DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

Pliocene planktic foraminifer census data from Deep Sea Drilling Project Hole 603C

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INTRODUCTION

The U. S. Geological Survey's PRISM Project is investigating the climatic and oceanographic conditions of the Pliocene. One of the major elements of the study involves the use of the quantitative composition of planktic foraminifer assemblages in conjunction with stable isotope analysis of planktic and benthic foraminifers to estimate sea-surface temperatures and identify major oceanographic boundaries and water masses within the North Atlantic Basin. We anticipate analyzing many samples during the project which will result in a large volume of raw census data. In addition, it is likely that all or some of the census data from individual cores will be incorporated into analyses for more than one report over the course of the project. Therefore, the raw census data are being published in a series of open-file reports that will provide basic data for future work. This report includes counting categories and raw census data for planktic foraminifer assemblages in 25 samples from DSDP Hole 603C (Fig. 1).

A variety of statistical techniques are being developed to transform census data of foraminifers in Pliocene deep-sea cores into quantitative estimates of Pliocene sea-surface temperatures. Details of current statistical techniques, taxonomic groupings, and oceanographic interpretations are in Dowsett (1991) and Dowsett and Poore (1990;1991).

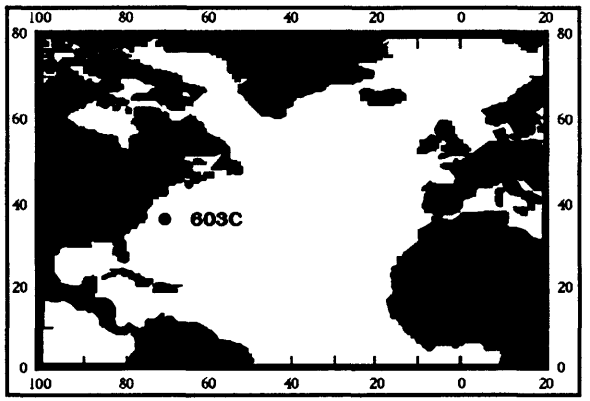

Figure 1 - Location of DSDP Hole 603C

Latitude, longitude, and water depth of DSDP Hole 603C are included in Table 1.

Table 1 - Latitude, longitude, and water depth (in corrected meters) for DSDP Hole 603C

Hole	Latitude	Longitude	Water Depth
603C	35°29'N	70°01'W	4,633m

Counts of variables tabulated in each sample are given in Table 2.

METHODS

The samples used in this study were washed using low temperature (isotope) procedures. Sediment samples were dried in an oven at ≤50°C. The dried bulk sample was disaggregated in a beaker with warm tap water and about 2 ml of dilute calgon solution (5 gm calgon to 1 liter water). The beaker was agitated on a shaker/hot plate without heating. Samples were then washed through a 63μ sieve using a fine spray hose and dried in an oven at ≤50° C. Each sample was washed an average of two cycles.

A split of 300-350 planktic foraminifer specimens was obtained from the ≥149μ size fraction using a Carpco sample splitter. Specimens were identified, sorted, and glued to a standard 60 square micropaleontological slide.

All samples examined from Hole 603C showed signs of strong dissolution. Evidence of dissolution consists of high abundances of benthic foraminifers, etching of tests of foraminifers, and large numbers of fragments. Fragments were too abundant in most samples to count and are not included in Table 2.

COUNTING CATEGORIES

Taxa included in counting categories and codes used for headings of Table 2 are summarized below. In general, our taxonomic concepts follow Parker (1962; 1967), and Blow (1969). Exceptions to their practices are noted below.

In Table 2, DSDP sample designations are abbreviated as core-section, depth within section in centimeters (eg. 10-5, 34 = core 10, section 5, 34 cm below top of section 5). The depth column lists depth of sample below sea floor in meters.

