SUMMARY REPORT ON MINERAL EXPLORATION

For Six Months Ending: April 1st, 2011
Operator/Manager: University of California at Riverside
Mineral(s) Sought: Rock samples for geochemical research
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SUMMARY OF OPERATIONS

SIX MONTHLY REPORT OF INSPECTION AND SAMPLE REMOVAL, FROM October 1st, 2009.

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CORE SAMPLE REMOVAL FROM PETROLEUM DRILLHOLES: GR-10, Altree-2 and 82-3.

DATE OF COMPLETION & WORK PLANNED:

This work will likely be completed in about one year. In this time, a full workup of biomarkers, iron speciation, sulfur isotopes and trace metal concentrations and isotopes will be attained.

NOTE OF CONFIDENTIALITY:

The work is not yet complete and we ask that you give us another year in which to publish our data before it is shared with a third party.

METHODS:

Inorganic analyses:

A stainless steel brush was used to remove the outer layer of the pieces of core and any faces that were easily cleaved open. The samples were then rinsed with DI water, allowed to dry, broken into small pieces in a mortar and pestle and crushed in a ball mill. Total carbon and sulfur concentrations were determined by combustion and total inorganic carbon was measured by acidification, all of which were measured on an Eltra CS-500 carbon/ sulfur analyzer. TOC was calculated by difference. Pyrite iron (Fe_P) was calculated (assuming a stoichiometry of FeS_2) based on wt% sulfur extracted during a two hour hot chromous chloride distillation followed by iodometric titration. Fe_{HCl} is extracted with boiling, concentrated HCl. The concentration of HCl-soluble iron is determined spectrophotometrically using the ferrozine method. From these parameters, degree of pyritization (DOP), which is defined as the ratio of pyrite iron to the sum of pyrite iron and HCl extractable iron, was calculated. A more complete analysis of the speciation of highly reactive iron (Fe_{HR}), which comprises pyrite iron and other iron phases that will react with sulfide to form pyrite in the water column or during early diagenesis, was obtained via a calibrated sequential extraction protocol. Briefly, ~100 mg of sample powder was first treated with a buffered sodium acetate solution, which extracts carbonate associated Fe (Fe_{NaAc}). Samples were then treated with a sodium dithionite solution (Fe_{Dith}), which consists of “reducible” iron oxide phases. Iron oxides that do not react with dithionite were extracted with an ammonium oxalate solution, yielding Fe_{Ox}. Sequential extracts were analyzed on an Agilent 7500ce ICP-MS after 100-fold dilution in trace-metal grade 2% HNO_3. The total amount of highly reactive iron is defined as $Fe_{HR} = Fe_{NaAc} + Fe_{Dith} + Fe_{Ox} + Fe_P$. Material used to determine sulfur isotopic compositions were obtained by a chromium reduction method similar to that described for Fe_P. The reaction mixture was heated for 2 h, with the liberated sulfide collected as silver sulfide after bubbling through 30 ml of 3 wt% silver nitrate solution with 10% NH_4OH by volume for isotopic analysis. Filtered, rinsed and dried Ag_2S precipitates were combined with an excess of V_2O_5 and analyzed for S-isotope composition following online combustion using a Thermo Instruments Delta V Plus isotope ratio mass spectrometer coupled with a Costech elemental analyzer at the University of California, Riverside. Sulfur isotope compositions are expressed as $\delta^{34}S = (R_{sample}/R_{standard} - 1) \times 1000$, where R is the ratio of $^{34}S/^{32}S$, reported as permil (‰).

