

Deep Diving in Submarine Canyons

In the summers of 1995 and 1996 and in October, 1998, Peter Brueggeman participated in three research cruises led by Dr. Eric Vetter studying submarine canyon ecology in Southern California submarine canyons. Here Peter is posing in the Delta submersible, just after a dive. Over the three trips, he did seventeen dives in this submersible.

These research cruises were undertaken by Dr. Vetter to extend deeper and more broadly the work he began in his Scripps doctoral dissertation on the benthic ecology of Scripps Canyon particularly the invertebrate population ecology in the debris mats. All cruises used the Delta two-man submersible to suction up bottom samples, take photos, and run video transects to determine relative abundance of macro-organisms.

Detailed information on the development of the Delta submersible, and its designer/owner Doug Privitt, as well as its dive logs, are on the web at <http://privitt.com/douglas.htm>



Here is Delta on the deck of the tender ship *Cavalier*.

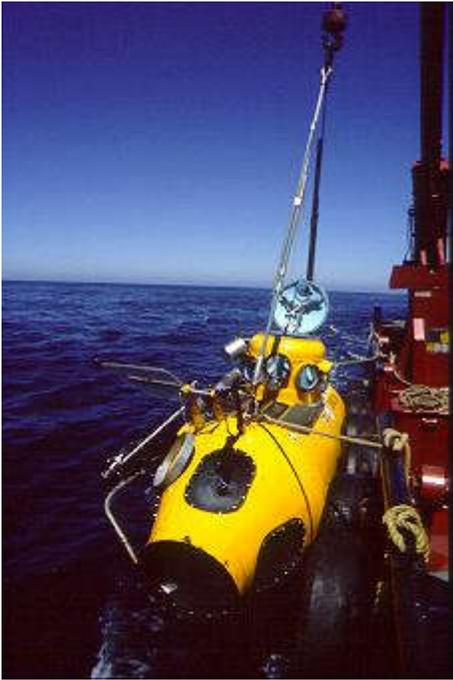
Delta is 15 1/2 feet long with a beam of 3 1/2 feet and a height of 6 feet. Delta has a maximum operating depth of 1,200 feet, cruises at 1.5 knots with a maximum speed of 3.5 knots and can stay down 144 man-hours

supporting two occupants (captain and scientist/observer). Here you can see Delta's accordion-pleated suction tube and external video and still cameras.



Bright and early, everyone gets up to put Delta into the water.

With a rolling sea, you have to be careful to hold Delta steady with guidelines so it doesn't crash around into the ship or people.



Delta gets tied up alongside the ship so you can load up gear and then people



After loading up Delta, it gets lowered into the water by all of us.

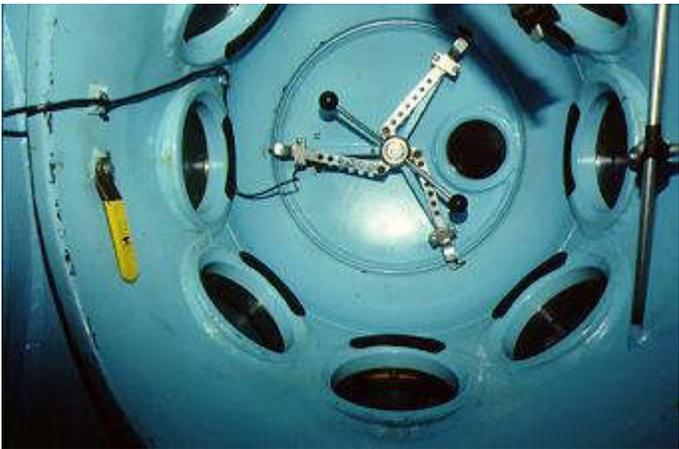
Here Delta is heading out from the tender ship a short distance away and then it will submerge and begin the dive.



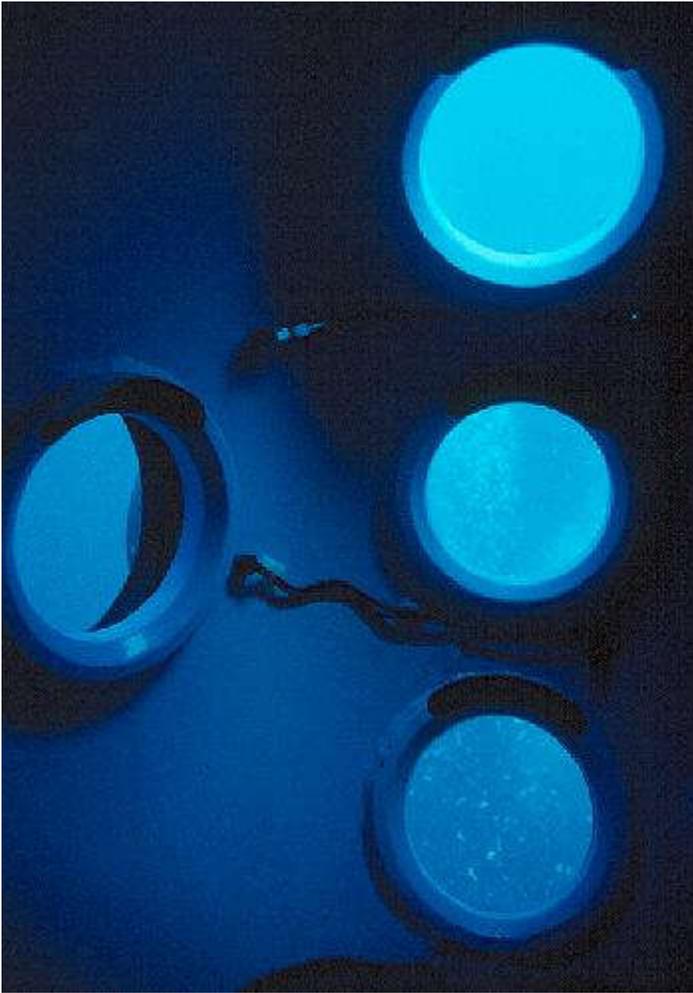
Inside Delta, it is tight for two grownups and just the right size for children! The forward observer lays stretched out towards the front and the captain sits on a seat looking out through the cupola's portholes. Here I am in front looking back at my son Leo sitting in the captain's seat inside Delta.



Here I sit in the captain's seat looking towards the front of Delta at my son Leo and Alyssa Vetter. You can see the front portholes that the forward observer uses to look out. Leo and Alyssa were so excited being inside Delta that I watched them closely to ensure they didn't start enthusiastically flipping switches and pressing buttons.



