

California Energy Commission

Lead Commissioners Workshop on California Nuclear Power Plant Issues

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California Energy Commission

DOCKETED

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Nuclear Power Plant Data Request

Progress in Completing AB1632 Report/ 2008 IEPR

A. Seismic Hazards at Diablo Canyon

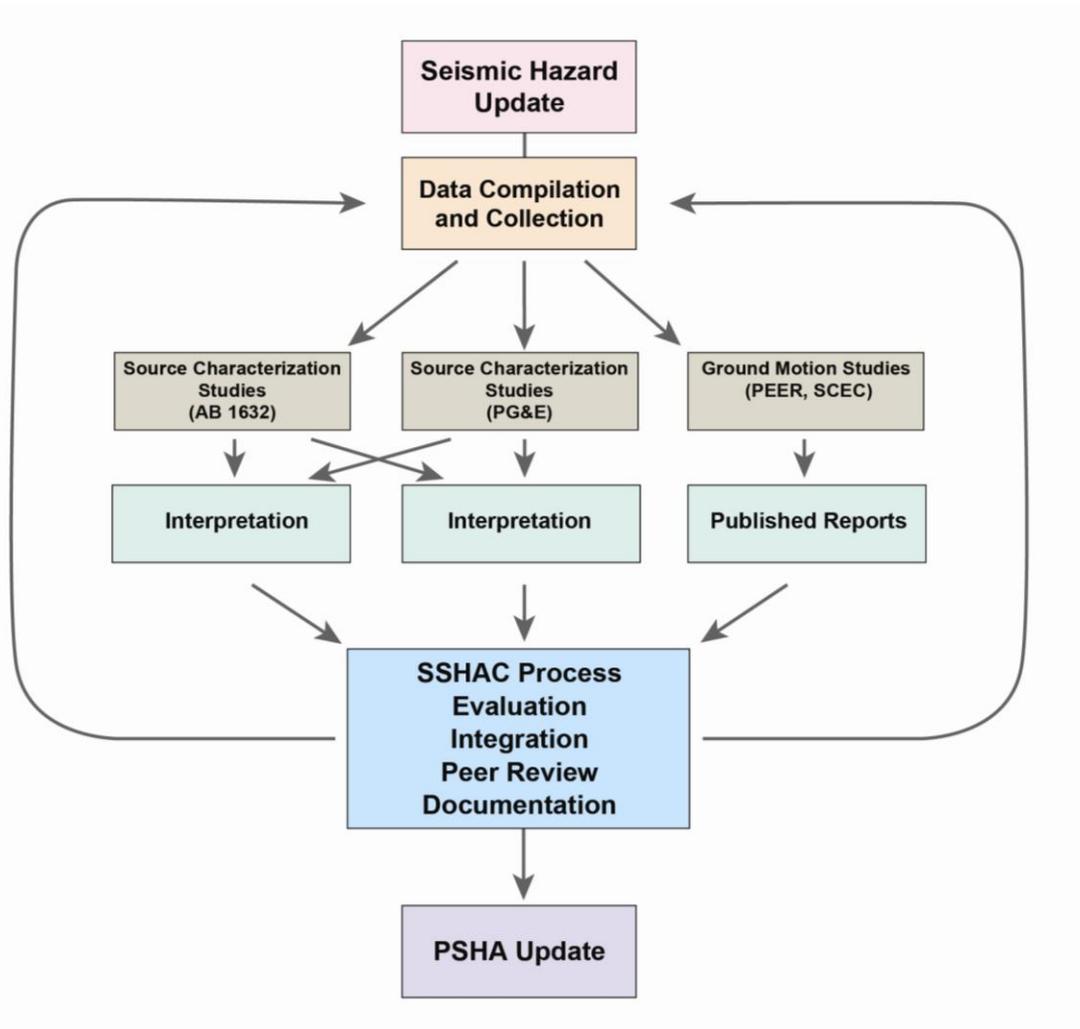
1. Please report on the overall status of ongoing efforts to understand seismic hazards affecting the Diablo Canyon site through its Long Term Seismic Program (LTSP) and the results of research efforts.



The Seismic Hazard Update currently underway at DCPP follows Senior Seismic Hazard Analysis Committee (SSHAC) Level 3 process¹ that is scheduled to be completed in March 2015

1- NUREG-2117 Practical Implementation Guidelines for SSHAC Level 3 and 4 Hazard Studies.

DCPD Seismic Hazard Update





Seismic Source Characterization

LTSP Tectonic Model

Marine Data

- Multi Beam Echo Sounding (MBES) Mapping
- 2D/3D Low Energy Seismic Reflection Surveys

Onshore Data

- 2D/3D Seismic Reflection Surveys
- Geologic Mapping
- Light Detection and Ranging (LiDAR) Mapping

Potential Field Mapping (gravity, magnetics)



Ground Motion Characterization

Next Generation Attenuation (NGA) Ground Motion Model

Ground Motion Data Base

NGA West2 Model Updates

Numerical Models

Dynamic Rupture Models

Finite Fault Simulations



A. Seismic Hazards at Diablo Canyon

2. Please discuss whether updates to ground motion models developed to date through the Senior Seismic Hazards Analysis Committee (SSHAC) Level 3 process indicate larger than expected seismic hazards at Diablo Canyon and, if so, whether the plant was built with sufficient design margins to continue operating reliably after experiencing these larger ground motions (Diablo Canyon).

The DCCP SSHAC Level 3 study is scheduled to be completed in March 2015



Progress in Completing 2011 IEPR Recommendations

A. Seismic Issues

1. Please provide an update on the progress in completing the AB1632 Report recommended seismic studies, including technical details and any significant updates of seismic hazard study plans completed, in progress or proposed since 2011 (as recommended in the 2008 IEPR Update) and the associated findings as applicable.



California Energy Commission

An Assessment of California's Nuclear Power Plants: AB 1632 Report

Recommended that PG&E and Southern California Edison update their seismic hazard assessments

Use 3D geophysical seismic reflection mapping and other advanced techniques to supplement previous and ongoing research programs



On January 10, 2010 PG&E filed Application (A.)10-01-014 with the CPUC for cost recovery of \$16.73 million associated with enhanced seismic studies recommended by the CEC AB1632 Report.

The CPUC issued Decision (D.) 10-08-003 to perform these additional studies on August 12, 2010.

On September 23, 2011 PG&E filed a motion to reopen A.10-01-014 to request additional funding for increased costs of the enhanced seismic studies at DCPP.

The CPUC issued D.12-09-008 authorizing PG&E to recover in rates an additional \$47.5 million above the \$16.73 million already approved in D.10-08-003 for a total of \$64.25 million.