Organic analyses:
Organic free solvents were used. Prior to use, all glassware and aluminum foil were fired at 550°C for 8h and glass wool; pipettes and silica gel were fired at 475°C for 8h. An organic clean table saw lubricated with 5x dichloromethane extracted water was used to cut off all edges of the core, including edges cut at the core shed. The pieces were separated into inside and outside. About 10-20g of the inside or outside, depending on size of the sample, were set aside for inorganic analyses of these samples. The inside and outside pieces were sonicated in separate, fired jars for 10 minutes in 5x dichloromethane extracted water, then in methanol and finally in dichloromethane. Samples were then crushed manually with the sample wrapped in fired aluminum foil. They were then ground to a fine powder in a SPEX 8510 Shatterbox fitted with an 8505 alumina ceramic puck mill that was carefully cleaned between samples with aqueous detergent, fired sand and finally rinsed with distilled water, methanol, dichloromethane and hexane. Rock powders were extracted using a MARS microwave extractor with a 9:1 mixture of dichloromethane and methanol. The resultant extracts were carefully filtered and evaporated under nitrogen to a volume of approximately 2 mL whereupon activated Cu was added to remove elemental sulfur. The sample was then separated by liquid chromatography on a silica gel 60 (Merck, 230-400 mesh) column using hexane to elute the saturate fraction, 4:1 hexane/dichloromethane to elute the aromatic fraction and 7:3 dichloromethane/methanol to elute the polar fraction. One milligram aliquots of the saturate and aromatic fractions were then reduced to 0.1 mL and added to insert vials together with 50 ng of internal standard. The saturate fraction was analyzed by GC-MS using D4 (D_4-$\alpha\alpha\alpha$-ethylcholestane, Chiron), an internal standard that served as an index of relative retention time and for quantification. The aromatic fraction was analyzed by GC-MS with 100 ng of D14 standard (d_{14} p-terphenyl, Cambridge Isotope Laboratories).

RESULTS:
The bitumens from 24 of the GR-10 samples have been studied, however the 4 deepest were too mature to yield substantial quantities of saturate biomarkers. Over 100 saturate biomarkers were quantified. Proxies of significance are givein in Table 1. The Ts/(Ts+Tm), moretane (M) to hopane (C_{30} H) and C_{31} H 22S/ (S+R) ratios are maturity proxiess that show the top of the core being early peak-oil window mature and the

deepest part of the core being late oil window mature. The 28,30-dinorhopane to hopane (28,30 DNH/ C_{30} H), gammacerane to hopane (γ/ C_{30} H) and homohopane index (HomoHI %) are stratification proxies indicating that these sediments were not deposited in a stratified setting. The low steranes to hopanes (Sts/Hs) ratio indicates that the community was dominated by bacteria. The 2α-methylhopane index (2αMeHI %) shows a small contribution from cyanobacteria, while the 3β-methylhopane index (3βMeHI %) shows a significant contribution from methanotrophy, suggesting the presence of methanogenic archaea. Not shown in the table, but important to note, is the presence of high abundances of aryl isoprenoids, diagnostic for the presence of both green and purple sulfur bacteria, in most of the shallow core samples. Also, all of the samples have an absence of regular steranes but significant concentrations of dinosteranes.

	Ts/ (Ts+Tm)	C_{30} M/ H	C_{31} H 22S/ (S+R)	28,30 DNH/ C_{30} H	γ/ C_{30} H	HomoHI %	Sts/ Hs	2αMeHI %	3βMeHI %
GR10 31.85	0.40	0.08	0.61	0.03	0.04	3.34	0.00	0.77	7.47
GR10 51.65	0.34	0.10	0.58	0.04	0.03	2.99	0.00	1.03	13.81
GR10 80.20	0.39	0.09	0.59	0.04	0.03	3.40	0.01	1.18	11.85
GR10 89.20	0.42	0.06	0.58	0.03	0.03	3.75	0.00	1.99	7.01
GR10 98.45	0.46	0.07	0.61	0.03	0.03	5.21	0.00	1.79	6.15
GR10 134.54	0.43	0.06	0.59	0.03	0.03	3.39	0.00	1.65	5.44
GR10 138.30	0.36	0.06	0.62	0.05	0.04	3.60	0.00	2.69	7.46
GR10 149.90	0.48	0.06	0.59	0.04	0.04	4.92	0.01	1.63	7.79
GR10 182.80	0.39	0.05	0.56	0.02	0.02	3.99	0.00	1.01	4.97
GR10 232.50	0.60	0.06	0.56	0.04	0.03	3.51	0.00	1.38	6.79
GR10 255.58	0.60	0.06	0.62	0.04	0.03	3.66	0.01	1.14	6.64

Table 1. Biomarker ratios of interest showing moderately thermally mature rocks deposited in a setting that was not stratified and heavily dominated by bacterial over eukaryotes with a minor contribution from cyanobacteria and a significant contribution from methanotrophs. Ts is 18α(H)-trisnorneohopane, Tm is 17α(H)-trisnorhopane, 28,30 DNH is 28,30-dinorhopane, C_{30} H is hopane, γ is gammacerane, Sts is for the sum of regular steranes and Hs is for the sum of hopanes. The homohopane index (HomoHI) was calculated as C_{35}H (R+S) *100/ C_{31}-C_{35}H (R+S) %. The 2α–methylhopane index and 3β-methylhopane index were calculated as the methyl hopane *100/ hopane + methylhopane %.