Here's a view looking straight up from the captain's seat at the hatch you use to enter Delta. You can see the cupola portholes that the captain uses to see while driving Delta.



Here's the forward observer's view of the portholes on the right side of Delta. You can look around in almost any direction.



You cannot be claustrophobic if you dive in Delta since space is tight and you only get a portholed look outside. Here's a view out through a front porthole at the tender ship *Cavalier*.



Here Delta is heading back towards the tender ship after a dive.

Delta approaches alongside the tender ship and two crew hook up a cable yoke with two hooks to front and back eyehooks on Delta. The ship's crane then yanks Delta out of the water into a hanging position alongside a mattress of old car tires on the side of the ship. Tie up the sub to ship cleats, open the hatch, and clamber out.



Here Delta is moving alongside to be landed onto the tender ship.



Reach down and quickly snap on the cable clips in order to pull up Delta and land it alongside the tender ship!



At the end of the day, Delta is brought back onto deck of the tender ship.

Following are my trip logs from three dive trips to various Southern California submarine canyons in 1995, 1996, and 1998, as well as an oceanographic research ship cruise to collect sediment core samples from these canyons in 1996.

Scripps Canyon, August 1995

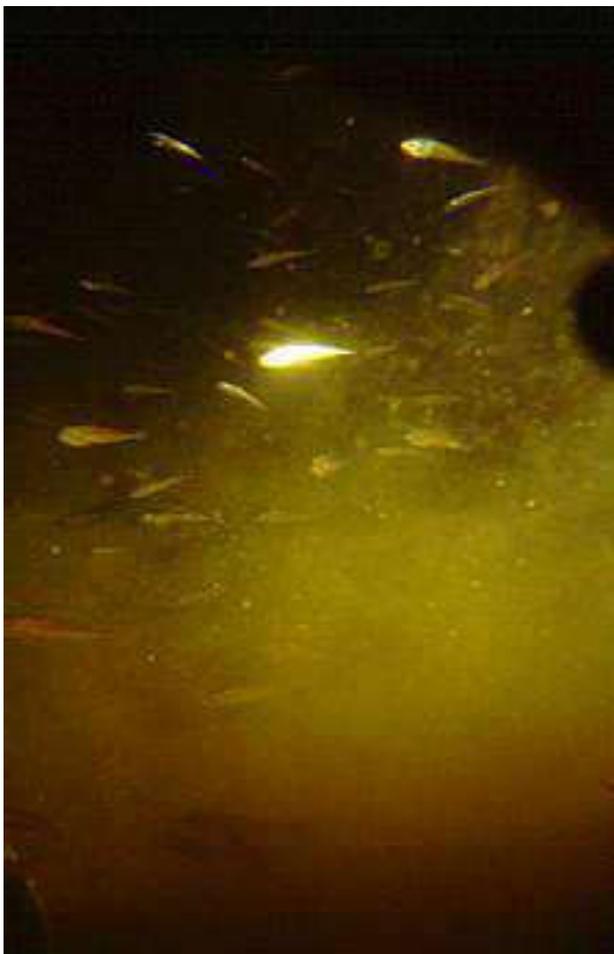


At the end of August 1995, I made two deep dives in Scripps Canyon in the two-man submersible Delta, and a dive to a non-canyon control site off Del mar.

Delta is pictured here heading towards its tender ship in the waters above Scripps Canyon.

On this cruise, Delta made a total of 27 dives over four days with the Del Mar dives collecting control samples.

Scripps Canyon: 550 feet



On this dive down into Scripps Canyon, we dropped down over the lip of the Canyon at 200 feet. There was a squid swarm at 328 feet. On the vertical wall of the Canyon down deep approaching the target depth, I saw orange cup corals, red galatheid crabs in profusion, white sponges with finger-like protrusions, and small quarter-coin-sized white anemones or hydroids. The wall was not a continuous carpet of marine life one sees when scuba diving at shallower depths. The wall down deep in this 500 foot range is much the same morphologically as seen shallower: overhangs, vertical cracks, ledges, etc even some long-lost/left-behind cables. The red galatheid crabs live down there in deeper water and were hanging about clinging to the walls. At the bottom of the canyon as we cruised along, the walls were 15 or so feet across and there was an immense

congregation of juvenile hake (seen here), so many that they were stirring up the silty, muddy bottom as they flitted about. The objective on these dives is to suck up bottom sediment into two sample bags so I saw more of the bottom than the walls. Some fish get inadvertently sucked up with sediment since there are so many fish.



There wasn't much debris intermingled into the mud; what debris there was mostly surfgrass which lasts longer than kelp in debris. Swarms of swimming invertebrates (mysids) were attracted to the submersible's floodlights as seen here.

This area of the canyon was obviously a rich area since it was supporting so many juvenile fish. The submersible stirred up the bottom mud and a mud cloud would follow the sub down the canyon. In the canyon, I also saw a chimaera ratfish, a blenny and a cusk eel.



At one point, we came up on a torpedo ray *Torpedo californica* which, obviously irritated, turned toward the submersible, and draped itself on a front viewport as seen here -- it was obviously shocking the Delta submersible. Rocks on the bottom of the canyon were covered with white hydroids. There were lots of small flatfish around. Photography

is difficult due to the darkness and the uneven lighting from Delta's floodlights.

My notes had max depth at 538 feet.

DELTA LOG

(S10-16)

Dive No: 3655 Date: 30 AUG 1995 Time down: 0920 Max Depth: 550'

Location: SCRIPPS CANYON Time up: 1010 DOWN 155m

Client: NURP-SCRIPPS Duration: 50 MIN

Purpose: BIOLOGICAL SAMPLING Water Vis: 10-15'

Pilot: CHRIS I JAMES Sea State: 0

Observer: PETER BRUEGGEMAN Recorder: RAS

Remarks: _____

Scripps Canyon: 500 feet

On this dive into Scripps Canyon, I saw rocks with white hydroids on them, vertical wall overhangs with white sponges and galatheid crabs, lots of hake and flatfish, even a horizontal cable in the Canyon which the sub had to carefully maneuver around. My notes had max depth at 499 feet.

Dive No: <u>3664</u>	Date: <u>31 AUG 1995</u>	Time down: <u>1310</u>	Max Depth: <u>500'</u>
Location: <u>SCRIPPS CANYON</u>		Time up: <u>1348</u>	
Client: <u>NURP - SCRIPPS</u>		Duration: <u>38min</u>	
Purpose: <u>BIOLOGICAL SAMPLING</u>		Water Vis: <u>10' TO 0</u>	
Pilot: <u>DAVID SLATER</u>		Sea State: <u>1</u>	
Observer: <u>PETER BRUEGGEMAN</u>		Recorder: <u>RAS</u>	
Remarks: _____			

Del Mar seafloor: 690 feet

This was a dive to a control site on the flat sandy seafloor off Del Mar in order to collect non-canyon bottom samples to compare to canyon bottom samples. My notes agreed with this depth.

