VEIN STRUCTURES AND FAULTS IN CORE SAMPLES FROM NantroSeize EXPEDITION 315, SITES C0001 AND C0002

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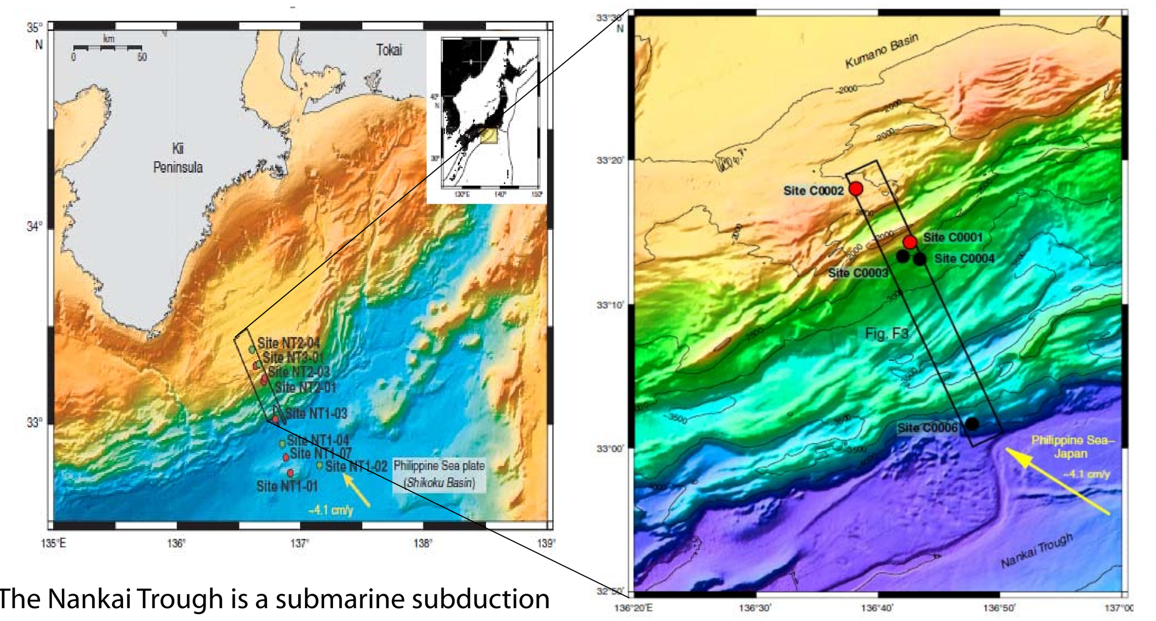
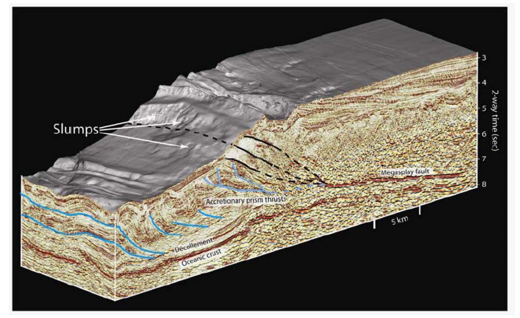
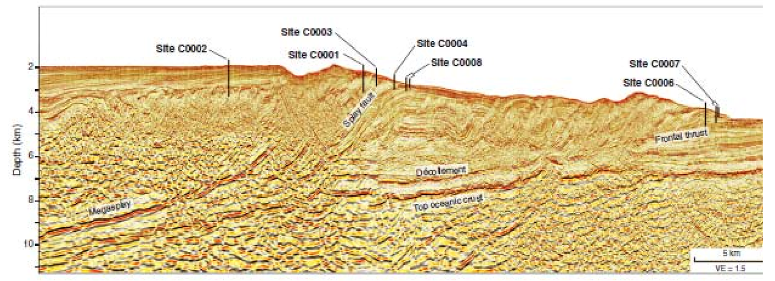
Cores retrieved from Sites C001 and C0002 during Integrated Ocean Drilling Program (IODP) Expedition 315 offshore SW Japan provide an excellent opportunity to examine deformation processes occurring across the Nankai Trough. Historically, this region is well known for its great (magnitude >8) earthquakes. On-board core logging and analysis of X-ray computed tomography scans revealed numerous core-scale deformation structures. These structures include faults, vein structures, kind bands, deformation bands, brecciated horizons, shear zones and rare folds. Here we document the first order geometries and textural characteristics specifically of faults and vein structures. This is done principally through mm-scale microscope observation and petrographic analysis. At the hand-sample-scale the faults and vein structures are mm-scale thick structures that appear visually as darker anastomosing features against the lighter colored wallrock. In thin section these structures show some sign of grain orientations oblique to bedding. The faults and vein structures have diffuse tips and terminations, respectively. The faults typically occur as isolated structures whereas the vein structures typically occur in groups of three or four. At Site C0001 these structures occur in zones with abundant faults and shear zones as noted during on-board core logging, and mostly occur below an m-scale thick zone of breccia encountered at ~220 meters below the sea floor. A single sample from C0002 displays particularly well-preserved cross-cutting relations between several faults. Preliminary analyses suggest that that the steeper dipping (>60°) faults are older than the shallower dipping (~45°) faults. These findings are being examined in the context of fault kinematic data obtained from core observations during the expedition in hopes of shedding light on the sequence of faulting within the accretionary wedge. Understanding how these deformation structures might fit into the earthquake cycle remains an important question.

