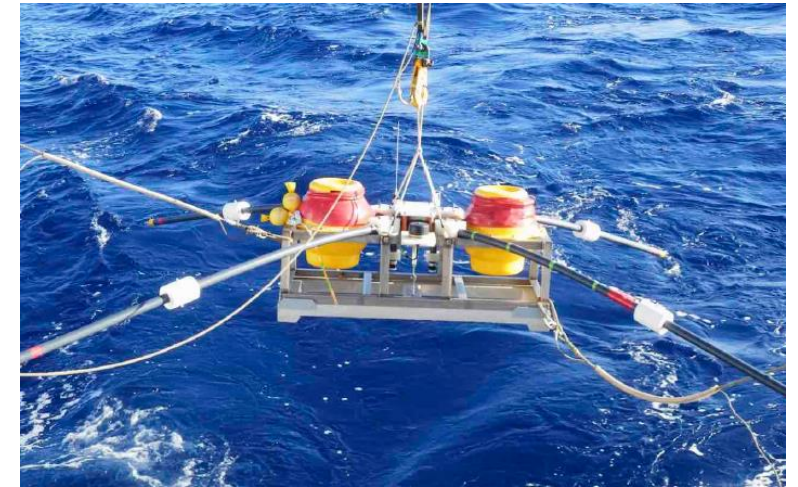
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OBEM



BBOBS

► plunged between them and the planet — researchers are refining their estimates of the rings' mass, as well as that of the planet's core, says Luciano Iess, a planetary scientist at the University of Rome La Sapienza.

The rings' mass provides a way to double-check calculations of their age: the more massive the rings are, the older they might be. Preliminary analysis of data from Cassini's grand-finale orbits have given Iess and his colleagues their best estimate of mass yet. "We cannot release any value yet," Iess says, "but this is the first indication that we have that probably the rings didn't form together with Saturn." By comparing those results with estimates from Cassini's dust analyser, researchers hope to be able to settle the question of ring age once and for all.

MAGNETIC MYSTERY

Cassini's magnetometer has already made some unexpected discoveries. Saturn's axis of rotation and its magnetic axis turn out to be almost perfectly aligned, says Linda Spilker, the mission's project scientist at NASA's Jet Propulsion Laboratory (JPL) in Pasadena, California. That has puzzled researchers, because models have suggested that there needs to be at least a slight offset between the two axes for the planet to maintain a magnetic field.

The finding "suggests that we don't really understand Saturn's internal structure and how the planetary dynamo is generated yet", says Michele Dougherty, a space physicist at Imperial College London. She estimates that it will take another three to six months to crunch through the data and understand exactly what they mean.

Other potential discoveries will require researchers to put together all of Cassini's data sets from its entire 13-year study of Saturn. That includes watching the planet and its moons change over time, given that 1 year on Saturn is about 29 Earth years. "We have a whole half-season of changes on Saturn and Titan to study," says Bonnie Buratti, a planetary scientist at JPL.

The Cassini team has another year's worth of funding to tease more secrets out of the data. But as of now, there are no US missions on the books to return to Saturn — unless researchers can persuade NASA or other space agencies to go back. ■



Islands between Japan and South Korea are the source of a long-running territorial dispute.

POLITICS

Ship name stirs up trouble

Marine scientists allege that Japanese researchers have been blocked from collaboration involving a South Korean vessel.

BY MARK ZASTROW

South Korea's flagship research ship *Isabu* seems to have sailed into a controversy with the Japanese government over its name. The incident has hindered some oceanographic research collaborations between the two countries.

The ship's name refers to a sixth-century Korean general, Kim Isabu. In South Korea, he is known for his maritime conquests, which in some historical accounts included two islets that are the subject of a decades-long territorial dispute between South Korea and Japan. Known as Dokdo in South Korea and Takeshima in Japan, the small islets are located

roughly midway between the two countries, more than 200 kilometres from each mainland. The 5,900-tonne ship launched late last year and is currently cruising the Philippine Sea. Its name was an option in a public poll held by the ship's operator, the Korea Institute of Ocean Science and Technology in Ansan.