Total carbon, sulfur and inorganic carbon have been measured on all of the GR-10 samples. Concentrations of pyrite iron and boiling HCl extractable iron are complete. The iron speciation protocol has been performed on all of the samples but the concentration of total iron needs to be found through total digests still before a complete interpretation can be made. Sulfur isotopes for all of the samples have been fully analyzed. Below is a chart with all of the inorganic data collected thus far (Table 2), including degree of pyritization (DOP) and Fe_P/Fe_{HR}, which are indicators of the redox conditions under which the sediment was deposited. For DOP values of 0 to 0.3 the sediments are considered to have been buried under oxic conditions, from 0.3 to 0.5 is suboxic and from 0.5 to 1, the deep waters are considered to have free hydrogen sulfide present (euxinic). Many of the samples plot in the euxinic region, providing evidence for significant spatial extent of euxinia. Assuming the sediments were deposited under anoxic conditions, a Fe_P/Fe_{HR} ratio above 0.8 indicated deposition under euxinic waters, while below 0.8 indicates the presence of iron rich or ferruginous waters. Most of the sulfur isotope values are heavy, suggestive that sulfate was low in the ocean at this time.

Sample	Sulfur	Carbon	TIC (%)	TOC (%)	wt% FeP	wt% FeHCl	DOP	FeHR wt %	FeP/ FeHR	$\delta^{34}S$ (‰)
GR10 28.35-.37	0.62%	5.84%	5.48	0.36	0.46	0.63	0.42	0.94	0.48	24.4
GR10 31.85-.90	0.58%	6.02%	5.19	0.83	0.36	0.75	0.32	0.77	0.47	25.5
GR10 41.59-.64	1.73%	6.34%	5.32	1.02	1.33	0.59	0.69	1.88	0.71	24.9
GR10 43.69-.71	1.14%	4.31%	2.03	2.28	0.87	0.60	0.59	1.16	0.75	24.8
GR10 44.99-45.01	1.05%	5.15%	3.13	2.02	0.55	0.64	0.47	1.11	0.50	24.5
GR10 45.57-.60	0.80%	4.61%	3.10	1.50	0.88	0.66	0.57	1.19	0.74	23.9
GR10 46.77-.79	0.85%	4.01%	2.50	1.51	0.85	0.52	0.62	1.17	0.73	24.5
GR10 48.96-.99	1.53%	5.29%	1.33	3.96	1.01	0.59	0.63	1.25	0.81	24.6
GR10 51.60-.62	1.51%	2.75%	0.74	2.01	0.77	0.70	0.52	1.16	0.66	23.9
GR10 51.65-.90	1.77%	2.63%	0.94	1.69	1.50	1.08	0.58	1.76	0.85	24.7
GR10 53.34-.37	2.41%	3.83%	0.58	3.25	2.28	0.74	0.75	2.87	0.79	23.7
GR10 53.59-.63	2.42%	5.02%	0.88	4.14	1.79	0.75	0.70	2.16	0.83	25.4
GR10 65.84-.88	2.57%	3.47%	1.15	2.33	2.40	0.92	0.72	2.97	0.81	20.7