Nankai Trough: Geologic & Geographic Setting

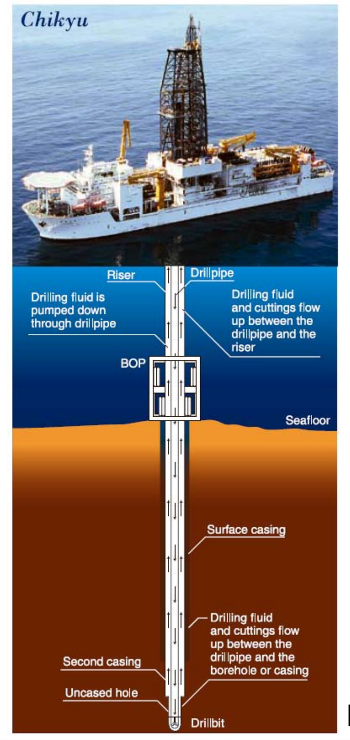


The Nankai Trough is a submarine subduction trench located offshore of Japan. This region is located off the Kii Peninsula, Japan. The Nankai trough itself is located southeast of both the Kii Peninsula and Kumano Basin. The Nankai Trough marks the spot where the Philippine Sea plate is subducting under the overriding Eurasian plate. The Philippine Sea Plate is subducting at a rate of about 4 centimeters per year. The Kumano Basin, which is a landward tilting accretionary prism stretching from the Kii Peninsula to the Nankai Trough.

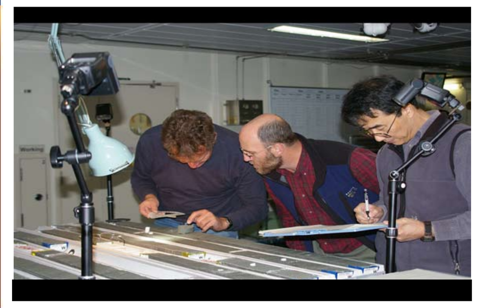




Why & How it was Drilled



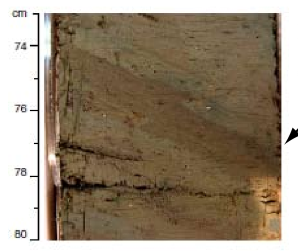
The cores that were recovered from Site C0001 & Site C0002 during the Integrated Ocean Drilling Project (IODP) Expedition 315 in the Nankai Trough, by the Chikyu Hakken. These cores were recovered as part of the Japanese-led initiative to drill through the Eurasian Plate - Philippine Sea Plate interface, as well as answer fundamental questions about subduction zone margins.



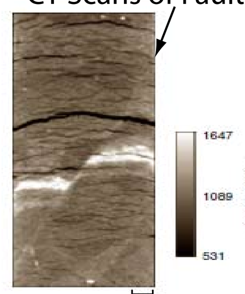
Types of Deformation Features Seen

Vein Structures

Shear Band with a small fault.

