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Sediment Color and Reflectance Record from Ocean Drilling Program Hole 625B, Gulf of Mexico (Marine Isotope Stage 5 interval)

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OFR99-413

INTRODUCTION

Analysis of climate indicators from the North Atlantic (McManus et al., 1994), California Margin (Poore et al., in prep.), and ice cores from Greenland (Dansgaard et al., 1993) suggest millennial scale climate variability is a component of earth's climate system during the last interglacial period (marine oxygen isotope stage 5). The USGS is involved in a survey of high resolution marine records covering the last interglacial period (MIS 5) to further document the variability of climate and assess the rate at which climate can change during warm intervals.

The Gulf of Mexico (GOM) is an attractive area for analysis of climate variability and rapid change. Changes in the Mississippi River Basin presumably are translated to the GOM via the river and its effect on sediment distribution and type. Likewise, the summer monsoon in the southwestern US is driven by strong southerly winds. These winds may produce upwelling in the GOM which will be recorded in the sedimentary record. Several areas of high accumulation rate have been identified in the GOM. Ocean Drilling Program (ODP) Site 625 appears to meet the criteria of having a well preserved carbonate record and accumulation rate capable of discerning millennial scale changes.

It is not cost effective to analyze high resolution (=high accumulation rate) MIS 5 sequences in the frequency domain using traditional paleoclimate proxies (e.g., total faunal analysis, stable isotopes). In order to discriminate events on millennial and sub-millennial scales, sample spacing needs to be on the order of 200-300 years. Given the duration of MIS 5 of ~60,000 years, a sample spacing of 300 years would require 200 time-intensive faunal analyses. Instead, we have developed a strategy which uses initial analysis of physical properties measurements to document the variability of sequences. This in turn allows us to target specific portions of sequences using fewer total faunal and stable isotopic analyses.

Physical properties measurements are routinely available for most later ODP Legs but are not available for Leg 100 (ODP625). This report documents the development of a sediment color and reflectance record for the MIS 5 interval of ODP Hole 625B in the northeastern Gulf of Mexico and analyzes that record in the frequency domain.

MATERIALS AND METHODS

ODP Site 625 was drilled in 1985 during a shakedown cruise of the *JOIDES Resolution.* Hole 625B was drilled in 889 m of water on the west Florida continental slope (28.831667°N, 87.160000°W), just south of Desoto Canyon. (FIGURE 1).

A 5.35 m.y. planktonic stable isotope record was developed for Hole 625B by Joyce et al. (1990). The stratigraphic resolution of their record is coarse (one sample every 15 cm) yet sufficient to recognize marine isotope stages and define the approximate limits of MIS 5 (FIGURE 2). The MIS6/5 (6.0) and MIS 5/4 (5.0) boundaries were placed at 15.80 and 12.70 m subbottom depth respectively (Martin et al., 1990). Correlation to the SPECMAP timescale (Imbrie et al., 1984) indicates a mean accumulation rate for this interval of 5.7 cm kyr^{-1}. All sample depths at Hole 625B were converted to age using the age model derived from the Joyce et al. (1990) isotopic data.

TABLE 1. Age model for ODP 625B.

Specmap isotopic event	Age (KY)[1]	Depth (m)[2]
4.0	59,000	11.70
5.0	71,000	12.70
6.0	128,000	15.80
7.0	186,000	17.45

An Analytical Spectral Devices (ASD) spectroradiometer (model FS-FR) was used to make measurements of the relative spectral reflectance of sediments from sections 625B-2H-6 through 625B-2H-4. The setup (FIGURE 3) consists of a halogen light source and fiber optic sensor connected to a spectrometer. The tip of the fiber optic sensor is set up 2.5

[1] Imbrie et al., 1984

[2] Martin et al., 1990

cm above the split core surface. The core is moved under the sensor at equally spaced increments. The light that is reflected off the sediment surface is captured by the sensor and collected in the spectrometer.

A continuous spectrum of reflected light was measured from 350nm to 2500nm at 2 cm intervals between 12.40 m and 16.98 m subbottom at ODP Hole 625B. The spectrometer was recalibrated to a white halon reference panel at the beginning of each core section. Raw data (FIGURE 4) was converted to percent reflectance and averaged in two 50-nm wide bands defined as blue (450-500nm) and red (650-700nm). These data are plotted in FIGURE 5 and attached as APPENDIX 1. The longer wavelengths of these spectra (reflected infrared), while commonly suitable to characterize mineral phases, were not utilized due to degradation of the spectra by the water content of the sediments.

After conversion to time using the age model described above, both red and blue band records were analyzed in the frequency domain using the ARAND[3] software package. Results are discussed below.

DISCUSSION

Both red and blue band records show 5 strong fall-offs in reflectance over the 5 meter long record (FIGURE 5). Two of these low reflectance peaks are associated with the 4/5 and 5/6 section breaks. On further inspection, the other 3 low reflectance values were found to be associated with voids in the core due to removal of material by previous investigators. These void and core break anomalies were removed prior to time series analysis.

Comparison of the reflectance records with the $\delta^{18}O$ record shows no obvious correlation (FIGURE 6). Between ~115 Ka and 65 Ka there is a general correlation suggesting higher reflectance is associated with lighter isotopic values. Between ~140 Ka and 115 Ka the correlation is poor but suggests the opposite, lighter isotopic values are associated with lower percent reflectance. The limits of MIS 5, events 5.0 and 6.0 do not show up in the

reflectance records. FIGURES 5 and 6 qualitatively show a regular cyclical pattern to both blue and red color reflectance records.

Based upon the age model developed above, the color reflectance record (2 cm sample interval) has a resolution of ~350 years. The reflectance records show numerous rapid (<400 year duration) terminations to many of the cycles. Both records were resampled at equal time increments of 400 years for time series analysis. The ARAND software package was used to perform cross spectral analysis on the blue and red reflectance records (FIGURE 7). Both records show a coherent concentration of spectral power at periodicity's of 1900 and 2900 years. Other higher frequency spectral peaks are ignored due to the 400 year sample spacing.

Preliminary faunal and isotopic work on portions of the MIS 5 sequence from Hole 625B show abundant fine grained material in many samples. Although degraded so as to not allow accurate identifications, the infrared portion of the spectra identifies various clay mineralogies. The amount and type of fine grained terrigenous material delivered to Hole 625B by rivers may account for changes in the reflectance record (see FIGURE 1).

