MOWALL
Moho Observation along transform fault WALLs

Background

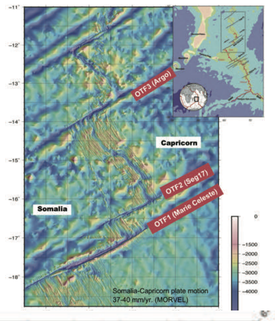
- In 1960’ s, we understood mid-ocean ridges as divergent plate boundaries where new oceanic crust and lithophsere are produced.
- In 1980’ s, we believed that crustal structure and ridge process were controlled by spreading rate.
- In 1990’ s, we discovered unexpected morphology/lithology and large diversity in global MORs, e.g., OCCs, ultraslow ridges ....
- Now, we acept the concept that modes of crustal formation at MORs is cotrolled by a rate between melt supply and plate separation (value M, Buck et al., 2005).
- But, we do not know what controlls the melt supply and its spatio-tempral variation. Does it depend on phisical condition beneath MORs or on chemical heterogeneity of uppe mantle?

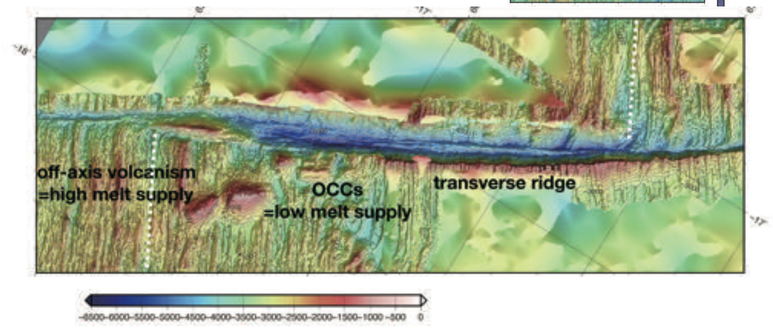
- Whole crustal section is exposed in chronological order along long oceanic transforms.
- Pioneering works along the Vema Transform (e.g., Bonatti et al., 2003) shows a 3-4 Myr. fluctuation of melt supply of this ridge segment based on dense sampling and gravity analysis.
- However, the cause of this fluctuation is still unknown and we do not know if this fluctuation is general character of global MORs. And the Vema study area is characterized by well-ordered abysal hills and does not include structures such as OCCs and smooth seafloor indicating lower melt supply.

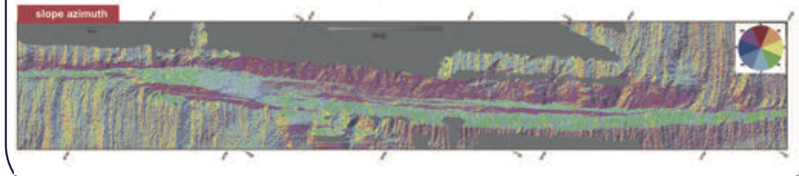
MOWALL-CIR

- Central Indian Ridge 18°S: full spreading rate 37-40mm/yr
- Marie Celeste Transform: offset ~215km (=12 Myr.)
- Pre-existed bathymetry data shows the sourhern transform wall is a good target to observe large temporal variation of melt supply
  - sheet lava on ridge axis / off-axis volcanoes = high melt supply
  - OCCs = low melt supply
  - transverse ridge = good exposure of crust section is expected

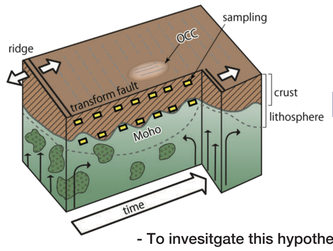
- R/V Hakuho-maru cruise is scheduled in October 2020. Systematic rock dredges and geophysical mapping are planned.







Concept



Question to be sloved

To obtain a comprehensive understanding in diversity of crustal structure and mid-ocean ridge proces, and spatio-temporal variation of chemical/phisical properties of underlying mantle.

Working Hypothesis

Diversity and temporal variation of crustal structure and its formation process are controlled by spatial heterogeneity of chemical composition of upper mantle.