DELTA LOG			
Dive No: <u>3643</u>	Date: <u>28 AUG 1995</u>	Time down: <u>1345</u>	Max Depth: <u>690'</u>
Location: <u>DEL MAR</u>		Time up: <u>1445</u>	<u>209m</u>
Client: <u>NURP - SCRIPPS</u>		Duration: <u>60min</u>	
Purpose: <u>BIOLOGICAL SAMPLING</u>		Water Vis: <u>30'</u>	
Pilot: <u>CHARLIS JAMES</u>		Sea State: <u>1-2</u>	
Observer: <u>PETER BRUEGGEMAN</u>		Recorder: <u>RAS</u>	
Remarks: _____			
<u>1st SURVEY</u>	<u>32° 56.137</u>	<u>117° 19.645</u>	<u>2nd SURVEY 32° 56.225 117° 19.598</u>

Southern California Submarine Canyons, July 1996

In mid-July 1996, I went out on another research cruise lasting eight days with Dr Eric Vetter using the Delta two-man submersible to study submarine canyon ecology in more Southern California canyons.

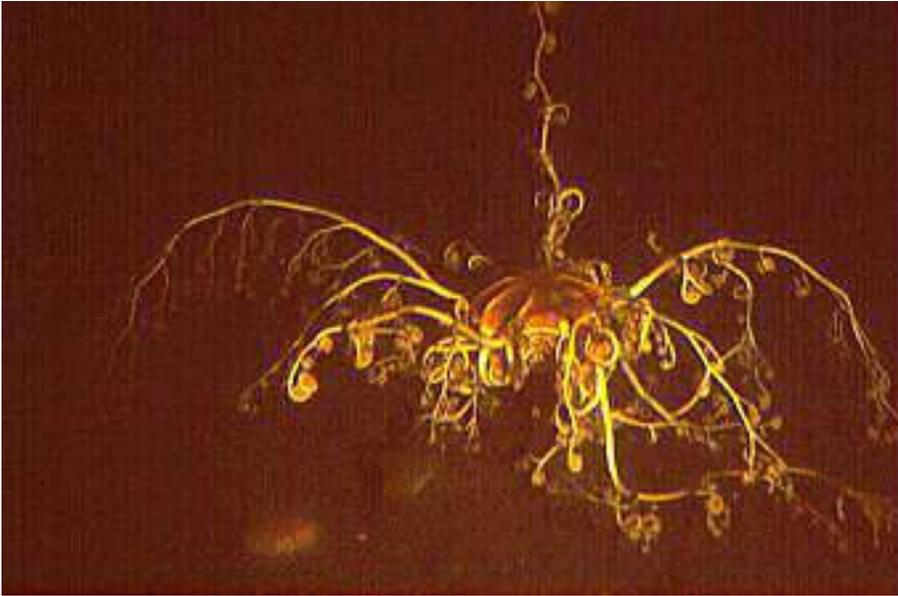
All the canyon sites I saw had muddy/silty bottoms with very infrequent rocks; I only saw canyon walls at Dume Canyon.

Several canyon bottoms accumulate trash which the fish and invertebrates shelter in and there are also kelp holdfasts and stipes that the urchins congregate on and eat. None of these canyon bottoms were loaded with detritus like Scripps Canyon.

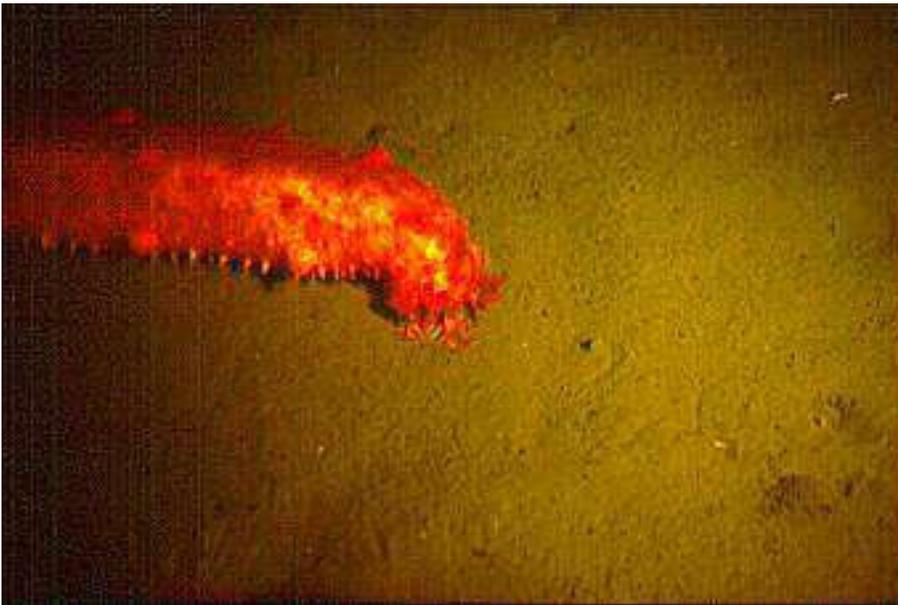
Dr. Vetter also did single scouting dives at Hueneme and Mugu Canyons which were not easily divisible due to currents and visibility. Walls were not seen and one canyon was swept by currents making it uninteresting.

A single scouting dive was done at Santa Cruz Canyon off Santa Cruz Island which was notable for a fishing boat wreck but no walls and generally an uninteresting canyon from a benthic ecology viewpoint.

Malibu seafloor: 650 feet



This was a control site dive to the seafloor well offshore Pepperdine University in Malibu. I saw many large white *Metridium* anemones but mostly sea urchins. Most spectacular were two *Gorgonocephalus* basket stars (one shown here).



On this seafloor dive off Malibu, I saw bright red sea cucumbers feeding on the seafloor (shown here). You can see its mouth parts sweeping the bottom to pick up loose material for consumption. I saw flatfish, octopus, rockfish, cusk eels, two large *Pleurobranchus* opisthobranch, big fluffy sea pen, and shrimp. I logged max depth at 670 feet.

