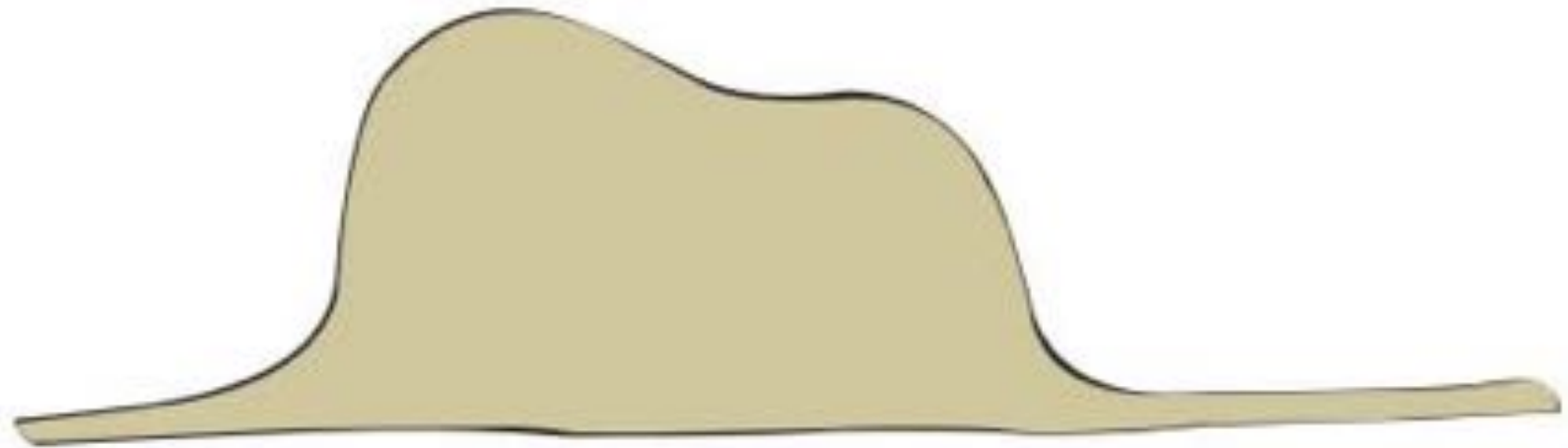


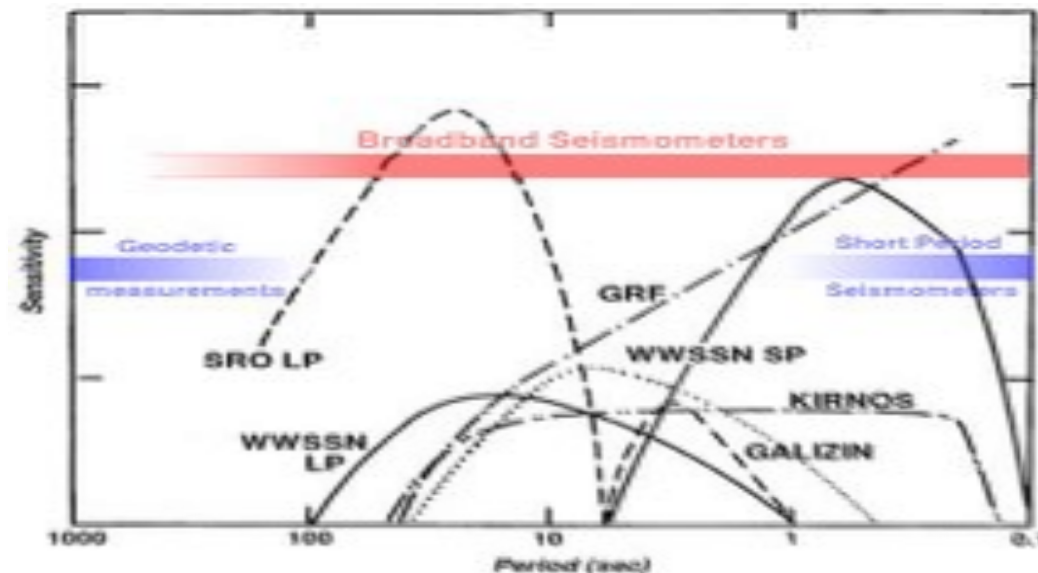
広帯域地震計とめぐる冒険 a broadband-seismometer chase

これ, 楽しくない?



広帯域地震計とめぐる冒険 a broadband-seismometer chase

これ, 楽しくない?



大事なことは目では見えない . . .

The joy of being a seismologist comes to you, when you find something new about the earth's interior from the observation of seismic waves obtained on the surface, and realize that you did it without penetrating the earth or touching or examining it directly.

-- Keiiti Aki (in the SSA presidential address "Possibilities of seismology in the 1980's", BSSA, 70, 1969-1976, 1980)

Global/
Deep Earth/
Geodynamics

Subduction
Zone

Earth activity
Gen-source
(MT/SF)

Volcano
Seismology

OBS
NOMan
LAB/LAS

80' 竹内研

Stanford

Kawakatsu1983grl

KawakatsuSeno1983jgr

Kawakatsu1985nature Caltech

Kawakatsu1989jgr GSJ

KugeKawakatsu1990grl

Kawakatsu1991nature

川勝1991地震

Kawakatsu1995grl

Kawakatsu1996gji

Hara++1995grl

Kawakatsu1998beri

Kawakatsu++1992grl ERI

Kawakatsu++1994grl

Kaneshima++1996science

Yamamoto++1999grl OHP

Kawakatsu++2000jvg OHRC

Yamamoto++2002grl 青い地球の地震学

SSP

Kawa+Niu1994nature

NiuKawakatsu1995grl

NiuKawakatsu1996jpe

KatoKawak2001grl

Kawakatsu2006eps

Nishida++2009science

NECESSArray

IritaniEtal2014eps

Tang++2014ngeo

Kawakatsu++2015gsa

Kawakatsu2016gji

Kawa+Watada2007science

Kawa+Yoshioka2011eps

Song+Kawakatsu2012grl

aniso
tropy

Kim++2021

Kawa+JPMont2008gji

Tsuruoka++2009pepi

Data analysis

Theory/computation

Review

Kawa+Yamamoto2007ToGP

Kawakatsu++2009science

NOMan

Kumar+Kawa2011g3

Takeo++2013jgr

Kawa+Utada2017areps

Takeuchi++2017science

Takeo++2018eps

Isse++2019eps

Kawano++2020grl

Pacific Array

array

real-
time

deep
EQ

array

array

90'

J-array

00'

10'

Global
Deep Earth
Geodynamics

Subduction
Zone

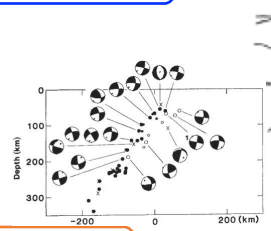
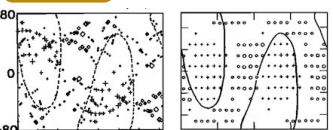
Earth activity
Gen-source
(MT/SF)

Volcano
Seismology

OBS
NOMan
LAB/LAS

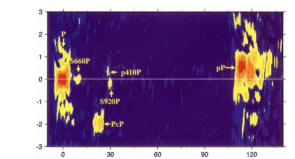
80' 竹内研

Stanford

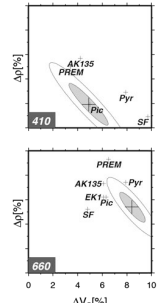


J-array

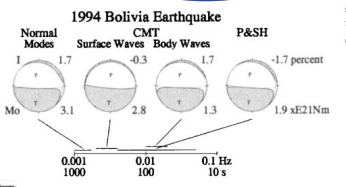
90'



00'

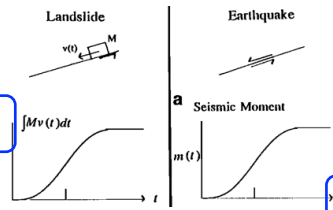


array

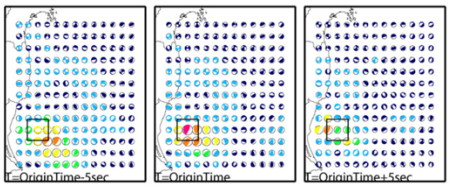
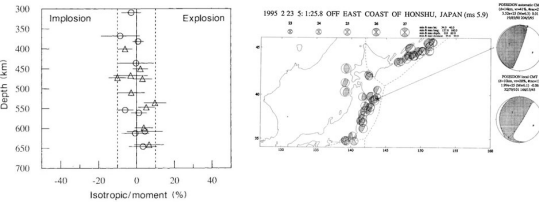
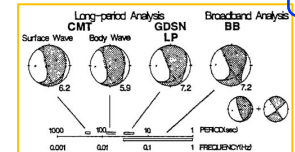


deep
EQ

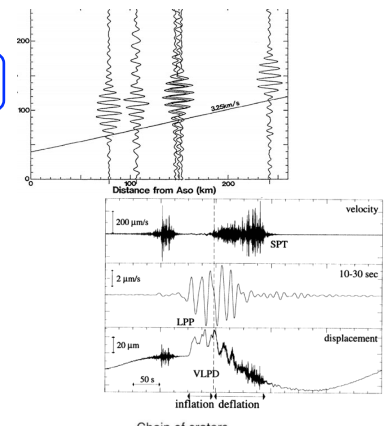
Caltech



GSJ



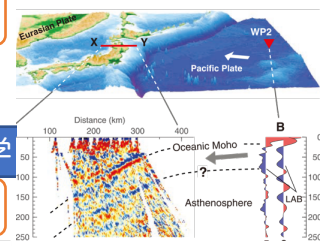
real-time



ERI

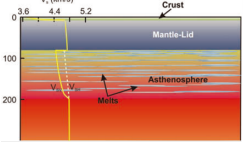
OHP

OHRC

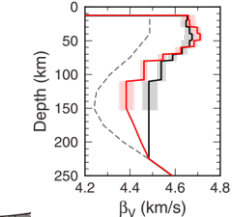


青い地球の地震学

SSP

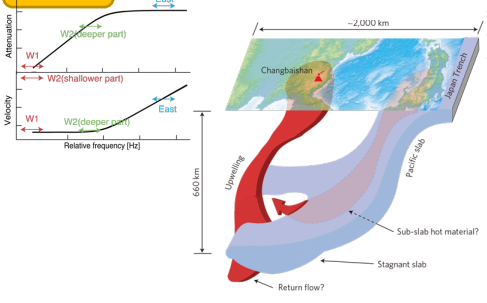


NOMan

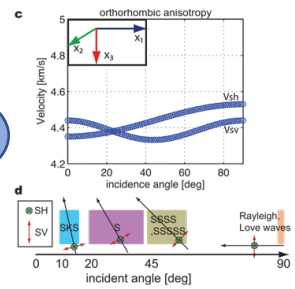


10'

NECESSArray

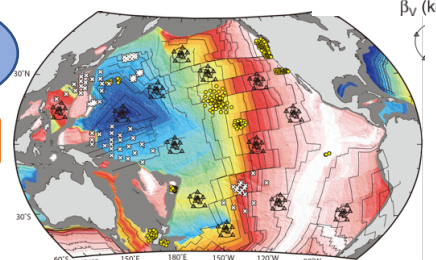


aniso
tropy



array

Pacific Array



広帯域地震計とめぐる冒険

Started in Tsukuba (GSJ) in 1991...