GR10 68.57-.60	2.95%	3.93%	1.39	2.54	2.28	0.89	0.72	2.80	0.81	21.7
GR10 74.97-75.00	1.09%	4.73%	2.91	1.82	0.99	0.60	0.62	1.45	0.68	24.8
GR10 78.22-.27	2.50%	5.14%	0.63	4.51	2.22	0.93	0.71	2.98	0.75	24.9
GR10 78.73-.78	3.50%	7.54%	0.70	6.85	2.76	0.92	0.75	3.30	0.84	25.4
GR10 79.69-.72	0.96%	4.24%	3.10	1.14	1.00	0.59	0.63	1.49	0.67	25.4
GR10 80.20-.30	2.43%	5.51%	2.70	2.81	2.45	1.03	0.70	2.86	0.86	24.9
GR10 86.24-.27	1.23%	6.94%	3.06	3.88	0.91	0.55	0.62	1.32	0.69	24.2
GR10 89.20-.40	0.70%	7.08%	5.41	1.67	1.19	0.60	0.66	1.59	0.75	25.8
GR10 92.82-.85	1.76%	6.28%	2.25	4.03	1.23	0.75	0.62	1.74	0.71	24.7
GR10 96.54-.56	1.84%	7.42%	2.24	5.18	1.33	0.49	0.73	1.71	0.78	25.5
GR10 98.45-.56	0.23%	6.07%	5.73	0.34	0.31	0.48	0.39	0.56	0.55	25.7
GR10 102.82-.84	1.63%	7.72%	1.86	5.86	1.16	0.50	0.70	1.47	0.79	24.7
GR10 108.18-.21	2.56%	7.61%	3.96	3.65	2.24	0.55	0.80	2.75	0.82	25.4
GR10 110.92-.95	1.42%	7.49%	3.83	3.66	0.92	0.50	0.65	1.29	0.71	25.3
GR10 111.22-.25	1.86%	6.83%	3.88	2.95	1.15	0.51	0.69	1.55	0.74	25.4
GR10 119.04-.06	1.04%	7.77%	5.10	2.67	1.17	0.51	0.70	1.61	0.73	24.6
GR10 124.45-.50	1.06%	5.71%	4.16	1.55	0.89	0.44	0.67	1.28	0.70	24.3
GR10 132.58-.60	0.69%	6.22%	5.68	0.54	0.56	0.55	0.51	1.08	0.52	24.2
GR10 134.54-.62	0.82%	7.94%	5.84	2.10	1.21	0.47	0.72	1.47	0.82	25.3
GR10 137.09-.14	1.61%	8.97%	5.33	3.64	1.18	0.27	0.81	1.67	0.71	24.8
GR10 138.30-.41	0.86%	7.76%	5.11	2.65	0.94	0.31	0.75	1.11	0.84	24.4
GR10 140.59-.65	1.71%	7.78%	5.22	2.56	0.87	0.61	0.59	1.38	0.63	25.6
GR10 149.44-.47	0.77%	7.44%	5.27	2.17	0.80	0.47	0.63	1.19	0.68	24.5
GR10 149.90-150.00	0.69%	7.40%	5.80	1.60	0.40	0.67	0.38	0.70	0.58	25.0
GR10 150.14-.17	0.80%	6.39%	6.37	0.01	1.88	0.56	0.77	2.39	0.79	25.3
GR10 162.58-.62	0.68%	6.30%	5.29	1.02	0.60	0.39	0.61	0.92	0.66	24.9
GR10 170.02-.06	1.08%	6.05%	3.55	2.49	0.87	0.52	0.63	1.19	0.74	25.9
GR10 175.52-.56	0.98%	5.50%	4.45	1.06	0.71	0.48	0.60	1.09	0.65	25.4
GR10 182.57-.59	1.46%	6.87%	5.24	1.63	1.13	0.73	0.61	1.70	0.66	26.5
GR10 182.80-.90	2.24%	6.96%	3.13	3.83	1.38	0.81	0.63	1.92	0.72	27.2
GR10 186.50-.53	1.28%	7.53%	4.92	2.61	0.85	0.57	0.60	1.33	0.64	22.5
GR10 197.35-.39	0.19%	1.82%	1.56	0.26	0.26	0.34	0.43	0.36	0.72	27.6
GR10 203.00-.06	1.13%	6.71%	5.01	1.71	0.95	0.50	0.66	1.34	0.71	24.1
GR10 219.15-.17	1.12%	6.56%	3.91	2.65	0.95	0.62	0.61	1.29	0.73	20.9

