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DATA ON THE DISTRIBUTION OF STABLE ISOTOPES AND  
AMINO ACIDS IN INDIAN OCEAN SEDIMENTS

by

Egon T. Degens and John M. Hunt

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TECHNICAL REPORT

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John M. Hunt, Chairman  
Chemistry Department

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INTRODUCTION

In February-March 1965, a series of piston cores were taken aboard ATLANTIS II off the coast of Arabia, Pakistan, and India (Figure 1) in water depths of about 3,000 meters. The principal objectives of this program were (a) to obtain information on the change in petrology of the sediments as a function of geography and depth (b) to study the microfauna in the sediment profiles, and (c) to apply geochemical tools for the elucidation of the diagenetic fate of the organic matter and the history of the sediments.

This article presents data on the geochemical part of the project. Principally, we are concerned with the oxygen and carbon isotope distribution in carbonates, the carbon isotope composition of sedimentary organic matter, and the amino acid composition of the sediment material. These studies represent a part of a larger program at our Institute which is concerned with the distribution of (a) stable isotopes and (b) organic compounds such as amino acids, carbohydrates, or hydrocarbons in recent and ancient sediments, natural waters, and marine organisms.

## BACKGROUND INFORMATION

### Geology

Most of the petrographical work on the Indian Ocean sediments (Konta, 1968) has been done on three piston cores (PC 17-19). These cores also were selected for the geochemical studies. Their geographical position is shown in Figure 1.

Interpretation of the data require a brief presentation of the geology of the prospective source area from which the sediment detritus in PC 17 to PC 19 has been derived.

Four areas can be considered as provenance for the continental detritus:

- (a) the drainage area of the Indus,
- (b) the Masqat region which borders the Gulf of Oman in the west,
- (c) the small river system in the coastal areas of southern Persia, and
- (d) the Mirbat region at the southern coast of Saudi Arabia.

The geological hinterland of the Indus (Tibet and Kashmir) is principally composed of acid intrusives and early Paleozoic and Precambrian sediment formations (Dir. Geol. Surv. India, 1959). Also some late Mesozoic sediments are exposed. Recent and post-glacial sediments, however, constitute the only deposits for the final 800 miles of the Indus to the coast.

The Masqat region contains sandstones, marls and limestones from the Triassic to early Tertiary, as well as two large isolated exposures of Paleozoic limestones, dolomites and shales. Of special significance in this context is the occurrence of the rather extended Semail igneous complex of Cretaceous/Tertiary age and its thermal effects on the sedimentary carbonates in terms of isotope re-equilibration. (U. S. Geol. Surv., 1963).



With exclusion of the Paleozoic sediments, the same rock formations exposed in the Masqat region are present in the coastal areas of southern Persia.

The Mirbat region is geologically outstanding in that aside of the early Tertiary and Cretaceous sediments exposed in the southeastern part of Saudi Arabia, outcrops of Paleozoic sandstone and of Precambrian gneiss and schist are found (U. S. Geol. Surv., 1963).

### Physiography

In Figure 2, a generalized map of the sea floor topography in the northern part of the Arabian Sea is presented (after Heezen, 1964). The Oman basin is clearly separated from the main stream of the deltaic deposits of the Indus by a sea mountain range; PC 17 is located in the deepest spot of the Oman basin about 50 miles offshore Masqat. On the other hand, PC 18 is centrally positioned in the Indus discharge area, while PC 19 is outside the main submarine delta of the Indus but still in the influence sphere of the river.