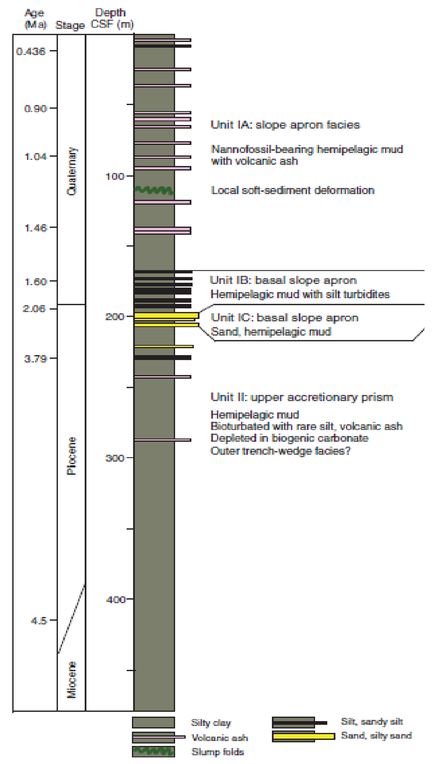


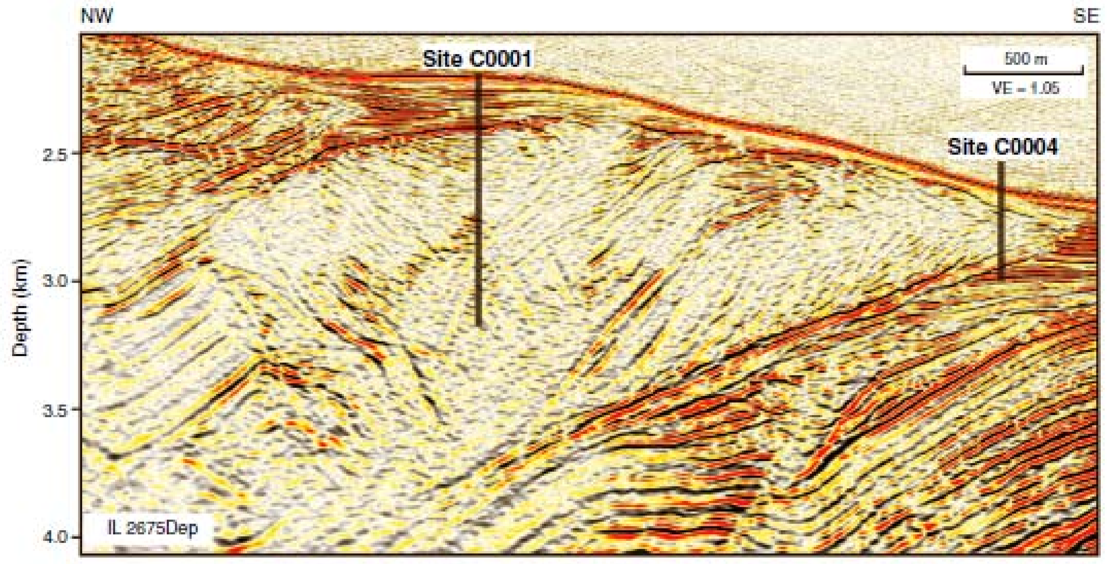
CT Scans of Fault.



A large normal fault.

Site C0001 Core Sections Background & Findings



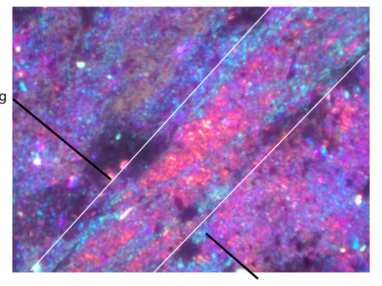


C0001H-12R-06 WW 31-33cm

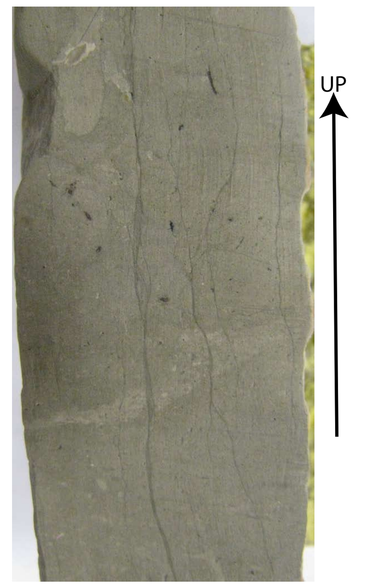
Polarized Light with a first order red shift plate