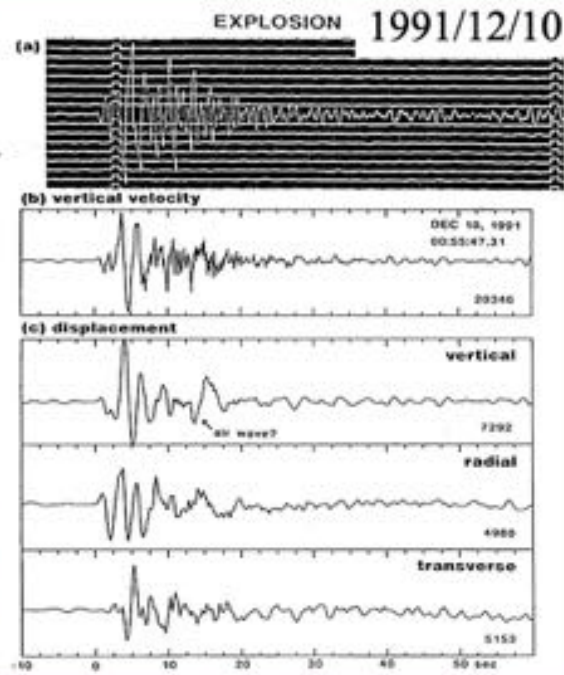
Adventure of Broadband Seismometers



from
Sakurajima
to
Aso

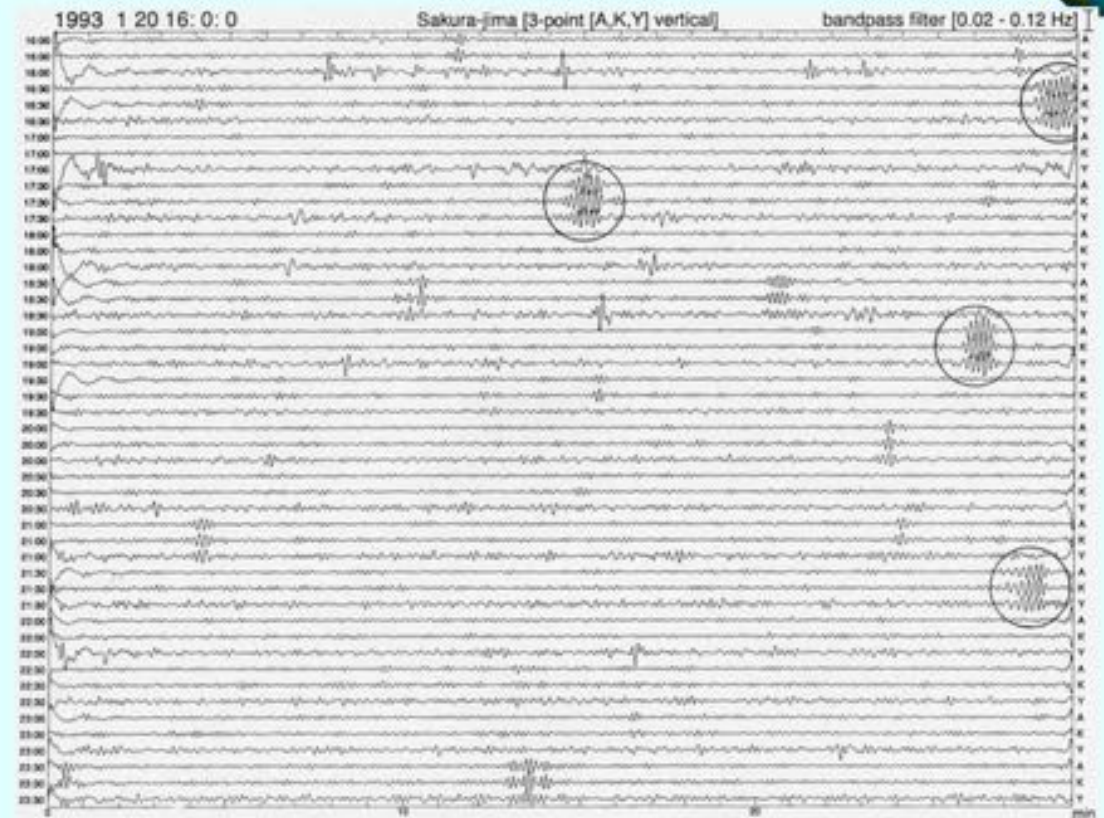


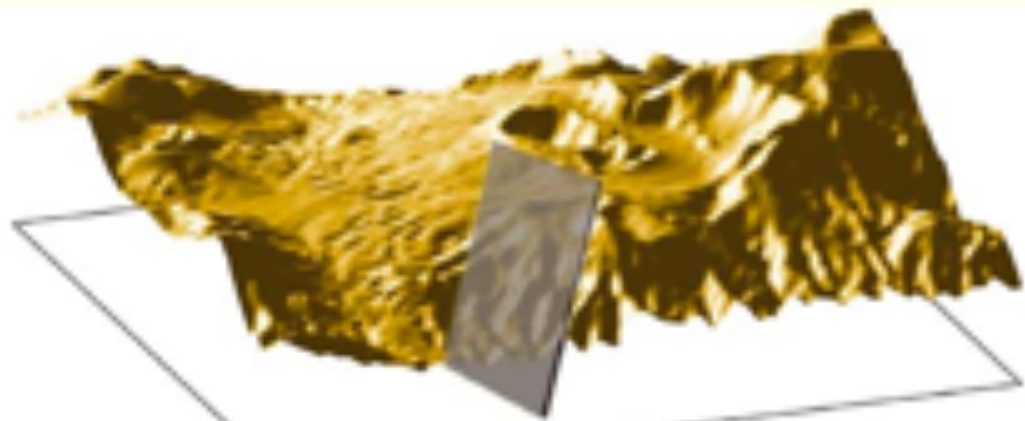
Explosion of Sakura-jima *first* broadband record!



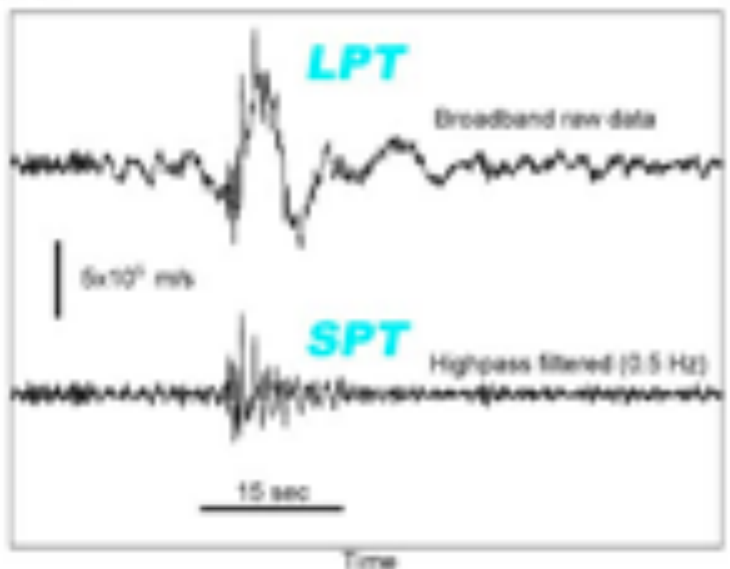
Kawakatsu et al. (1992)

Sakurajima is vibrating @ 10s?

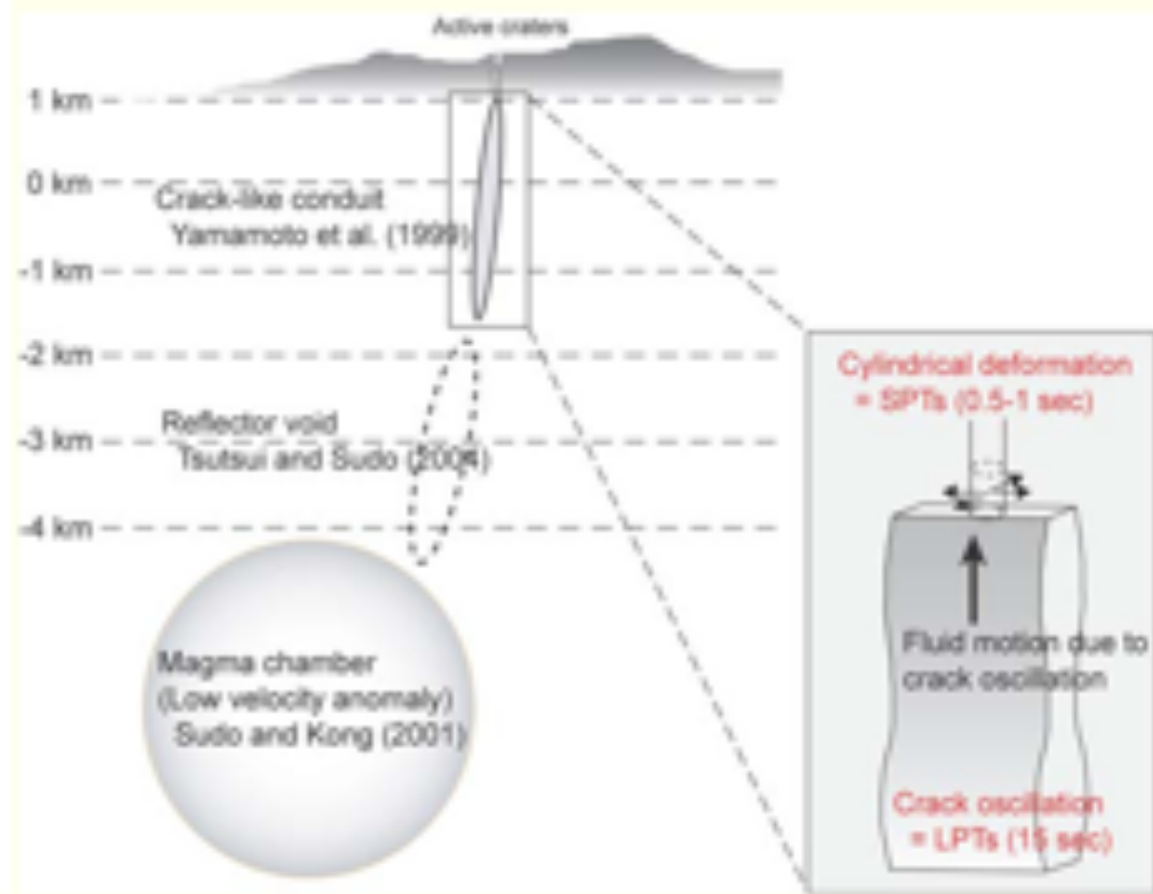




Mt. Aso



ショット



• What's new:
 料研の報告書が出来ました(2008/5/09)

これ, 楽しくない?