The Japanese government has issued no formal protest over the ship's name, but four scientists in South Korea and Japan have told *Nature* that researchers at Japan's national marine-research agency have been instructed not to participate in any collaborations or cruises involving *Isabu*. An e-mail sent in January by an official at the Japan Agency for Marine-Earth Science and Technology

CHANG JUBI/GETTY

Nature news
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Prof. Utada (ERI The University of Tokyo)



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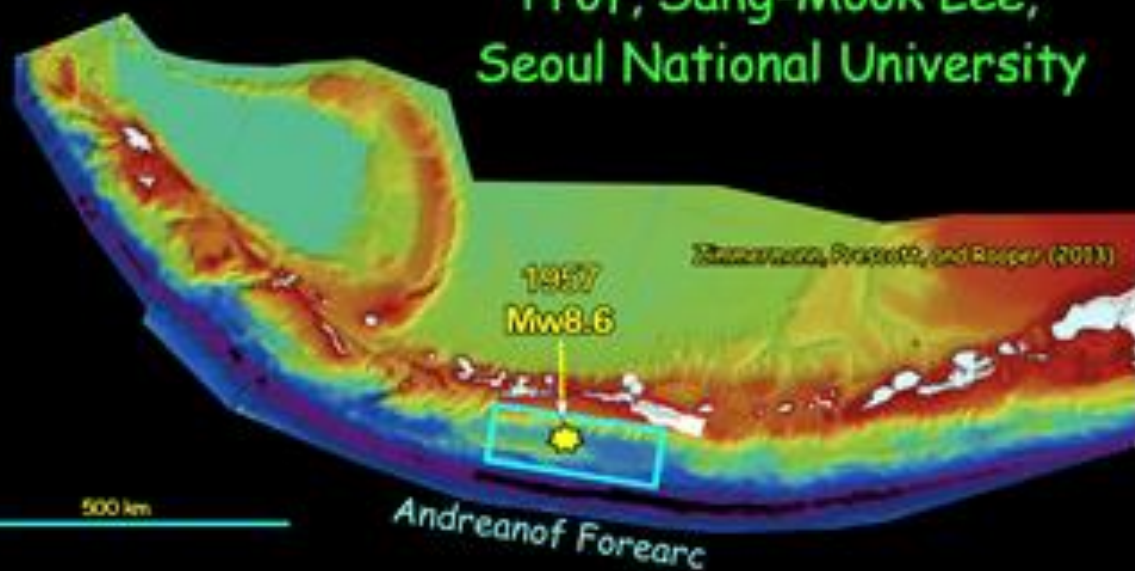
For The Aleutian Area, Acquiring Target-area Multibeam Maps and Seismic Lines to Address Scientific Questions is a Challenging Funding and Operational Enterprise.

Through the Efforts of Prof. Sang-Mook Lee, Seoul Nat. Univ., Korean State-of-the-art Research Vessels Might Become Available to Assist Future Aleutian Bathymetric and Seismic Studies.

Courtesy of David Scholl (USGS)



Prof, Sang-Mook Lee,
Seoul National University



Korean Icebreaker,
R/V Araon



Korean 2D Seismic Vessel,
Tamhae II



Korean 3D Seismic Vessel,
Tamhae III

I should be in this picture in the middle.