SUMMARY AND CONCLUSIONS

This report documents our ability to generate low cost physical properties measurements on deep sea cores for the purpose of determining variability in sedimentation.

Millennial scale variability within MIS 5 in the northeastern Gulf of Mexico occurs at periodicities very similar to those found in the North Atlantic, North Pacific, and ice cores. These cycles may reflect changes in the hydrology of that part of North America that drains into the GOM.

In order to better understand the significance and meaning of these cycles we have re-sampled 625B for isotopes and total faunal analysis at 4 cm intervals. This will increase the resolution of the Joyce et al. (1990) isotopic record and allow comparisons between it,

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[3] The ARAND software package is available from Philip Howell, Brown University Geological Sciences,

the color reflectance record, and the planktic foraminifer assemblages which will be used to estimate sea surface temperatures within MIS 5.

The data developed in this report are available from the USGS at http://chht-ntsrv.er.usgs.gov/warmclimates/products.html or by contacting the author at *hdowsett@usgs.gov.*

ACKNOWLEDGEMENTS

This paper benefited from reviews and discussions with R.Z. Poore, M. Podwysocki and S. Verardo. I would like to thank M. Podwysocki for the time he spent instructing me on the capabilities of the spectrometer and pointing out other potential uses in paleoceanographic work. V. Lovern assisted with the analyses and processed the spectra. R. Martin provided the original 625B stable isotope record. I thank the personnel of the ODP East Coast Repository for their help with sampling the core. This work was supported by the USGS Global Change and Climate History Program.

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Imbrie, J., Hays, J.D., Martinson, D.G., McIntyre, A., Mix, A.C., Morley, J.J., Pisias, N.G., Prell, W.L. and Shackleton, N.J., 1984. The orbital theory of Pleistocene climate: support from a revised chronology of the marine $\delta^{18}O$ record. Berger, A.L. et al. (Eds.), *Milankovitch and Climate, Part 1*. D. Reidel. 269-305.

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McManus, J.F., Bond, G.C., Broecker, W.S., Johnsen, S., Labeyrie, L. and Higgins, S., 1994. High resolution climate records from the North Atlantic during the last interglacial. *Nature* 371: 326-329.

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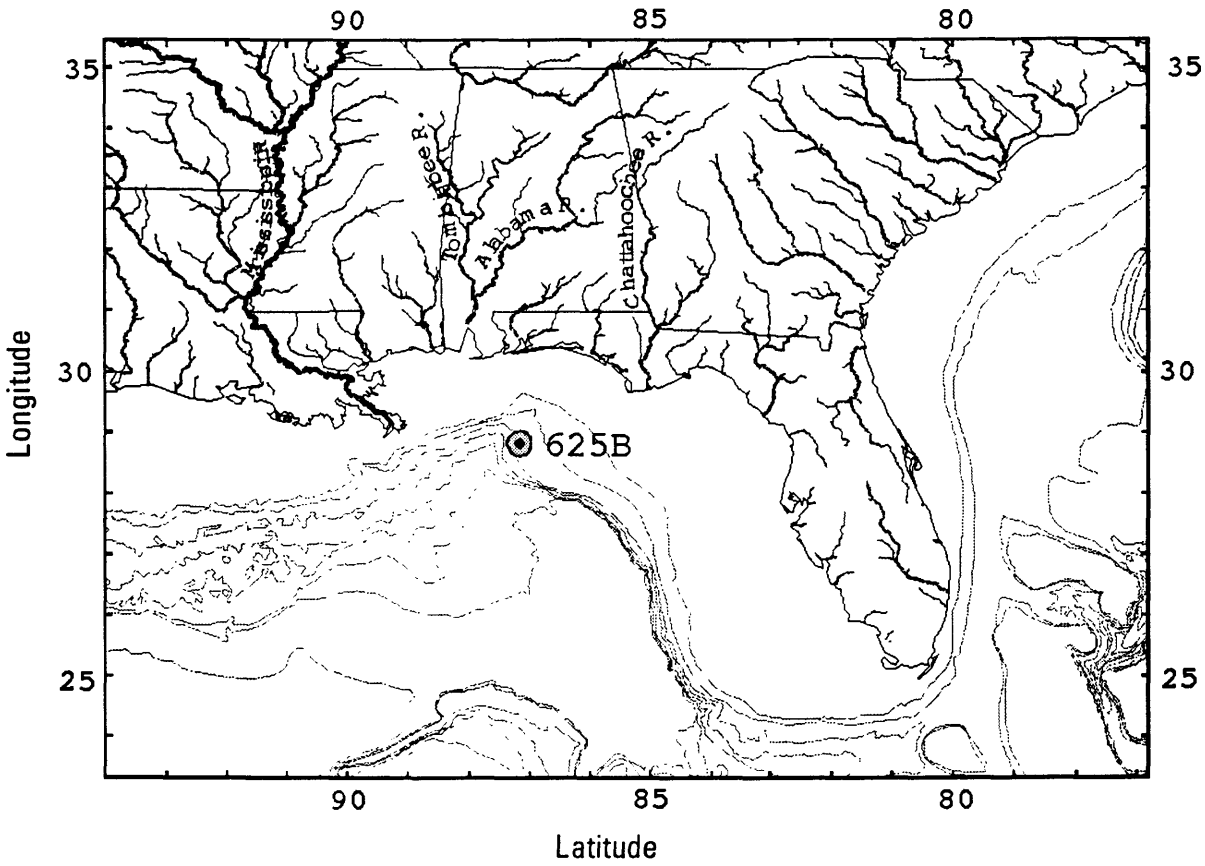

Figure 1. Location of ODP Site 625, northeastern Gulf of Mexico.