The Great Gatsby

“もし人格というものが、人目につく素振り（ジェスチャー）の途切れない連続であるとするれば、この人物にはたしかに驚嘆すべきものがあった。人生のいくつかの約束に向けて、ぴったりと照準を合わせることで、できるときすまされた感覚が、彼には備わっていたのだ。一万マイル離れた場所に起こった地震にさえも反応する精緻な計器につながれているかのように”

-- 村上春樹訳

*The Great Kanto Earthquake and
F. Scott Fitzgerald ,
EOS, Transactions,
American Geophysical Union,
vol. 82, 577, 2001
by H. Kawakatsu & C. R. Bina*

*“If personality is an unbroken
series of successful gestures, then
there was something gorgeous
about him, some heightened
sensitivity to the promises of life,
as if he were related to one of
those intricate machines that
register earthquakes ten thousand
miles away”*

お宝
文理融合
エッセイ



the New York Times

Sunday, September 2, 1923

"All the News That's Fit to Print."

The New York Times.

THE WEATHER

NEW YORK, SUNDAY, SEPTEMBER 2, 1923

GREAT EARTHQUAKE AND FIRE RAVAGE TOKIO AND YOKOHAMA; MANY PERISH, BUILDINGS COLLAPSE; SURVIVORS FLEE IN PANIC; ITALY SEIZES TWO MORE ISLANDS; LEAGUE TAKES UP THE CASE

COAL STRIKE FORCES INDEPENDENT TIE-UP; EXCESS IN PARLEY'S
61 of 12,000 Miners, Except Maintenance Men, Stop Work and Quit.

DISPUTANTS CENTER AGAIN
Must Be Settled for Staff of Mine and Their Agents and Workmen.

GOVERNOR WANTS IMPROVAL
Should Not Be Held in Office, and Governor's Wife Resigns of Public Opinion.

PHYSICIANS DENY ITALIAN HAS CANCER
Dr. John J. Walsh, President of National Cancer Society.

ALIENS ON FOUR SHIPS TOO SOON TO ENTER
Fleet of 1,200 Will Arrive in Sea Instead of After War.

WIDE GREEK ISLANDS SEIZED
Italian Forces Occupy Passes and Antipassos, Strategic Points.

GREEN STEAMER FIRED ON
Shelled by Under Watercraft, Italian Submarine Command of Tolo Waterway.

NO MORE SECURED LINEUP
Red Hawk Order Still Being Applied to Current Arrests, Ready for Action.

AREA OF EARTHQUAKE DAMAGE IN JAPAN
JAPAN SEA PACIFIC OCEAN

FIRES RAGE IN WHOLE TOKYO DISTRICT
All Yokohama Burning and Neighboring Towns Are Involved as Water Systems Are Wrecked—Business Suspended.

TREMENDOUS LOSS OF LIFE AND PROPERTY INDICATED
700 Are Killed in the Asakusa Tower—People Flee to Shores—Earthquake Centres in the East—Volcano of Fuji—Cables Interrupted.

COAST GUARD SCRAMBLE TO EXPLORE OF JAPAN
Many Orders Vessels to Tokyo from the Coast Guard.

COAST GUARD SCRAMBLE TO EXPLORE OF JAPAN
Many Orders Vessels to Tokyo from the Coast Guard.

Japanese Earthquake Recorded Across the World From Hawaii to London by Observatory Instruments

HILO, Hawaii, Sept. 1 (Associated Press).—The seismograph at Keenakekua at 7 o'clock last night registered a severe distant earthquake.

Sampans in the harbor were warned to beware of a tidal wave. Reports received here said a slight tidal wave was noticed at the Island of Puna, off the coast of Ecuador. No damage was reported.

BERKELEY, Cal., Sept. 1.—The seismograph of the University of California recorded a "very severe" earthquake starting at 10 minutes and 16 seconds after 7 o'clock last night and lasting for three hours and fifty minutes. The indicated distance was 5,400 miles and the point of origin in the region between Tokio and Osaka, Japan.

WASHINGTON, Sept. 1.—An earthquake described as extremely severe and continuing nearly five hours last night and early today was recorded on the Georgetown University seismograph. Beginning at 10:12 P. M., the disturbance reached a maximum intensity between 10:30 and 11 o'clock, and lasted until 3 A. M. Director Tondorf of the observatory estimated the centre of the disturbance at about 6,300 miles from Washington.

WEST BROMWICH, England, Sept. 1 (Associated Press).—An exceptionally severe earthquake shock was recorded at the observatory here at about 4:11 this morning.

The seismograph indicated that the origin of the tremors was 5,500 miles distant from here. The movement was sufficiently strong to ring an alarm bell and disarrange the mechanism of the recording instrument.

Acknowledgement:

The book *Honyaku Yawa* by *Haruki MURAKAMI* and *Motoyuki SHIBATA* was our inspiration for examining *The Great Gatsby* anew.

The Great Kanto Earthquake and F. Scott Fitzgerald , EOS, Transactions, American Geophysical Union, vol. 82, 577, 2001 by H. Kawakatsu & C. R. Bina

<http://www.eri.u-tokyo.ac.jp/people/hitosi/gatsby.html>

a Christmas present:

川勝均さま

先日、地震／ギャツビー・エッセイをお送りいただいた文学部の柴田です。

村上春樹さんの奥さんから葉書が来て、春樹さんがあのエッセイを「熱心に読んで」いて、「面白かった」と言っていたそうです。

01/12/24 柴田元幸

Started in Beijing in 2005...



NECESSArray

NorthEast China Extended SeiSmic Array

international collaboration
Yong CHEN, Qi-fu CHEN
(CEA, China)
Steve GRAND, James NI,
Fenglin NIU (USA)

China	→ 140
Japan+US	→ 140
total	280

2008~2010



宮川 川勝

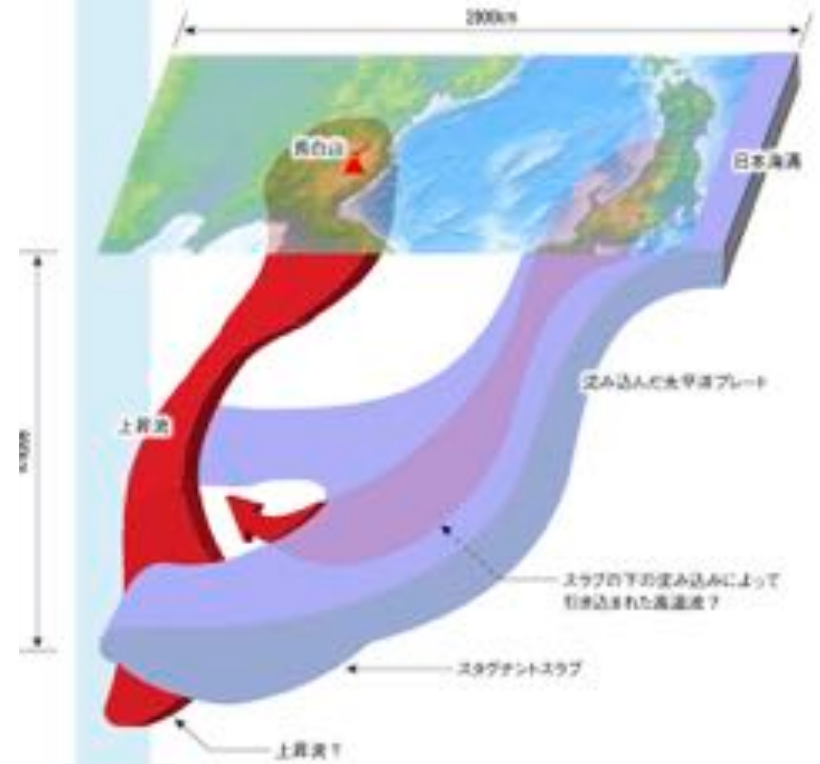
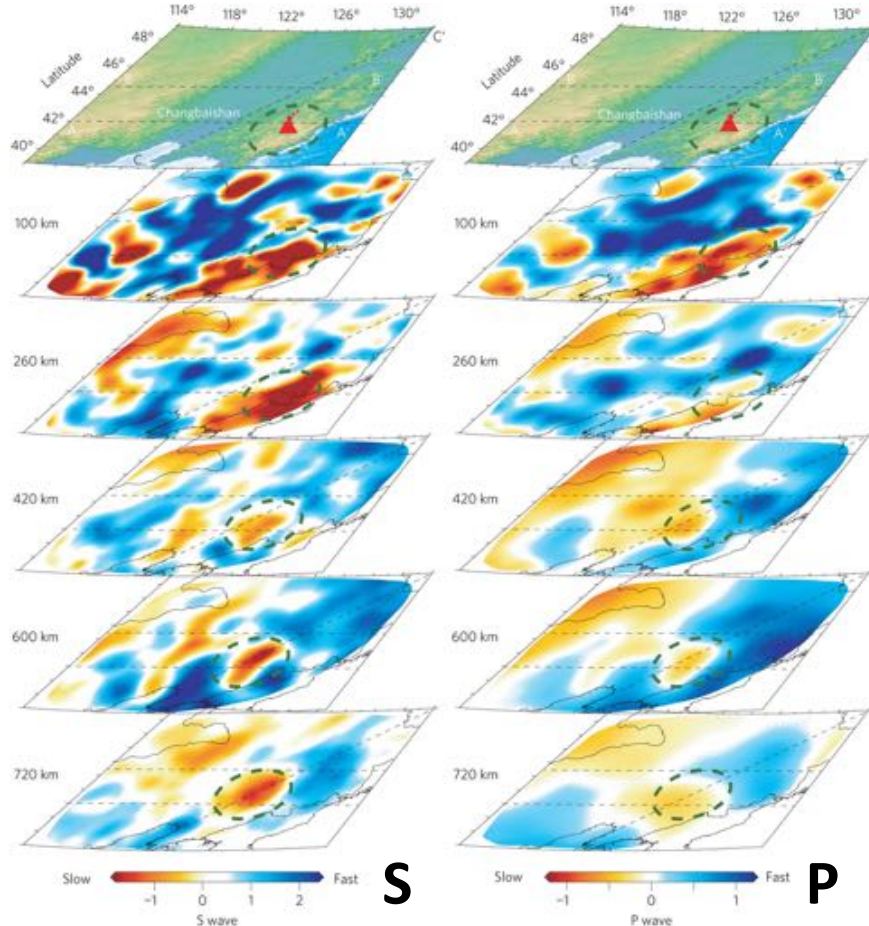
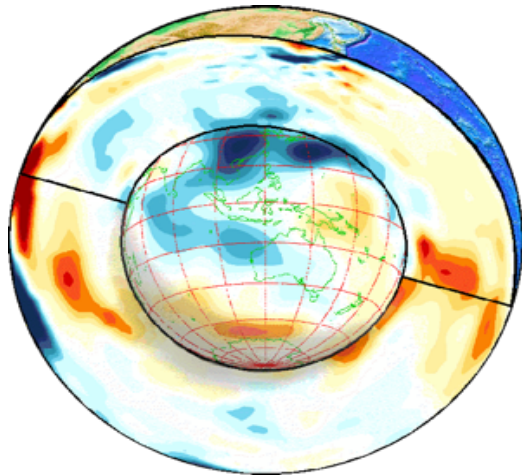
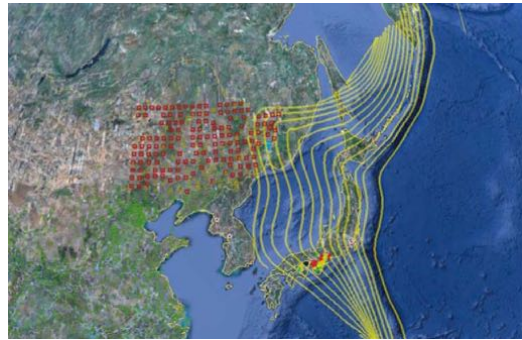
Grand