25	Dive No: 3179	Date: 7.17.96	Time down: 1624	Max Depth: 650'
	Location: SANTA MONICA		Time up: 1710	
	Client: SCRAPPS		Duration: 46min.	
	Purpose: CANYON		Water Vis: 25'	
	Pilot: O. JAMES.		Sea State: 1	
	Observer: P. BELEGEMAN		Recorder: Slater	
	Remarks: 198m			

Dume Canyon: 660 feet



This dive into Dume Canyon was my favorite dive on this research cruise. I saw lots of big white shrimp that were sized like small lobsters and looked pretty yummy to me.



Here is a shrimp rearing up in defense with its claws attacking at the approach of Delta. It was a tough little fellow and held its ground until it was forced to retreat at the last second.

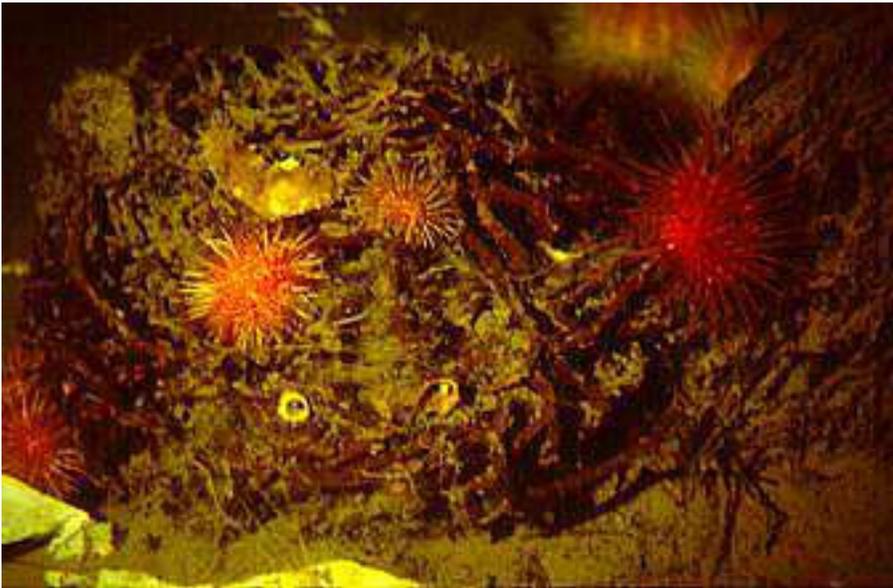


I saw flatfish which can be very well camouflaged on the bottom.

Locate the flatfish's two side-by-side eyes to find the flatfish.



There were lots of drift kelp holdfasts scattered around the bottom of Dume Canyon. The holdfasts are tougher and heavier than the kelp blades and so find their way deeper into submarine canyons before being consumed. Shrimp sheltered under these drift kelp holdfasts.



I saw sea urchins piled up and consuming these drift kelp holdfasts and stipes.



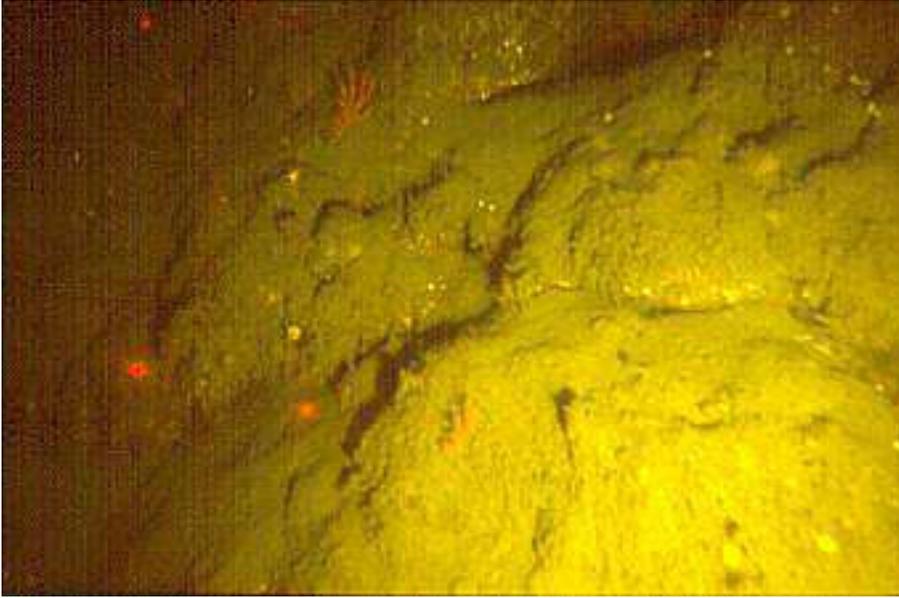
I saw many other things on this Dume Canyon dive. The most alien sight to me is shown here and I saw two of them: a tethered, floating egg-shaped large orange siphonophore *Dromalia alexandri*.

I also saw *Pleurobranchus* opisthobranchs, cusk eels, rockfish, red anemones, and long rope-like siphonophores.

My notes logged max depth at 680 feet.

3 Dive No: 3785 Date: 7.18.95 Time down: 1422 Max Depth: 66' 1/2
Location: Pt. Dume Time up: 1528
Client: Scripps Duration: 60min.
Purpose: Canyon Survey Water Vis: 15'
Pilot: C. James Sea State: 0
Observer: P. BRUGGEMAN Recorder: SLAM.
Remarks: JSM. JSM.

Dume Canyon: 335 feet



On this dive into Dume Canyon, I saw octopus, two hagfish (not slimey), flatfish, and no sea urchins. The Delta sub dropped down a short vertical stretch of the west wall and hit the canyon bottom at 110ish meters; here is the Dume Canyon wall at approx 310 feet. Delta left Dume Canyon by ascending its east wall from 95 up to 60 meters. The

Dume Canyon wall is a shelly aggregate, deeply eroded with big overhangs and infolds and has lots of caverns and columns. The wall is covered with rockfish. My notes record this dive at 360 feet.

37	Dive No: 3791	Date: 7.19.94	Time down: 18:16	Max Depth: 335'
	Location: Pt DUME		Time up: 19:02	
	Client: SOPEES		Duration: 46 MIN	
	Purpose: Coastal Survey		Water Vis: 10-15'	
	Pilot: C. James		Sea State: 2	
	Observer: Peter QUASSTMAN		Recorder: SLATM	
	Remarks:			
		DIVE DATA	10514	

Santa Cruz Island seafloor: 450 feet



On this control site dive to the seafloor off Santa Cruz Island, I saw a featureless mud plain.

I saw two *Metridium* anemones, several species of sea pen (one shown here and they were exquisitely beautiful), sea whips, cancer crabs, small flatfish, and small seastars.



My Santa Cruz Island seafloor dive was marked by octopus!

I saw many octopus trying to look inconspicuous in shallow seafloor holes as the Delta sub passed by.