### Petrography

Mineralogically, the sediments of the three cores differ in the following way (Konta, 1968). The amount of carbonate is highest in PC 19 (~55%), intermediate in PC 18 (~40%), and lowest in PC 17 (~15%) (Tables 1 to 3). Whereas high magnesium calcite and some dolomite is present in varying amounts in PC 17, the carbonates in PC 18 and PC 19 are principally low-magnesium calcites derived from foraminifera and coccoliths. Some aragonite has been found in all three cores. In PC 17, foraminifera and coccoliths are virtually restricted to a few thin layers and are rarely found in the bulk of the sediment

material. Mica and chlorites are highly abundant in PC 17 but present in only medium to small quantities in PC 18 and PC 19; the highest degree of crystallinity is observed in the PC 17 samples. Montmorillonites are moderately (PC 18) to highly (PC 19) abundant; in contrast, no montmorillonite is present in PC 17. Quartz and well-preserved feldspars (K-feldspar and acid plagioclase) make up a larger portion of the insoluble residue in PC 17 compared to the residue in PC 18 and PC 19. The content of organic matter increases in the order PC 17 ( $\approx 0.5\%$ ), PC 18 ( $\approx 1.0\%$ ), and PC 19 ( $\approx 1.5\%$ ).

In summary, the sediments of PC 18 and 19 are petrographically related, while the sediments of PC 17 are distinctly different from PC 18 and PC 19 in many aspects.

In PC 18 and PC 19 the carbonate fraction is virtually composed of foraminifera and coccoliths. The variation in the  $O^{18}$  content of the carbonates is most probably a result of the change in water temperature.

The amount of chlorite and dioctahedral mica decreases with distance from the mouth of the Indus, i.e. from PC 18 to PC 19, whereas montmorillonite increases in the same direction. This factor may be attributed to a preferential settling in the sense that in PC 18 chlorite, mica, and quartz became preferentially deposited, whereas with the progressive distance from the Indus outlet more and more montmorillonite could settle to the bottom of the sea. The differences in the rate of deposition between the two cores would support this inference. On the other hand, there is the possibility that some diagenetic readjustment has occurred in the sense that montmorillonite has been diagenetically generated from other clay minerals. Yet, the preferential settling mechanism appears to us the most likely incident leading to the observed distribution pattern of the sedimentary matter.

In addition to detritus from the Indus, which are mainly fine clay particles, some of the sediment material in PC 19 must have come from local outcrops exposed in the Marbat area. Based on petrographic evidence (Konta, 1968), layers highly enriched in coarse quartz and feldspar material co-exist or are interlayered with montmorillonite and carbonate bands. It is tentatively proposed that similar to the Oman basin, periodic rainfalls have occasionally contributed local detritus to the Arabian Sea, hereby competing with the fine detrital material (e.g. montmorillonite) derived from the Indus or with the biological carbonates derived from the sea.

#### STABLE ISOTOPES

The organic carbon in the sediments was converted to carbon dioxide and subsequently purified of any contaminating gas in the combustion system following a procedure outlined by Craig (1953) and Sackett and Thompson (1963). The carbonates in the sediment were prepared for isotope analysis by the method of McCrea (1950) which involves the acid decomposition of carbonate by 100 per cent phosphoric acid at 25°C. The isotope data are reported as per mil deviation relative to the PDB Chicago belemnite standard (Craig, 1953, 1957):

$$\delta C^{13} = \left( \frac{R}{R_s} - 1 \right) \times 1000$$

R = C<sup>13</sup>/C<sup>12</sup> ratio in sample

R<sub>s</sub> = C<sup>13</sup>/C<sup>12</sup> ratio in the standard.



Appropriate correction factors described by Craig (1957) were applied.  $\delta O^{18}$  data are defined in similar terms.