出原

利根川 入谷 Chen 鈕 田中 Tang

Changbaishan volcanism in northeast China linked to subduction-induced mantle upwelling

Youcai Tang^{1,2}, Masayuki Obayashi³, Fenglin Niu^{1,4*}, Stephen P. Grand², Yongshun John Chen⁵, Hitoshi Kawakatsu⁶, Satoru Tanaka³, Jieyuan Ning⁵ and James F. Ni⁷



海 半球観測研究センターの川勝 均 教授らは、広帯域地震計120点から成る大規模な地震観測網NECESSArrayを、中国とアメリカとの国際協力で、中国東北部に構築。2009年9月から2011年8月まで2年間、観測を行った。中国大陸の下にある深部スラブの穴、スラブと火山形成の関係、マンツルの底、内核の東半球と西半球……。予測通りのもの、予測を覆すもの。NECESSArrayによって見えてきた地球内部の新しい姿について、良い観測研究には「予測する“理”と予測を外す“勘”が必要」と言う川勝教授に聞いた。

特集
フロンティア地球観測
予測外の発見を求めて

Started at ERI in 2006...

「知っている」ということと「分かっている」ということは全く別のこと

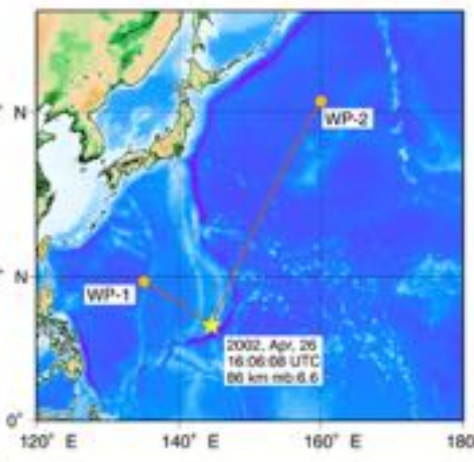
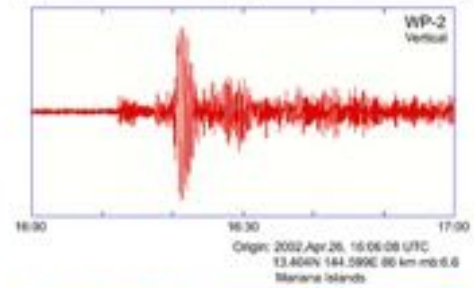
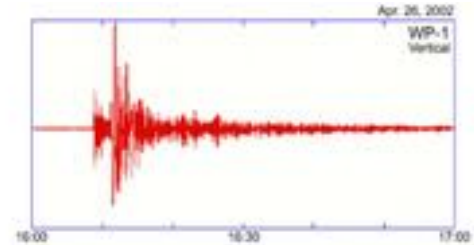
海半球 10-year external review

“陸と同様のレベルの観測ができる！”

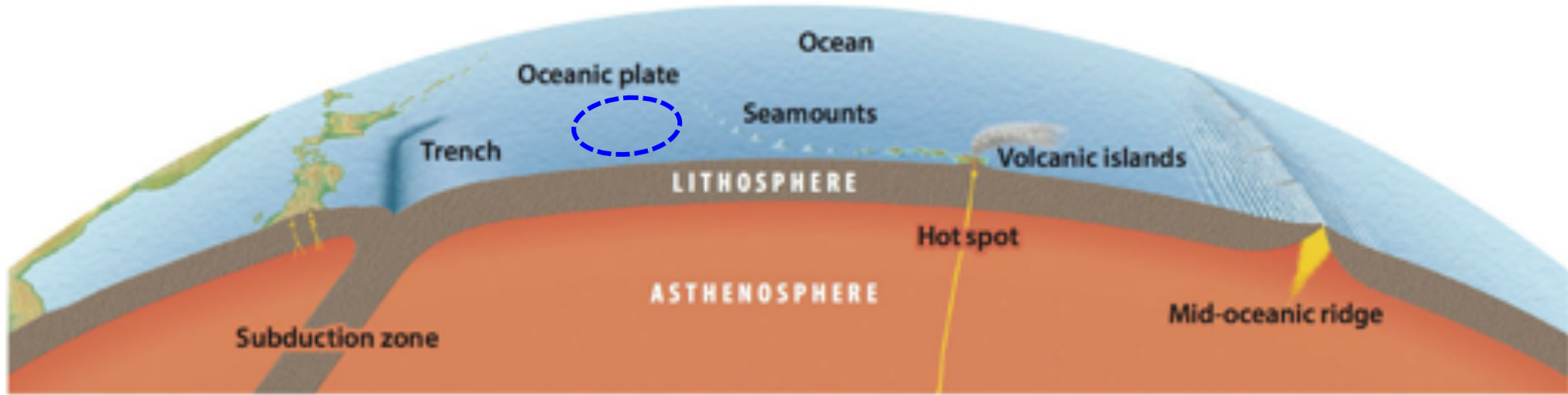


Developments

Seafloor Borehole Seismic Observatory (SBSO)

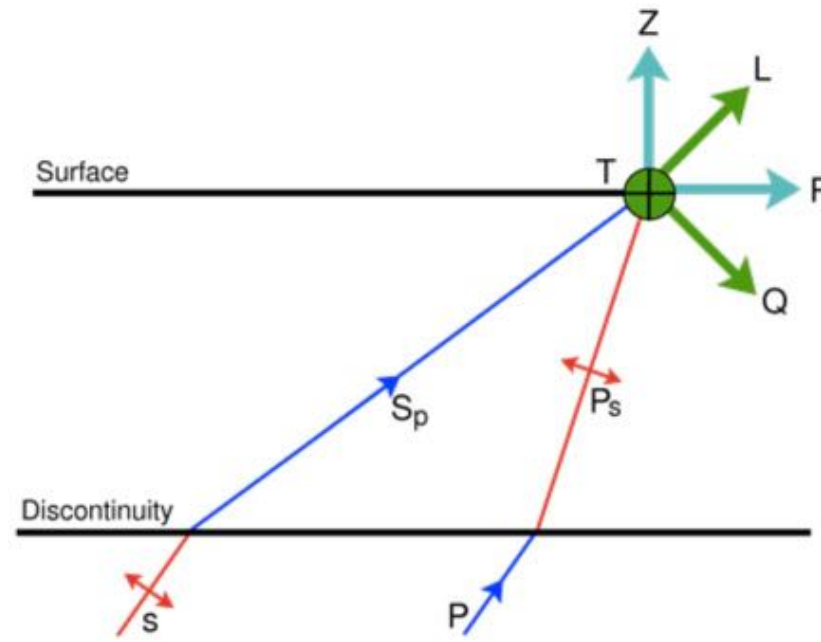


“陸と同様のレベルの観測ができる！”