My notes recorded max depth at 480 feet.

42

Dive No: 3796	Date: 7-21-96	Time down: 10:42	Max Depth: 450'
Location: Santa Cruz Is.		Time up: 11:16	
Client: Scripps		Duration: 34 MIN	
Purpose: Canyon Survey		Water Vis: 30'	
Pilot: Dave Slater		Sea State: 0	
Observer: Peter Bruggeman		Recorder: CBA	
Remarks:			

Carlsbad Canyon: 415 feet

On this dive into Carlsbad Canyon, I saw two squid, two octopus, small white urchins, lots of worm tubes, lots of white shrimp, sea cucumbers, seastars, cusk eels, and lots of juvenile hake. Clouds of invertebrates were attracted to the Delta flood lights. My notes had our max depth at 410 feet.

2

Dive No:	3756	Date:	7-14-96	Time down:	10:27	Max Depth:	415'
Location:	Carlsbad	Time up:	11:14				
Client:	Scripps	Duration:	47 min.				
Purpose:	Canyon Benthic Survey	Water Vis:	10'-15'				
Pilot:	Dave Slater	Sea State:	0				
Observer:	Peter Bruggeman	Recorder:	CBT				
Remarks:	No fish						ON BOT. 250' 90m

Redondo Canyon 288 feet

I did a dive into Redondo Canyon in which there was lots of trash and reduced visibility. I saw rockfish, cusk eels, octopus, small flatfish, sea pens, a big wolf eel (!), prawns, a ray, and a chimaera rattfish. My notes have max depth at 300 feet.

3

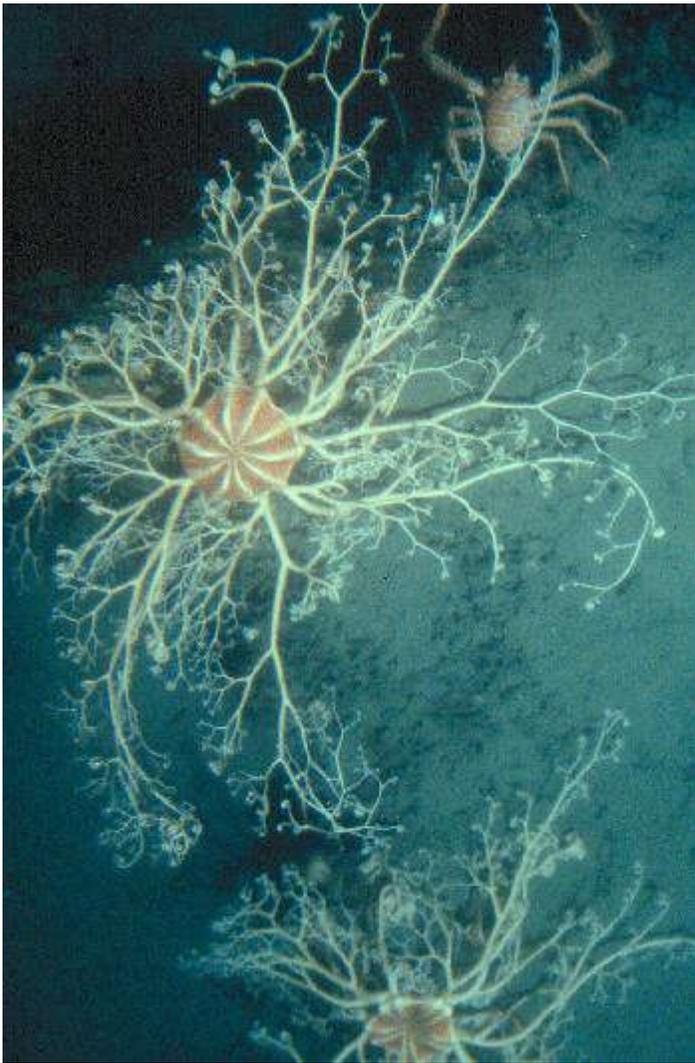
DELTA LOG

Dive No:	3770	Date:	7-16-96	Time down:	10:58	Max Depth:	288'
Location:	Redondo	Time up:	11:36				
Client:	Scripps	Duration:	38 MIN				
Purpose:	Canyon Benthic Survey	Water Vis:	10-15'				
Pilot:	Dave Slater	Sea State:	0				
Observer:	Peter Bruggeman	Recorder:	CBT				
Remarks:	fish No PRESENT						ON BOT 278'

Southern California Submarine Canyons, October 1998

The October 5-12, 1998 Delta cruise was tendered by the 106 foot workboat *McGaw*. We spent most of our time diving in Scripps Canyon, La Jolla Canyon, and Dume Canyon off Point Dume / Zuma Beach in Malibu. We also did some non-canyon control site dives as well as a few forays into Carlsbad Canyon offshore from the powerplant. Down deep the water temperatures were 9-10 deg C (48-50 deg F).

Scripps Canyon: 806 feet



On the way down to the target depth in the canyon bottom, I saw a *Gorgonocephalus* basket star perched on the canyon wall (at left). At 208 meters depth, the precipitous walls of Scripps Canyon were too narrow to take Delta down another fifteen feet to the bottom. Delta is 3.5 feet across in beam so this was indeed a narrow-walled section of Scripps Canyon. We moved up shallower to 204 meters where the canyon walls were twelve feet apart in order to get a bottom sample.

On the bottom there were schools of hake flitting about; the hake were 5-6 inches long. Many of the hake would be settled on the bottom and when flitting off in a startle reaction to the sub, each hake would stir up a small cloud of bottom sediment. With a big school of hake flitting about and stirring things up, the

final one foot of water column can get pretty cloudy with sediment so you can't see the hake there. You see them above the cloud but see them intermittently in the brown mud cloud on the bottom. The hake flash silver in Delta's floodlights so you are looking out on a flashing school of fish above a low-lying brown mud cloud with some silver fish showing here and there in the mud cloud.



Hake that are very close up in the floodlight show violet color flashes. Hake everywhere! Intermingled here and there with the hake were several long silver ribbon-like fish with one long undulating fin running down their body. These ribbon-like fish were hard to see in their narrow top-to-bottom cross-section but were broad and shiny silver from side view. These are cutlassfish, ribbonfish or scabbardfish -- can't tell without looking

at some slides. These ribbon-like fish were positioned vertically heads-up which is a typical hunting position to spot the dark shadow of prey outlined against the dim light coming down from the surface. Of course my human eye couldn't see any light looking up but the fish can; it becomes totally dark to my eye at about 400-500 feet depth. Some of these ribbon-like fish moved in close to Delta's front portholes in a slow, deliberate movement and I swear they were curious and looking inside at me (the sub has low-lighting inside).



