

SUMMARY REPORT ON MINERAL EXPLORATION

For Six Months Ending: April 1st, 2010

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 two years. 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 two full years 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 measured on an Eltra CS-500 carbon/ sulfur analyzer. Pyrite iron 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. 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 been euxinic.

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 5xDCM 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 5xDCM 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 (D₄- $\alpha\alpha\alpha$ -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 (d₁₄ p-terphenyl, Cambridge Isotope Laboratories).

RESULTS:

The bitumens from seven of the GR-10 samples have been studied so far. They look very promising for high concentrations of biomarkers (Table 1). Total carbon and sulfur have been measured on 27 of the GR-10 samples and total inorganic vs. organic carbon measurements are in progress. Worked has been started on concentrations of pyrite iron and sulfur isotopes for 30 of these samples as well. Below is a chart with all of the inorganic data collected thus far (Table 2), including degree of pyritization (DOP), which is an indicator for the redox conditions under which the sediment was deposited. All samples give a DOP number greater than 0.5, indicating euxinic deep water in the oceans at that time.

Sample	31.85i	31.85o	51.65i	80.20i	89.2i	98.45i	134.54i	Blank 1	138.30i
Extracted (g)	20.0	20.0	15.0	10.3	10.8	10.3	10.3	5.2	10.1
OE (mg)	22.0	18.5	18.5	21.3	37.8	29.5	29.8	0.3	24.1
Sats	3.3	2.3	2.3	2.4					
Aros	5.3	4.1	4.2	4.0					
Polars	10.7	9.4	11.8	11.4					

Table 1. Organic data including amount of rock extracted, organic matter extracted (OE) from that rock and, after column chromatography, the weight of the saturate, aromatic and polar fractions. The i or o indication pertains to the inside or outside cuttings of a rock.

Sample	Sulfur	Carbon	wt% Fe pyr	DOP
GR10 41.59-.64	1.73%	6.34%	1.10	0.65
GR10 43.69-.71	1.14%	4.31%	0.87	0.59
GR10 44.99-45.01	1.05%	5.15%	0.55	0.47
GR10 46.77-.79	0.85%	4.01%	0.85	0.62
GR10 48.96-.99	1.53%	5.29%	1.08	0.65
GR10 51.60-.62	1.51%	2.75%	0.77	0.52
GR10 53.34-.37	2.41%	3.83%	2.28	0.75
GR10 53.59-.63	2.42%	5.02%	2.07	0.73
GR10 65.84-.88	2.57%	3.47%	2.40	0.72
GR10 68.57-.60	2.95%	3.93%	2.47	0.73
GR10 74.97-75.00	1.09%	4.73%	0.92	0.61
GR10 78.22-.27	2.50%	5.14%	2.22	0.71
GR10 78.73-.78	3.50%	7.54%	2.70	0.75
GR10 79.69-.72	0.96%	4.24%	1.00	0.63
GR10 86.24-.27	1.23%	6.94%	1.17	0.68
GR10 92.82-.85	1.76%	6.28%	0.78	0.51
GR10 96.54-.56	1.84%	7.42%	1.32	0.73
GR10 102.82-.84	1.63%	7.72%	1.16	0.70
GR10 108.18-.21	2.56%	7.61%	2.24	
GR10 110.92-.95	1.42%	7.49%	0.92	
GR10 111.22-.25	1.86%	6.83%	1.58	
GR10 119.04-.06	1.04%	7.77%	1.17	
GR10 124.45-.50	1.06%	5.71%		
GR10 137.09-.14	1.61%	8.97%		
GR10 140.59-.65	1.71%	7.78%		
GR10 149.44-.47	0.77%	7.44%	0.62	0.57
GR10 170.02-.06	1.08%	6.05%		
GR10 175.52-.56	0.98%	5.50%	1.51	0.76
GR10 182.57-.59	1.46%	6.87%		
GR10 186.50-.53	1.28%	7.53%		
GR10 197.35-.39	0.19%	1.82%		
GR10 203.00-.06	1.13%	6.71%	1.10	0.69
GR10 219.15-.17	1.12%	6.56%		
GR10 238.62-.66	1.46%	7.02%	1.38	0.66
GR10 253.52-.56	1.78%	6.68%	1.64	0.79
GR10 272.75-.78	1.88%	5.05%	1.58	0.70
GR10 468.15-.20	0.55%	4.62%		
GR10 470.98-471.04	1.05%	4.02%		
GR10 485.24-.28	1.00%	3.50%		
GR10 488.24-.28	0.50%	2.93%		
GR10 502.19-.24	1.12%	4.73%	1.12	0.61
GR10 514.39-.45	1.01%	5.27%	1.00	0.59
GR10 519.11-.17	1.18%	4.78%		

Table 2. Inorganic data including percent sulfur, carbon, iron in the form of pyrite and the degree of pyritization.