GR10 219.84-.87	1.30%	4.76%	3.19	1.56	1.08	0.53	0.67	1.40	0.77	24.1
GR10 232.54-.69	0.68%	6.14%	5.58	0.56	0.61	0.69	0.47	0.91	0.67	22.6
GR10 238.62-.66	1.46%	7.02%	4.54	2.48	1.38	0.71	0.66	1.66	0.83	16.7
GR10 253.52-.56	1.78%	6.68%	3.58	3.09	1.64	0.44	0.79	1.91	0.86	24.5
GR10 255.58-.66	0.66%	7.16%	5.91	1.25	0.69	0.56	0.56	0.96	0.73	27.5
GR10 272.75-.78	1.88%	5.05%	2.52	2.53	1.58	0.69	0.70	1.89	0.83	18.4
GR10 284.33-.36	0.73%	4.09%	3.53	0.56	1.04	0.57	0.65	1.30	0.80	15.0
GR10 302.95-303.10	0.19%	3.17%	2.58	0.59	0.35	0.20	0.64	0.38	0.93	34.5
GR10 305.27-.50	0.49%	4.86%	4.46	0.41	0.80	0.68	0.54	1.13	0.71	31.7
GR10 306.30-.33	1.12%	3.81%	2.47	1.34	1.16	0.51	0.70	1.39	0.84	35.0
GR10 319.09-.12	0.72%	3.94%	3.25	0.69	0.65	0.81	0.44	0.92	0.70	35.8
GR10 321.87-.90	1.12%	3.93%	3.27	0.66	0.94	0.81	0.54	1.24	0.76	36.8
GR10 334.94-.98	1.08%	3.82%	3.06	0.76	1.01	0.74	0.58	1.36	0.75	37.5
GR10 352.09-.19	0.67%	4.79%	4.41	0.38	0.83	0.48	0.63	1.08	0.77	25.4
GR10 353.40-.43	1.35%	4.13%	3.11	1.02	1.36	0.79	0.63	1.63	0.84	27.7
GR10 354.76-.79	1.13%	3.81%	2.97	0.83	0.90	0.65	0.58	1.08	0.84	31.2
GR10 365.78-.82	0.74%	3.05%	2.57	0.49	0.70	0.89	0.44	0.90	0.78	21.7
GR10 384.06-.17	0.32%	3.83%	3.52	0.30	0.41	0.45	0.48	0.53	0.77	16.1
GR10 385.21-.25	1.29%	4.14%	3.10	1.04	1.13	0.70	0.62	1.30	0.87	19.6
GR10 398.27-.33	0.54%	4.02%	3.45	0.57	0.54	0.84	0.39	0.71	0.76	16.0
GR10 398.86-.94	0.81%	4.84%	4.13	0.71	0.85	0.81	0.51	1.10	0.77	14.8
GR10 399.09-.13	0.71%	4.10%	3.36	0.74	0.77	0.57	0.57	0.99	0.77	14.9
GR10 414.30-.34	0.98%	3.11%	2.80	0.32	1.01	0.27	0.79	1.27	0.80	14.9
GR10 419.33-.36	0.90%	2.88%	2.11	0.76	1.12	0.92	0.55	1.30	0.87	12.4
GR10 432.91-.94	0.82%	4.45%	3.81	0.64	1.02	0.86	0.54	1.28	0.80	13.4
GR10 434.94-435.03	0.54%	6.08%	5.60	0.49	0.47	0.69	0.40	0.83	0.57	14.0
GR10 438.02-.04	0.90%	3.59%	2.88	0.71	1.00	0.64	0.61	1.16	0.86	14.8
GR10 449.40-.45	0.91%	3.77%	3.01	0.75	0.81	0.90	0.47	1.02	0.79	11.6
GR10 468.15-.20	0.55%	4.62%	3.70	0.93	0.63	1.04	0.38	1.14	0.55	18.9
GR10 470.98-471.04	1.05%	4.02%	3.15	0.87	1.23	0.97	0.56	1.68	0.73	9.7
GR10 485.24-.28	1.00%	3.50%	2.96	0.54	0.98	0.68	0.59	1.21	0.82	34.3
GR10 488.24-.28	0.50%	2.93%	2.47	0.46	0.54	1.20	0.31	0.92	0.59	23.0
GR10 488.38-.43	0.42%	2.89%	2.76	0.13	0.47	0.47	0.50	0.67	0.71	20.6
GR10 502.19-.24	1.12%	4.73%	3.45	1.28	1.04	0.71	0.60	1.46	0.71	18.3
GR10 514.39-.45	1.01%	5.27%	4.59	0.68	1.00	0.69	0.59	1.46	0.69	30.2
GR10 519.11-.17	1.18%	4.78%	3.32	1.46	1.15	0.72	0.62	1.43	0.81	26.8
GR10 531.46-.60	0.30%	2.99%	2.74	0.25	0.56	0.32	0.64	0.73	0.77	17.2
GR10 532.52-.56	0.56%	2.10%	1.87	0.23	0.53	0.95	0.36	0.71	0.75	17.9
GR10 537.90-.92	0.15%	0.37%	0.20	0.17	0.18	0.90	0.17	0.24	0.75	25.4
GR10 551.39-.43	0.85%	3.90%	2.95	0.95	0.61	0.94	0.39	0.83	0.74	17.3
GR10 568.65-.69	0.72%	1.85%	0.99	0.86	1.10	1.23	0.47	1.29	0.86	18.9
GR10 568.84-.93	0.24%	2.52%	1.79	0.73	0.54	0.81	0.40	0.73	0.74	20.6
GR10 569.60-.65	0.60%	2.32%	1.39	0.94	0.52	0.90	0.37	0.67	0.78	17.0
GR10 571.22-.25	3.08%	2.75%	1.44	1.31	2.06	0.79	0.72	2.52	0.82	16.6
GR10 584.83-.86	0.88%	3.28%	2.68	0.60	1.15	0.84	0.58	1.43	0.80	10.8
GR10 601.53-.60	1.08%	3.95%	2.59	1.36	1.06	0.77	0.58	1.42	0.75	18.0
GR10 603.64-.69	2.66%	5.57%	2.19	3.38	2.00	0.89	0.69	2.74	0.73	34.1
GR10 610.62-.68	1.81%	3.81%	2.90	0.91	1.54	0.58	0.73	2.04	0.76	23.1