AB 1632

2010 – 2013

California Public Utilities Commission

Independent Peer Review Panel

CA Coastal Commission

Cal EMA

CA Energy Commission

CA Geological Survey

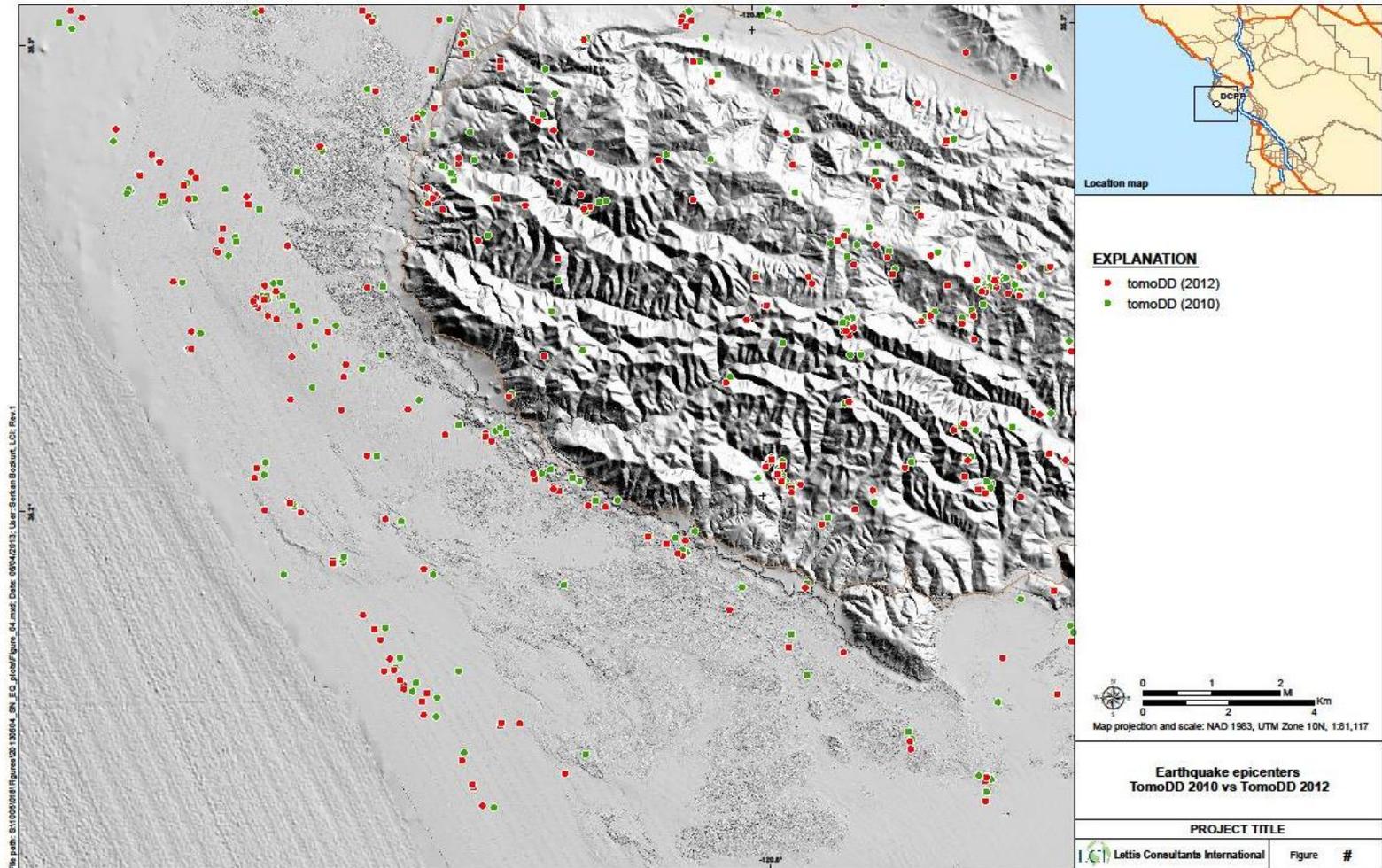
CA Public Utilities Commission

CA Seismic Safety Commission

County of San Luis Obispo

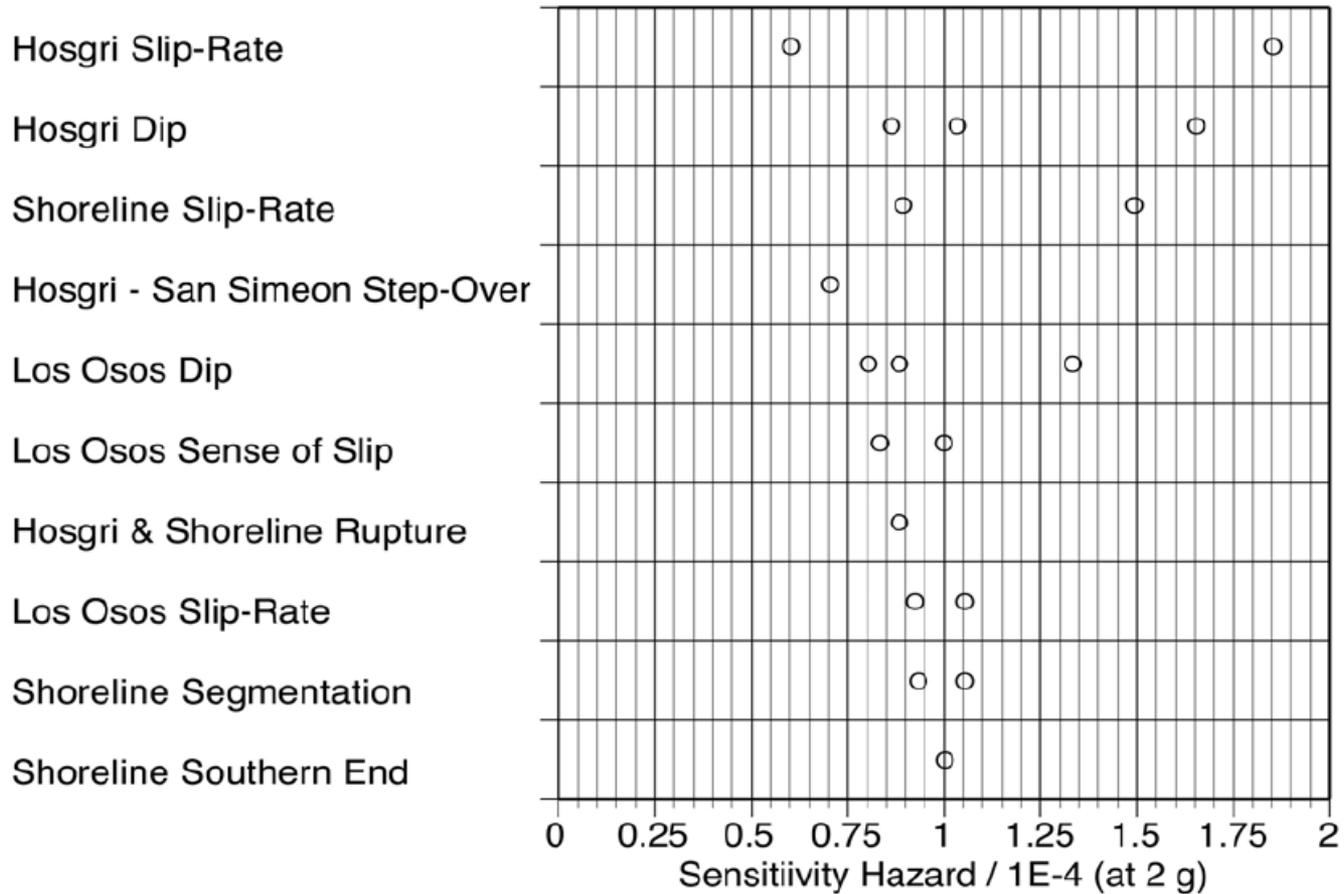


Seismicity 1987-2012





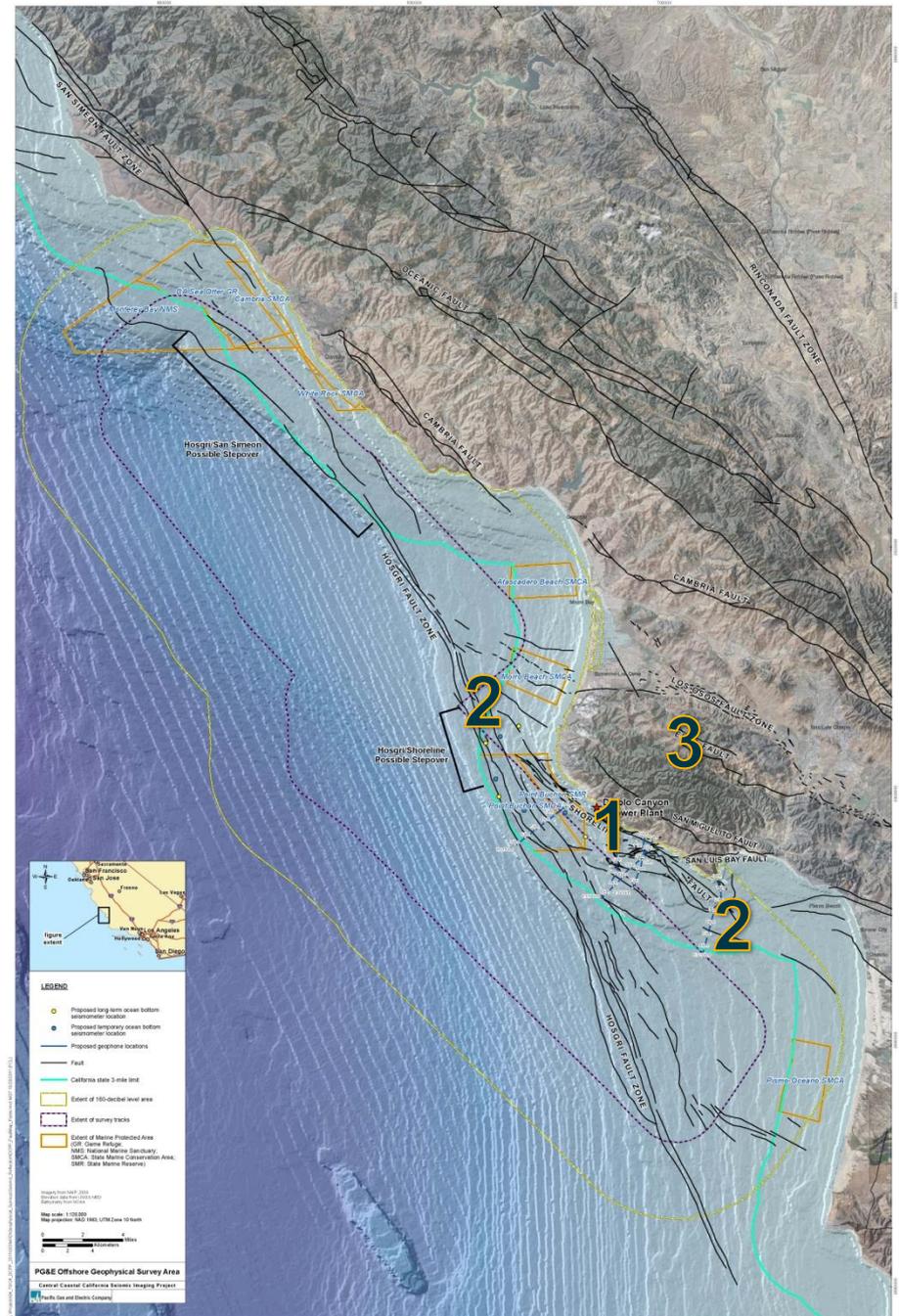
Seismic Source Characterization Sensitivity Study





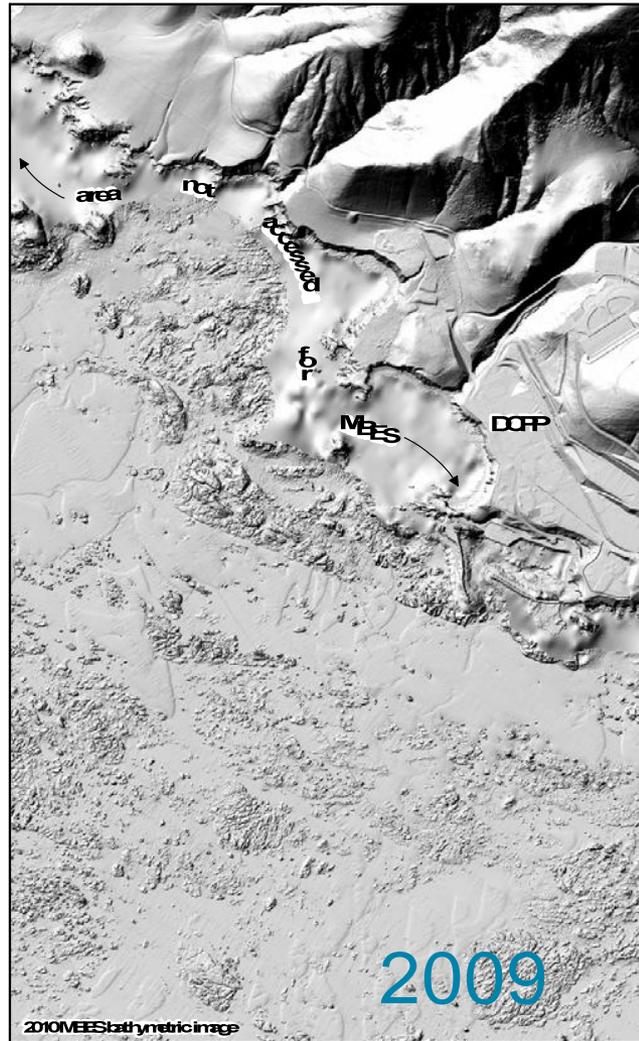
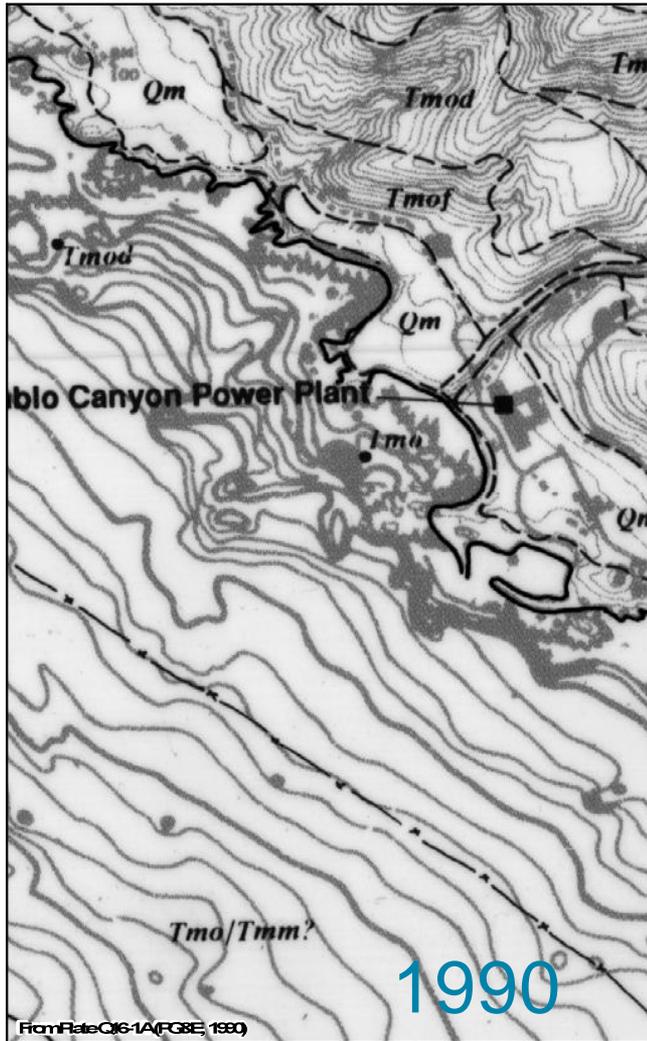
Central Coastal California Seismic Imaging Project 2009-2011

1. Multi Beam & Potential Field Mapping
2. 2D/3D Low Energy Seismic Surveys (LESS) - Shoreline Fault Zone
3. 2D/3D Onshore Seismic Reflection Surveys - Irish Hills/Los Osos Valley





Bathymetric Mapping



Map scale: 1:15,000
Map projection: NAD 1983, UTM Zone 10 North
0 0.1 0.2 0.3 0.4 0.5
Miles
0 0.2 0.4 0.6 0.8
Kilometers

Comparison of 1990 LTSP bathymetry
with the 2009 MEBES bathymetry
offshore DOPP area

SHORELINE FAULT ZONE STUDY

Lion Rock

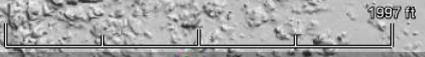


Image © 2012 DigitalGlobe
Data © 2012 ESRI, CA OPC
© 2012 Google

Google earth

1994

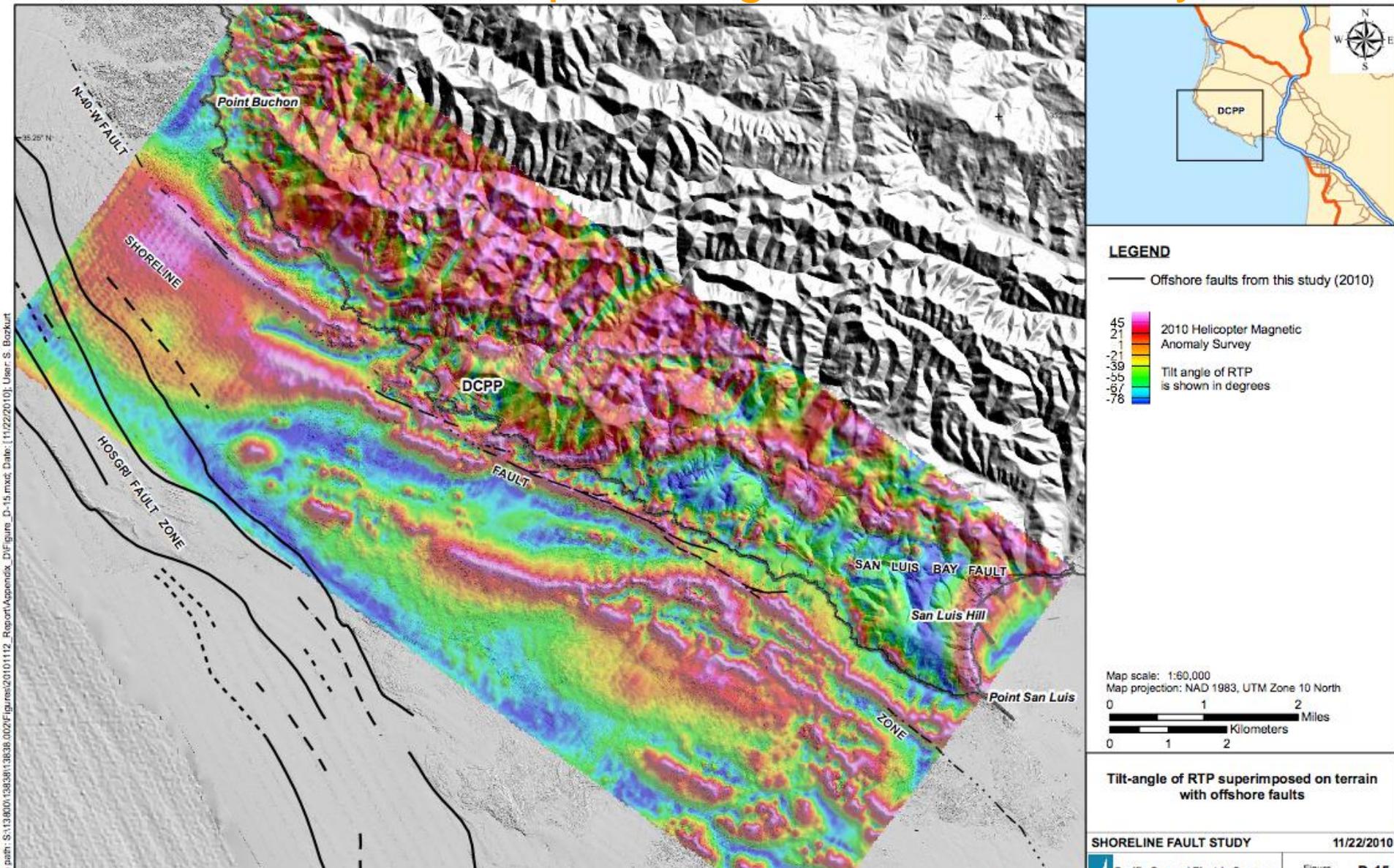
35° 12' 34.84" N 120° 51' 31.61" W elev 0 ft

