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Pliocene planktic foraminifer census data from Deep Sea Drilling Project Hole 396 and Ocean Drilling Program Hole 672

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INTRODUCTION

The U.S. Geological Survey is conducting a long-term study of the climatic and oceanographic conditions of the Pliocene. One of the major elements of the study involves the use of 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 we have decided to make the raw census data available in a series of open-file reports that will provide basic data for future work. In this report we present counting categories and raw census data for planktic foraminifer assemblages in 39 samples from DSDP Hole 396 and ODP Hole 672 (Fig. 1).

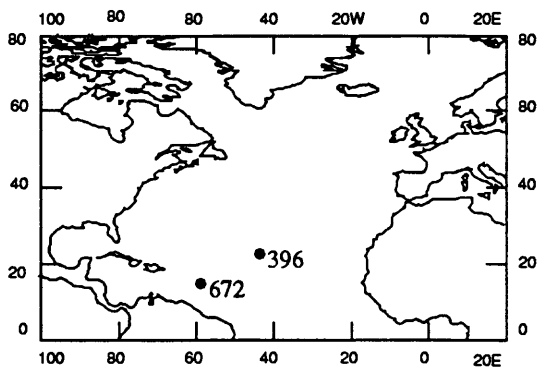

FIGURE 1. Location of Sites 396 and 672.

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 statistical techniques, details of taxonomic groupings, and oceanographic interpretations are presented in more formal publications (Dowsett and Poore, 1990, 1991; Dowsett, 1991).

Latitude, longitude, and water depth for each locality are in Table 1. Counts of variables tabulated in each sample are given in Tables 2-3.

TABLE 1. Localities discussed in text

Site	Lat.	Lon.	Depth
396	22.90	-43.50	4450.0 m
672	15.50	-58.50	4975.0 m

Negative longitude is West longitude.

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 63 μm sieve using a fine spray hose and dried in an oven at ≤50° C. Many samples required an additional treatment with about 10 ml of 10% H2O2 added to the wash in order to obtain clean specimens.

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

COUNTING CATEGORIES

Taxa included in counting categories and codes used for headings of Tables 2-3 are summarized below. In general, our taxonomic concepts follow Parker (1962; 1967) and Blow (1969). Exceptions to their practices are noted below.

DSDP and ODP sample designations are abbreviated in Tables 2-3 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

Cande *Candeina*

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

falco *Globigerina falconensis* Blow

pseud *Globigerina pseudobesa* (Salvatorini)

incis *Globigerina incisa* (Bronnimann and Resig)

praed *Globigerina praedigitata* Parker

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

decor *Globigerina decoraperta* Takayanagi and Saito

nepen *Globigerina nepenthes* Todd

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

aequi *Globigerinella aequilateralis* (Brady)

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

congl *Globigerinoides conglobatus* (Brady)

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

ruber *Globigerinoides ruber* (d'Orbigny)

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

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

altis *Globoquadrina altispira* (Cushman and Jarvis)

venez *Globoquadrina venezuelana* (Hedberg)

cibao *Globorotalia cibaoensis* Bermudez
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".

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

viola *Globorotalia viola* Blow. Both encrusted (*G. crassula* of Blow, 1969) and non-encrusted specimens are included.

hirsu *Globorotalia hirsuta* (d'Orbigny)

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

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.

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.

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

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

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

hexag *Globorotaloides hexagona* (Natland)

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

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

datca *Neogloboquadrina atlantica* (Berggren) right-coiling

humer *Neogloboquadrina humerosa* (Takayanagi and Saito)

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.