GR10 611.25-.37	0.49%	9.40%	8.03	1.36	0.56	0.40	0.58	0.71	0.79	23.4
GR10 612.96-613.00	1.47%	3.02%	1.67	1.35	1.28	0.61	0.68	1.68	0.76	18.3
GR10 617.28-.31	1.54%	2.80%	2.22	0.58	1.37	0.81	0.63	1.66	0.82	19.2
GR10 629.03-.07	0.98%	1.82%	1.20	0.61	0.90	1.04	0.46	1.26	0.71	0.5
GR10 633.95-.99	1.02%	2.18%	1.18	0.99	0.82	0.86	0.49	1.12	0.73	6.5
GR10 635.22-.27	1.05%	1.54%	0.77	0.77	0.98	0.73	0.57	1.20	0.81	7.2
GR10 644.05-.20	0.00%	7.38%	6.61	0.77	0.03	0.79	0.03	0.17	0.16	
GR10 649.01-.06	0.22%	0.96%	0.47	0.50	0.21	0.92	0.19	0.85	0.25	-5.6
GR10 660.47-.50	0.00%	3.29%	3.43	-0.13	0.02	1.29	0.02	0.68	0.03	
GR10 663.80-.84	0.00%	2.39%	2.62	-0.24	0.03	1.05	0.03	0.33	0.10	
GR10 676.40-.43	0.00%	5.02%	4.73	0.28	0.03	1.08	0.02	0.29	0.09	
GR10 678.93-.97	0.00%	3.19%	3.36	-0.16	0.03	0.89	0.03	0.25	0.10	
GR10 692.80-.90	0.01%	6.58%	6.38	0.20	0.03	0.82	0.03	0.16	0.16	
GR10 695.38-.41	0.00%	4.34%	4.20	0.14	0.02	1.35	0.02	0.16	0.14	

Table 2. Inorganic data including percent sulfur, total, organic and inorganic carbon, pyrite iron, HCl extractable iron, degree of pyritization (DOP), iron speciation and sulfur isotopes.

CONCLUSIONS:

The biomarkers indicate that the ecological community was bacterially dominated with a struggling, non-diverse eukaryotic community comprised of dinoflagellates (or their ancestors). There were also green sulfur bacteria, purple sulfur bacteria and methanotrophs present. If methanotrophy was present, likely so was methanogenesis, which suggests that sulfate was low. This is corroborated by the sulfur data. The iron speciation data suggest that the deep waters had a significant extent of euxinia. It is our hypothesis that the green and purple sulfur bacteria lived on shelves in mats with free sulfide present in shelf porewaters in a water column that was oxic at the surface and euxic at mid to possibly deep water depths.

FUTURE WORK:

We are currently performing trace metal analyses on the GR-10 core, aquiring both the total iron concentrations to finish the iron speciation analyses and a variety of metal isotope data for molybdenum, iron and uranium, affording a rich characterization of the deep water redox. Similar work has begun on the 82/3 core (the organic analyses on 13 samples have been completed, but the inorganic work is still in progress). Organic work on the Altree-2 samples is just beginning and any inorganic work has yet to begin.