High-school text-book view of plate tectonics

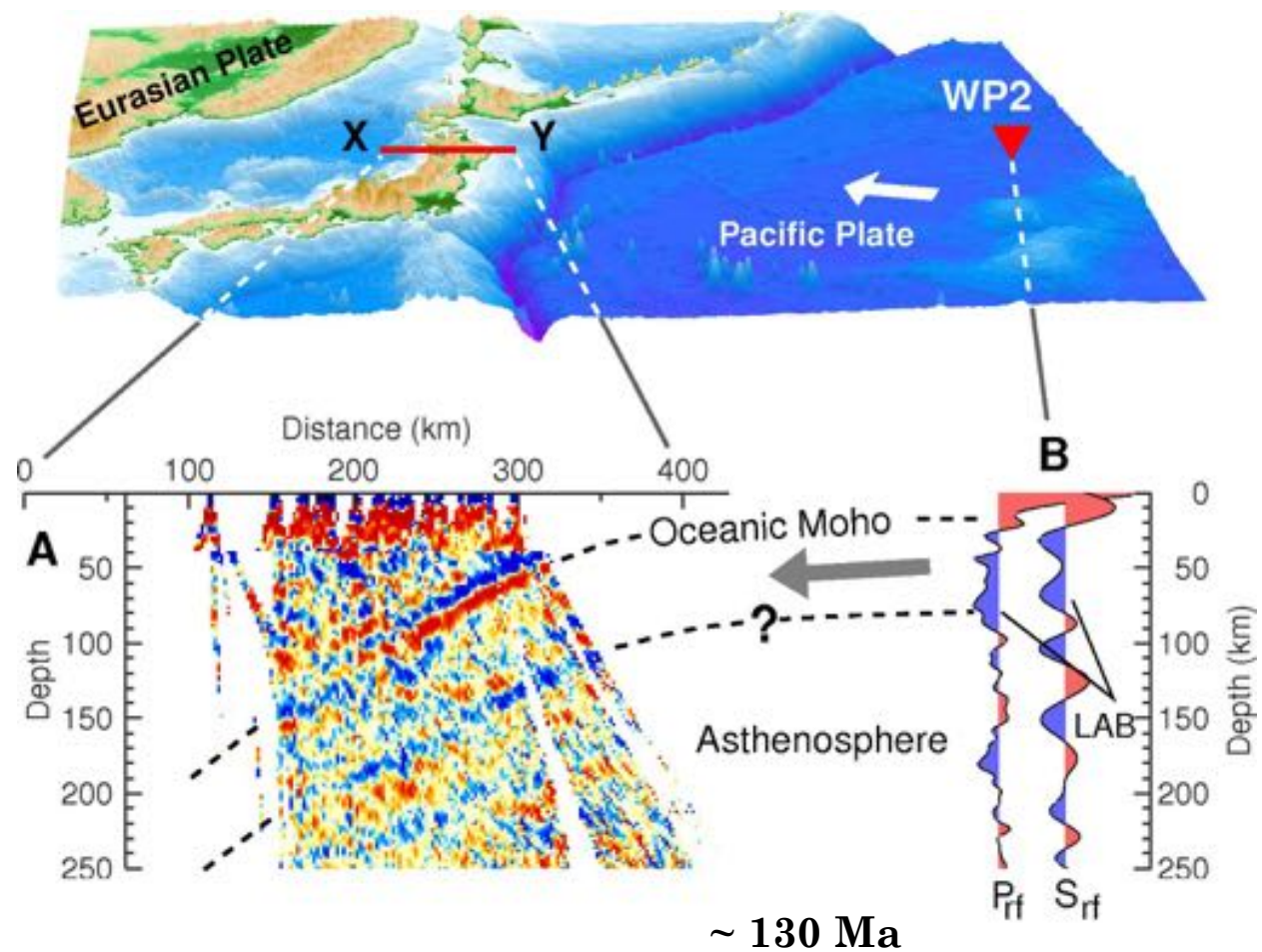
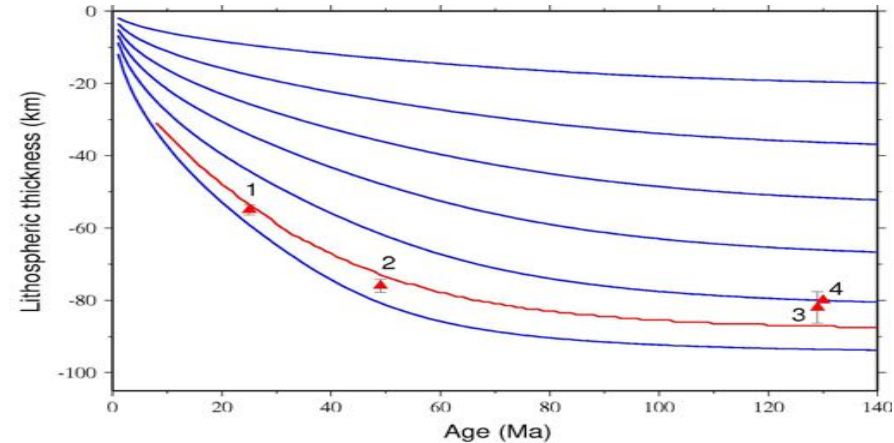
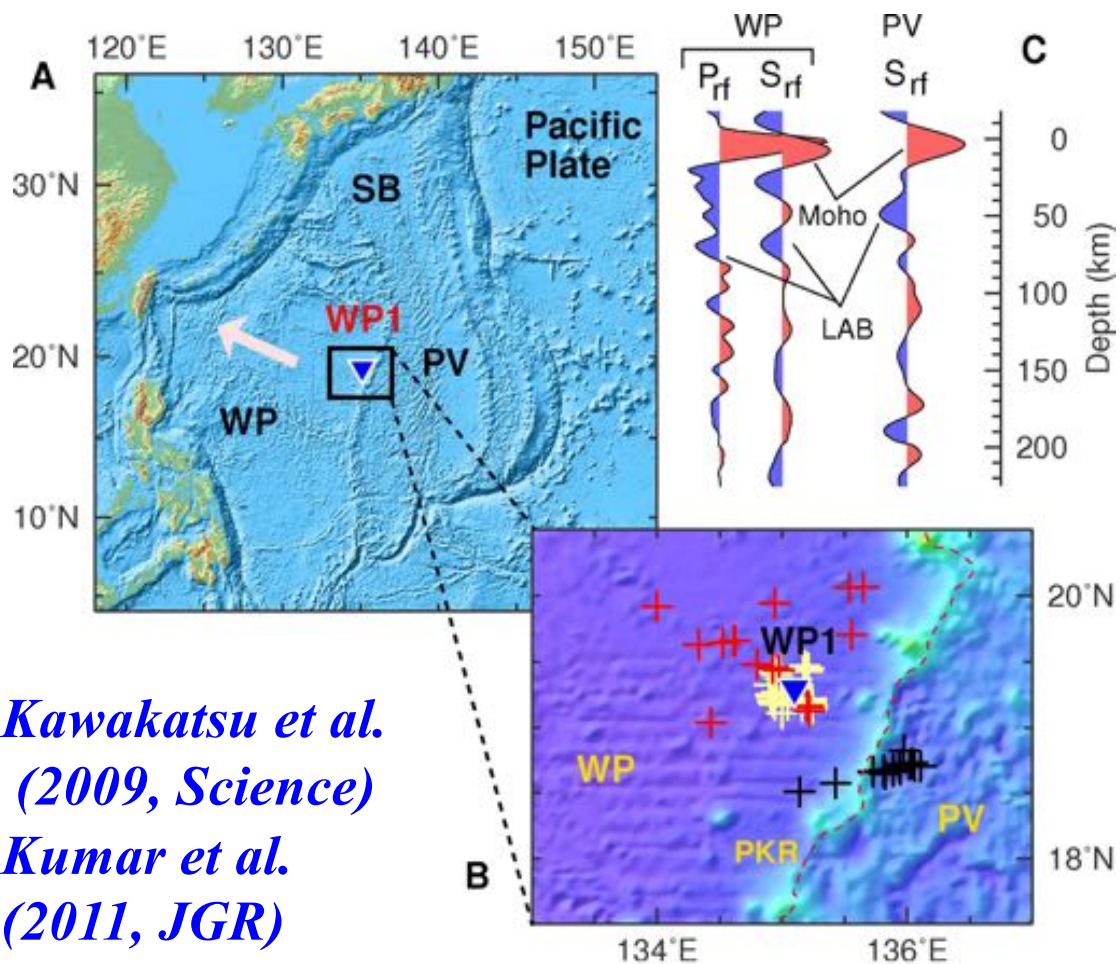
LAB
(lithosphere-asthenosphere boundary)



Prakash Kumar
(NGRI)

Receiver Function (RF) analyses of Seafloor Borehole Broadband Seismic Observatory data

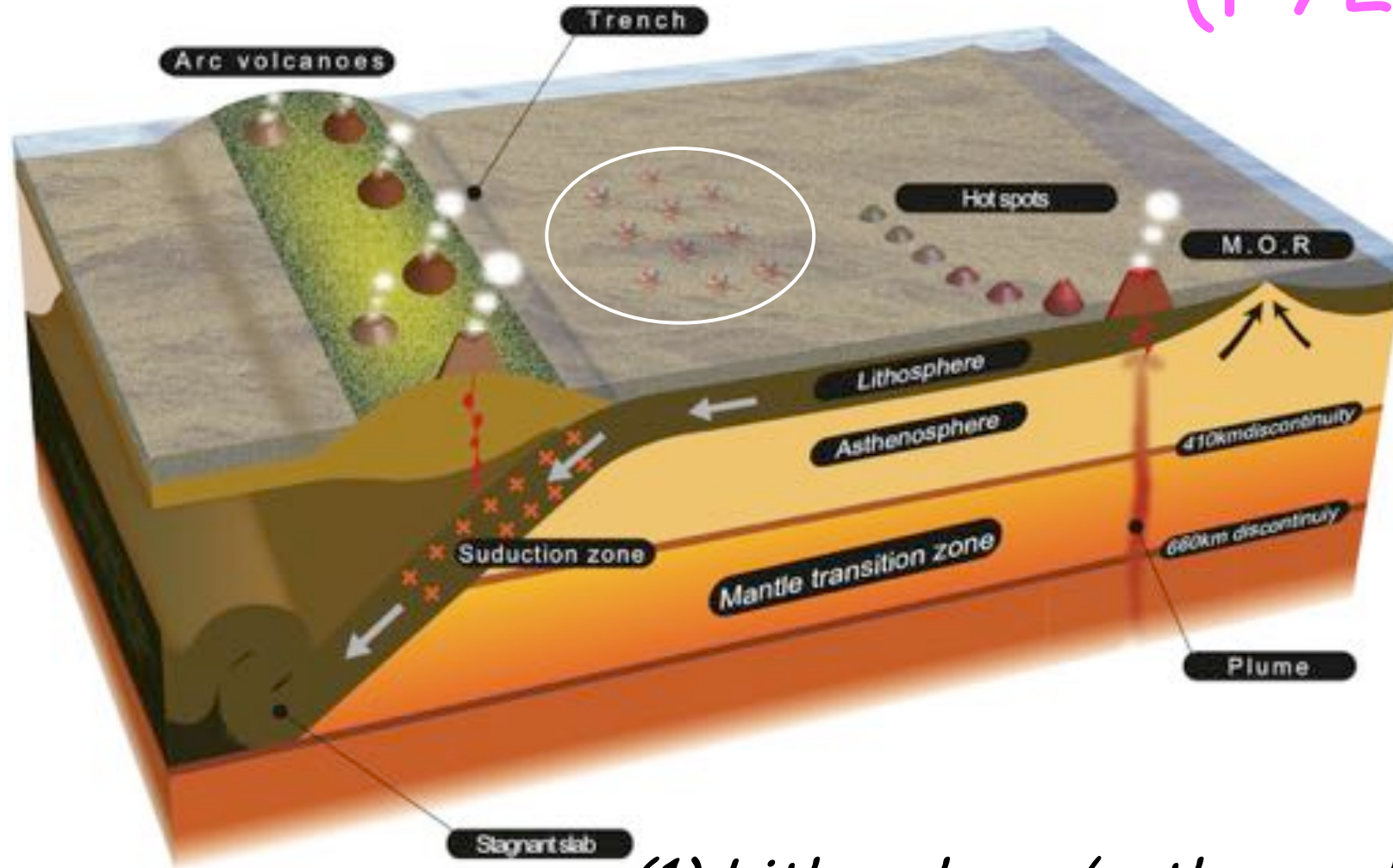
~ 50 Ma ~ 20 Ma



Kawakatsu et al. (2009, Science)
Kumar et al. (2011, JGR)