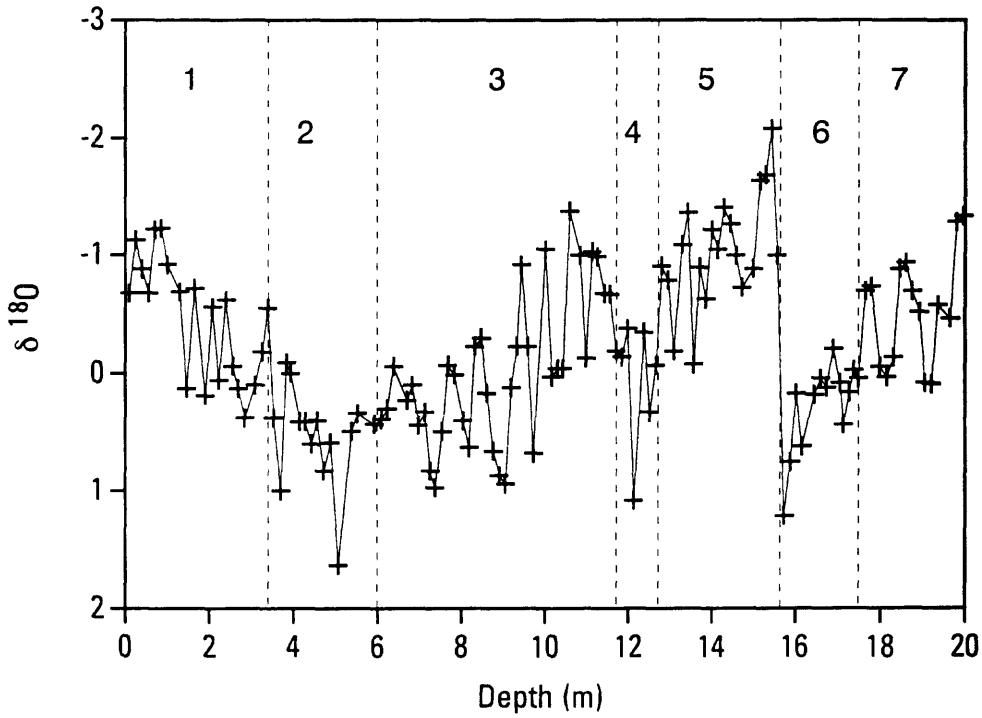

Figure 2. Upper 20 m of 625B $\delta^{18}O$ record from Joyce et al. (1990). Vertical dashed lines indicate marine isotope stage boundaries.

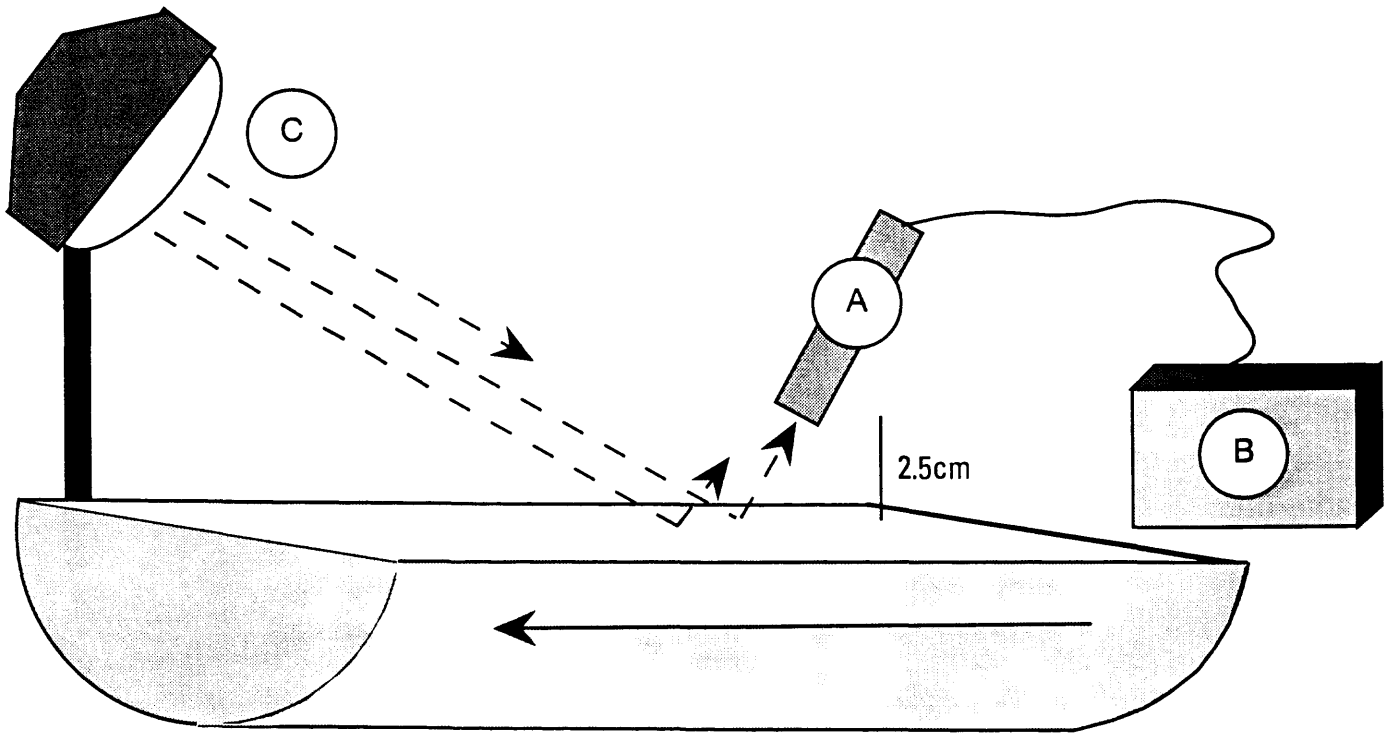

Figure 3. Spectrometer settup. Core sections are illuminated with a Halogen light source (C) and passed from top (left) to bottom under receiver (A). Continuous spectra from 350nm to 2500nm are taken at 2cm intervals along the core and saved on disk in the spectrometer (B).