Thin Section Photos

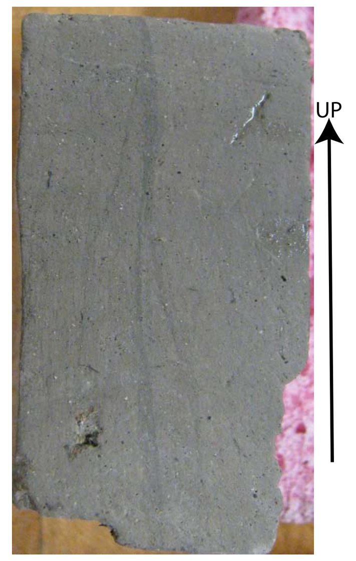
C0001H-12R-06 WW 31-33cm



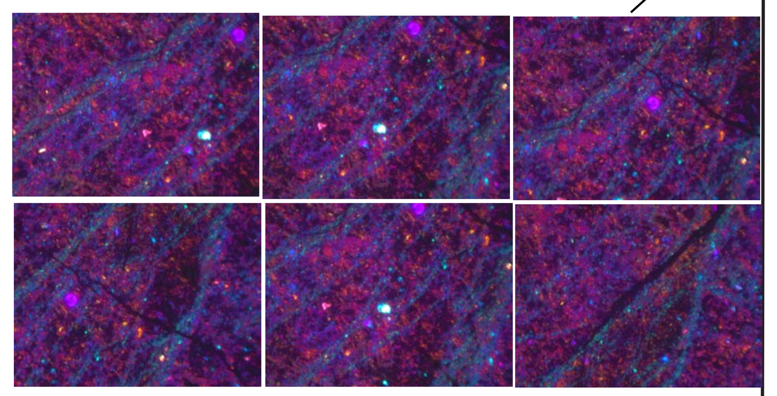
C0001H-10R-02 WW 2-12cm

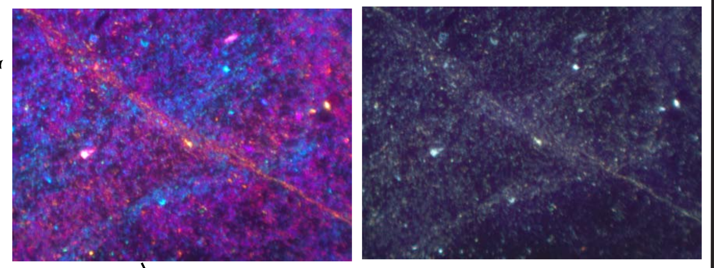


C0001B-03H-07 WW 6-11cm

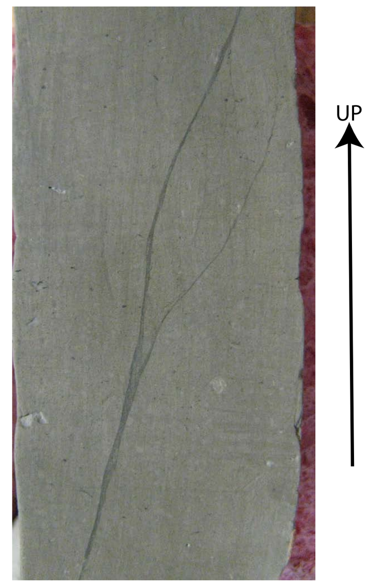


C0001-11R-05 WW 27-36cm

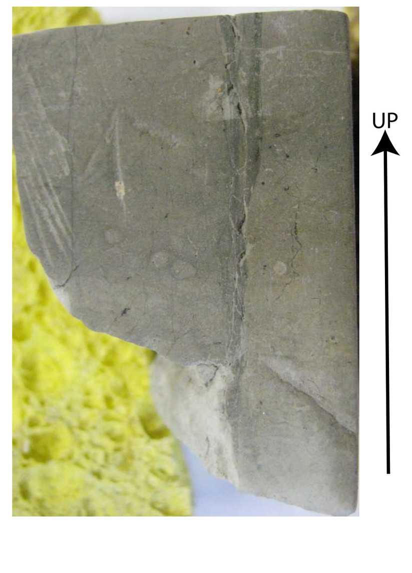




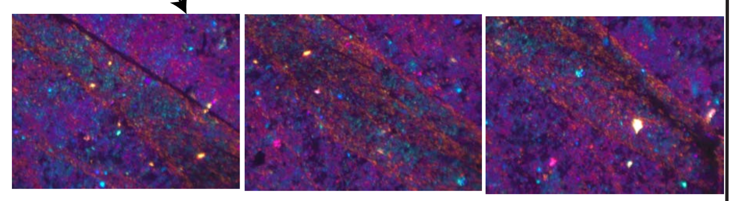
C0001-11R-05 WW 27-36cm



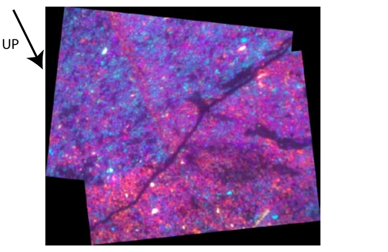
C0001H-8R-02 WW 135-140cm