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.*

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

Orbul *Orbulina universa* d'Orbigny

Sphae *Sphaeroidinella* and *Sphaeroidinellopsis*

quinq *Turborotalita quinqueloba* (Natland)

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

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

frags fragments of planktic foraminifers

bform benthic foraminifers

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TABLE 3. ODP Hole 672A planktic foreminifer census data.

core	sec	int	depth	other	ruber	obliq	ssccu	bulls	falco	dpach	ecost	humer	gluti	Orbul	Gnoid	hexag	aequi	congl	woodi	decor	pseud	incis	Neogl	Sphae	Cande	altis	praed	plata	crass	tocat	Pulle	cnglm	sp. 1	marga	scitu	hirsu	Gital	tumid	menar	total plank	bform	frags
7	2	23	52.53	12	19	2	6	3	0	0	0	0	1	18	0	0	0	65	0	0	0	1	0	133	0	0	2	3	48	0	0	0	0	1	1	0	0	0	0	315	130	>3,000
7	4	101	56.31	1	102	55	61	23	0	0	7	31	4	12	0	0	0	19	7	0	0	1	0	0	0	0	2	23	23	0	0	0	0	0	2	0	0	0	0	373	4	>350
7	5	20	57.00	0	122	19	36	6	0	2	12	46	13	5	0	0	0	8	25	5	0	0	0	4	0	0	1	0	6	0	0	0	0	0	0	0	0	0	36	346	2	189
8	1	101	61.31	1	70	29	30	4	0	3	6	46	26	2	10	0	0	20	29	7	0	3	5	10	0	0	3	0	11	3	0	0	0	0	1	0	0	3	34	358	1	228
8	3	101	64.31	0	84	18	34	1	0	2	6	27	12	5	7	0	2	7	20	2	0	0	1	17	0	37	1	1	10	0	0	0	1	0	2	0	0	0	16	313	1	164
8	5	76	67.06	1	36	60	9	6	0	1	4	60	22	7	0	5	1	46	7	1	0	0	4	1	0	29	0	0	4	0	0	0	3	0	0	0	0	0	23	332	1	395
8	5	126	67.56	0	40	12	54	4	0	0	6	55	20	7	0	0	1	50	15	0	0	0	2	3	1	29	0	0	9	0	0	0	3	0	0	0	0	1	0	11	323	2	280
8	6	26	66.06	3	37	27	37	0	0	0	5	35	18	6	1	0	1	34	9	0	0	0	0	12	3	54	0	0	12	0	0	1	0	0	0	4	0	0	23	322	3	252
8	6	76	68.56	2	27	30	44	0	0	0	18	34	4	6	0	0	0	55	7	0	0	0	0	13	1	32	2	0	12	0	0	1	0	0	4	2	0	0	28	322	1	479
8	6	121	69.01	0	47	41	49	6	0	5	9	37	22	12	1	2	2	51	8	1	30	0	0	8	0	34	0	0	6	8	0	0	0	0	2	0	0	0	23	402	2	236
8	7	31	69.61	0	6	23	150	1	0	1	5	35	0	17	2	0	1	28	4	0	0	1	0	11	0	13	1	0	6	0	0	4	0	0	0	2	0	0	41	352	6	840
9	1	91	70.71	0	60	22	56	3	0	4	6	45	20	6	0	0	0	42	17	0	0	0	1	5	1	43	0	0	4	0	0	4	0	0	2	1	0	0	23	365	0	125
9	1	111	70.91	2	15	18	85	4	0	6	3	49	12	3	0	0	0	31	1	0	0	1	2	32	1	33	2	0	1	0	0	10	0	0	3	1	1	0	13	329	2	534
9	1	141	71.21	3	34	30	83	2	0	3	8	60	13	4	0	3	2	25	7	0	0	0	0	11	0	36	0	0	0	0	0	2	0	0	0	7	1	0	37	371	1	273
9	2	18	71.46	1	42	28	68	5	1	1	6	49	10	3	0	3	0	36	5	0	0	0	0	26	0	52	1	0	0	0	0	2	0	0	0	9	4	0	11	363	1	384
9	2	44	71.74	6	34	29	77	2	2	3	5	66	11	2	0	1	2	25	5	0	0	0	1	22	2	41	1	0	0	0	0	5	0	0	7	0	0	0	29	378	3	301