Eye alt 8319 ft



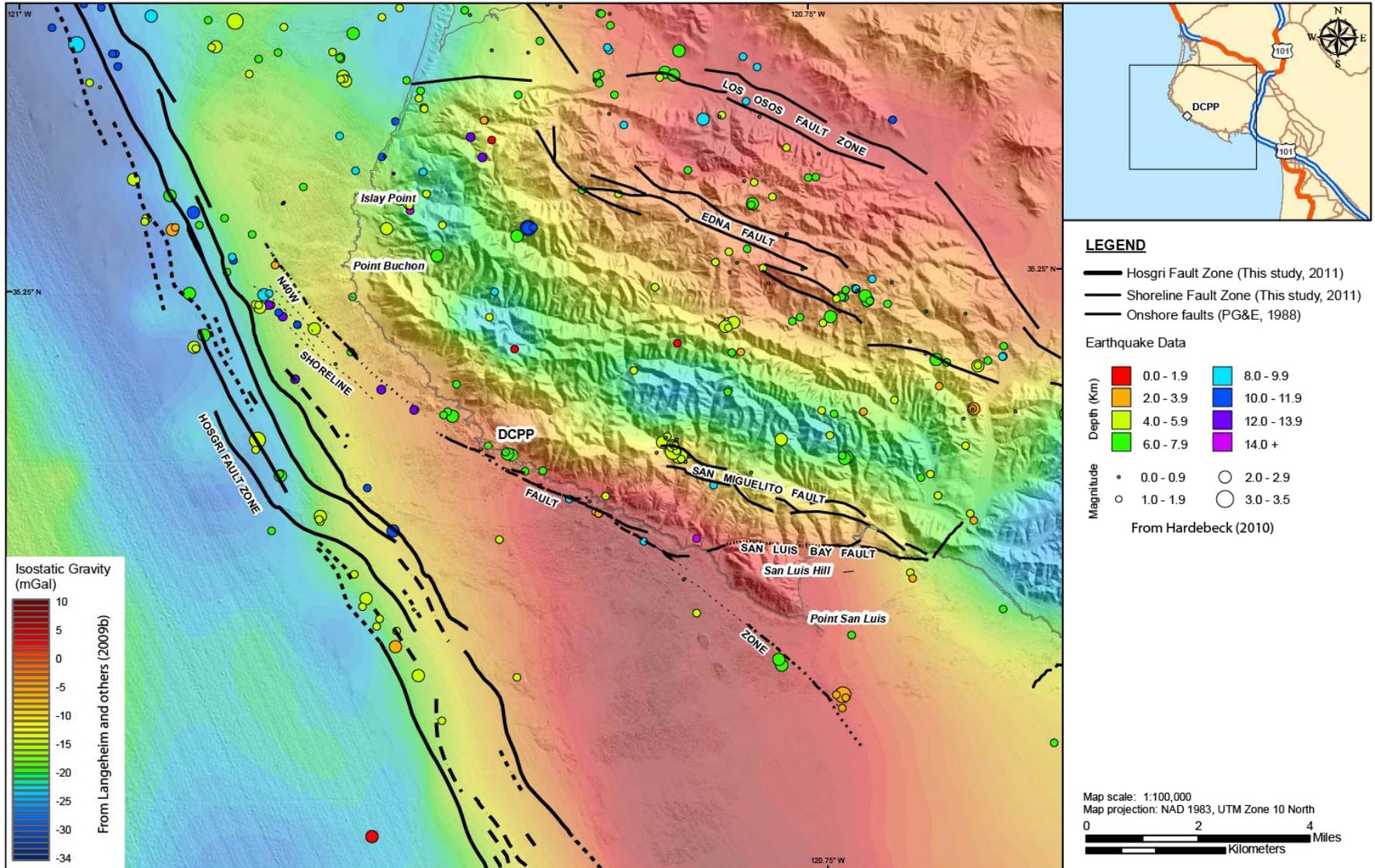
Potential Field Mapping

2010 Helicopter Magnetic Field Survey





Earthquake Epicenters Isostatic Gravity Field

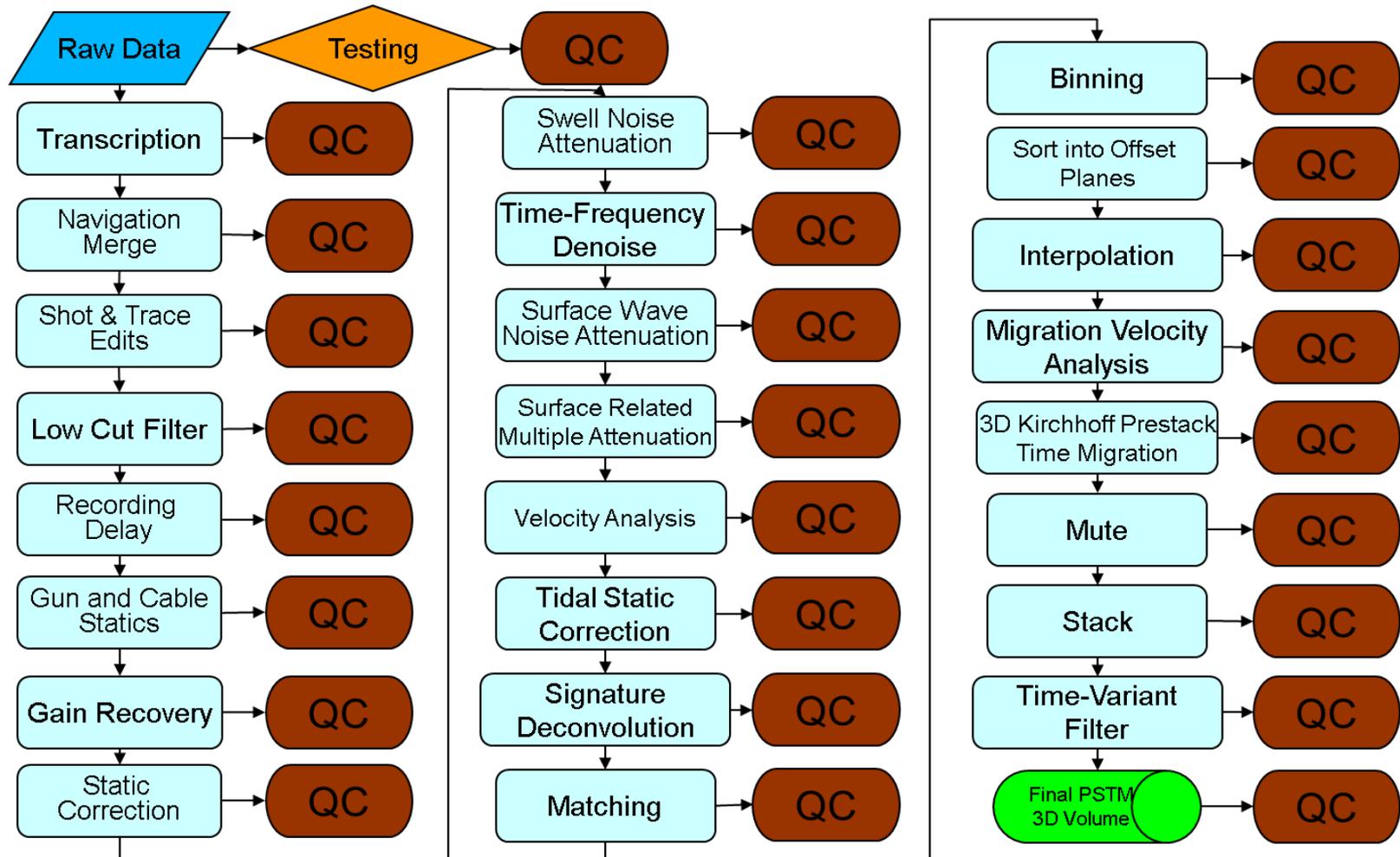


**High Resolution 2D/3D
Low Energy Seismic Surveys (LESS)
2010 – 2012**

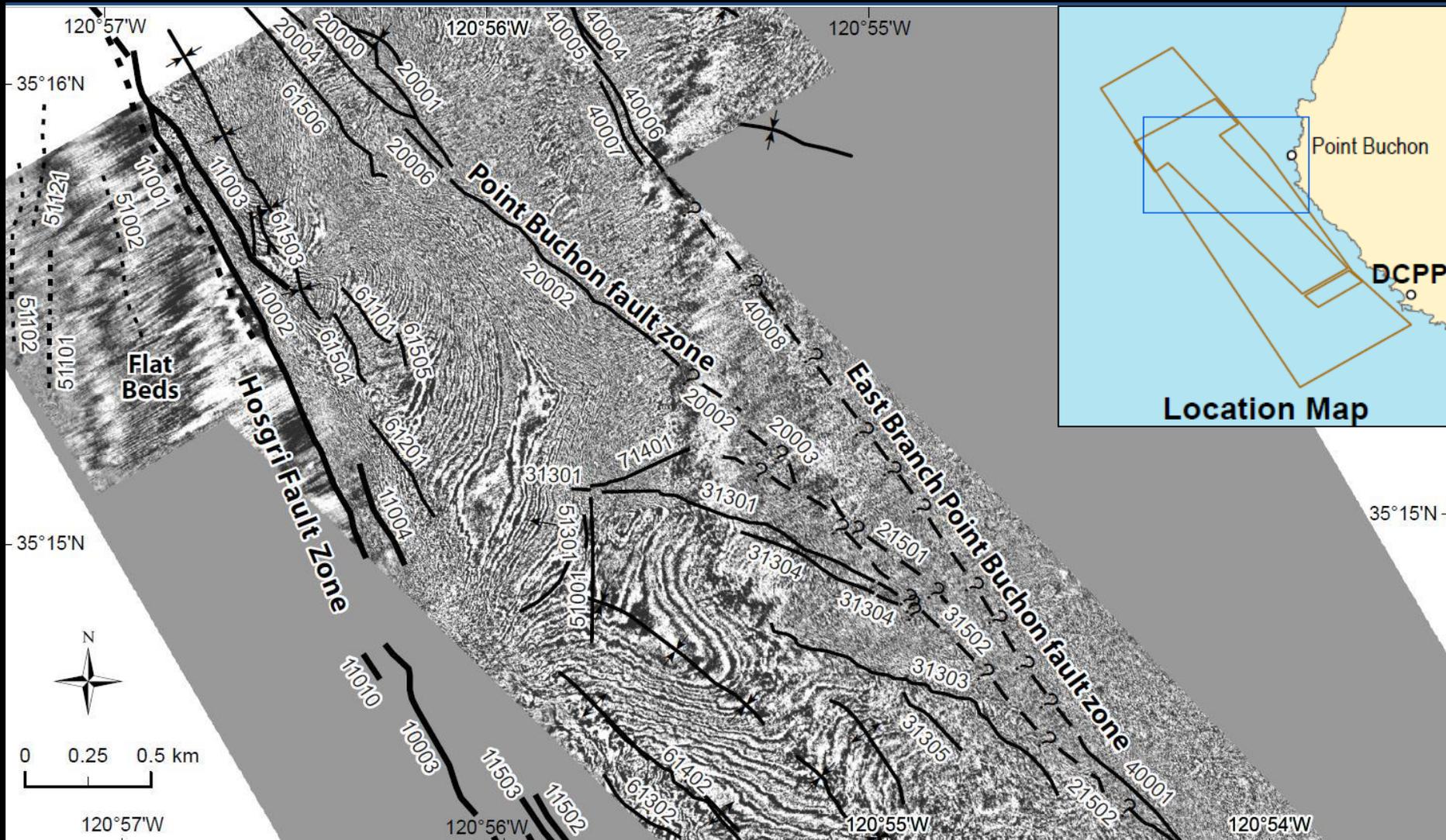




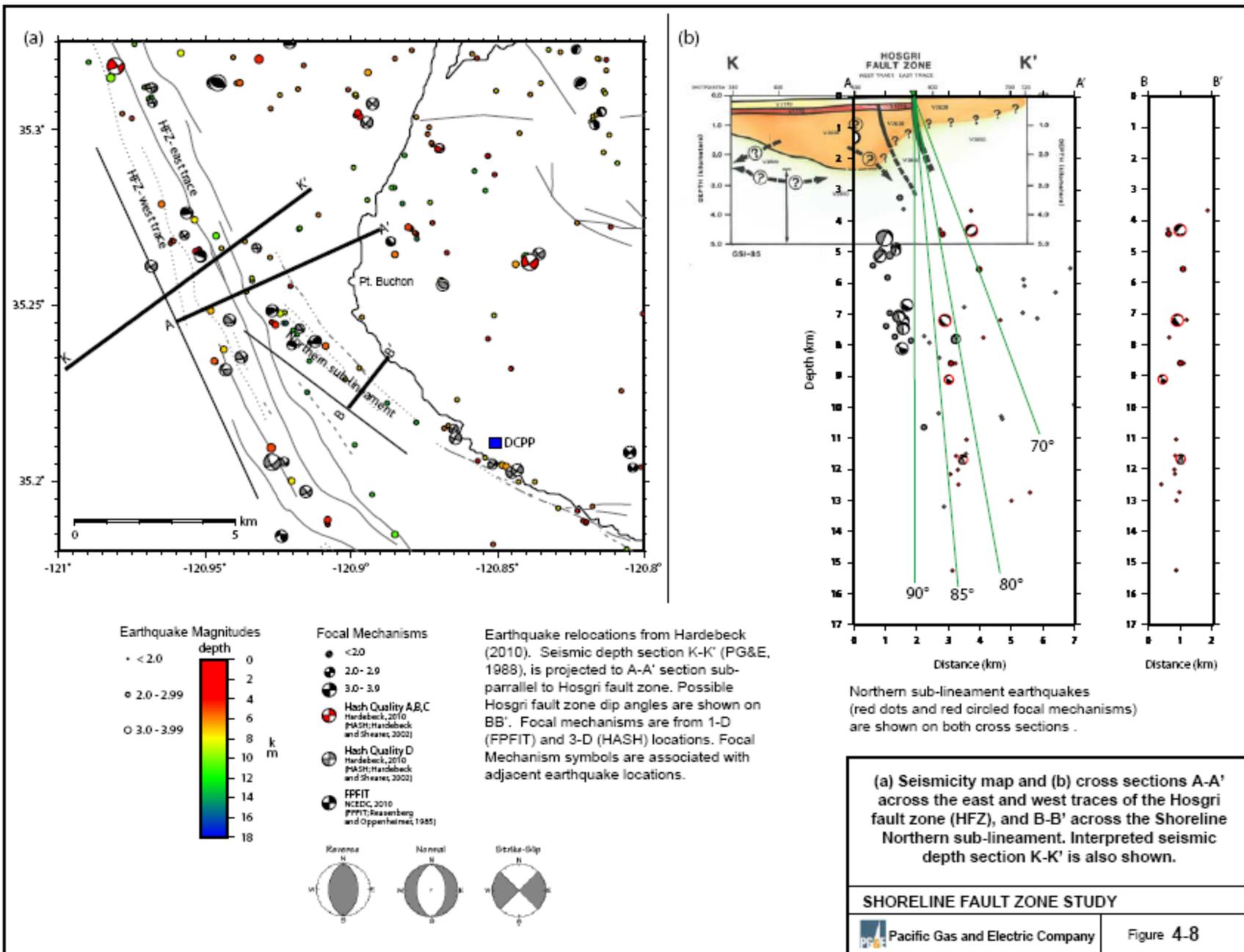
3D Data Processing Flow



3D LESS Amplitude Time Section



Time Slice @ 150 ms, ~ 115 m depth





DCPP 3D/2D Seismic-Reflection Investigation of Structures Associated with the Northern Shoreline Seismicity Sublineament of the Point Buchon Region

PG&E GEO.DCPP.TR.12.01 R0

Technical Report describing the 2010/2011 2D/3D survey of the northern segment of the Shoreline Fault was released in 2012 and transmitted to the PUC IPRP as well as the SSHAC study team.

The Technical Report and associated LESS data are available at <http://www.pge.com/dcpp-ltsp>

