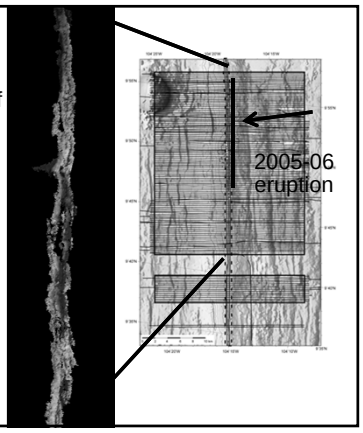
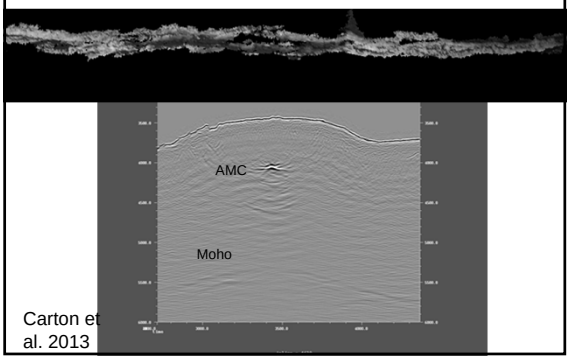
EPR 3D multi-streamer survey of the R/V Langseth

Imaging the magma reservoir beneath an erupting region of the northern EPR



Carton et al. 2013

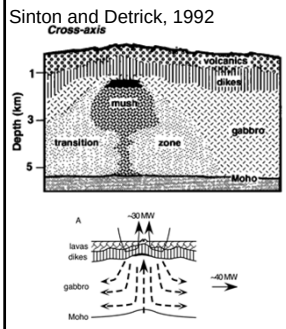
Highest resolution image of magma reservoir beneath any volcano on earth – difficult to attain on land.



Carton et al. 2013

Prevailing view of MOR magmatic system

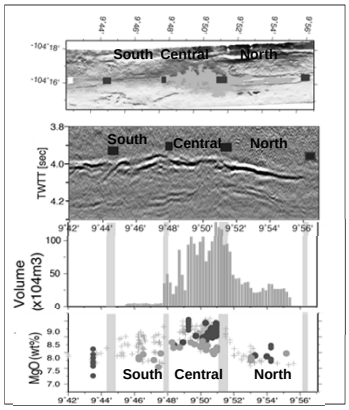
Sinton and Detrick, 1992



Phipps Morgan and Chen 1993; Henstock et al., 1993

Fast Spreading Ridges:

- Melt ponded in quasi-continuous thin magma lens beneath axis
- Upper crust formed from dike intrusion/eruption from axial magma lens
- Melt below the axial magma lens distributed in a broad crystal mush zone
- Lower crust- gabbro glacier
- Crustal formation narrowly focused to the ridge axis



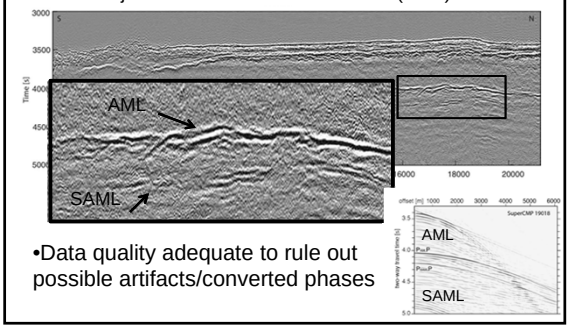
Finely segmented discontinuous magma reservoir

3 lens segments beneath eruption, each associated with distinct flow morphology and lava chemistry

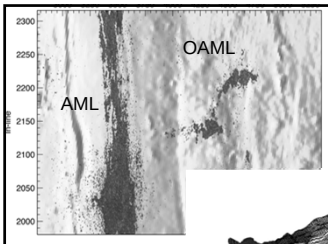
Carbotte et al. Nature Geoscience (2013)