9	2	86	71.96	4	42	15	87	4	0	1	5	86	17	7	2	1	0	21	25	0	0	0	6	13	3	1	1	0	0	0	0	6	2	0	5	3	0	0	16	373	3	195
9	2	91	72.21	1	30	32	139	2	0	0	3	62	9	2	2	3	0	29	2	0	0	0	2	8	2	21	2	0	0	0	0	3	0	0	3	3	1	0	17	378	8	712
9	2	116	72.46	2	16	23	107	3	0	0	4	39	2	11	1	2	1	26	1	0	0	1	2	18	2	30	3	0	0	0	12	10	1	0	3	9	2	0	17	348	11	1604
9	2	141	72.71	2	25	29	114	4	0	1	1	48	0	23	8	1	2	25	0	0	0	1	2	40	0	10	14	0	0	0	15	5	0	0	1	8	2	0	4	383	42	2700
9	3	16	72.96	5	24	10	72	2	0	2	1	46	12	4	0	6	4	17	0	0	0	1	3	49	3	34	2	0	0	0	4	6	1	0	3	10	0	0	15	336	3	439
9	3	43	73.23	1	37	15	59	9	0	0	1	65	8	2	0	10	0	11	1	0	0	11	2	45	0	34	2	0	0	0	20	3	0	0	3	2	0	0	23	384	8	683
9	3	86	73.46	1	16	16	56	1	0	1	0	14	1	20	7	1	0	17	0	0	0	2	0	170	0	2	8	0	0	0	3	1	0	0	0	0	0	0	0	337	34	1316
9	3	91	73.71	0	96	28	38	5	2	0	0	48	15	4	1	3	3	4	18	0	0	5	0	25	0	33	2	0	2	0	17	2	0	0	3	0	0	0	24	378	3	269
9	3	117	73.97	2	10	17	52	4	0	0	0	41	3	21	0	1	0	20	0	0	0	12	0	130	0	13	6	0	0	0	36	4	0	0	0	0	1	0	2	375	18	1920
9	3	141	74.21	3	70	28	89	2	0	0	5	47	16	5	1	0	3	11	1	0	0	10	0	7	3	45	3	0	5	0	0	2	0	0	4	0	1	0	18	379	0	423
9	4	16	74.46	2	40	10	113	1	0	1	4	45	12	11	0	3	2	8	7	0	0	16	1	27	0	50	1	0	5	0	0	3	0	0	1	0	2	0	13	376	6	872
9	4	41	74.71	3	31	27	48	3	0	1	8	20	0	16	0	1	0	32	0	0	0	2	0	155	0	1	11	0	5	0	0	2	0	0	1	0	0	0	0	367	82	2832
9	4	86	74.96	1	50	29	91	7	0	1	0	48	17	19	5	1	1	12	4	0	0	1	0	25	1	23	2	0	8	0	0	3	0	0	1	0	0	0	17	367	10	734
9	4	91	75.21	0	46	44	97	2	0	0	3	34	7	20	3	2	0	16	0	0	0	13	0	26	0	11	9	0	10	0	0	7	0	0	3	0	0	0	8	361	6	1104
9	4	113	75.43	1	39	14	86	3	0	2	0	48	7	14	2	0	2	23	1	0	0	19	1	32	1	26	3	0	12	0	0	4	0	0	6	0	0	0	24	370	4	862
9	5	101	76.81	0	17	23	58	1	0	3	5	31	0	6	0	3	1	21	1	0	0	7	0	83	0	6	8	0	10	0	0	4	0	0	0	0	0	0	62	350	8	1320
9	6	101	78.31	3	18	33	93	1	1	0	5	41	14	1	1	0	0	31	1	0	0	7	1	33	3	71	2	0	9	0	0	0	0	0	1	1	0	0	1	372	2	655
9	7	21	79.01	1	26	43	52	4	7	0	6	45	17	1	1	1	2	37	1	0	0	0	0	11	2	43	2	0	5	0	0	5	0	0	1	0	0	0	42	355	0	0
10	1	61	79.91	3	49	55	41	6	3	0	7	37	19	2	2	0	0	17	1	0	0	0	1	22	3	47	2	0	8	0	1	0	0	0	3	0	0	0	41	370	1	140
10	2	101	81.81	1	11	55	96	2	0	1	2	59	5	4	0	0	1	16	0	0	0	3	0	47	1	27	4	0	2	0	0	2	0	0	0	0	1	0	33	373	5	658
10	3	141	83.71	7	4	64	83	2	0	2	4	34	9	2	0	1	0	20	1	0	0	2	1	33	4	48	2	0	8	0	0	0	0	0	2	0	0	0	45	358	3	509
10	4	51	84.31	0	0	76	32	8	2	5	24	51	16	2	0	0	0	25	3	0	0	8	0	16	0	81	0	0	3	0	3	0	2	0	0	0	1	0	27	365	0	202
10	5	101	86.31	7	3	107	42	2	0	1	13	37	17	4	0	0	0	5	9	0	0	12	0	27	1	72	1	0	2	0	0	0	1	5	0	0	1	0	8	377	4	0