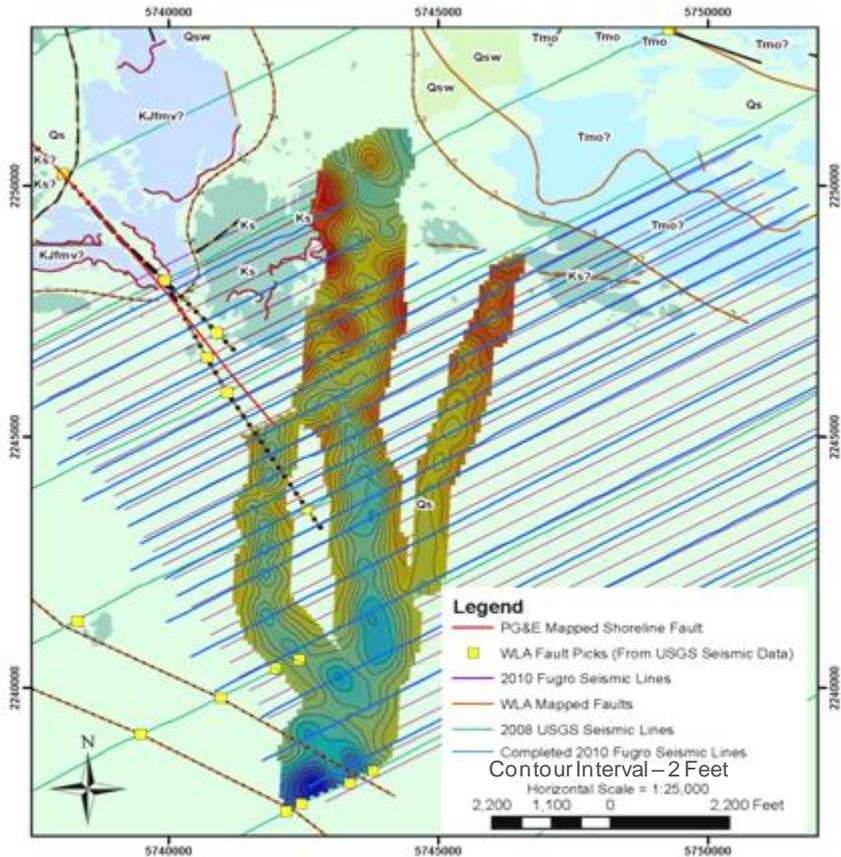
2011/2012 3D Low Energy Seismic Survey San Luis Bay & Southern End of the Shoreline Fault Zone



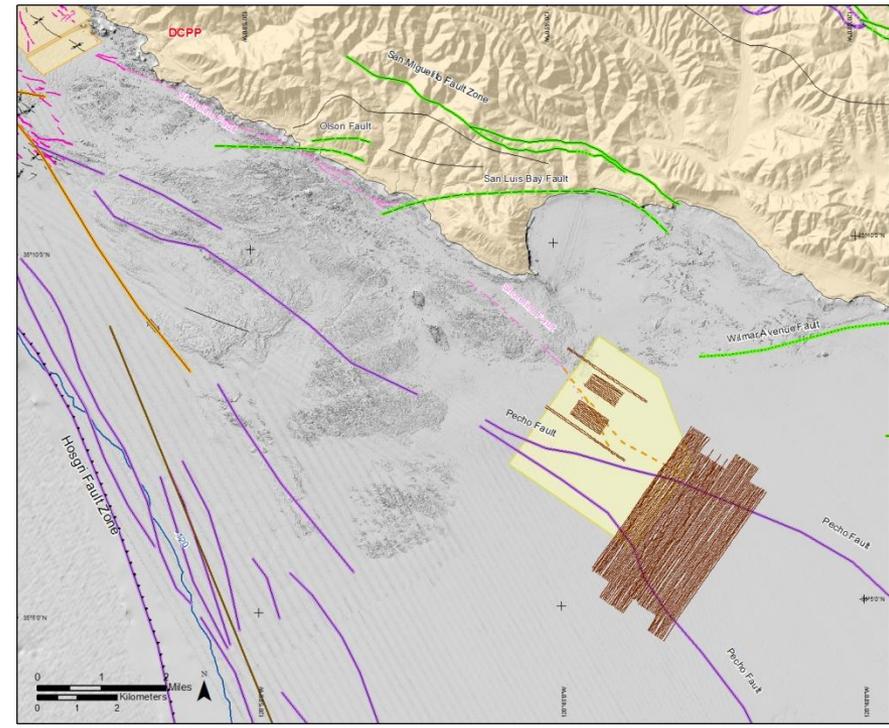
- SubSea Systems AP3000 Triple Plate Boomer
 - Geometrics P-cable System
 - 12 to 14 - 50 m long Solid Streamers w/ 8 Hydrophones @ 6.25 m Group Interval
 - Bin Size 3.125 m x 3.125



2011/2012 3D LESS Southern End of Shoreline Fault Zone San Luis Bay



MAPPED PALEOCHANNELS WITHIN SURVEY AREA 2
PG&E 3D SEISMIC REFLECTION SURVEYS
Offshore Central California





San Luis Bay 3D Line 7660 Uninterpreted

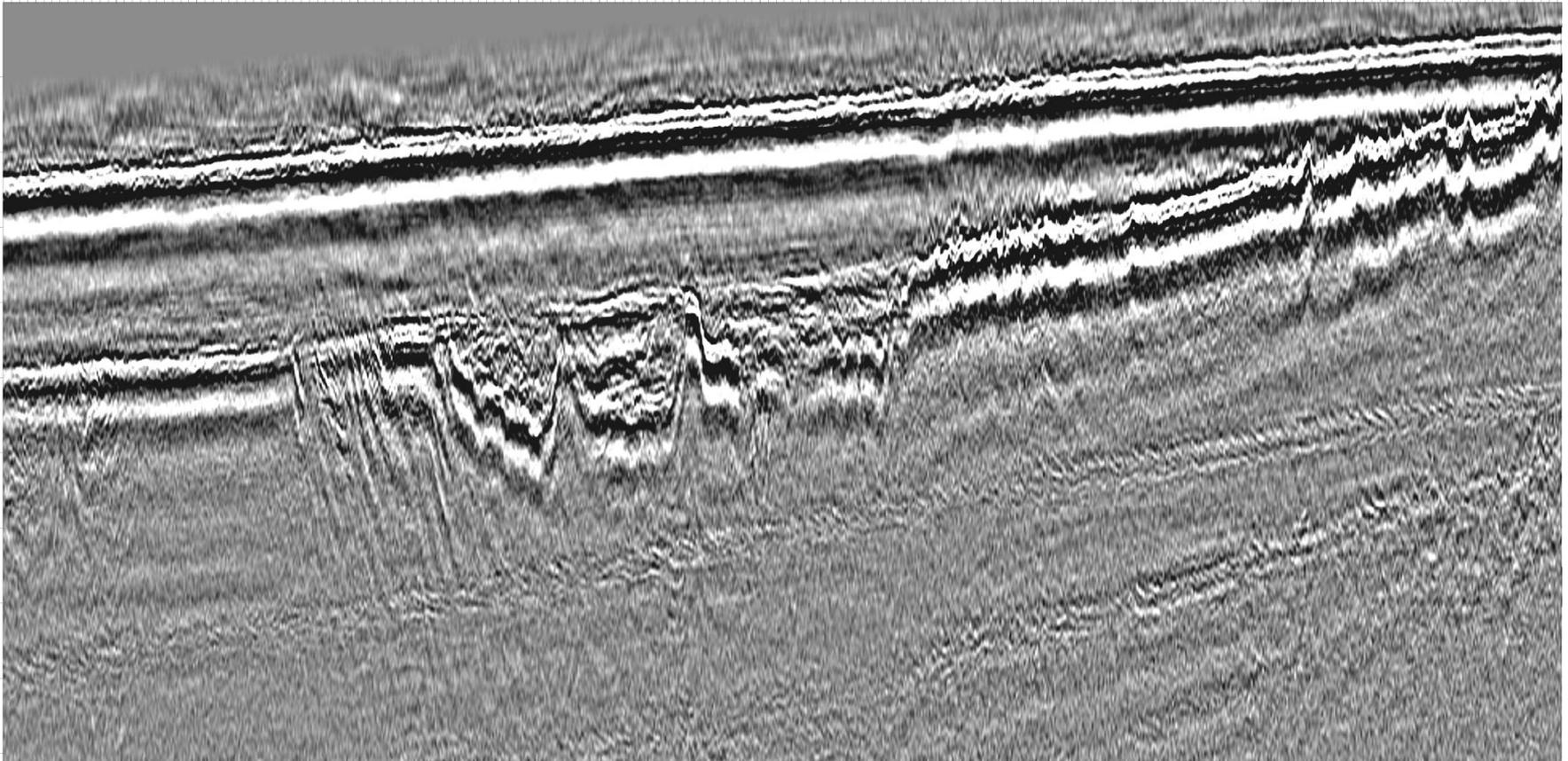
SW

San Luis Bay 3D Line 7660

NE

Line:	7660.0	7660.0	7660.0	7660.0	7660.0	7660.0	7660.0	7660.0	7660.0	7660.0	7660.0	7660.0	7660.0	7660.0	7660.0	7660.0	7660.0	7660.0	
Trace:	1050.0	1100.0	1150.0	1200.0	1250.0	1300.0	1350.0	1400.0	1450.0	1500.0	1550.0	1600.0	1650.0	1700.0	1750.0	1800.0	1850.0	1900.0	1950.0