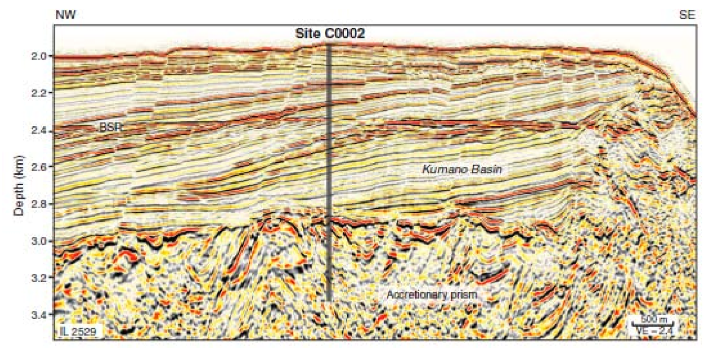
C0001F-14H-02 WW 06-13cm



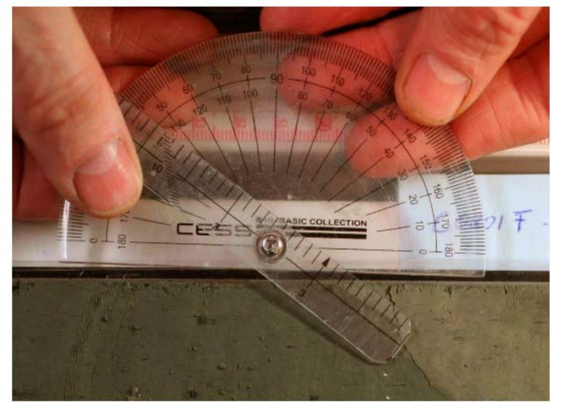
C0001H-10R WW 2-12cm

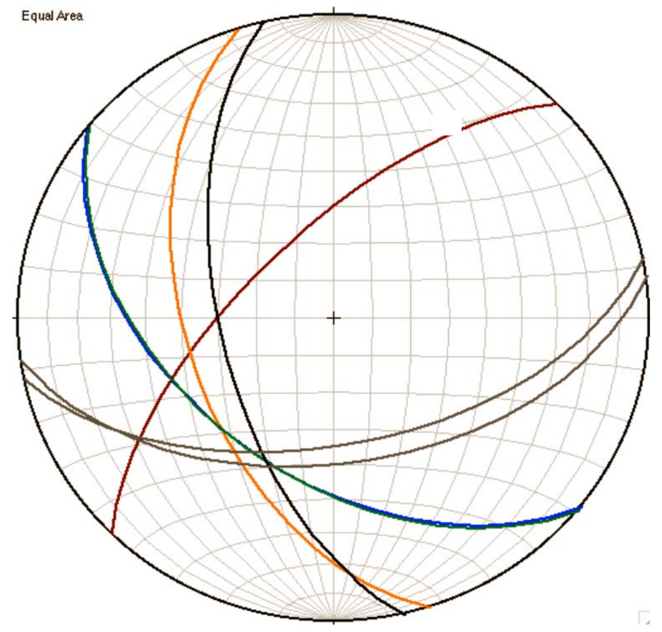


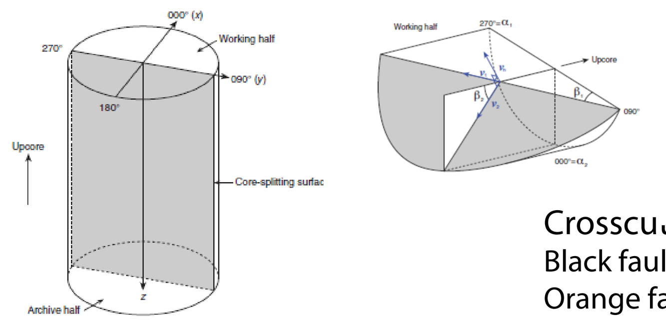
Site C0002 Core Section Background & Findings

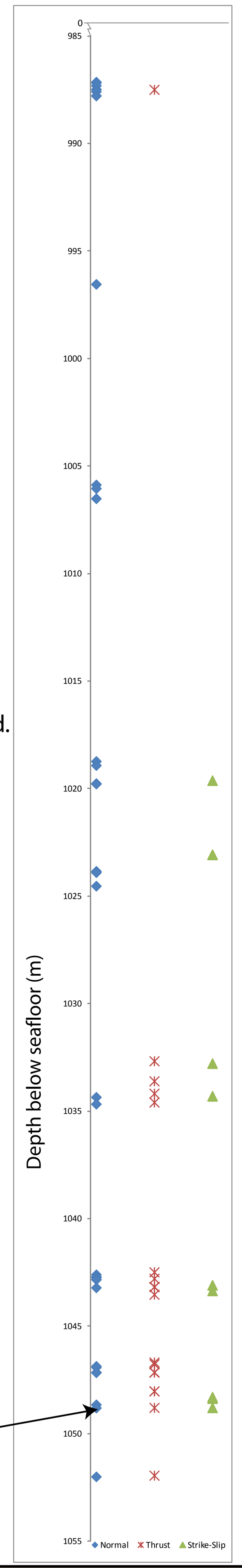


	Working Half Face		Working Half Rounded Edge		Best Fit Plane			
	Strike	Dip	Strike	Dip	Strike	Dip	Dip Direction	Color
Fault 1	270	60	180	22	167.0	60.3	W	Black
Fault 2	270	50	180	20	162.4	51.0	W	Orange