Cancer crabs were here and there (shown here). One cancer crab waved its clawed arms at hake while in the midst of a thick hake school. That crab was either being defensive about being crowded by hake or was trying to grab one that bumped in close. The canyon bottom was a fine silty mud with hydrogen sulfide blackened sediment underneath with seagrass debris mixed in. There were eel-like fish similar

to cusk eels, shrimp, flatfish, chimaera ratfish, lizardfish, and some deepwater urchins.

The vertical or steeply dropping canyon walls were rocky and sprinkled with red galatheid crabs with occasional orange anemones, sea cucumbers, and orange cup coral. There were big bouldering sections of the canyon walls with cracking; there was a fine dusting of silt on the canyon walls. Occasionally there was an orange-red small gorgonia on the wall. Delta dives by others at 100m spotted a sunken inflatable boat that was grey with orange markings; the engine was uncovered and

had some encrusting growth. Observers deemed the boat itself in good condition and covered with a dusting of mud.

My notes have this dive at max depth of 682 feet, evidently way off.

Dive No: 4592	Date: 10/6	Time down: 1224	Max Depth: 806'
Location: SCRIPPS CANYON		Time up: 1354	
Client: SCRIPPS/NURP		Duration: 88min	
Purpose: CANYON SAMPLE		Water Vis: 15'-20'	
Pilot: C. James		Sea State: 0	
Observer: PETER BRUEGGEMAN		Recorder: Slater	
Remarks: Sample 1 - FIX #43			
Sample 2 - FIX #48			248m

Dume Canyon: 693 feet

At this depth, Dume Canyon had sloping soft mud walls. The bottom was soft mud and there were fat worm tubes in the canyon bottom sediment below the surface. Typical for some submarine canyons, there were aged broken-down kelp holdfasts with sea urchins on them. Sightings included: chimaera ratfish; small and large shrimp; lots of cusk-eel-like fish and other small fish; an octopus near a 50-gallon drum with a bat star inside; small flatfish; hermit crabs; fiberglass skin of a surfboard. My notes had max depth at 692 feet.

Dive No: 4596	Date: 10/7	Time down: 1020	Max Depth: 693'
Location: Dume Canyon		Time up: 1130	
Client: SCRIPPS/NURP		Duration: 70 MIN	
Purpose: canyon transect/sample		Water Vis: 15'-20'	
Pilot: C. James		Sea State: 0	
Observer: Peter Brueggeman		Recorder: JL	
Remarks: Sample 1 - FIX #36 178m			
Sample 2 - FIX #32 211m			195m 211m

Dume Canyon: 1075 feet



At this depth, Dume Canyon has a steep mud slope on its bottom. Saw lots of pink *Allocentrotus* urchins which are a deepwater species usually found below 100 meters. The water column near the bottom had lots of small jellies and ctenophores (like *Beroe*). Other dives at this depth in Dume Canyon sighted the orange Dumbo octopus *Grimpoteuthis* but I never saw them.



Sightings included: large orange octopus (shown here); small flatfish; red galatheid crabs; sea cucumbers; and, head-down ribbon-like fish just above the canyon bottom.

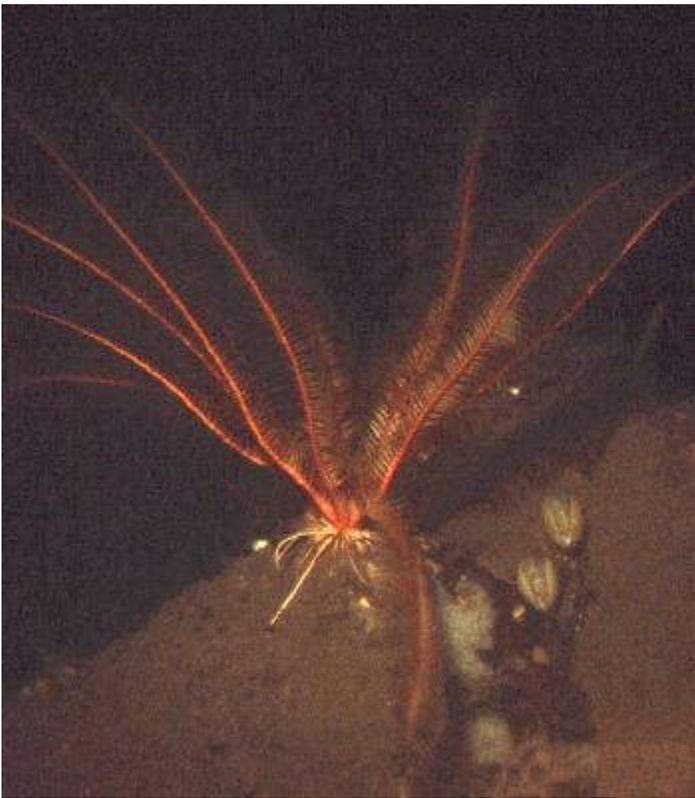


Other sightings included: large *Pleurobranchus* opisthobranchs (shown here).



Around 656 feet (200 meters) in Dume Canyon, there were lots of *Dromalia alexandri* siphonophores. *Dromalia alexandri* is a colonial orange-colored floating filter-feeding siphonophore that is roughly sphere-shaped. It floats just off the bottom tethered by many thin white threads. When disturbed, it

pulls in its threads and lowers itself closer to the bottom. The mud canyon bottom is marked by crab tracks running along it. Sightings at this depth range included: hagfish; *Gorgonocephalus* basket stars; crinoids; California king crab; rockfish.



At 525 feet (160 meters), a wall of Dume Canyon with big stretches of rock outcrops was a crinoid garden (shown here). Individuals and clusters of crinoids were feeding with outstretched arms and were attached to rock with their specialized curved structures called cirri. *Gorgonocephalus* basket stars with their outstretched arms were sprinkled here and there amongst the crinoids. Red galatheid crabs were tucked in rock cracks (shown above). Sightings at this depth range included: lizard fish; white sponges; *Metridium* anemones; orange anemones; shrimp; bright red scorpionfish *Sebastolobus*.

My notes recorded max depth at 1073 feet.