1. Overview of Vessel



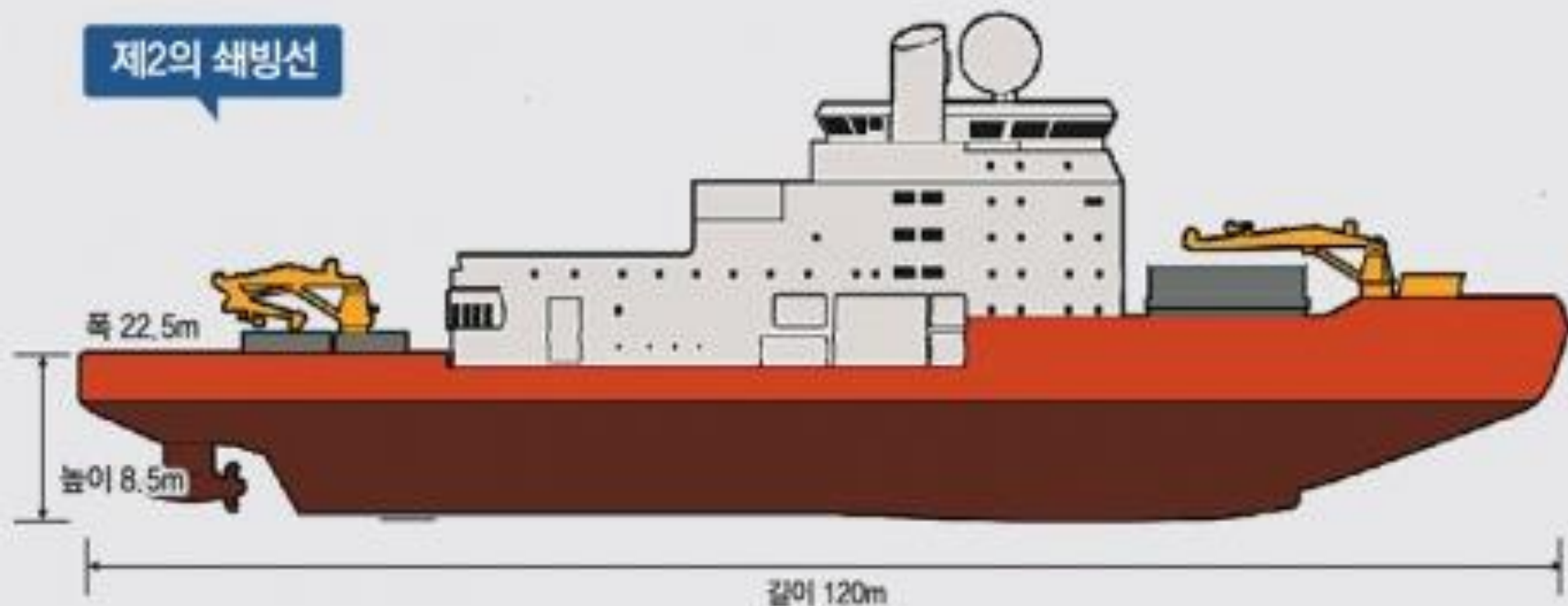
Description	Specification	Description	Specification
L x B x D x d	92 x 21 x 9 x 7.3(6.5)m	Complement	50P (crew :22 + scientiss: 28)
Speed (trial/cruising)	15.2 / 14 knots	Max. Towing Capacity	85 ton at 4~5 knots (Max. B.P:120ton)
Propulsion System	4 Elec. motors x 2 CPP	Streamer	8 x 6,000m
Propeller	CPP 3.7m Dia. with duct	Seismic Compressor	3 x 1,800 cfm (for 6 Gun-Array)
	4 x 1,800 kW with		30ton for oceanographic

1. Overview of Vessel

❖ General Specification

	TAMHAE 2(Current Vessel)	NEW VESSEL
3D Streamers	3 km × 2	6 km × 8
2D Streamers	Up to 6 km	Up to 12 km
Sound Source	4,000 in ³	> 6,000 in³
Tonnage (GRT)	2,085 ton	6,497 ton
Overall Length	64.4 m	92.0 m
Breath	15.0 m	21.00 m
Draft	5.5 m	6.5 m 내 외
Max. Speed	14 knot	17 knot
Cruise Distance	12,000 nautical miles	20,000 nautical miles
People	37	50
Sea State	Level 4 (1.25~2.5 m)	Level 5 (2.5~4 m)
Multi-component Survey	Small Scale OBS/OBC	OBN
Ice Class	x	Ice-1B
Dynamic Positioning	x	DP-2

제2의 쇄빙선



아라온



제2의 쇄빙선

아라온

내한
성능



승선
인원



헬기 운용
대수



무게



주요 활동
해역



쇄빙능력

POLAR20
(두께 2m 얼음을
3노트 속도로 썬)

POLAR10
(두께 1m 얼음을
3노트 속도로 썬)

북극항로와 전통항로



“The Korean Singapore Dream”

Summary

- Shared Use with the academic community has become the new norm in Korea
- RV isabu and other KIOST research vessels operate annually in the Western Pacific and Indian Ocean. The Icebreaking Research Vessel is part of shared-use system
- KIGAM is somewhat concerned about good use of their seismic vessel because the Korean EEZ is very small
- KIGAM is also part of **IODP**
- Hopefully, Korea will become an important contributor to global marine sciences