Fault 3	270	60	0	60	224.8	67.3	W	Red
Fault 4	90	10	180	50	82.0	50.4	S	Green
Fault 5	90	15	180	55	78.5	55.8	S	Blue
Fault 6	270	35	180	41	128.2	48.0	S	Gray
Fault 7	270	36	180	40	129.2	47.9	S	Gray





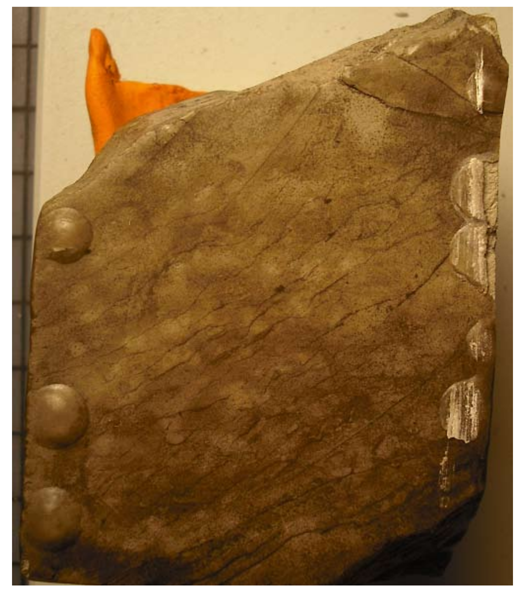




Crosscu...ng Relationships were found to be such:
Black fault crosscuts the orange fault.
Orange fault crosscuts red fault.
Black fault crosscuts blue fault.
Blue fault crosscuts green fault.
The Gray faults: no crosscutting relationship could be found.