DELTA LOG			
Dive No: <u>4602</u>	Date: <u>10/8</u>	Time down: <u>1015</u>	Max Depth: <u>1075'</u>
Location: <u>Dume Canyon</u>		Time up: <u>1115</u>	
Client: <u>Scripps/WURP</u>		Duration: <u>60 min</u>	
Purpose: <u>squid chase</u>		Water Vis: <u>15-20'</u>	
Pilot: <u>D. Slater</u>		Sea State: <u>0</u>	
Observer: <u>Peter Bruggeman</u>		Recorder: <u>SL</u>	
Remarks: _____		<u>326m</u>	<u>327m</u>

Scripps Canyon: 626 feet

At the max depth, the canyon walls were vertical towering up over fifty feet high with a slope above that. The opposing canyon walls were like slabs with a canyon span of 8-15 feet. One really feels closed in dropping down into such a relatively narrow canyon bottom and seeing walls close by through sub portholes on either side. The bottom six feet of these slab-like walls were slick and above that the walls had little growth except for some white spots (sponges?).

Sightings included: large and small shrimp; hake; big sheep crab; sea cucumbers; galatheid crabs. The big sheep crab I saw set a documented depth record of 191 meters for that species (according to two Scripps graduate students who visited onboard and were studying sheep crabs). Male sheep crabs are known to move into deeper water foraging; we saw some really big ones in Scripps and La Jolla Canyon. The usual reaction is "Oh my God" on seeing one of these monsters; they are easily twice as large as ones I have seen scuba diving in Sumner Canyon. The canyon bottom is sandy mud with blackened surfgrass. Spotted a seastar on the canyon wall; one doesn't see that many seastars in the canyon at depth. There were a few jellies in the water column above the bottom and euphausiids or some crustaceans swimming about and drawn to Delta's floodlights.

My notes record max depth at 627 feet.

Dive No: 4607	Date: 10-9	Time down: 1335	Max Depth: 626'
Location: La Jolla/Scripps	Time up: 1413		
Client: Scripps/MRP	Duration: 38 min.		
Purpose: Sample	Water Vis: 20'		
Pilot: C. James	Sea State: 0		
Observer: Peter Bangermann	Recorder: JC		
Remarks: Sample 1 - Fish 3 @ 191m			
Sample 2 - Fish 7 @ 188m			191m

Oceanside seafloor: 702 feet

A small school of big mackerel were attracted to Delta's floodlights while we were cruising along the seafloor. Out of the dark they rushed and smacked into the sub, flipping about on it. Inside the sub, one could easily hear their thuds and flipping so it sounded like an attack on the sub was in progress. Sightings included: two octopus; flatfish; several species of large and small shrimp; big tall *Metridium* anemones where there was something to attach; purple anemones in the sandy bottom; many different types of fish; three types of sea pens; urchins; seastar; large hake; a lingcod.

This was a non-canyon control site and it is very evident that at the same depth the canyon bottom and its rich ecosystem support a greater variety and abundance of life. We switched off Delta's floodlights at the bottom to plunge ourselves into darkness to observe the bioluminescence triggered by a fleet of crustaceans flitting about. On the way up in the water column at 500 feet, there were two long white rope-like siphonophores; one was coiled up and the other was stretched out about twelve feet in length. My notes record the same max depth.

DELTA LOG			
Dive No: 4614	Date: 10/10	Time down: 0901	Max Depth: 702'
Location: Oceanside		Time up: 10:05	
Client: Scripps/MURP		Duration: 64 min.	
Purpose: Transsect/sample		Water Vis: 30'	
Pilot: D. Slater		Sea State: 0	
Observer: Peter Brueggeman		Recorder: JC	
Remarks: Sample 1 - Fix # 20			
Sample 2 - Fix # 30			20-904 214 M

Oceanside seafloor: 331 feet

The aim of this non-canyon control site dive and the following control site dive was to suction up benthic samples. Sightings on both dives encompassed: flatfish; purple anemones in the sand; fish; sea pens; seafloor was hummocky; good-sized halibut; small white urchins; seastars; dogfish in the distance. My notes recorded the max depth of this dive at 341 feet.

Dive No: 4616	Date: 10/10	Time down: 1201	Max Depth: 331'
Location: Oceanside		Time up: 1252	
Client: Scripps/NERP		Duration: 51 min	
Purpose: sample/transsect		Water Vis: 25'	
Pilot: D. Slater		Sea State: 0	
Observer: P. Bruggeman		Recorder: JL	
Remarks: SAMPLE 1 - Fix # 13 } 101 m			93 m
SAMPLE 2 - FIX # 28			

Oceanside seafloor: 328 feet

Anoter non-canyon control site dive. My notes recorded the max depth of this dive at 325 feet.

DELTA LOG			
Dive No: 4618	Date: 10/10	Time down: 1430	Max Depth: 328'
Location: Oceanside		Time up: 1506	
Client: Scripps/NERP		Duration: 36 min	
Purpose: canyon/transsect		Water Vis: 30'	
Pilot: D. Slater		Sea State: 0	
Observer: P. Bruggeman		Recorder: JL	
Remarks: Sample # 15 @ 99m			
Sample # 22 @ 98m			101m

Oceanside seafloor: 1.5 hour transect from 943 feet to 328 feet



A non-canyon control site dive to suction up benthic samples. Down deep, there were orange floating *Dromalia alexandri* siphonophores. Sightings included: large greenish-white urchins with spines askew; pink medium-size urchins with erect spines; flatfish and various fish; California king crab (shown here); big, tall *Metridium* anemones where there was something to attach; octopus; small shrimp of various species; buried purple anemones; reddish sea cucumbers; a small *Metridium* attached to a Miller Lite

beer can; various whip-like and quill-like sea pens; very large pink sunstar. Shallower, there was much less life and sightings included: very small white urchins; flatfish; whip-like sea pens; cancer crabs.

My notes recorded the max depth at 948 feet.

Dive No: 4670	Date: 10/11/98	Time down: 0933	Max Depth: 943'
Location: Oceanside		Time up: 1113	
Client: Scripps/MURP		Duration: 100 min	
Purpose: transect		Water Vis: 30'	
Pilot: D. Slater		Sea State: 0	
Observer: P. Bruggeman		Recorder: SL	
Remarks:			290m