Code **Taxon (taxa) comments**

acost *Neogloboquadrina acostaensis* (Blow) and *N. continuosa* (Blow)

aequi *Globigerinella aequilateralis* (Brady)

altis *Globoquadrina altispira* (Cushman and Jarvis)

bform benthic foraminifers

bulls *Globigerina bulloides* (d'Orbigny) and *G. praebulloides* Blow

Cande *Candeina*

congl *Globigerinoides conglobatus* (Brady)

conom *Globorotalia conomiozea* Kennett

crass *Globorotalia crassaformis* (Galloway and Wissler). This category includes *G. ronda* Blow and *G. oceanica* Cushman and Bermudez . Specimens with a distinct keel on the entire ultimate whorl are tabulated separately under "kcras".

datca *Neogloboquadrina atlantica* (Berggren) right-coiling

decor *Globigerina decoraperta* Takayanagi and Saito

dpach *Neogloboquadrina pachyderma* (Ehrenberg) right-coiling. This category is restricted to specimens with 4 chambers in the ultimate whorl. Right-coiling specimens close to *N. pachyderma* that have more than 4 chambers in the ultimate whorl are tabulated as "dupac."

dupac This category is used for specimens of right-coiling *Neogloboquadrina* with more than four chambers in the ultimate whorl that are transitional between *N. pachyderma* and *N. acostaensis* or *N. atlantica.*

falco *Globigerina falconensis* Blow

Gltal This category includes *Globorotalia* that could not be confidently identified to specific level.

gluti *Globigerinita glutinata* (Egger) s.l.

Gnoid *Globigerinoides* spp. Representatives of *Globigerinoides* (usually small) that could not be confidently assigned to *G. ruber, G. obliquus* (s.l.) or *G. conglobatus.*

hexag *Globorotaloides hexagona* (Naland)

hirsu *Globorotalia hirsuta* (d'Orbigny) and *Globorotalia praehirsuta* Blow

humer *Neogloboquadrina humerosa* (Takayanagi and Saito)

incis *Globigerina incisa* (Bronnimann and Resig)

kcras This category includes *G. crassaformis* with fully keeled ultimate whorl.

marga *Globorotalia margaritae* Bolli and Bermudez

menar *Globorotalia menardii* (Parker, Jones, and Brady) s.l. This category includes various members of the *G. menardii* lineage such as *G. limbata* (Fornasini) and *G. miocenica* Palmer.

Neogl This category includes *Neogloboquadrina* that were not identified to specific level but generally does not include representatives of *N. atlantica.*

obliq *Globigerinoides obliquus* Bolli and *G. extremus* Bolli and Burmudez

ocods ostracodes

Orbul *Orbulina universa* d'Orbigny

OTHER This category includes unidentified specimens and taxa that are rare within assemblages.

plata *Globorotalia inflata* (d'Orbigny) and *G. puncticulata* (Deshayes)

praed *Globigerina praedigitata* Parker

pseud *Globigerina pseudobesa* (Salvatorini)

Pulle *Pulleniatina*

pumil This category includes small forms with 5-7 chambers in the ultimate whorl that are similar to *Globorotalia pumilio* Parker, *G. praepumilio* (Parker) and *G. pseudopumilio* Bronnimann and Resig.

quinq *Turborotalita quinquiloba* (Natland)

ruber *Globigerinoides ruber* (d'Orbigny)

saccu *Globigerinoides sacculifer* (Brady), *G. quadrilobatus* (d'Orbigny) and *G. trilobus* (Reuss)

satca *Neogloboquadrina atlantica* (Berggren) left-coiling. See Poore and Berggren, 1975 for discussion of this highly variable taxon.

scitu *Globorotalia scitula* (Brady) s.l. This category includes various members of the *G. scitula* group, for example *G. subscitula* Conato.

sp. 1 *Globigerina* sp. 1. Taxon resembles *G. falconensis* but has reticulate surface texture similar to *G. woodi* group.

spach *Neogloboquadrina pachyderma* (Ehrenberg) left-coiling. Relatively small, compact *Neogloboquadrina* with 4-5 chambers in the ultimate whorl, kummerform ultimate chamber, and a slightly to distinct oval equatorial outline are included here. Separating small left-coiling *N. atlantica* from large left-coiling *N. pachyderma* is arbitrary in many North Atlantic high-latitude sites.