~ 130 Ma

Normal Oceanic Mantle (NOMan) Project (FY2010-2014)

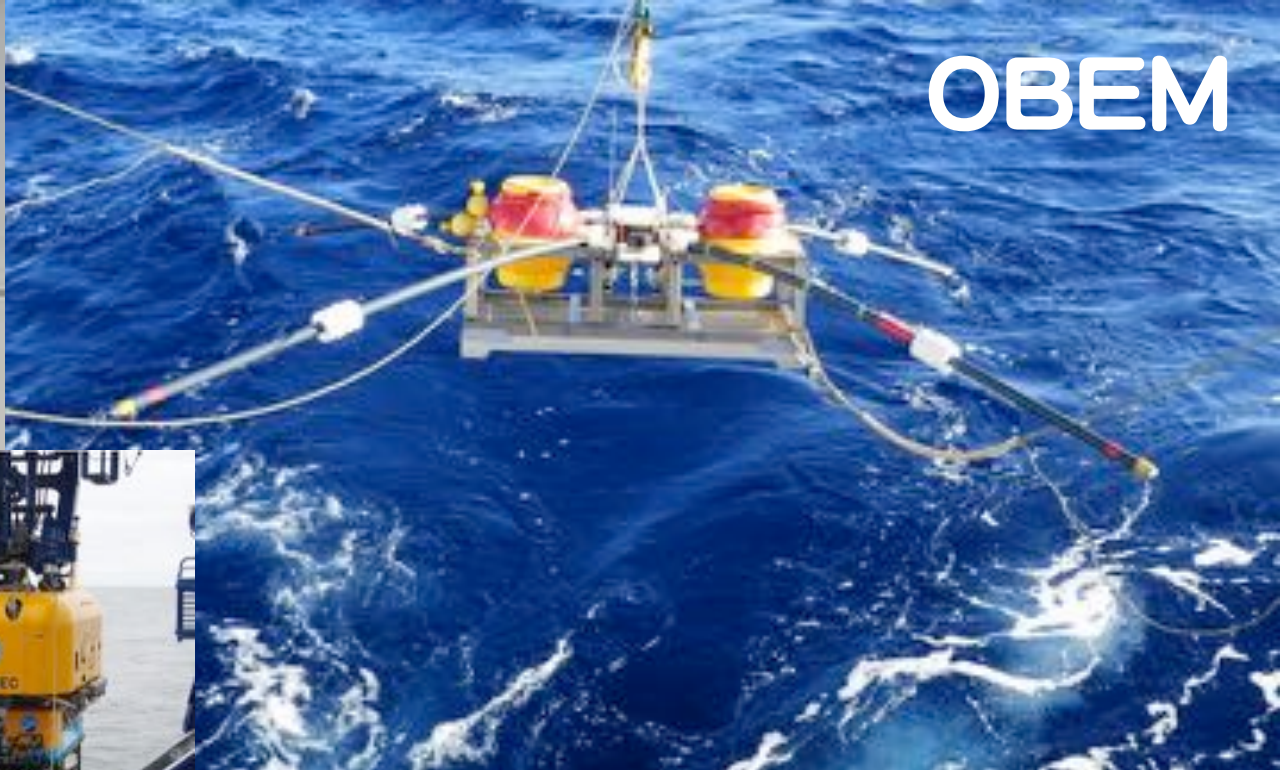


- (1) Lithosphere/asthenosphere system
- (2) Water (volatiles) in the transition zone