Sills in crust beneath the AML- supports lower crust formation via sheeted sills

Marjanovic et al. Nature Geoscience (2014)



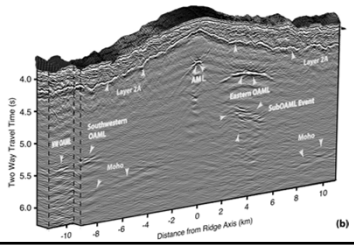
•Data quality adequate to rule out possible artifacts/converted phases

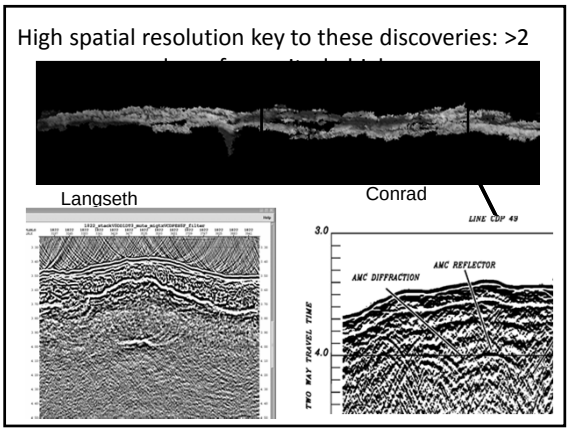


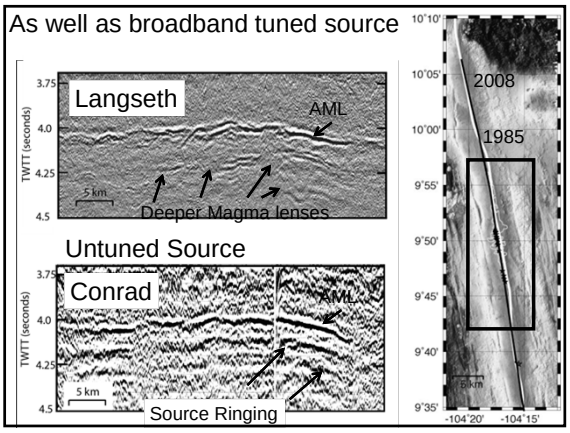
Off-axis magma bodies- off-axis eruptions and hydrothermalism

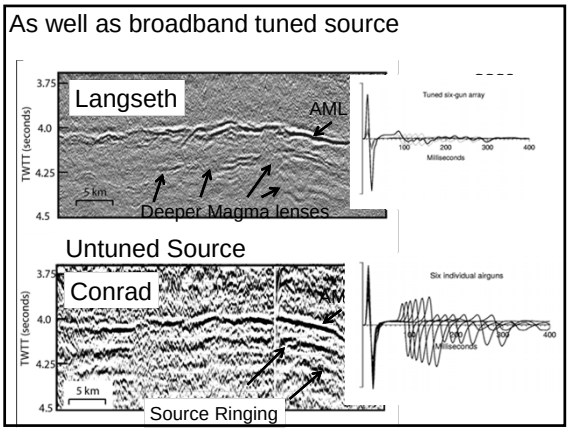
Canales et al., Nature GeoScience 2012

Han et al. EPSL,2014




High spatial resolution key to these discoveries: >2
Langseth
Conrad
LINE CDP 49
AMC REFLECTOR
AMC DIFFRACTION
TWO WAY TRAVEL TIME
3.0
4.0


As well as broadband tuned source
Langseth
AML
Deeper Magma lenses
Untuned Source
Conrad
AML
Source Ringing
TWTT (seconds)
5 km
2008
1985
10°10'
10°05'
10°00'
9°55'
9°50'
9°45'
9°40'
9°35'
-104°20'
-104°15'


As well as broadband tuned source
Langseth
AML
Deeper Magma lenses
Tuned six-gun array
Millseconds
Untuned Source
Conrad
AML
Six individual airguns
Source Ringing
TWTT (seconds)
5 km