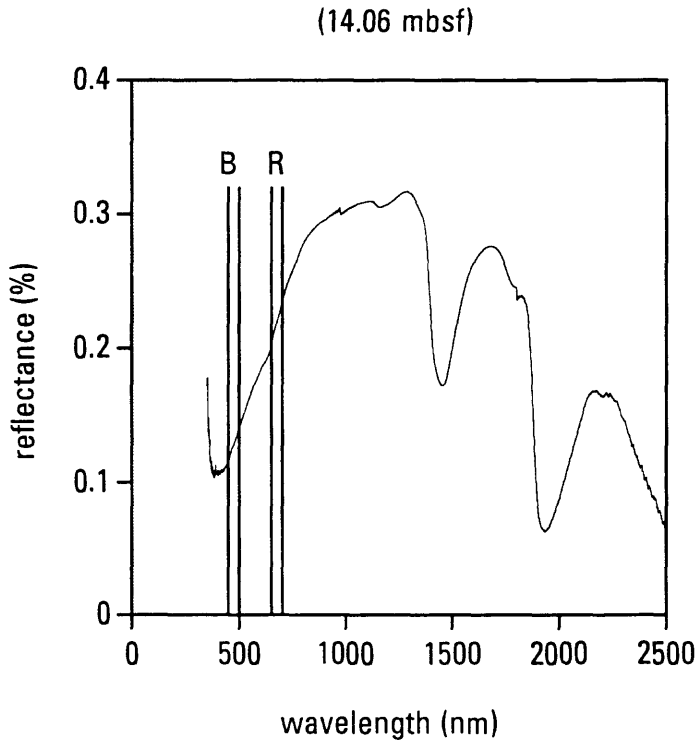

Figure 4. Raw spectra obtained from 2 second scan at 14.06 m subbottom, ODP625B. B and R indicate widths of blue (450-500nm) and red (650-700nm) windows respectively.

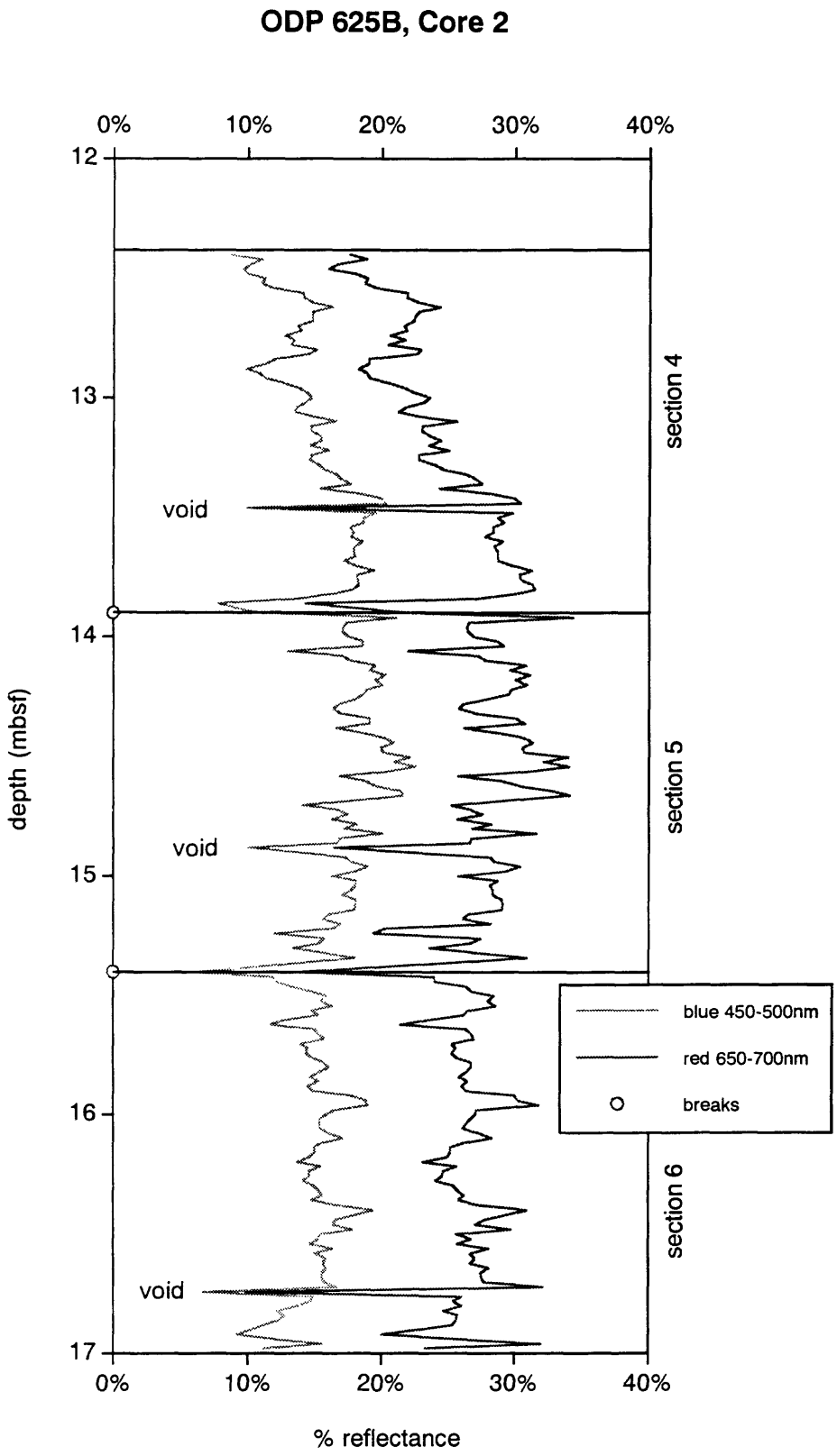

Figure 5. Blue and red band percent reflectance records developed for ODP Hole 625B. Note most low reflectance minima correspond to core breaks or voids in the core material.