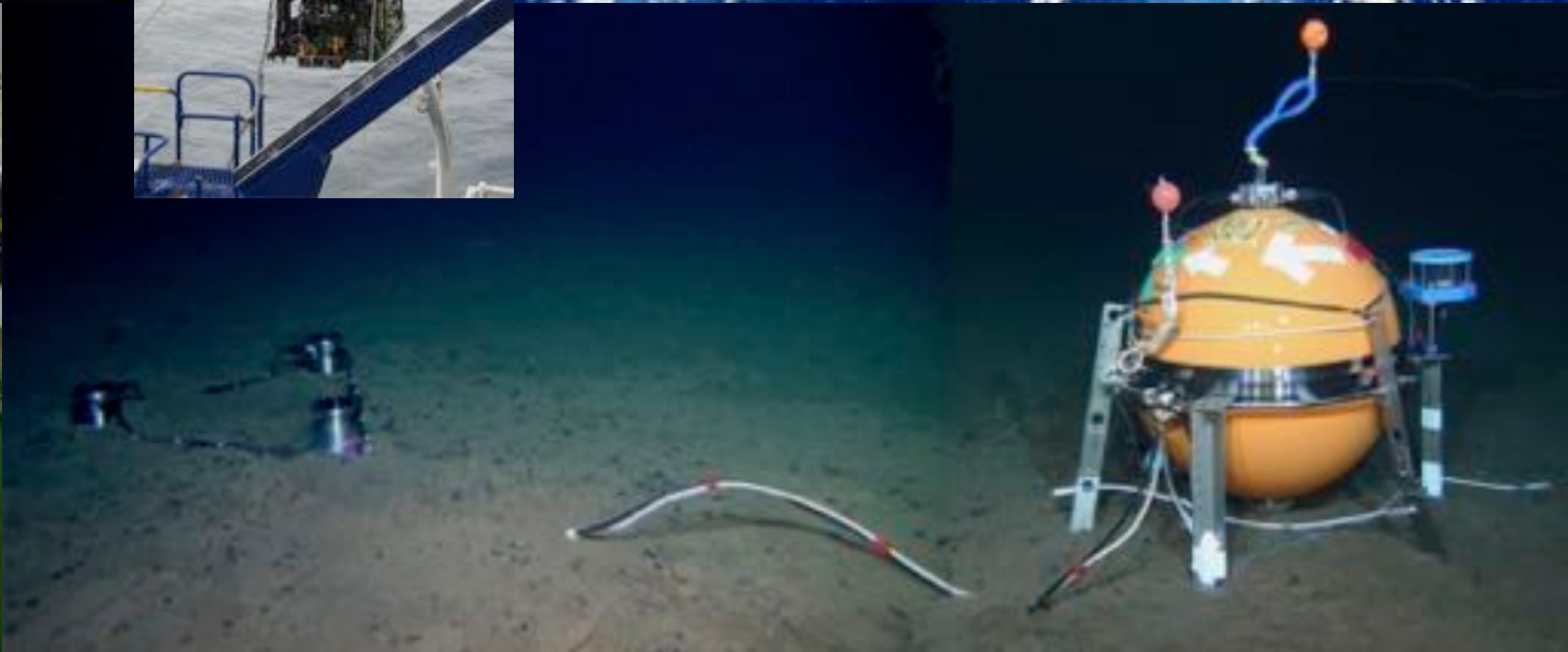
BBOBS



OBEM



BBOBS-NX

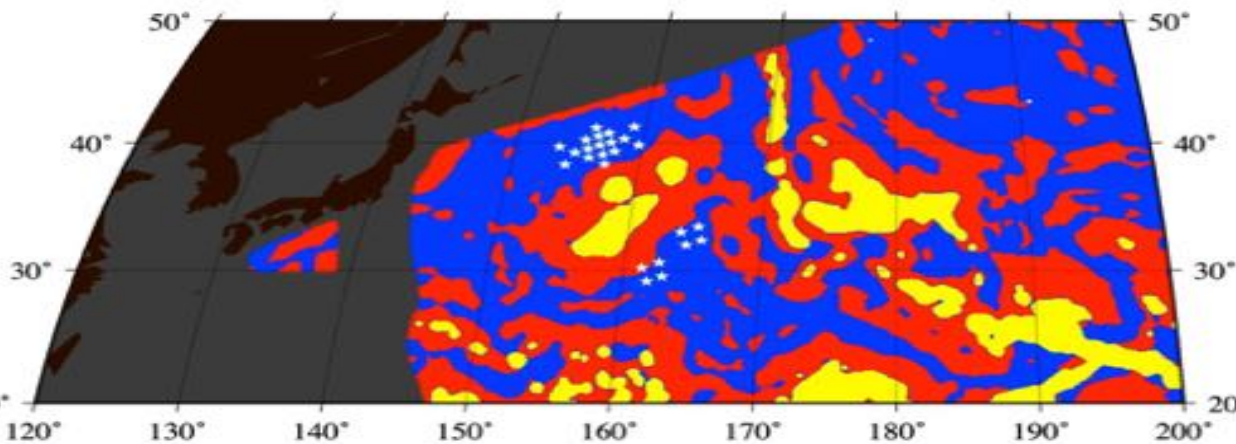


Deployment

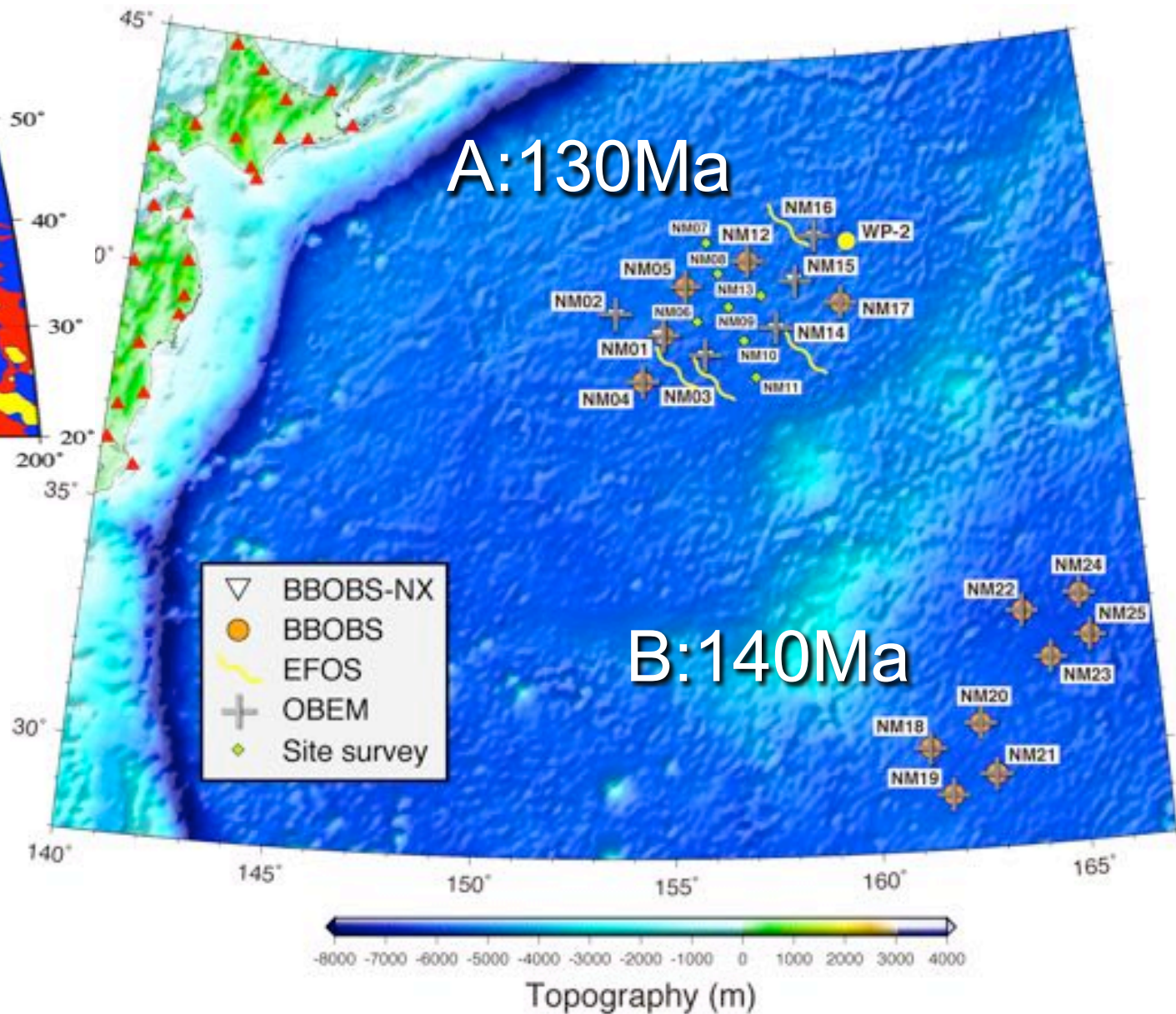
A: 2010/6-2012/8-2014/9

B: 2011/11-2013/8-2014/9

Normal crust (blue) by correlation criterion

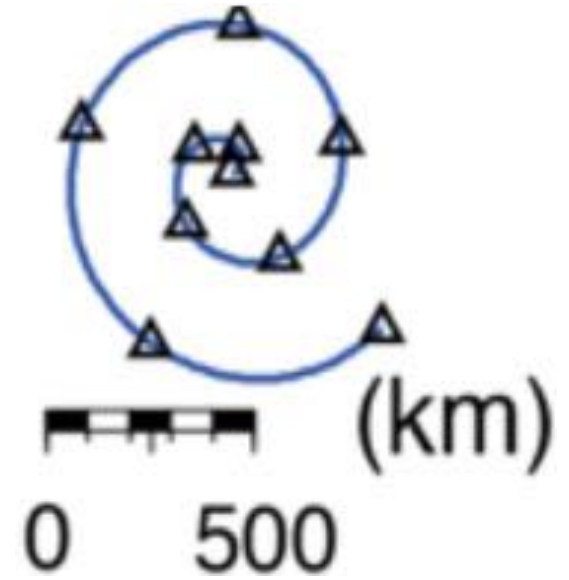
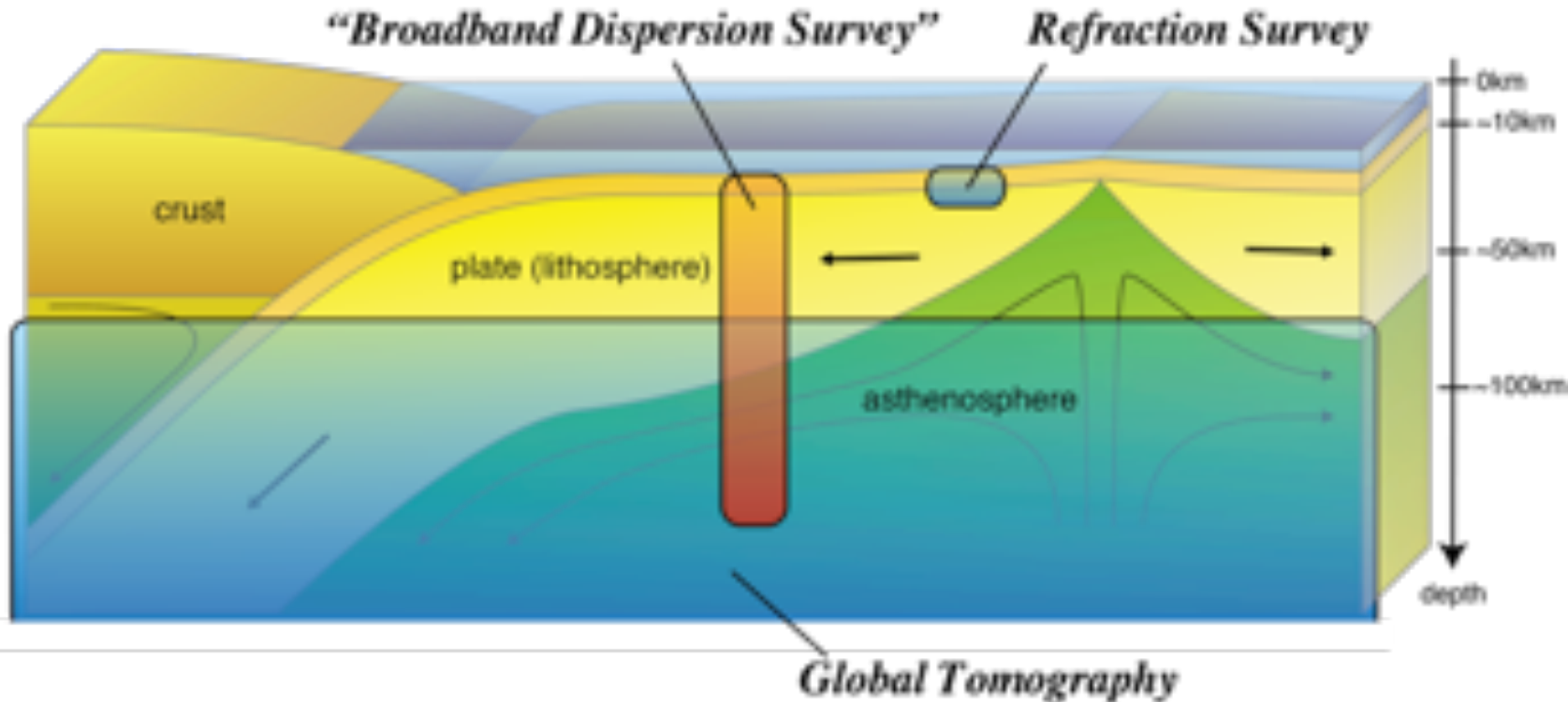


Korenaga & Korenaga (2008)

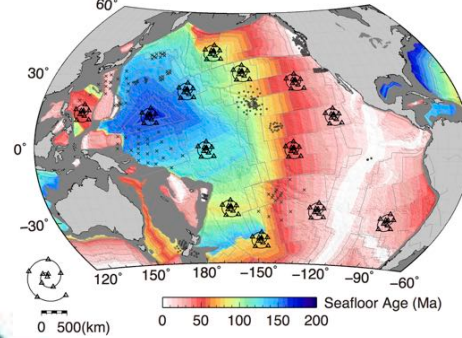
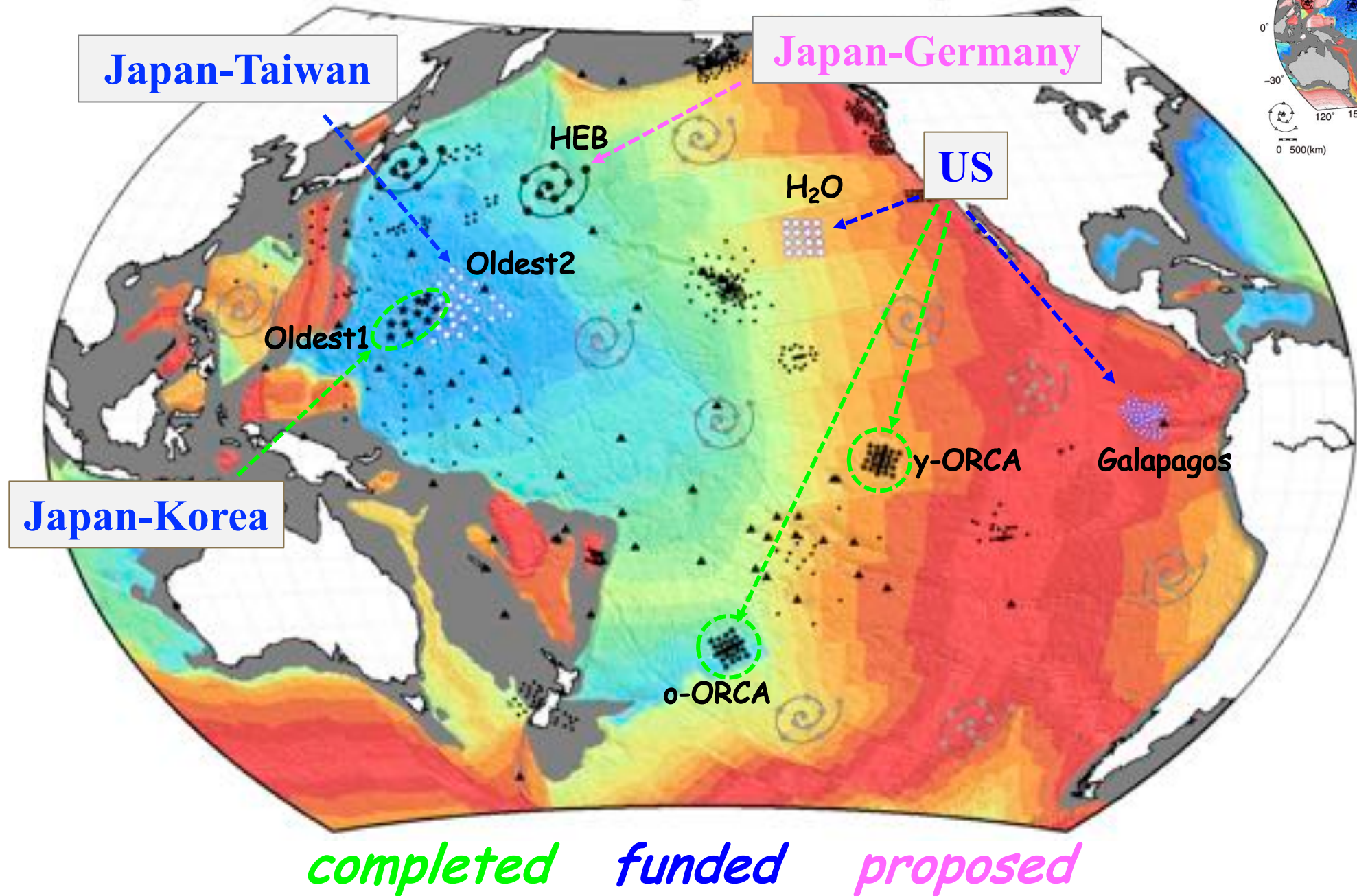