0.100





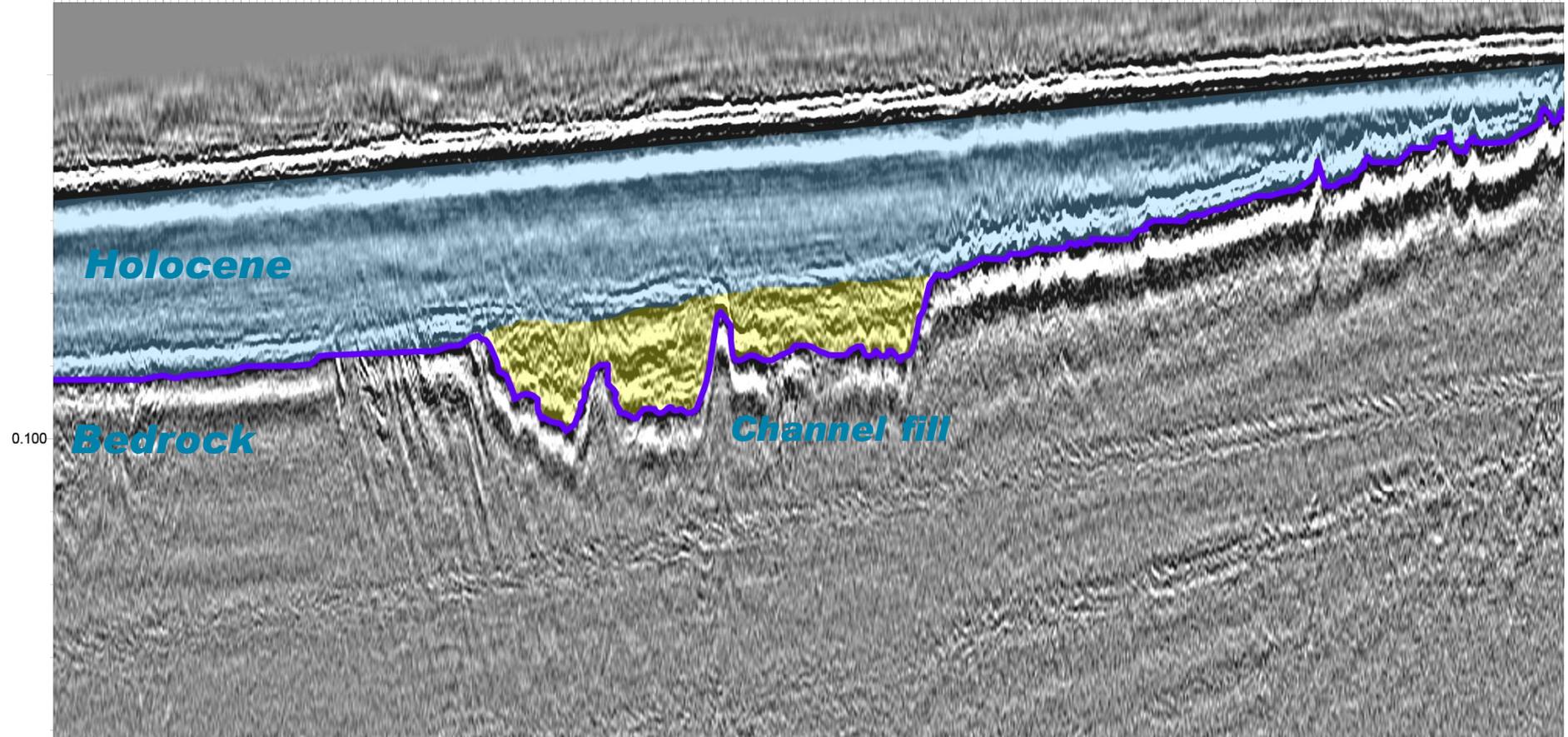
San Luis Bay 3D Line 7660 Interpreted

SW

San Luis Bay 3D Line 7660

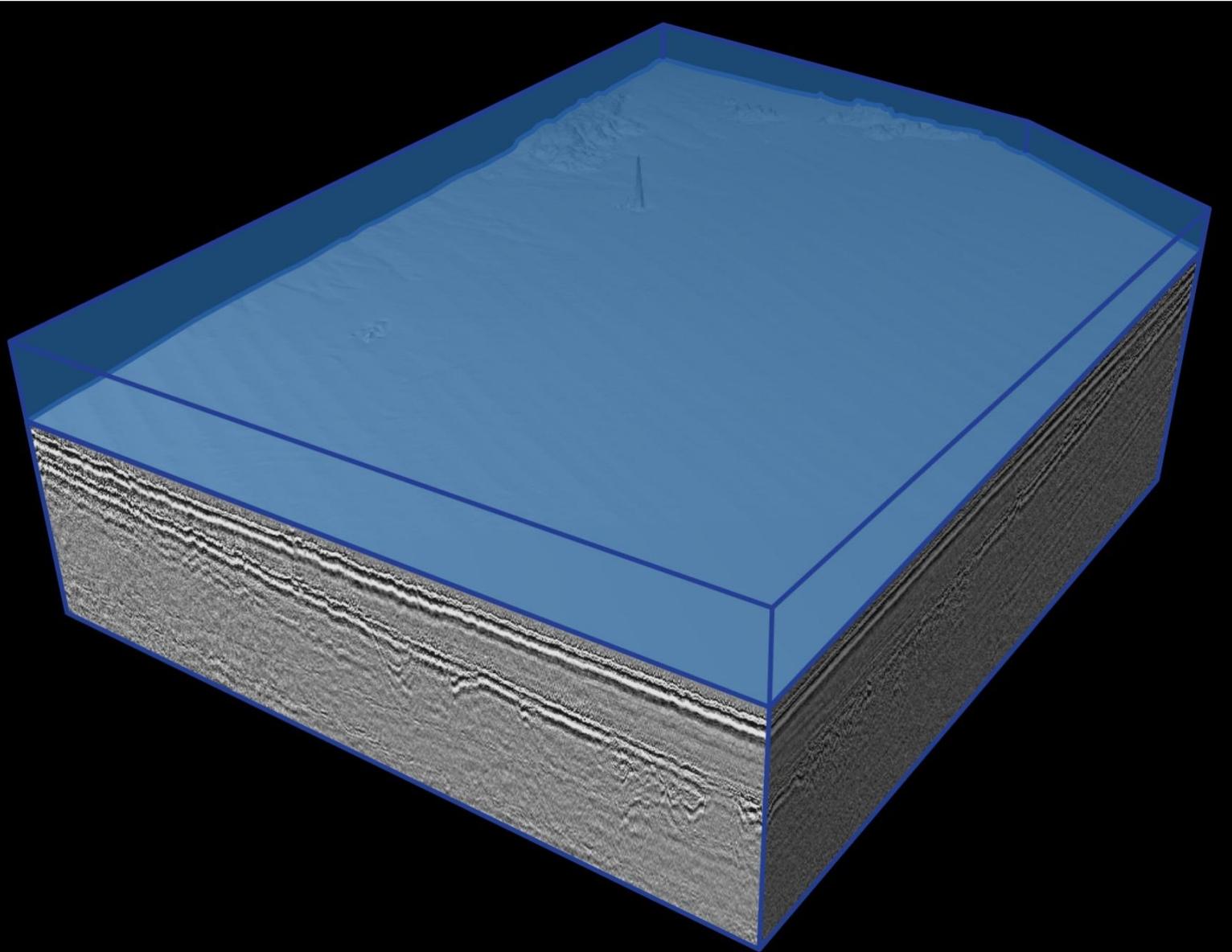
NE

Line: 7660.0	7660.0	7660.0	7660.0	7660.0	7660.0	7660.0	7660.0	7660.0	7660.0	7660.0	7660.0	7660.0	7660.0	7660.0	7660.0	7660.0	7660.0	7660.0
Trace: 1050.0	1100.0	1150.0	1200.0	1250.0	1300.0	1350.0	1400.0	1450.0	1500.0	1550.0	1600.0	1650.0	1700.0	1750.0	1800.0	1850.0	1900.0	1950.0



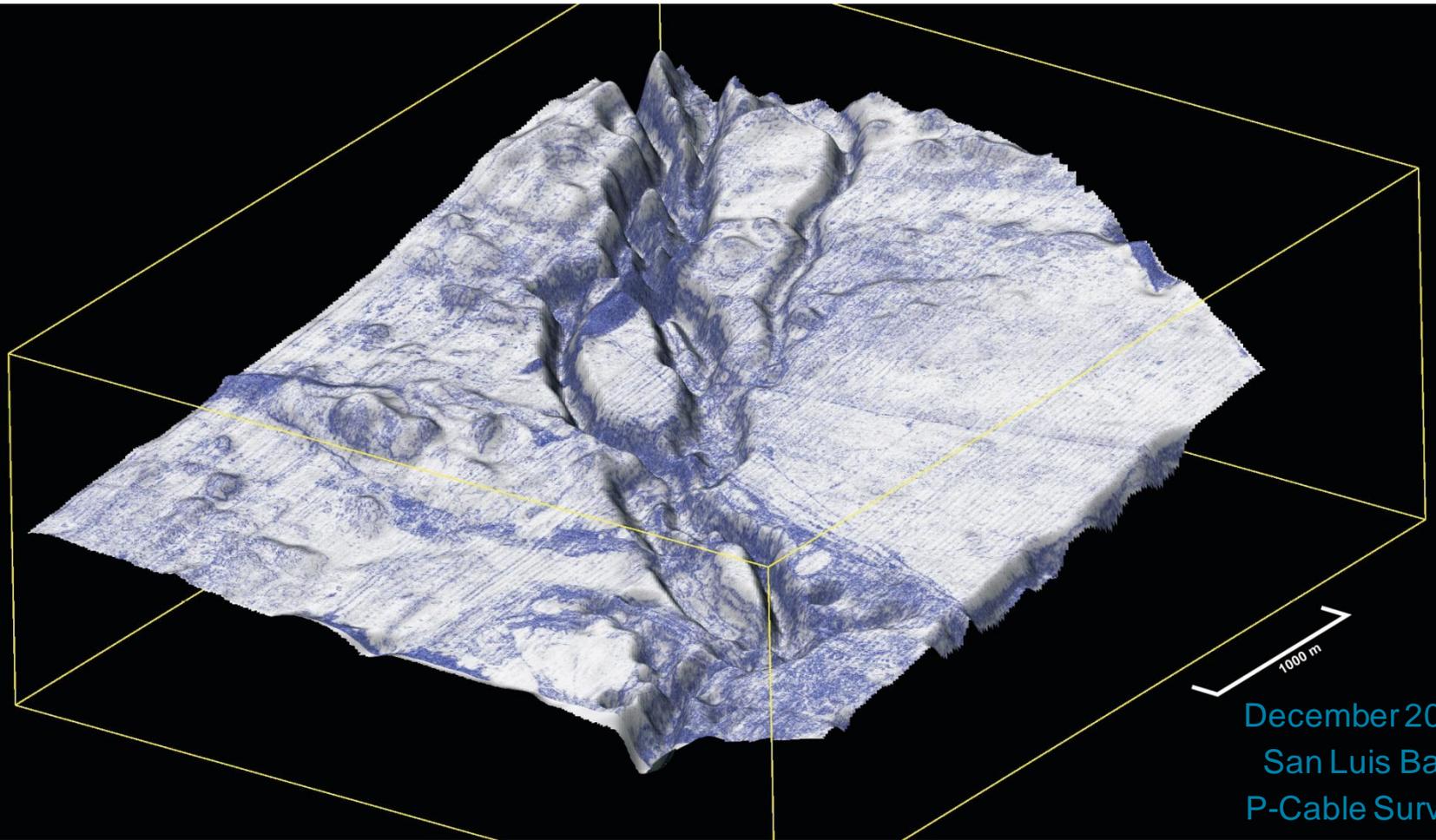


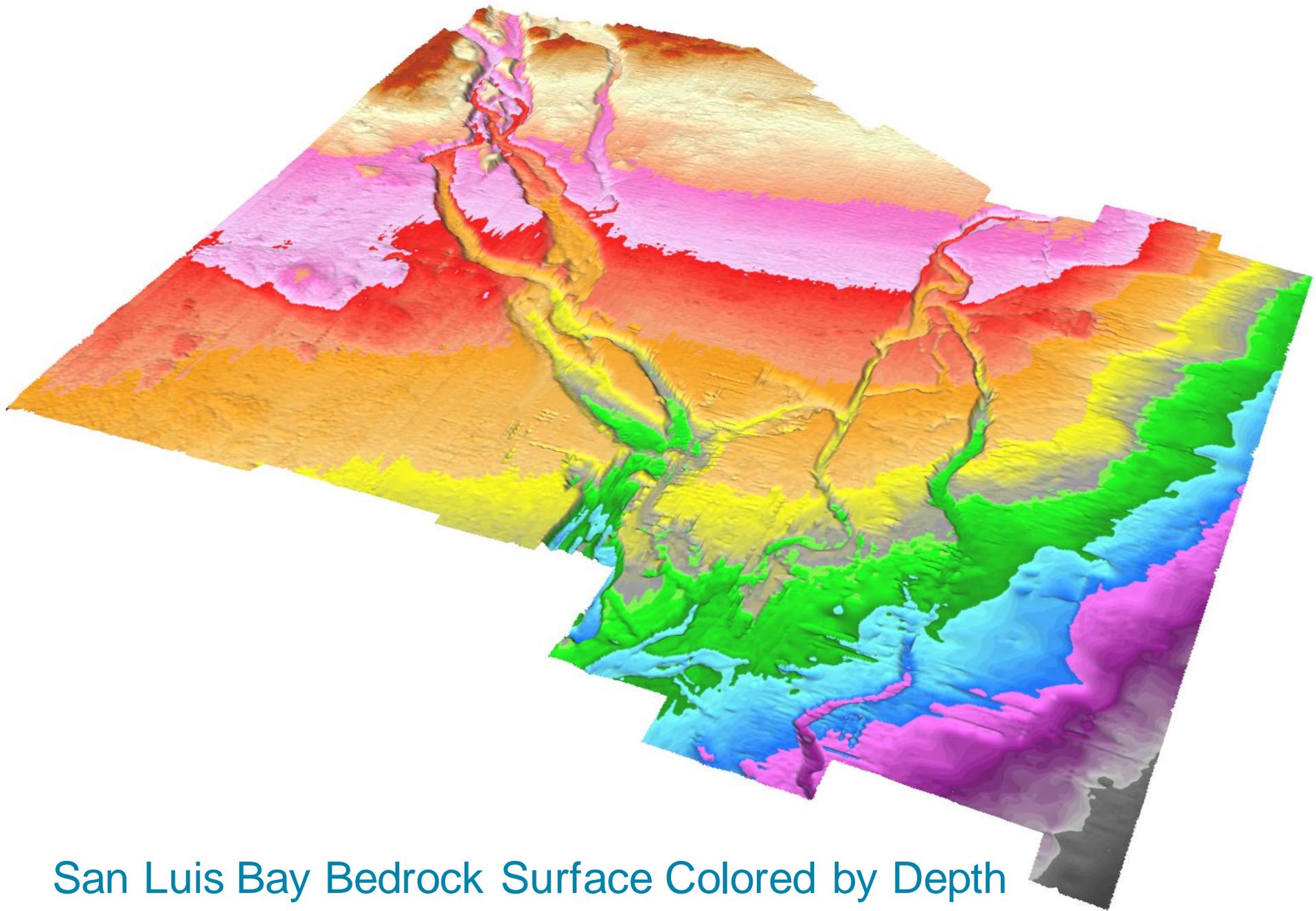
San Luis Bay 3D P-Cable Survey Block Diagram Animation