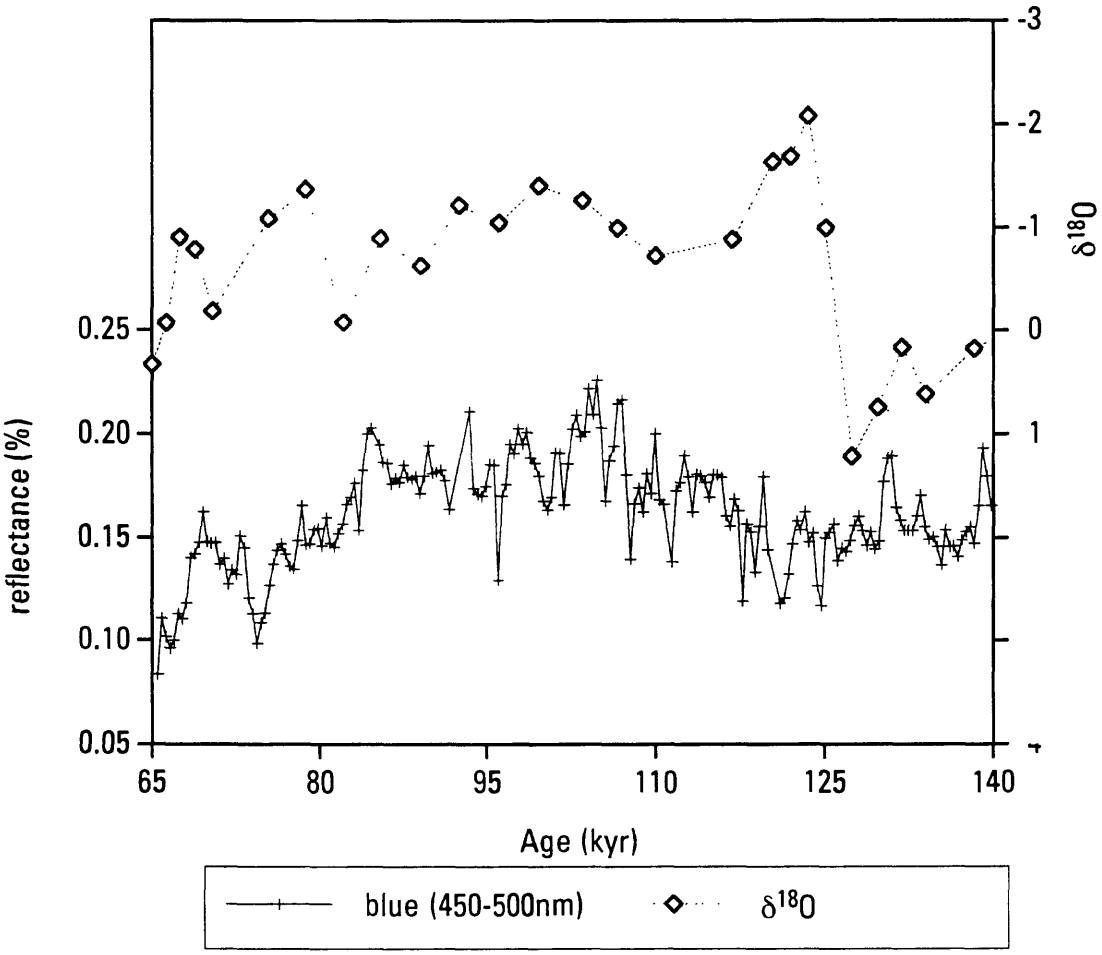

Figure 6. Comparison of blue reflectance record and $\delta^{18}O$ record of Joyce et al. (1990).

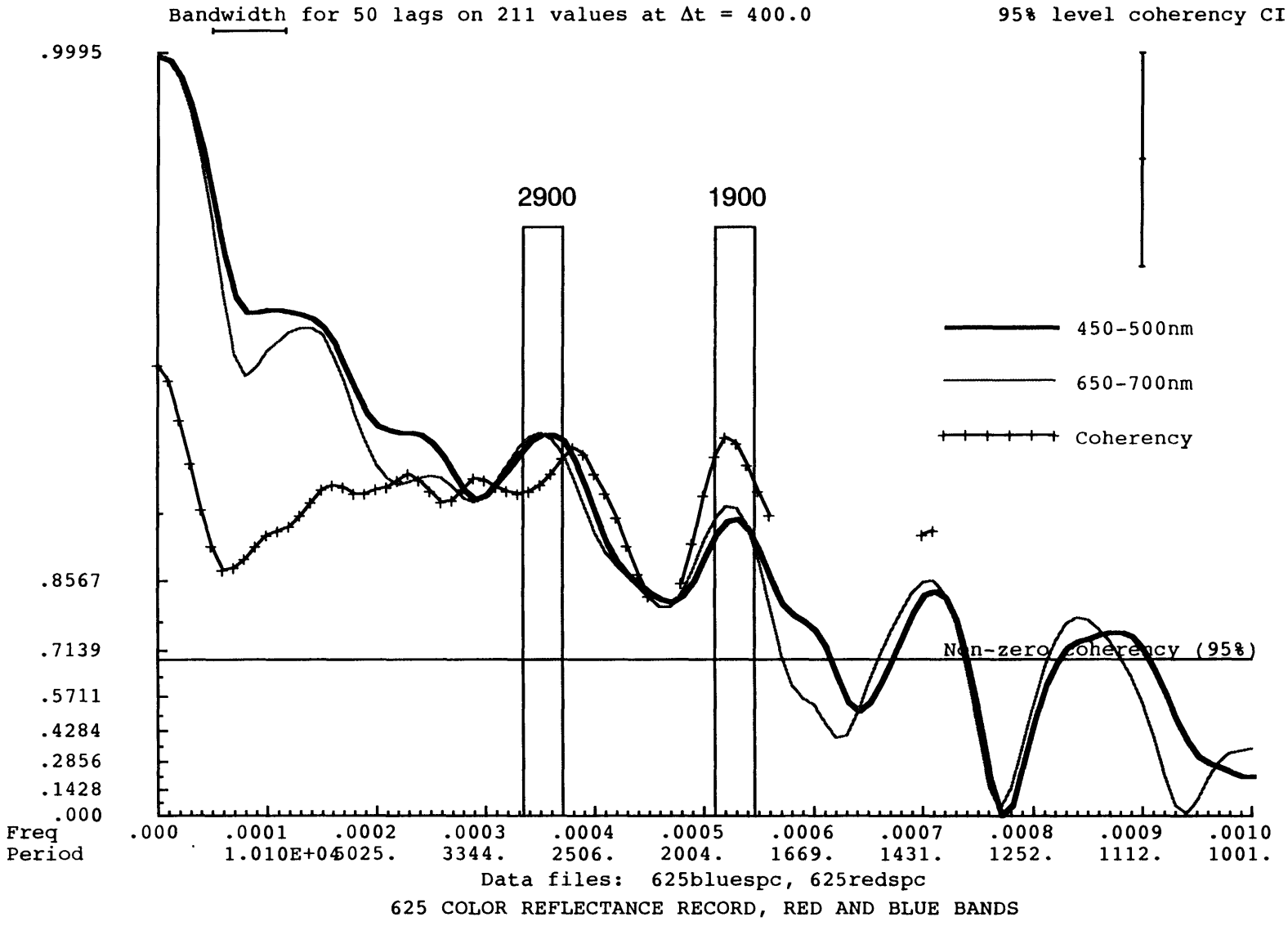

Figure 7. Results of cross-spectral analysis of % reflected light in blue and red bands.