Broadband Ocean Bottom Seismology

- 1D S-wave anisotropic (RA/AA) structure of the entire lithosphere/asthenosphere system can be estimated by deploying ~10-15 broadband OBSs, & more



Pacific Array 2021 spring



Enigma of Seafloor flattening

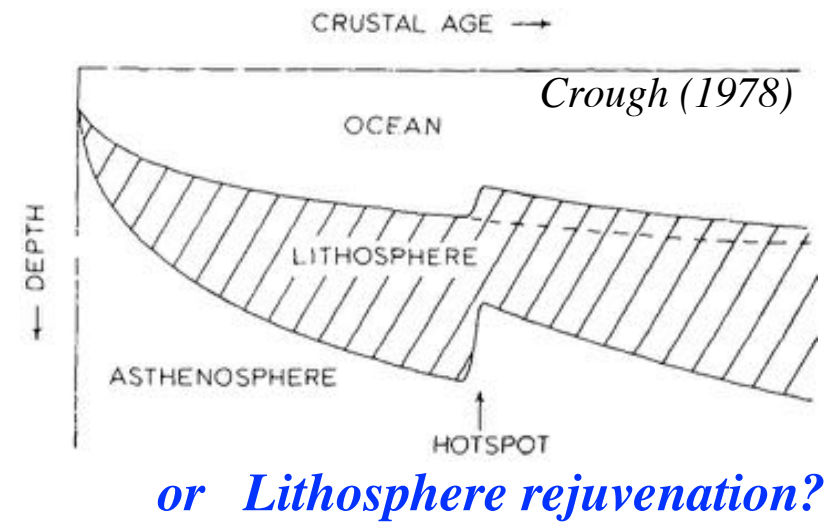
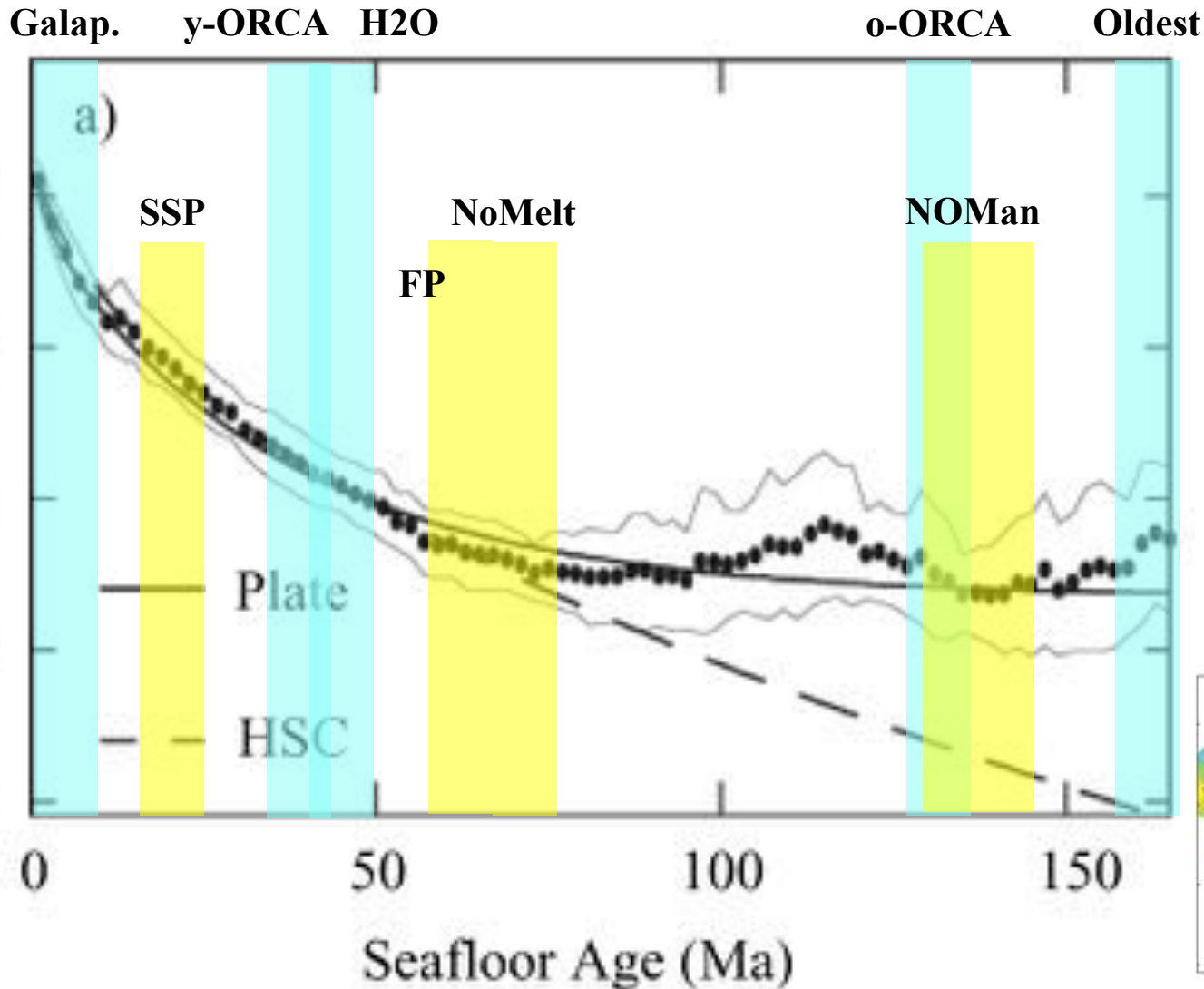
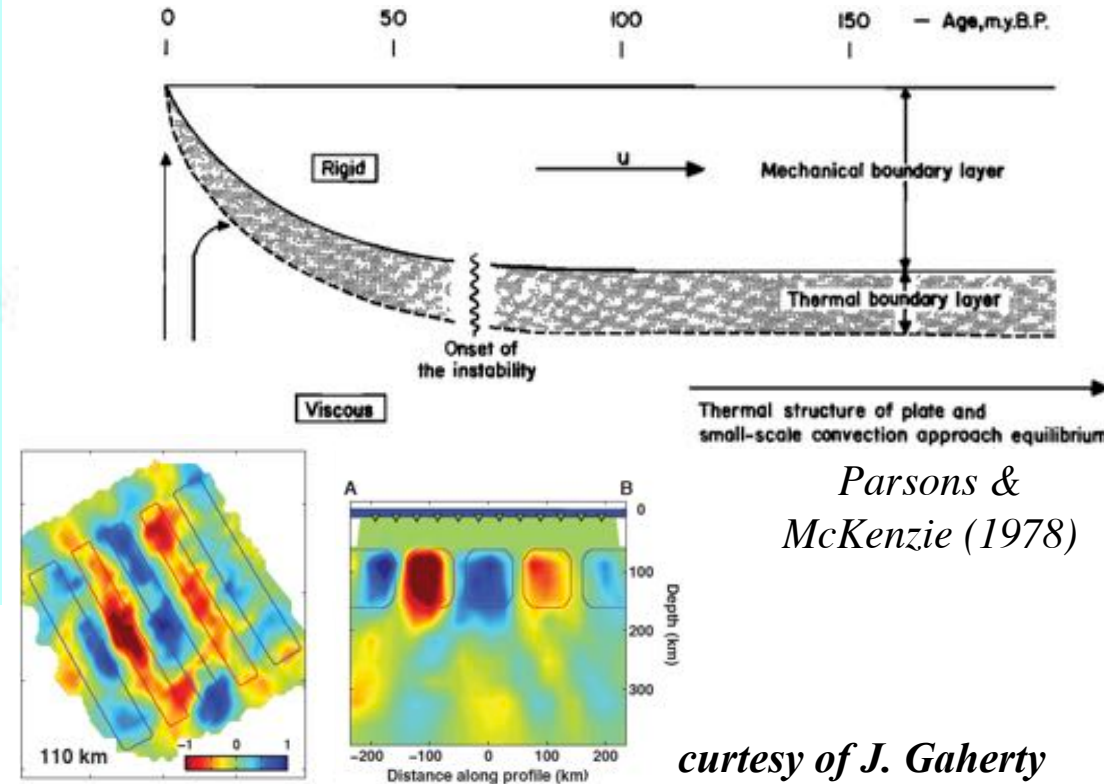


Plate model & small-scale convection?



to be continued

A new adventure will start in 2021 ...

inspired by ...