Perspective View of Bedrock Surface Smoothed Dip of Maximum Similarity

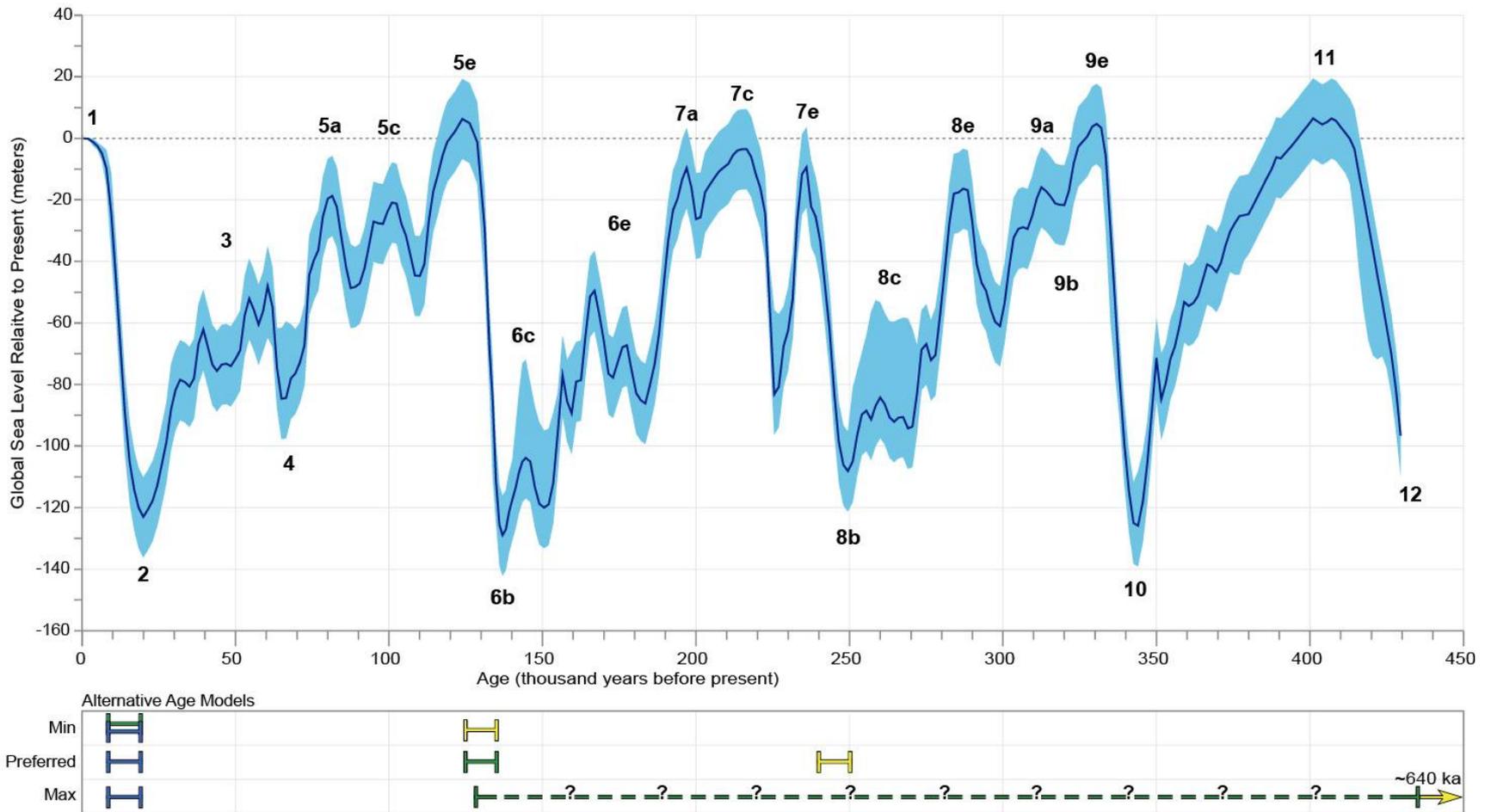




San Luis Bay Bedrock Surface Colored by Depth



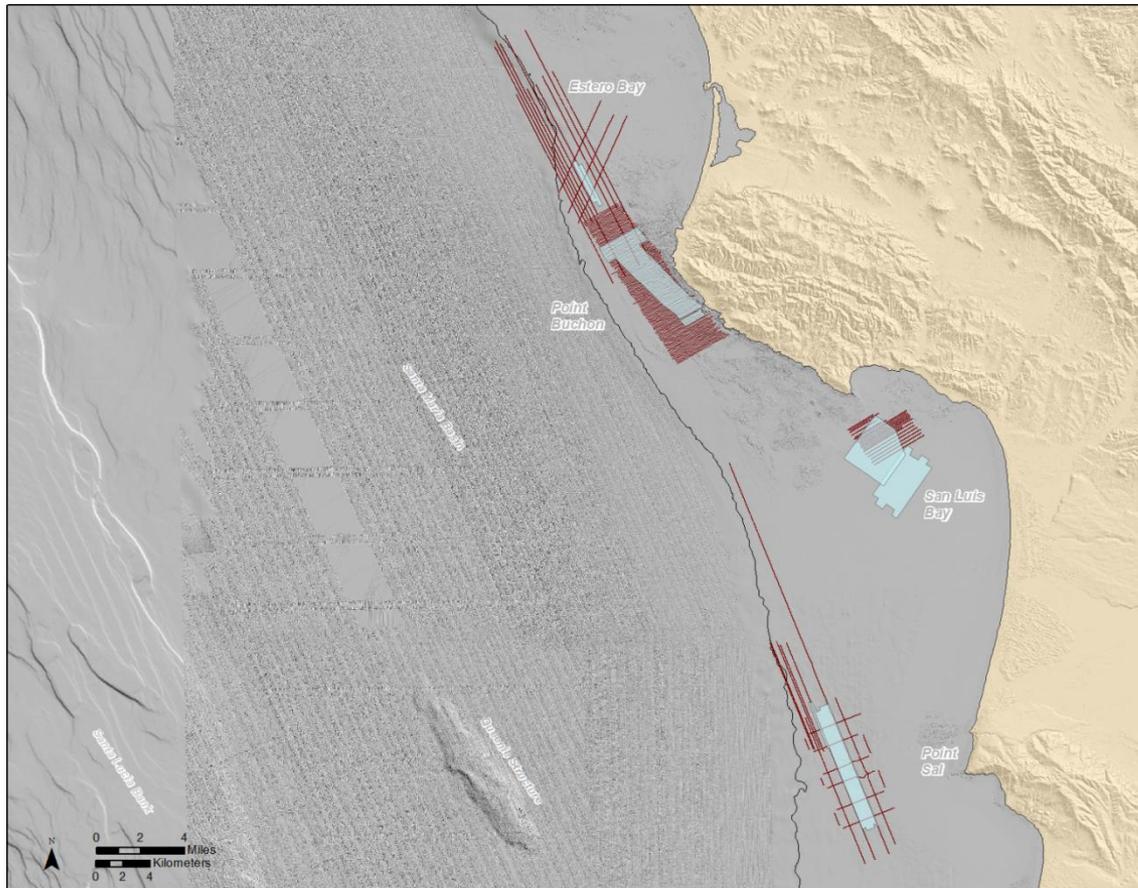
Reconstructed Sea Level Curve Past 430 ka



(Modified from Waelbroeck et al., 2002)