The sample comes from the Prism

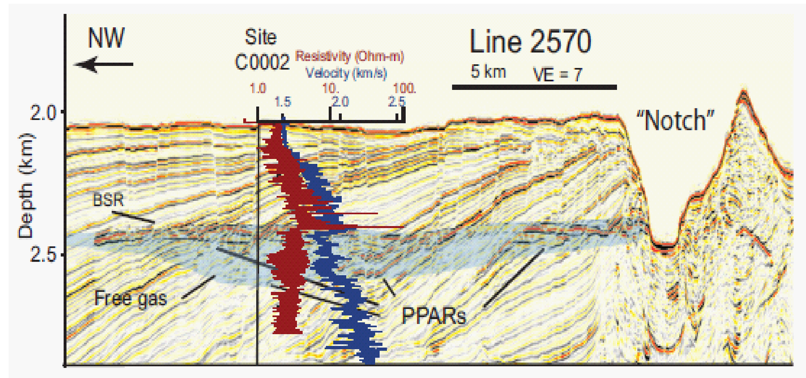
Hand Sample C0002



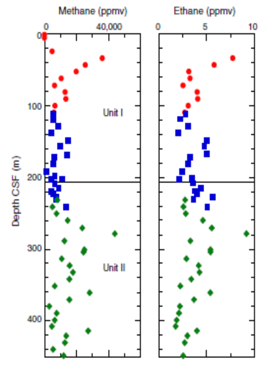
The sample comes from this interval.

Implications:

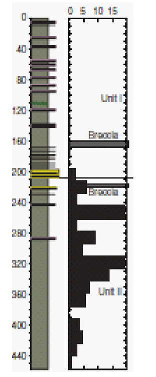
Methane venting as mechanism for Vein structure occurrence?



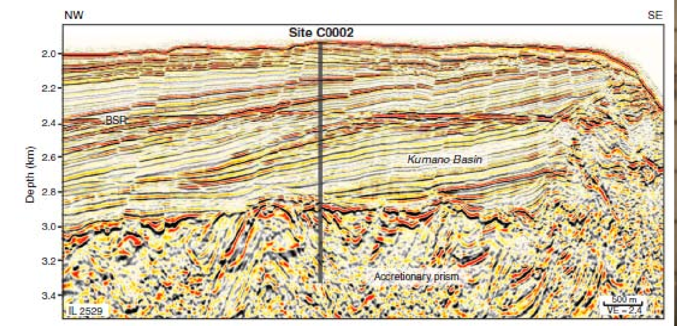
At site C0002, there is a layer of free methane gas that resides ~500m below sea floor. This methane release causes small (m-scale) pockmarks to form. Sandy Turbidite layers provide the best conduits for gas migration. Earthquake and coseismic slip provide means for destabilization.



Nearly all samples from C0001 lie below the 200m sea floor breccia zone.
The vein structures are strongest below this zone.
If methane was present at or near same level as Site C0002, then, the vein structures may have been the result of methane release into the breccia zone, as the result of seimsogenic activity.



The Faults in Site C0002 could record the extension and compression of the Kumano Basin.



Further Research:

The core sections will be geographically reoriented by paleomagnetic data. And the kinematic data of the faults will be recorded.

Acknowledgements:

I would like to acknowledge IODP, NantroSEIZE and The Consortium for Ocean Leadership for their financial support of this project. Furthermore, I would like to thank Indiana University of Pennsylvania and IUP's Geoscience Department for the opportunity to pursue this research project. Additionally, I would like to thank Dr. Jon Lewis for allowing me to join this research endeavor. Finally, I would like extend my gratitude to Dan O'Hara, Mark Smith and Ellen Lamont for their unparallel help in proofreading and critical analysis of my research and this poster.

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