Appendix 1. ODP625B reflectance data.

			Reflectance	
spectra file	depth (mbsf)	Age (kyr)	blue 450-500nm	red 650-700nm
625B-HD.000	12.40	65.4838710	0.083335294	0.176176431
625B-HD.001	12.42	65.8516129	0.110769765	0.188504961
625B-HD.002	12.44	66.2193548	0.101746608	0.166474882
625B-HD.003	12.46	66.5870968	0.096139824	0.159800333
625B-HD.004	12.48	66.9548387	0.099861373	0.179771804
625B-HD.005	12.50	67.3225807	0.112930078	0.189696667
625B-HD.006	12.52	67.6903226	0.110420941	0.187510765
625B-HD.007	12.54	68.0580645	0.118327588	0.195456392
625B-HD.008	12.56	68.4258065	0.140480725	0.219516020
625B-HD.009	12.58	68.7935484	0.142133157	0.218877216
625B-HD.010	12.60	69.1612903	0.147841922	0.227863784
625B-HD.011	12.62	69.5290323	0.162747745	0.243939020
625B-HD.012	12.64	69.8967742	0.148193294	0.227831294
625B-HD.013	12.66	70.2645161	0.147453824	0.225008294
625B-HD.014	12.68	70.6322581	0.147754157	0.223871784
625B-HD.015	12.70	71.0000000	0.137139333	0.216899490
625B-HD.016	12.72	71.3677419	0.140181235	0.219009745
625B-HD.017	12.74	71.7354839	0.127486039	0.206241118
625B-HD.018	12.76	72.1032258	0.134490098	0.217601922
625B-HD.019	12.78	72.4709677	0.132123961	0.204860784
625B-HD.020	12.80	72.8387097	0.151023137	0.229164137
625B-HD.021	12.82	73.2064516	0.145339333	0.225980569
625B-HD.022	12.84	73.5741936	0.120837510	0.190183549
625B-HD.023	12.86	73.9419355	0.112850549	0.190106667
625B-HD.024	12.88	74.3096774	0.098343549	0.182250765
625B-HD.025	12.90	74.6774194	0.108561275	0.188949784
625B-HD.026	12.92	75.0451613	0.113414745	0.190883549
625B-HD.027	12.94	75.4129032	0.127141588	0.205825353
625B-HD.028	12.96	75.7806452	0.137218314	0.216419784
625B-HD.029	12.98	76.1483871	0.144053255	0.224230098
625B-HD.030	13.00	76.5161290	0.147166275	0.236199941
625B-HD.031	13.02	76.8838710	0.142273980	0.231035529
625B-HD.032	13.04	77.2516129	0.136238824	0.218418667
625B-HD.033	13.06	77.6193548	0.134886941	0.212004078
625B-HD.034	13.08	77.9870968	0.148723275	0.228568373
625B-HD.035	13.10	78.3548387	0.165813980	0.256792647
625B-HD.036	13.12	78.7225807	0.146680392	0.230860843
625B-HD.037	13.14	79.0903226	0.147254608	0.230206275
625B-HD.038	13.16	79.4580645	0.154067706	0.236640784
625B-HD.039	13.18	79.8258065	0.154790000	0.244709843
625B-HD.040	13.20	80.1935484	0.146210176	0.235020902
625B-HD.041	13.22	80.5612903	0.159979000	0.250582000
625B-HD.042	13.24	80.9290323	0.147552902	0.227976059

Appendix 1. ODP625B reflectance data.

			Reflectance	
spectra file	depth (mbsf)	Age (kyr)	blue 450-500nm	red 650-700nm
625B-HD.043	13.26	81.2967742	0.145774431	0.227788667
625B-HD.044	13.28	81.6645161	0.152288196	0.240001275
625B-HD.045	13.30	82.0322581	0.156740843	0.246789510
625B-HD.046	13.32	82.4000000	0.166318431	0.262815863
625B-HD.047	13.34	82.7677419	0.169873588	0.270999941
625B-HD.048	13.36	83.1354839	0.176872627	0.275239353
625B-HD.049	13.38	83.5032258	0.153806451	0.243200510
625B-HD.050	13.40	83.8709677	0.182956843	0.281680941
625B-HD.051	13.42	84.2387097	0.200301216	0.299665412
625B-HD.052	13.44	84.6064516	0.203133235	0.304556961
625B-HD.053	13.46	84.9741936	0.098623863	0.122014294
625B-HD.054	13.48	85.3419355	0.195206627	0.298331608
625B-HD.055	13.50	85.7096774	0.186591255	0.287151941
625B-HD.056	13.52	86.0774194	0.186366373	0.292070588
625B-HD.057	13.54	86.4451613	0.176363176	0.283638784
625B-HD.058	13.56	86.8129032	0.179112294	0.283923471
625B-HD.059	13.58	87.1806452	0.177185235	0.277674294
625B-HD.060	13.60	87.5483871	0.185481314	0.290866333
625B-HD.061	13.62	87.9161290	0.179506157	0.284272941
625B-HD.062	13.64	88.2838710	0.178623294	0.287041294
625B-HD.063	13.66	88.6516129	0.180027059	0.287152627
625B-HD.064	13.68	89.0193548	0.171827961	0.287281804
625B-HD.065	13.70	89.3870968	0.180026843	0.297545392
625B-HD.066	13.72	89.7548387	0.194651569	0.313420882
625B-HD.067	13.74	90.1225807	0.181490549	0.303637922
625B-HD.068	13.76	90.4903226	0.182052353	0.304422627
625B-HD.069	13.78	90.8580645	0.183004137	0.313175157
625B-HD.070	13.80	91.2258065	0.178089392	0.314970471
625B-HD.071	13.82	91.5935484	0.164049392	0.302158882
625B-HD.072	13.84	91.9612903	0.138170137	0.270635294
625B-HD.073	13.86	92.3290323	0.075384980	0.142855529
625B-HD.074	13.90	93.0645161	0.107071941	0.218112902
625B-HD.075	13.92	93.4322581	0.210960294	0.343915529
625B-HD.076	13.94	93.8000000	0.174139922	0.266298157
625B-HD.077	13.96	94.1677419	0.171390353	0.264451255
625B-HD.078	13.98	94.5354839	0.170414216	0.265143451
625B-HD.079	14.00	94.9032258	0.175241725	0.269624843
625B-HD.080	14.02	95.2709677	0.185831118	0.286358471
625B-HD.081	14.04	95.6387097	0.185533235	0.291834176
625B-HD.082	14.06	96.0064516	0.129549314	0.219864392
625B-HD.083	14.08	96.3741936	0.170397431	0.272915471
625B-HD.084	14.10	96.7419355	0.176213608	0.277934157
625B-HD.085	14.12	97.1096774	0.195273431	0.308801804