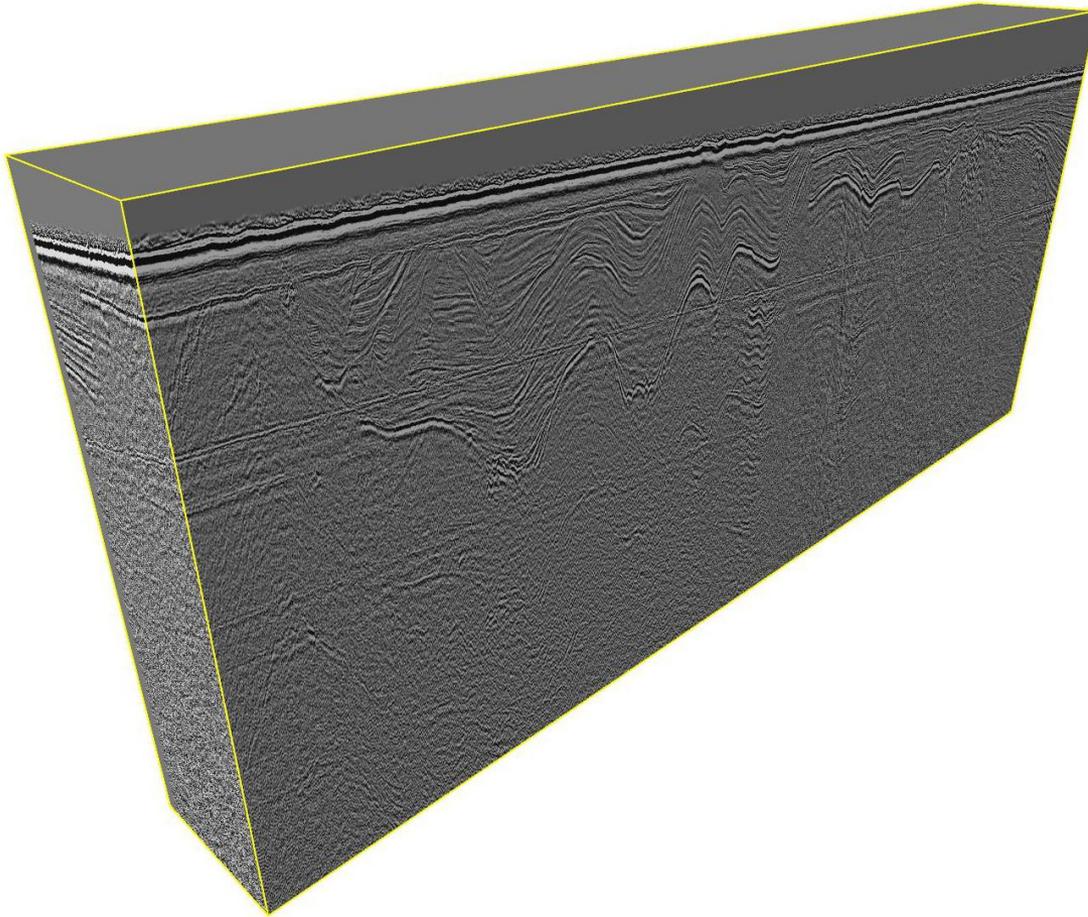


2010-2012 2D/3D Low-Energy Seismic Survey Tracklines



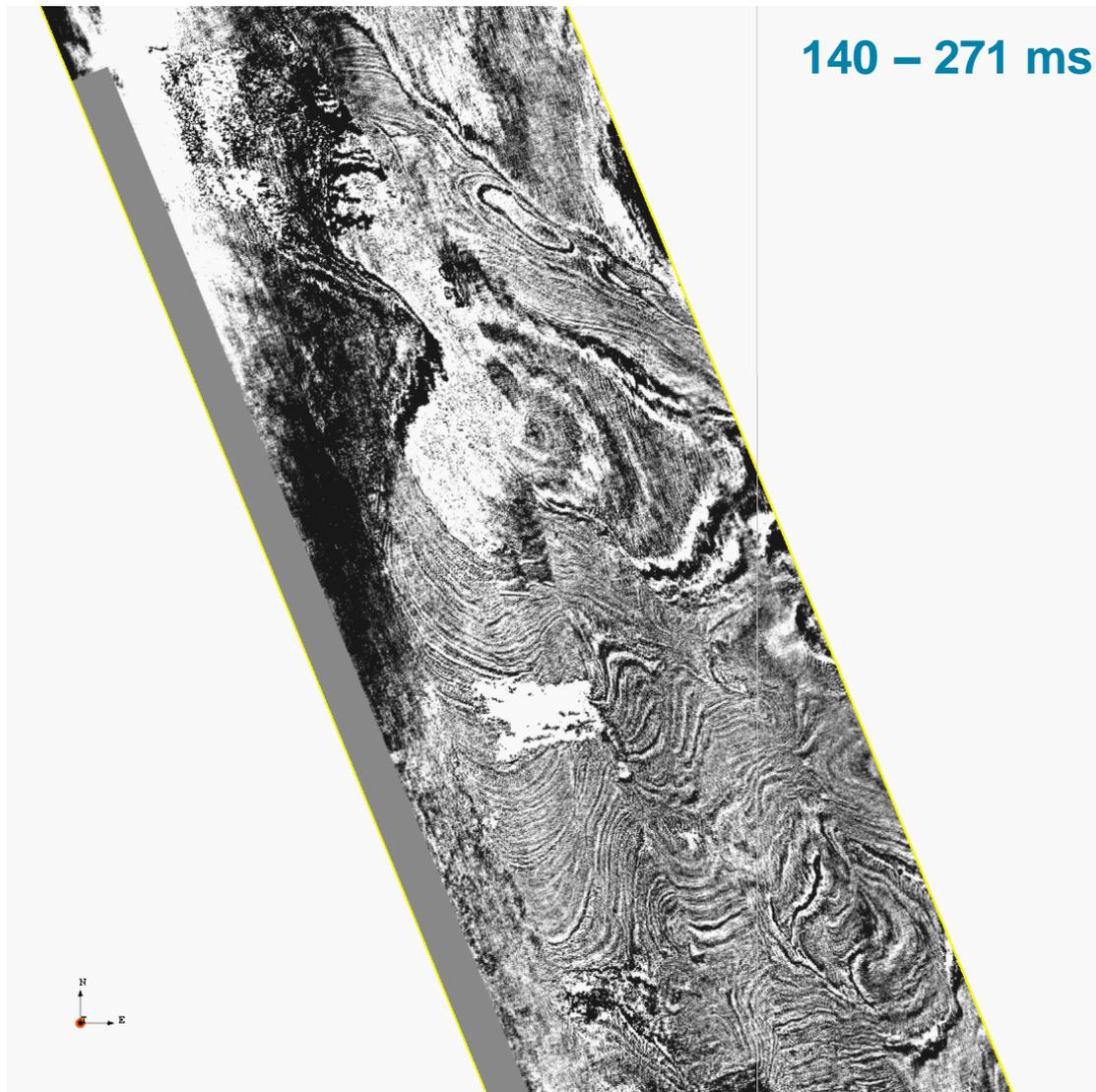
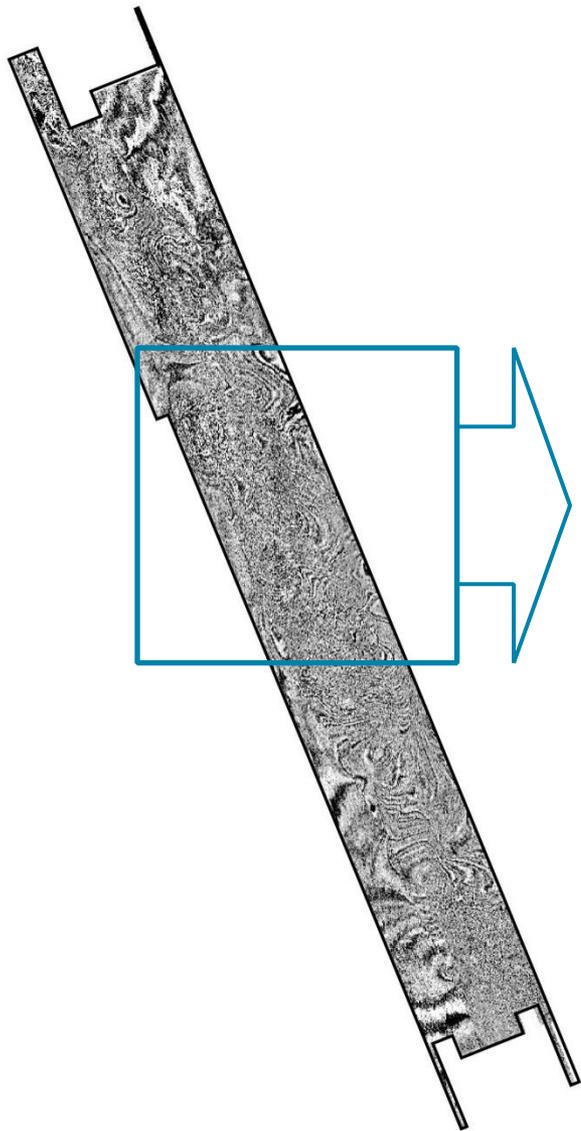


Point Sal 3D Amplitude Volume



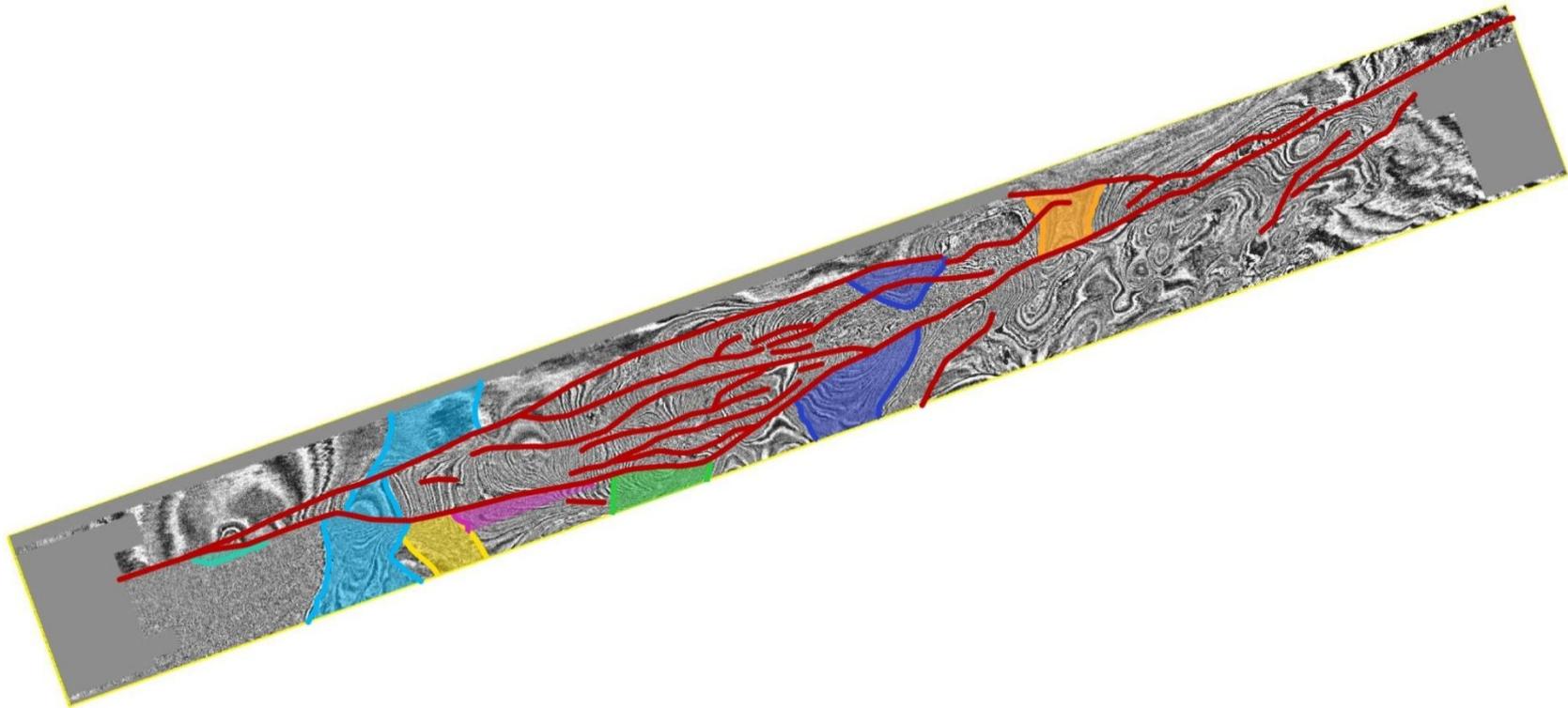


Time Slice Animation





Paleochannels and Faults Plan View





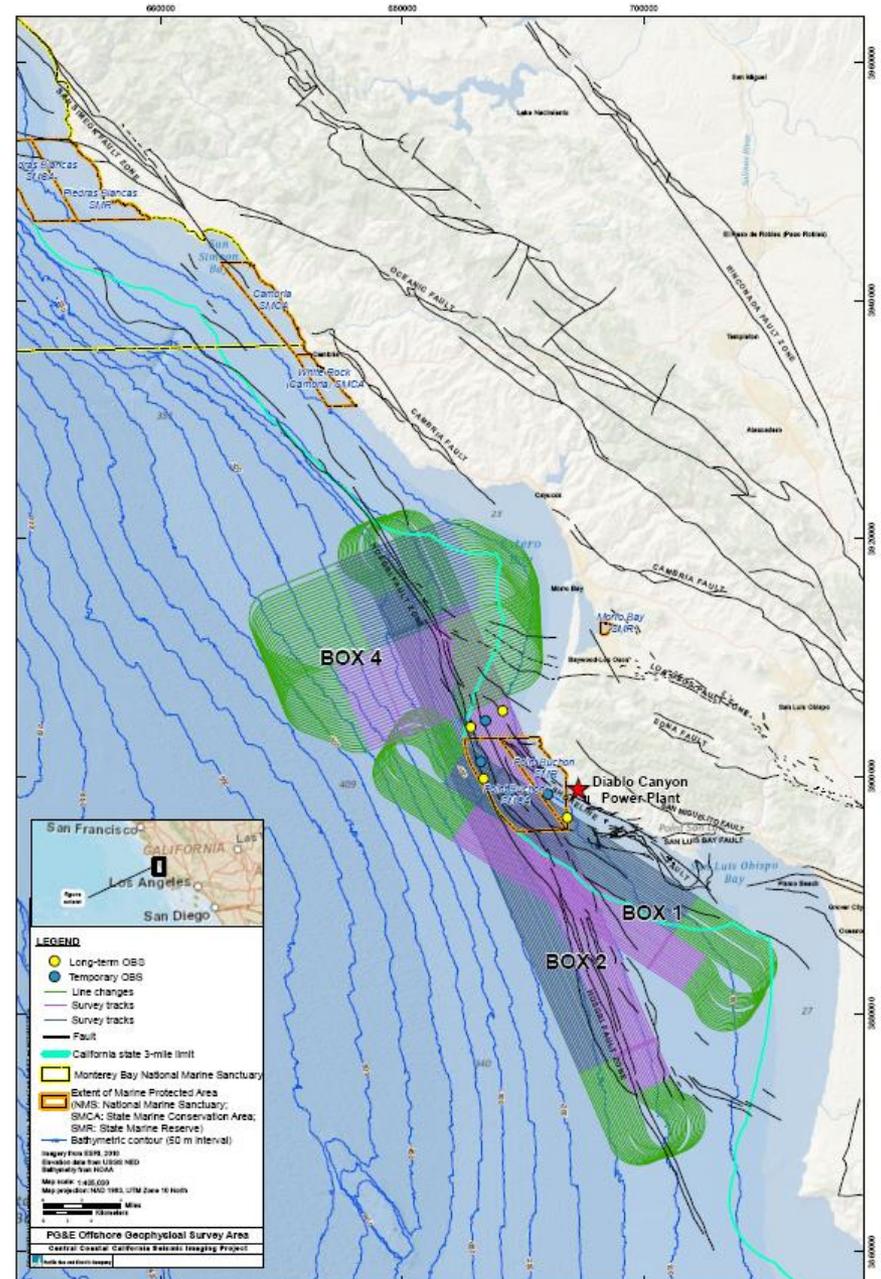
Technical Reports describing the 2011 and 2012 Low Energy Seismic Surveys of the southern segment of the Shoreline Fault Zone and the Hosgri Fault Zone will be issued in the fourth quarter of 2013.



Proposed 3D High Energy Seismic Survey (HESS)



R/ V Marcus Langseth





May 2011

PG&E files for CA State Lands Commission Geophysical Survey Permit
Environmental Impact Report process begins

July 2011

PG&E issue RFP for geophysical survey vessel to conduct 3D HESS
offshore DCP.

2012

PG&E initiates Federal permit/ authorization process to conduct
3D HESS in Federal and state waters offshore DCP.