Sphae *Sphaeroidinella* and *Sphaeroidinellopsis*

tocat *Globorotalia tosaensis* Takayanagi and Saito and *G. truncatulinoides* (d'Orbigny)

TOTAL PLANK Total number of planktic forams in the counting split.

tumid *Globorotalia tumida* (Brady) s.l. and *G. plesiotumida* Blow and Banner.

venez *Globoquadrina venezuelana* (Hedberg)

viola *Globorotalia viola* Blow.

woodi *Globigerina woodi* Jenkins and *G. apertura* Cushman

ACKNOWLEDGEMENTS

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SAMPLE	DEPTH	ruber	obliq	saccu	bulls	falco	datca	dupac	acost	humer	gluti	Orbul	Gnoid	incis	praed	satca	dpach	spach	Neogl	aequi	sp. 1	congl	woodi	decor
2 - 2 , 113	4.63	32	1	92	3	7	0	10	0	33	18	15	7	3	0	0	0	5	2	1	0	4	0	3
2 - 5 , 110	9.10	51	3	30	25	12	0	15	0	41	16	12	14	7	0	0	2	0	0	3	0	0	1	0
3 - 1 , 109	12.69	58	5	40	8	2	0	20	0	85	41	3	11	0	0	0	15	20	6	5	0	0	5	0
3 - 2 , 109	14.19	73	0	21	13	3	0	23	0	93	35	5	8	1	0	0	19	2	0	5	0	3	2	2
3 - 4 , 110	17.20	72	4	20	18	15	2	14	7	17	38	7	15	3	0	0	1	0	0	0	1	3	1	0
3 - 5 , 107	18.67	71	2	10	14	5	0	22	0	54	40	3	7	3	0	1	7	3	0	0	0	2	2	1
3 - 6 , 108	20.18	77	4	25	22	15	0	19	0	27	30	6	9	3	0	0	17	1	0	2	3	5	2	2
4 - 1 , 107	22.27	18	1	3	4	0	4	24	0	71	16	4	3	2	6	0	8	1	0	0	0	1	3	1
4 - 2 , 112	23.82	47	5	11	12	7	3	24	0	94	18	14	6	0	2	0	6	0	0	0	0	2	0	1
4 - 3 , 112	25.32	58	4	41	40	47	0	7	2	11	20	3	11	1	0	0	2	0	0	2	0	5	6	6
4 - 4 , 112	26.82	34	3	19	13	11	1	41	0	26	27	7	6	0	0	0	37	1	0	0	0	1	3	0
4 - 5 , 112	28.32	57	9	30	27	45	0	11	3	10	27	1	14	12	0	0	4	1	0	1	0	0	3	0
4 - 6 , 112	29.82	30	3	3	6	9	0	23	0	49	5	1	8	0	1	0	5	0	0	0	0	0	2	2
5 - 2 , 108	33.38	44	3	25	14	21	2	14	1	42	26	8	4	13	1	0	8	0	0	1	1	1	1	0
5 - 3 , 108	34.88	59	5	62	24	39	0	3	0	22	15	14	13	8	0	0	0	1	0	1	0	5	1	0
5 - 4 , 112	36.42	37	3	8	11	7	1	22	0	26	17	9	19	4	2	0	5	0	0	0	0	1	2	0
5 - 5 , 108	37.88	65	3	8	19	30	0	15	0	20	33	16	6	5	0	0	8	0	0	6	0	4	4	5
5 - 6 , 116	39.46	45	5	17	26	29	0	33	0	22	59	3	4	5	0	0	2	0	0	2	0	4	2	1
6 - 2 , 108	42.98	72	7	34	21	17	0	19	0	19	60	5	13	3	4	0	7	0	0	0	0	1	0	2
6 - 3 , 108	44.48	26	2	27	7	6	0	49	0	51	13	3	11	3	3	0	38	2	0	0	1	3	2	0
6 - 6 , 108	48.98	42	5	47	30	23	0	16	0	35	54	16	1	3	0	0	6	3	0	0	0	2	0	0
7 - 3 , 110	54.00	39	6	18	20	23	0	27	0	16	46	3	1	0	1	0	15	1	0	0	0	1	3	0
7 - 4 , 109	55.49	74	3	29	30	15	1	5	0	12	44	4	6	2	0	0	5	1	0	0	1	0	9	1
7 - 5 , 110	57.00	104	5	17	10	12	1	12	0	24	23	10	8	1	0	0	5	0	0	1	0	4	4	0
8 - 1 , 108	60.48	66	4	28	30	6	0	19	0	37	36	8	6	4	1	0	4	0	0	0	0	0	1	0
8 - 2 , 110	62.00	57	2	13	41	6	2	23	1	25	66	3	3	3	0	0	9	0	0	6	0	1	10	3
8 - 3 , 109	63.49	18	2	32	41	34	0	9	0	24	92	6	2	4	0	0	5	0	0	3	0	1	4	0
8 - 4 , 107	64.97	50	3	11	33	24	0	18	0	23	72	8	15	0	2	0	1	0	0	0	1	0	7	0
9 - 4 , 109	73.39	75	1	46	10	5	0	15	0	35	21	24	5	11	0	2	5	0	0	0	4	4	26	0
9 - 5 , 108	74.88	128	23	38	20	18	0	5	0	21	7	8	18	0	0	1	1	0	0	1	2	3	18	0
10 - 1 , 109	78.39	108	2	0	18	10	0	9	0	19	79	15	13	1	0	0	3	0	0	0	1	8	4	0