Appendix 1. ODP625B reflectance data.

			Reflectance	
spectra file	depth (mbsf)	Age (kyr)	blue 450-500nm	red 650-700nm
625B-HD.086	14.14	97.4774194	0.191077824	0.296488275
625B-HD.087	14.16	97.8451613	0.202887549	0.311752216
625B-HD.088	14.18	98.2129032	0.195481392	0.300620275
625B-HD.089	14.20	98.5806452	0.200992765	0.309502725
625B-HD.090	14.22	98.9483871	0.188740824	0.297124275
625B-HD.091	14.24	99.3161290	0.186306000	0.295616706
625B-HD.092	14.26	99.6838710	0.180000196	0.278412275
625B-HD.093	14.28	100.0516129	0.168002902	0.261598529
625B-HD.094	14.30	100.4193548	0.163703392	0.258277373
625B-HD.095	14.32	100.7870968	0.169921314	0.271739451
625B-HD.096	14.34	101.1548387	0.191313039	0.301007608
625B-HD.097	14.36	101.5225807	0.191070510	0.307914863
625B-HD.098	14.38	101.8903226	0.166149020	0.261658902
625B-HD.099	14.40	102.2580645	0.185949118	0.288619275
625B-HD.100	14.42	102.6258065	0.202406961	0.307445627
625B-HD.101	14.44	102.9935484	0.209181000	0.314157216
625B-HD.102	14.46	103.3612903	0.199256941	0.305645176
625B-HD.103	14.48	103.7290323	0.201363235	0.307359196
625B-HD.104	14.50	104.0967742	0.221747725	0.340331647
625B-HD.105	14.52	104.4645161	0.209415353	0.322086529
625B-HD.106	14.54	104.8322581	0.225823373	0.341106098
625B-HD.107	14.56	105.2000000	0.203150118	0.309048431
625B-HD.108	14.58	105.5677419	0.168138627	0.257653647
625B-HD.109	14.60	105.9354839	0.187591804	0.290308373
625B-HD.110	14.62	106.3032258	0.194478412	0.302977804
625B-HD.111	14.64	106.6709677	0.214498627	0.327794706
625B-HD.112	14.66	107.0387097	0.216369471	0.341453196
625B-HD.113	14.68	107.4064516	0.180854608	0.294259510
625B-HD.114	14.70	107.7741936	0.139756471	0.252818941
625B-HD.115	14.72	108.1419355	0.166825686	0.266768255
625B-HD.116	14.74	108.5096774	0.174584333	0.276126667
625B-HD.117	14.76	108.8774194	0.162884490	0.256975294
625B-HD.118	14.78	109.2451613	0.181387824	0.282466667
625B-HD.119	14.80	109.6129032	0.171661941	0.268379471
625B-HD.120	14.82	109.9806452	0.200455412	0.316291902
625B-HD.121	14.84	110.3483871	0.168561647	0.268188961
625B-HD.122	14.86	110.7161290	0.166367922	0.266227686
625B-HD.123	14.88	111.0838710	0.099984882	0.164295275
625B-HD.124	14.90	111.4516129	0.138430647	0.222866353
625B-HD.125	14.92	111.8193548	0.173149451	0.281937745
625B-HD.126	14.94	112.1870968	0.176990294	0.285307314
625B-HD.127	14.96	112.5548387	0.189978000	0.304351882
625B-HD.128	14.98	112.9225807	0.179965098	0.293142314

Appendix 1. ODP625B reflectance data.