Involves coordination with many agencies including SLC, CCC, NSF and
NOAA National Marine Fisheries

EIR submitted to State Lands Commission



August 2012

Geophysical Survey Permit issued by the CA State Lands Commission

EIR certified

Initiate environmental monitoring programs

Initiate pre-mobilization activities for RV Langseth

NSF holds field hearings in SLO

November 2012

Coastal Development Permit denied by the CA Coastal Commission

Federal Incidental Harassment Authorization withdrawn

2013

Final decision on HESS studies pending review of existing data



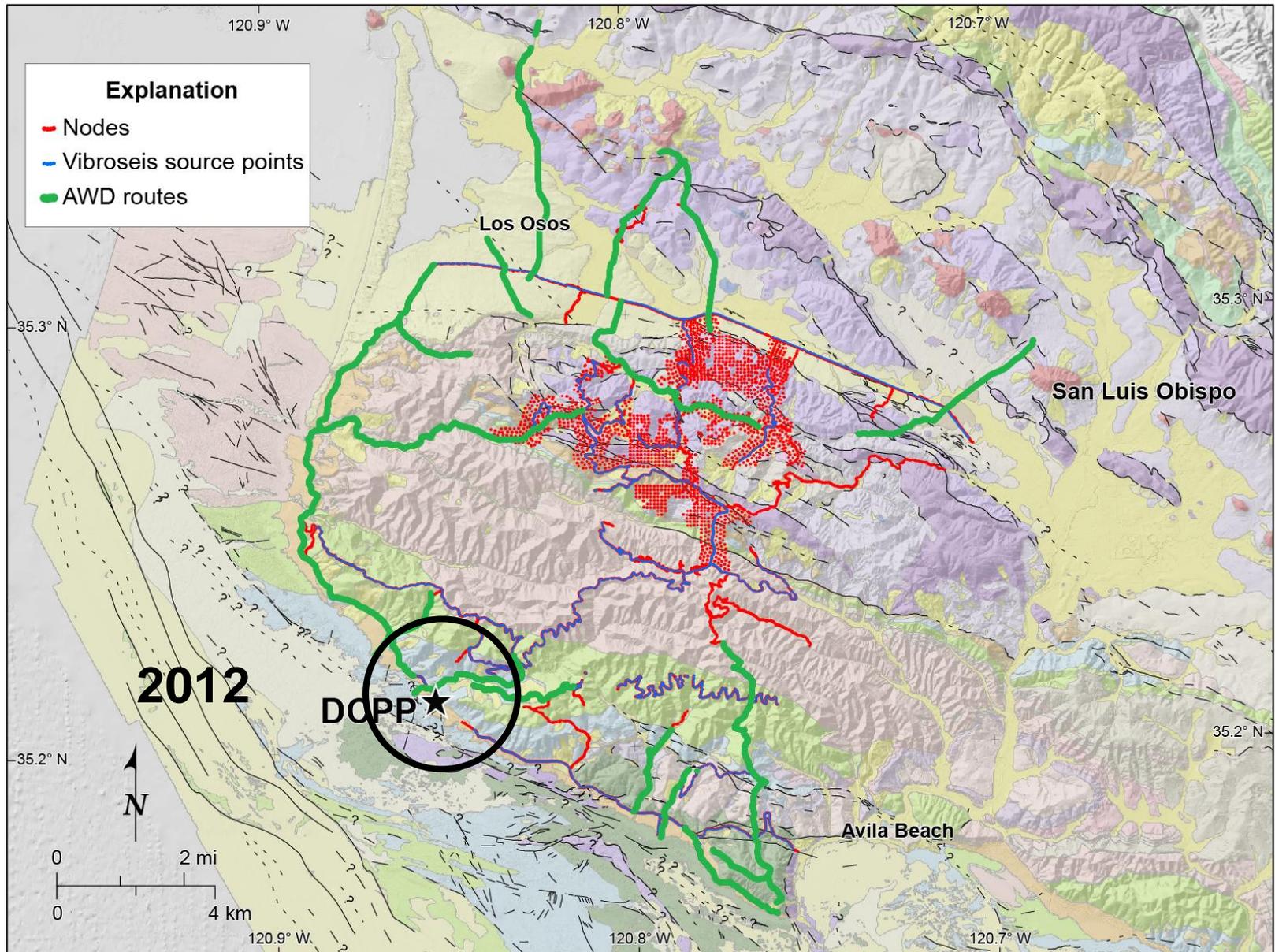
2D/3D Land Seismic Reflection Surveys

Irish Hills/ Los Osos Valley



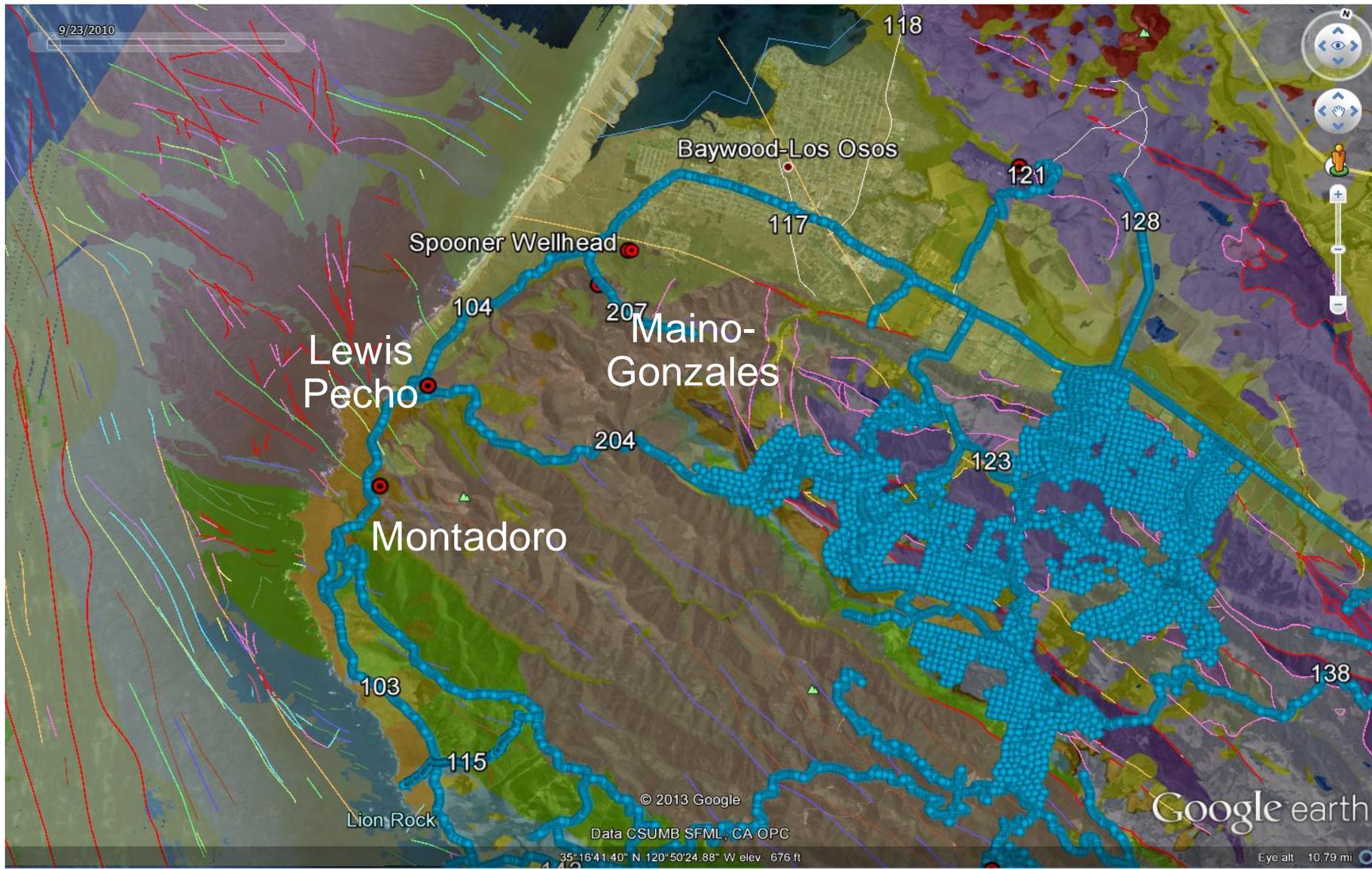


2011- 2012 2D/3D Seismic Reflection Surveys





P104 Well Coverage – 4 Wells with Stratigraphy

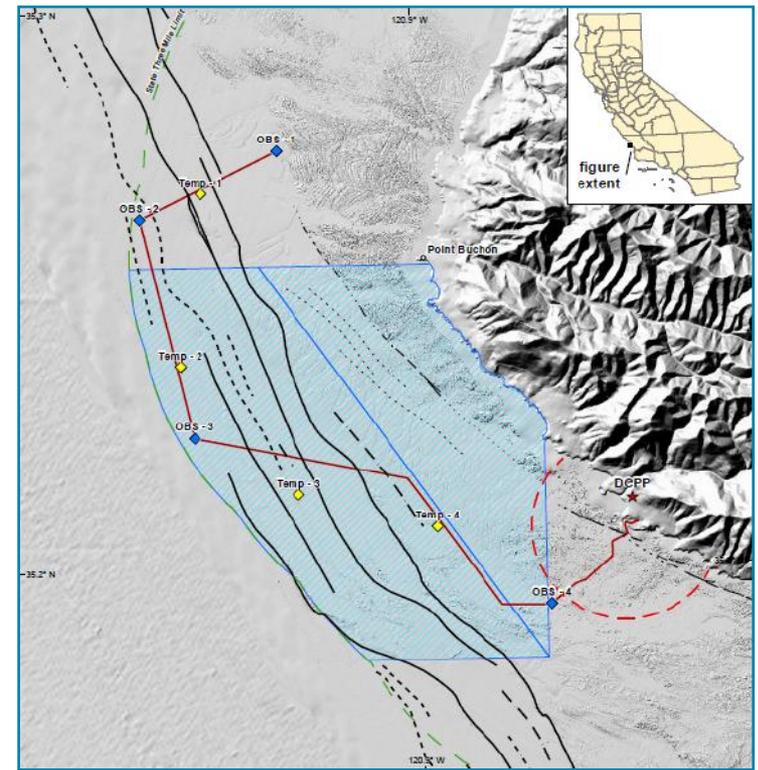
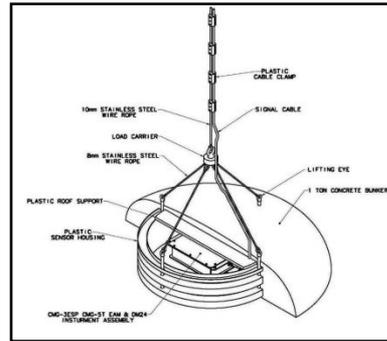




Technical Reports describing the
2011 and 2012 2D/3D Land Seismic Reflection Surveys
will be issued in the second quarter of 2014.



Ocean Bottom Seismometers



PG&E has applied for and received the necessary state and Federal permits to deploy and operate a network of four (4) Ocean Bottom Seismometers (OBS) offshore Point Buchon.

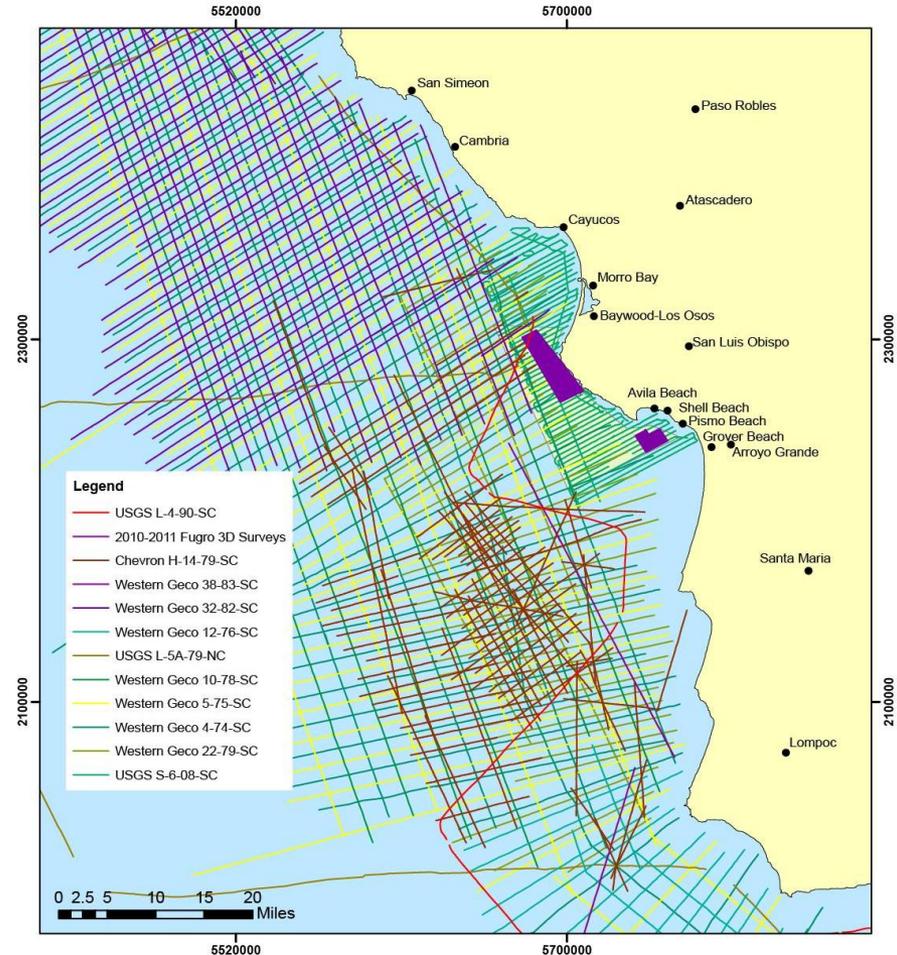
The objective of the OBS network is to improve the detection capability and location accuracy of earthquakes in this region.

OBS instruments are scheduled to be deployed in the third quarter of 2013



Legacy Data Archive

- Earthquakes
- Geology
- GPS
- LiDAR
- Multi Beam Echo Sounding
- Potential Field (Magnetics/ Gravity)
- Seismic Reflection/ Refraction



SEISMIC DATA AVAILABLE OFFSHORE CENTRAL CALIFORNIA
PG&E 3D Seismic Reflection Surveys
Offshore Central California

<http://www.pge.com/dcphp-ltsp>



Thank You !