pseud	Gltal	conom	viola	quinq	Sphae	Cande	Pulle	altis	scitu	plata	crass	tumid	menar	pumil	hexag	tocat	hirsu	venez	kcras	OTHER	bform	ocods	TOTAL PLANK	SAMPLE
0	0	0	0	2	1	0	3	0	1	8	79	15	11	0	0	0	0	0	0	3	15	0	359	2 - 2 , 113
0	0	0	1	0	3	0	0	0	0	39	54	0	5	0	0	0	0	0	0	4	4	0	338	2 - 5 , 110
0	0	0	0	0	1	1	0	0	3	13	0	1	8	0	0	0	0	0	0	3	3	4	354	3 - 1 , 109
0	0	0	0	1	4	0	0	0	1	8	0	0	0	0	0	0	0	0	0	2	10	2	324	3 - 2 , 109
3	0	0	0	0	6	2	5	0	0	89	0	2	3	0	0	1	0	0	0	0	1	0	349	3 - 4 , 110
1	0	0	0	0	6	0	3	0	0	54	0	0	1	0	0	0	0	0	0	4	7	0	316	3 - 5 , 107
2	0	0	0	2	1	0	4	0	0	45	0	0	0	3	0	9	0	0	0	3	3	0	338	3 - 6 , 108
0	0	0	0	0	23	0	31	0	0	34	0	0	0	21	0	0	136	0	0	1	22	0	416	4 - 1 , 107
4	1	0	0	0	15	0	10	0	0	23	0	0	0	0	0	2	100	0	0	3	36	0	410	4 - 2 , 112
4	0	0	0	2	0	0	2	0	1	37	0	0	0	5	0	5	51	0	0	6	9	2	379	4 - 3 , 112
1	0	0	0	1	2	0	7	0	3	55	0	0	0	16	0	56	5	0	0	4	17	0	380	4 - 4 , 112
2	0	0	2	2	1	0	1	0	3	43	3	3	4	1	0	0	46	0	0	5	5	0	371	4 - 5 , 112
1	0	0	0	0	0	0	3	0	0	117	1	21	17	0	0	0	7	0	0	1	13	0	315	4 - 6 , 112
2	0	0	0	0	7	0	7	1	0	94	0	0	0	0	0	13	0	0	0	2	23	0	356	5 - 2 , 108
5	0	0	0	0	3	0	6	0	1	85	1	0	0	1	0	0	29	1	0	5	9	0	409	5 - 3 , 108
1	0	0	0	0	21	0	6	0	0	104	2	0	0	13	0	0	54	0	0	3	15	0	378	5 - 4 , 112
6	1	0	1	1	0	2	0	0	6	63	4	0	0	7	0	0	10	0	0	4	2	0	352	5 - 5 , 108
0	0	0	4	1	4	0	0	0	4	0	26	10	3	7	0	0	11	0	0	5	35	0	334	5 - 6 , 116
4	0	0	5	0	4	0	0	0	0	0	29	0	0	18	0	0	5	0	0	3	13	0	352	6 - 2 , 108
0	0	0	1	0	12	0	0	0	0	44	54	0	0	2	0	0	0	0	0	3	24	0	363	6 - 3 , 108
2	6	0	0	0	3	0	4	0	3	0	96	0	0	4	0	0	0	0	11	4	47	0	416	6 - 6 , 108
0	0	0	0	0	10	0	9	0	1	0	124	0	0	9	0	0	0	0	5	5	40	0	383	7 - 3 , 110
0	3	0	3	0	6	0	4	0	0	1	78	0	0	9	0	11	0	0	6	4	46	0	367	7 - 4 , 109
0	0	0	0	0	2	0	29	0	0	0	47	0	0	8	0	11	0	0	1	3	8	0	342	7 - 5 , 110
1	0	0	0	0	26	0	0	0	0	0	47	0	2	8	0	4	0	0	0	2	40	0	340	8 - 1 , 108
0	1	0	0	0	0	0	0	0	0	0	27	0	1	12	1	2	0	0	0	6	65	0	324	8 - 2 , 110
1	0	0	0	0	6	1	1	0	1	0	17	0	1	21	0	0	0	0	0	6	19	0	332	8 - 3 , 109
2	0	0	0	0	3	0	0	0	4	0	14	0	0	12	0	0	0	0	0	2	65	6	305	8 - 4 , 107
2	0	0	4	0	12	0	0	0	1	0	25	0	2	11	0	0	3	0	0	4	12	1	353	9 - 4 , 109
5	0	0	0	0	2	0	0	0	5	1	17	0	6	2	0	0	0	0	0	0	15	0	350	9 - 5 , 108
0	0	3	4	0	2	0	0	0	4	0	48	0	10	0	0	0	0	0	0	2	39	0	363	10 - 1 , 109