			Reflectance	
spectra file	depth (mbsf)	Age (kyr)	blue 450-500nm	red 650-700nm
625B-HD.129	15.00	113.2903226	0.162770725	0.257645882
625B-HD.130	15.02	113.6580645	0.180931529	0.287537784
625B-HD.131	15.04	114.0258065	0.180256922	0.281693765
625B-HD.132	15.06	114.3935484	0.177044765	0.283768294
625B-HD.133	15.08	114.7612903	0.170005373	0.283394686
625B-HD.134	15.10	115.1290323	0.180860314	0.290254412
625B-HD.135	15.12	115.4967742	0.180635824	0.291231137
625B-HD.136	15.14	115.8645161	0.179559255	0.290588392
625B-HD.137	15.16	116.2322581	0.161014627	0.265817353
625B-HD.138	15.18	116.6000000	0.155946608	0.261555863
625B-HD.139	15.20	116.9677419	0.169038373	0.282225471
625B-HD.140	15.22	117.3354839	0.163349039	0.202534529
625B-HD.141	15.24	117.7032258	0.119357059	0.194098235
625B-HD.142	15.26	118.0709677	0.156870804	0.274664412
625B-HD.143	15.28	118.4387097	0.153023765	0.266074784
625B-HD.144	15.30	118.8064516	0.133500353	0.235724961
625B-HD.145	15.32	119.1741936	0.155981784	0.271612059
625B-HD.146	15.34	119.5419355	0.179894216	0.309459784
625B-HD.147	15.36	119.9096774	0.144369000	0.257414922
625B-HD.148	15.40	120.6451613	0.060235216	0.136974314
625B-HD.149	15.42	121.0129032	0.118228725	0.239954922
625B-HD.150	15.44	121.3806452	0.120821157	0.239958235
625B-HD.151	15.46	121.7483871	0.132712471	0.263187843
625B-HD.152	15.48	122.1161290	0.147170647	0.268280725
625B-HD.153	15.50	122.4838710	0.158342784	0.284901196
625B-HD.154	15.52	122.8516129	0.154187039	0.280031314
625B-HD.155	15.54	123.2193548	0.162822647	0.286105647
625B-HD.156	15.56	123.5870968	0.148006314	0.264971882
625B-HD.157	15.58	123.9548387	0.152548863	0.262333902
625B-HD.158	15.60	124.3225807	0.126726098	0.235330392
625B-HD.159	15.62	124.6903226	0.117016176	0.214242255
625B-HD.160	15.64	125.0580645	0.149855686	0.263619471
625B-HD.161	15.66	125.4258065	0.152803176	0.268041137
625B-HD.162	15.68	125.7935484	0.156976098	0.269520647
625B-HD.163	15.70	126.1612903	0.138988549	0.252880353
625B-HD.164	15.72	126.5290323	0.145087941	0.256482588
625B-HD.165	15.74	126.8967742	0.143479118	0.252889059
625B-HD.166	15.76	127.2645161	0.148806216	0.257483078
625B-HD.167	15.78	127.6322581	0.156314510	0.267790235
625B-HD.168	15.80	128.0000000	0.160632137	0.267652373
625B-HD.169	15.82	128.3677419	0.153868784	0.264214765
625B-HD.170	15.84	128.7354839	0.146430902	0.258606902
625B-HD.171	15.86	129.1032258	0.153133745	0.264606039

Appendix 1. ODP625B reflectance data.

			Reflectance	
spectra file	depth (mbsf)	Age (kyr)	blue 450-500nm	red 650-700nm
625B-HD.172	15.88	129.4709677	0.144743902	0.260384392
625B-HD.173	15.90	129.8387097	0.148293137	0.263707333
625B-HD.174	15.92	130.2064516	0.177257451	0.300318020
625B-HD.175	15.94	130.5741936	0.188598882	0.302718039
625B-HD.176	15.96	130.9419355	0.189731137	0.318418588
625B-HD.177	15.98	131.3096774	0.164786235	0.271593275
625B-HD.178	16.00	131.6774194	0.158620706	0.270987667
625B-HD.179	16.02	132.0451613	0.153830490	0.266830706
625B-HD.180	16.04	132.4129032	0.153787431	0.263874196
625B-HD.181	16.06	132.7806452	0.153658431	0.260933608
625B-HD.182	16.08	133.1483871	0.160835255	0.273768941
625B-HD.183	16.10	133.5161290	0.170924608	0.282902784
625B-HD.184	16.12	133.8838710	0.155675745	0.262244706
625B-HD.185	16.14	134.2516129	0.149432902	0.252199608
625B-HD.186	16.16	134.6193548	0.150594725	0.252412941
625B-HD.187	16.18	134.9870968	0.145941843	0.250213333
625B-HD.188	16.20	135.3548387	0.137025784	0.231326216
625B-HD.189	16.22	135.7225807	0.154157804	0.256671196
625B-HD.190	16.24	136.0903226	0.145836784	0.246860020
625B-HD.191	16.26	136.4580645	0.146153902	0.245918059
625B-HD.192	16.28	136.8258065	0.140947157	0.240663647
625B-HD.193	16.30	137.1935484	0.149101294	0.254192706
625B-HD.194	16.32	137.5612903	0.153024059	0.257920706
625B-HD.195	16.34	137.9290323	0.155655745	0.262427882
625B-HD.196	16.36	138.2967742	0.147510137	0.258327431
625B-HD.197	16.38	138.6645161	0.165944980	0.272655039
625B-HD.198	16.40	139.0322581	0.193526627	0.309527784
625B-HD.199	16.42	139.4000000	0.180239314	0.294777627
625B-HD.200	16.44	139.7677419	0.165990804	0.277752490
625B-HD.201	16.46	140.1354839	0.163186745	0.270714471
625B-HD.202	16.48	140.5032258	0.178336784	0.297609529
625B-HD.203	16.50	140.8709677	0.154184098	0.256402157
625B-HD.204	16.52	141.2387097	0.152941765	0.267598549
625B-HD.205	16.54	141.6064516	0.146090569	0.257531686
625B-HD.206	16.56	141.9741936	0.163199647	0.280948804
625B-HD.207	16.58	142.3419355	0.150292510	0.266925392
625B-HD.208	16.60	142.7096774	0.158453569	0.270686863
625B-HD.209	16.62	143.0774194	0.155883627	0.267052078
625B-HD.210	16.64	143.4451613	0.158620333	0.280817176
625B-HD.211	16.66	143.8129032	0.155672275	0.274565333
625B-HD.212	16.68	144.1806452	0.154715275	0.275259392
625B-HD.213	16.70	144.5483871	0.157154627	0.276971000
625B-HD.214	16.72	144.9161290	0.166629588	0.321575451

Appendix 1. ODP625B reflectance data.

			Reflectance	
spectra file	depth (mbsf)	Age (kyr)	blue 450-500nm	red 650-700nm
625B-HD.215	16.74	145.2838710	0.065423471	0.098576667
625B-HD.216	16.76	145.6516129	0.148957824	0.260457686
625B-HD.217	16.78	146.0193548	0.146772569	0.254055902
625B-HD.218	16.80	146.3870968	0.136586490	0.260606353
625B-HD.219	16.82	146.7548387	0.121558922	0.246775863
625B-HD.220	16.84	147.1225807	0.127609941	0.257506961
625B-HD.221	16.86	147.4903226	0.122718059	0.256318941
625B-HD.222	16.88	147.8580645	0.111984588	0.253518451
625B-HD.223	16.90	148.2258065	0.102085137	0.226738510
625B-HD.224	16.92	148.5935484	0.091386490	0.200657373
625B-HD.225	16.94	148.9612903	0.121032745	0.259068922
625B-HD.226	16.96	149.3290323	0.155236235	0.320076980
625B-HD.227	16.98	149.6967742	0.111796471	0.233153392