Carlsbad Canyon: 650 feet

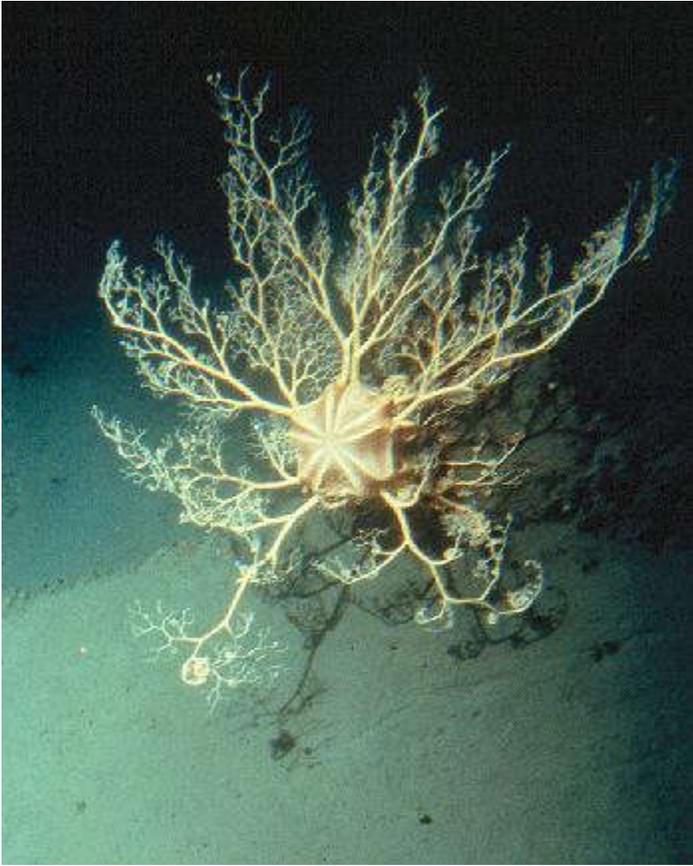
Down deep, there were orange floating *Dromalia alexandri* siphonophores. *Metridium* anemones were clustered on a rock. The canyon bottom was spotted with debris. Pink *Allocentrotus* urchins climbed on old kelp holdfasts. A school of approx twenty flashing silver-blue mackerel over one foot long shot right into the sub with many hitting the sub and making a flippery beating sound as they skittered along the sub. Sightings included: large and small shrimp of various species; large pink sunstar.

Canyon walls were usually sloping sediment but passed one long section of towering vertical rock walls approx 50-100 feet high on the south wall of Carlsbad Canyon. This rock section had crinoids attached here and there along with red galatheid crabs with their outstretched clawed arms raised in alarm at us. Sightings included: octopus, various fish including flatfish and one of those heads-up long slender silver ribbon-like fish (cutlassfish, ribbonfish or scabbardfish) which approached the front of Delta with some curiosity.

My notes recorded the max depth at 630 feet.

DELTA LOG			
Dive No: 4622	Date: 10/14/86	Time down: 1502	Max Depth: 650'
Location: Carlsbad Canyon		Time up: 1550	
Client: Scripps/MURP		Duration: 48min	
Purpose: transect		Water Vis: 25'	
Pilot: D. Slater		Sea State: 0	
Observer: P. Brueggeman		Recorder: JC	
Remarks:	A. l. n. #7 1-772m 200m		

La Jolla Canyon: 1.5 hour transect from 903 feet to 285 feet



Down deep, La Jolla Canyon had a steep rocky wall on the south side with escarpments and bouldering. A *Gorgonocephalus* basket star was perched on the top of one part of the wall.



On the canyon bottom, sightings included: fish of various species (chimaera ratfish shown here); occasional long silver heads-down eel-like fish; small silver fish holding themselves in a U-shape a meter or two off the bottom (eelpout ?).



Other bottom sightings included: galatheid crabs (shown here); shrimp of several species; California king crab; orange floating *Dromalia alexandri* siphonophores; large *Pleurobranchus opisthobranchus*; a few urchins but not many; big cancer crabs.

Down deep, there were lots of little jellies and clear shrimp in the water column above the canyon bottom.



Up shallower, there was a talus slide down the north canyon wall which narrowed the canyon to a vertical channel about twelve feet across. A big electric torpedo ray *Torpedo californica* was seen at 220 meters depth (shown here). The sub passed through a school of hake at 210 meters.



There was a huge sheep crab at 100 meters. In some areas of the canyon, shrimp dominated the bottom by far and were situated about every square foot. There were many small juvenile fish of various species in the canyon bottom. Saw three squid - one alone, two together. Up shallower, the canyon walls were the typical mudstone familiar to La Jolla Canyon scuba divers. Saw a small pink sunstar and a few other seastars. Some *Metridium* anemones and orange anemones. There was a rope line across

the La Jolla Canyon bottom at 90 meters or so.

My notes recorded max depth at 919 feet.

----- DNE DAI #70 -----

Dive No: <u>4623</u>	Date: <u>10/12</u>	Time down: <u>0735</u>	Max Depth: <u>871 903'</u>
Location: <u>La Jolla Canyon</u>	Time up: <u>0925</u>		
Client: <u>Scipps/NURP</u>	Duration: <u>115m</u>		
Purpose: <u>Transect canyon</u>	Water Vis: <u>15'</u>		
Pilot: <u>D. Slater</u>	Sea State: <u>0</u>		
Observer: <u>P. Bluessenian</u>	Recorder: <u>SL</u>		
Remarks: _____			<u>278m</u>



1996 Submarine Canyons of Southern California Cruise on the R/V Roger Revelle

I participated in two round-the-clock days of sediment collecting in several Southern California submarine canyons during a five-day cruise of the R/V Roger Revelle at the end of September 1996.

Sunrise off Malibu was particularly memorable, while working on deck winching the multicorer up and down, unloading and reloading corer tubes, etc.

Using a multicorer (shown here), Dr. Eric Vetter (back to camera, in middle, wearing blue tee shirt, blue shorts, orange life jacket) orchestrated a gang of us into six-hour round-the-clock shifts, bringing up a lot of samples both

within canyons and on non-canyon control sites. Here the multicorer is being brought onboard after a trip to the bottom to gather sediment samples.



After landing it on deck, the core sample tubes are removed and taken to a lab room for unloading of the sediment samples.

Here's Dr. Eric Vetter on the left during the process to unload the sediment in a corer tube into sample jars.



Scripps graduate student Jana Davis suctions out some sediment surface water from the top of the corer tube, while Ruth Gustafson steadies the contraption.

A particularly memorable incident for me was assisting Gene from SIO Shipboard Technical Support with the unbolting of a stern railing so that we could winch gear up and down from the deck. We were having a conversation about our fathers teaching us about tools, their proper usage, and things mechanical. I loosened a tight nut by kicking the ratcheting spanner as I had seen others do; however the direction of my kick was towards the sea and I perfectly kicked the spanner overboard as it slipped off the tight nut. I sheepishly watched it drop down into the briny deep as

Gene said with amusement "I wonder what your father would say about that."



Thank you to Dr Eric Vetter (shown here) for allowing me to participate in his research cruises.

Thanks also to the Delta pilots, David Slater and Chris Ijames, who made Delta diving a fun experience.

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