SAMPLE	DEPTH	ruber	obliq	saccu	bulls	falco	datca	dupac	acost	humer	gluti	Orbul	Gnoid	incis	praed	satca	dpach	spach	Neogl	aequi	sp. 1	congl	woodi	decor
10 - 3 , 108	81.38	107	9	16	18	8	0	4	7	15	20	5	10	8	0	0	0	0	0	6	0	8	28	1
10 - 5 , 101	84.31	72	10	41	20	31	0	7	0	8	42	16	14	4	0	7	0	0	0	1	0	0	15	2
14 - 1 , 145	108.25	46	25	19	11	6	0	2	7	17	32	5	13	3	0	2	0	0	0	5	0	8	37	11
14 - 2 , 145	109.75	71	9	53	3	8	0	4	6	2	11	3	7	1	0	0	0	0	0	3	0	7	11	0
14 - 3 , 71	110.51	83	13	21	6	21	2	28	10	12	32	4	0	0	2	0	4	0	0	2	0	23	12	1
14 - 4 , 71	112.01	65	20	49	15	33	0	11	9	8	39	2	16	2	0	1	5	0	0	1	0	9	10	3
15 - 1 , 71	117.11	57	40	30	6	50	0	1	9	0	30	6	4	0	5	7	0	0	0	2	0	7	11	2
15 - 1 , 145	117.85	40	15	13	16	31	0	2	3	0	23	6	1	0	4	0	0	0	0	0	0	8	14	6
15 - 2 , 71	118.61	86	34	19	5	27	3	2	2	6	23	1	15	0	5	2	2	0	0	0	0	6	47	15
15 - 3 , 71	120.11	39	10	24	17	30	0	4	4	4	77	9	7	4	3	2	0	1	0	2	0	1	8	6
15 - 7 , 24	125.64	48	30	51	3	1	0	9	5	7	24	27	13	3	5	0	3	1	0	2	0	1	9	3
16 - 3 , 71	129.71	12	27	25	16	37	2	6	14	9	69	4	3	5	0	0	3	2	0	2	0	1	15	3
16 - 4 , 71	131.21	48	39	3	13	23	0	2	3	1	34	4	22	0	2	2	0	1	0	2	0	1	9	2
16 - 5 , 71	132.71	38	23	65	6	28	0	1	3	4	36	17	7	1	3	0	0	0	0	7	0	1	10	0
17 - 1 , 145	137.05	10	20	33	8	33	2	4	5	2	22	7	5	0	10	2	0	0	0	2	0	3	18	1
17 - 5 , 106	142.66	34	45	28	18	48	0	0	2	6	15	14	16	2	2	0	0	0	0	1	0	6	20	0
18 - 1 , 70	145.90	36	49	15	16	55	0	2	2	33	37	4	6	11	1	0	0	0	0	1	0	1	7	0
18 - 1 , 145	146.65	14	15	27	22	32	0	19	21	7	41	10	1	6	0	3	4	1	0	3	0	0	15	0
18 - 3 , 145	149.65	25	12	49	21	65	1	9	3	4	27	10	7	0	3	1	2	1	0	1	1	9	13	3
18 - 7 , 11	154.31	23	17	6	30	46	0	4	5	3	34	8	15	0	3	0	0	0	0	1	0	3	17	1
19 - 3 , 145	159.25	29	31	32	11	20	0	2	2	3	38	24	11	15	1	0	0	0	0	0	0	5	7	5
19 - 4 , 71	160.01	19	12	20	20	46	2	1	4	3	37	15	6	27	4	3	1	0	0	1	0	0	19	4