TABLE 4. DSDP Hole 396 planktic foraminifer census data.

core	sec	int	depth	other	ruber	obliq	ssccu	bulls	falco	acost	humer	gluti	Orbul	aequi	congl	woodi	Sphae	Cande	altis	plata	crass	tocat	Pulle	scitu	tumid	menar	total plank	bform	frags
8	6	71	69.37	5	85	121	45	5	1	13	7	8	4	9	3	8	0	0	0	0	1	0	0	0	0	1	316	6	75
8	6	126	69.92	3	93	130	54	1	0	0	0	12	5	6	0	8	0	0	0	0	1	0	0	0	0	1	314	3	100
9	5	79	77.20	2	121	91	23	0	0	4	5	7	6	2	2	12	0	0	0	1	1	0	2	1	3	3	286	0	49
9	5	131	77.72	0	78	131	57	2	0	7	6	5	5	7	5	12	1	1	0	0	0	0	0	0	0	0	317	2	55
10	1	133	80.97	1	125	68	48	1	0	2	2	6	6	5	0	4	2	0	6	1	1	3	1	0	0	1	303	3	76
10	2	41	81.55	3	111	93	41	5	0	0	6	8	4	7	6	10	1	0	2	0	1	0	0	0	2	1	301	2	100
10	2	121	82.35	5	109	107	59	0	0	7	5	8	7	8	5	2	0	0	3	0	0	0	0	0	0	1	326	1	100
10	3	41	83.05	2	105	110	48	1	0	8	6	7	5	5	4	1	1	1	5	2	1	3	0	0	0	1	316	2	185
10	3	136	84.00	2	114	100	54	3	0	0	6	9	3	4	6	3	0	0	0	0	1	0	1	0	3	1	312	5	69
10	4	41	84.55	1	98	125	57	8	0	2	5	12	4	6	3	1	5	0	1	0	0	0	0	0	0	0	326	4	75
10	4	111	85.25	0	101	121	29	7	2	3	4	3	9	1	3	5	1	0	0	3	1	5	0	0	0	4	302	8	45
10	5	51	86.15	0	105	109	53	4	0	6	3	5	6	5	2	0	3	1	2	0	0	0	0	1	1	1	305	5	40
10	5	111	86.75	1	87	127	35	1	0	19	0	6	4	11	1	2	1	0	8	0	1	0	0	0	0	1	305	3	75
10	6	71	87.65	2	96	119	48	0	0	0	2	4	4	2	7	8	4	0	16	0	1	0	0	0	5	1	317	2	154