- To invesitgate this hypothesis, long oceanic transform wall is the best place, where we can access a long-term (> 10 Myr.) record of whole crustal section.
- We select two focused study areas;
  - Marie Celeste Transform at the Central Indian Ridge
  - Parece Vela Rift in the Philippine Sea
- Systematic rock sampling along transform walls and bathymetryc/gravity surveys

Structure

MOWALL-CIR

Central Indian Ridge
Marie Celeste OTF
- slow-spreading MOR
- active
- very long, flexure ridge
- OCC/off-axis large volcano =large variation in M

MOWALL-PVB

Parece Vela Basin
S1/S2, S2/S3 OTFs
- backarc
- inactive
- OCC/SS=large variation in M
- no normal phase after OCC/SS

long-term variation

short-term, large variation

CIR-off axis

MOWALL-SWIR

MOWALL-SB

big-MOWALL
- cold seepage on transform floor
- geobiological studies

Time line

MEXT KAKENHI:Grants-in-Aid for Scientific Research (B) 2018-2022

	2018	2019-2021	2022-
MOWALL-PVB	MOR process forming OCC/SS; prep. survey data analysis		
MOWALL-CIR off-axis(KH-15-5)	processing	long-term variation using long-offset OTF; prep. survey data analysis	
MOWALL-SWIR	ancillary proposal for East Scotia survey project; comparative study	prep. survey analysis	
big-MOWALL			collaboration with biology/chemistry

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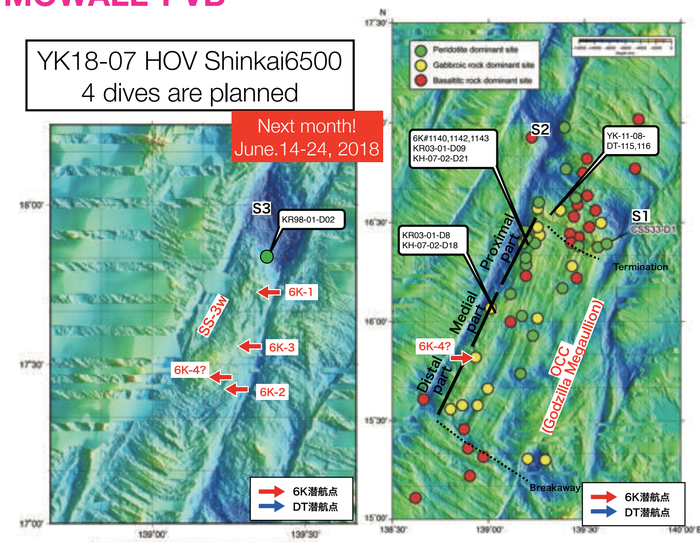
MOWALL-PVB

YK18-07 HOV Shinkai6500
4 dives are planned

Next month!
June.14-24, 2018



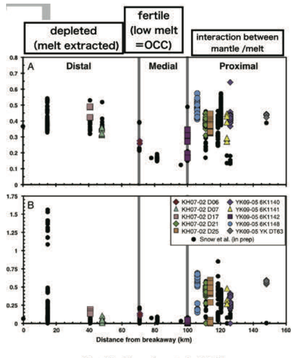
(Modified Ohara, 2016, age data from Tani et al., 2011)

- Parec Vela backarc basin spreading center
- Rift axis is highly segmented and had been active by 8-10Ma.

- Segment S1 at 16°30’ N is accompanied with the world largest OCC “Godzila Megamullion (GM)”
- Focused rock sampling was done over the mullion strucuture.
- Peridotite samples show clear fluctuation of degree of melting from distal, medial to proximal parts of the GM.

- Segment S2 and S3 are accompanied by smooth seafloors.

- R/V Yokosuka cruise is scheduled in June, 2018, with 4 Shinkai 6500 dives. We plan to focus the transfom fault wall southwest of Segment S3, where smooth seafloor is dominant. Detailed graviy survey is also planned.



(Modified Loocke et al., 2013)

If you are interested in MOWALL, vist our web site http://ofgs.aori.u-tokyo.ac.jp/~okino/mowall/ (now only in Japanese, English version is coming soon) and contact Kyoko OKINO (okino@aori.u-tokyo.ac.jp).