pseud	Gltal	conom	viola	quinq	Sphae	Cande	Pulle	altis	scitu	plata	crass	tumid	menar	pumil	hexag	tocat	hirsu	venez	kcras	OTHER	bform	ocods	TOTAL PLANK	SAMPLE
3	0	0	4	0	0	0	0	0	5	0	31	0	13	9	0	0	0	0	4	4	7	0	343	10 - 3 , 108
1	0	0	2	0	0	0	0	0	0	10	34	0	1	0	0	0	0	0	0	3	36	0	341	10 - 5 , 101
2	0	2	0	0	2	0	0	0	2	42	23	0	12	0	0	0	0	0	0	1	9	0	335	14 - 1 , 145
1	0	0	1	0	0	0	0	0	1	34	7	0	75	0	0	0	0	0	0	1	32	0	319	14 - 2 , 145
2	2	0	7	0	3	1	0	0	2	4	7	0	14	0	0	0	0	0	0	5	14	0	323	14 - 3 , 71
0	0	0	3	0	5	0	0	0	0	27	8	0	8	0	0	0	0	0	0	2	60	0	351	14 - 4 , 71
0	0	0	8	0	1	0	0	4	0	0	23	7	12	0	0	0	0	0	0	2	12	0	324	15 - 1 , 71
0	0	0	10	0	0	0	0	3	3	6	39	0	10	0	0	0	0	0	0	2	41	0	255	15 - 1 , 145
0	0	1	5	0	3	0	0	9	2	5	18	0	1	3	0	0	0	0	0	9	42	0	356	15 - 2 , 71
0	0	0	7	3	6	0	0	4	0	6	49	0	3	0	0	0	0	0	0	6	62	0	336	15 - 3 , 71
0	3	0	1	0	23	1	0	6	3	0	25	5	18	0	0	0	0	5	0	4	7	0	339	15 - 7 , 24
0	5	0	0	1	3	0	0	7	6	3	22	0	12	0	0	0	0	1	0	5	21	0	320	16 - 3 , 71
0	0	2	4	0	4	0	0	18	2	1	40	0	3	0	0	0	0	0	0	4	32	0	289	16 - 4 , 71
0	0	0	0	2	0	0	0	14	0	1	38	0	1	0	0	0	0	13	0	3	15	0	322	16 - 5 , 71
1	3	1	1	0	3	0	0	8	0	20	9	0	12	0	0	0	0	0	0	3	44	0	248	17 - 1 , 145
0	0	0	0	1	0	1	0	11	5	2	2	0	2	0	0	0	56	9	0	4	13	0	350	17 - 5 , 106
0	0	2	0	0	3	0	0	16	6	0	0	0	3	0	0	0	33	18	0	7	33	0	364	18 - 1 , 70
2	0	0	0	2	3	0	0	21	4	0	0	0	13	0	0	0	47	0	0	7	26	0	340	18 - 1 , 145
0	0	0	0	0	3	0	0	0	2	11	0	0	11	1	0	0	25	0	0	5	33	1	325	18 - 3 , 145
1	0	0	0	0	0	0	1	5	2	0	0	0	14	10	0	0	41	0	0	4	19	0	294	18 - 7 , 11
0	0	0	0	1	7	0	0	12	0	0	0	0	9	0	0	0	113	5	0	9	101	0	392	19 - 3 , 145
0	0	1	0	1	5	1	0	8	3	0	0	0	8	3	0	0	43	0	0	8	47	0	325	19 - 4 , 71

Table 2 - DSDP Hole 603C continued