The bulk of the carbonate in PC 18 and 19 is foraminifera. Assuming that the shell material has been formed in isotopic equilibrium with the sea, the  $\delta O^{18}$  data reflect water surface temperatures in the range of 23°C ( $\delta O^{18} = -1.5\text{‰}$ ) to 17°C ( $\delta O^{18} = -0.2\text{‰}$ ) (Tables 1-3). Three highs (surface, 250 and 600 cm), and two lows (450 and 950 cm) can be observed in PC 18, whereas two highs (surface and 400 cm), and two lows (250 and 650 cm) can be recognized in PC 19. It is tentatively suggested that the first two highs and lows are stratigraphically correlated which implies that the rate of deposition is less in PC 19 relative to PC 18 by about 40 to 50%. This assumption conforms with the petrographical evidences such as the lesser abundance of mica and quartz, and the higher yields in carbonate, montmorillonite, and organic matter in PC 19 compared to PC 18. It is noteworthy, that the  $\delta C^{13}$  in the combustible organic matter is uniform throughout PC 18 and 19 with an average  $\delta C^{13}$ -value of  $-19.5\text{‰}$ . Diagenesis thus has not isotopically modified the organic debris. In general, marine organic matter becomes progressively lighter eventually approaching  $\delta C^{13}$  values of  $-25$  to  $-26\text{‰}$ . These light values, however, have been shown in the JOIDES cores to occur at depths exceeding 100 meters (Hunt, 1967).

In contrast to the relative normal isotope distribution in PC 18 and 19, the  $\delta$ -values for the carbonates in PC 17 suggest a different source and origin of the sediments in general.

The carbonate material in the sediments of PC 17 is isotopically light especially regarding its  $O^{18}/O^{16}$  ratio. Such values are commonly found in Paleozoic and Precambrian marine rock formations (Degens and Epstein, 1962). They are rarely observed in

geologically younger marine carbonates except when they are hydrothermally altered or metamorphosed. Fresh water limestone which is also isotopically light can be excluded as a potential contributor in this case.

It is interesting to observe that wherever we have high  $\delta O^{18}$  values, i.e. at 350, 550, and 675 cm respectively, foraminifera are highly abundant. This phenomenon can be attributed to differences in deposition rates. Namely, in case the influx of continental detritus is reduced due to climatical circumstances (slow rate of deposition), there is more time available for the accumulation of sizable amounts of foraminiferal tests. Consequently, the layers of foraminifera may be used as a criterion for estimates of fluctuations in the detrital load of the rivers discharging into the Oman basin, and may allow insight into the pluvial history of the surrounding area.

At present the annual rainfall in the coastal areas of Oman, southern Persia, Pakistan, and Saudi Arabia is less than 10 inches per year. Consequently, only the Indus is a main contributor and constant source of continental debris presently discharged into the Arabian Sea. However, periodic rainfalls are observed throughout the area which may fill the Wadis and discharge the detritus into the open sea. Many such pluvial incidents have occurred during historic and prehistoric times. The extension and duration of an individual pluvial period as well as the frequency of such incidents are not known.

Isotopic and petrographic data clearly show that the bulk of the sediment material in PC 17 is derived from a different source than in either PC 18 or PC 19. The Indus can definitely be excluded as a major source of the sediment material in PC 17 in contrast to PC 18 which has solely derived its continental detritus from this river. Instead, the



detrital sediment material in the Oman basin has principally come from the Paleozoic to Tertiary sediments and Cretaceous/Tertiary igneous complex exposed in Oman and southern Persia. Based on isotope evidence, the bulk of the carbonates in PC 17 represents recrystallized fossil limestone material. As previously mentioned, there are occasional interstratifications of foraminifera beds throughout PC 17, and these beds coincide with an increase in  $O^{18}$  in the carbonate material. The most plausible interpretation for this phenomenon is to postulate periodic fluctuations in the amount of continental detritus carried by the river into the sea. In pluvial times, the detrital discharge was heavy and in turn the rate of deposition fast; in contrast, during inter-pluvial times little or no sediment debris was carried into the ocean and consequently the foraminifera had abundant time to accumulate in sizable amounts at the sediment/water interface.

We presently do not know the time intervals involved between pluvial and non-pluvial times although we are planning to date some of the cores.\*

#### AMINO ACIDS

The sediments were treated following a procedure outlined by Degens and Reuter (1964). Principally, 10 g of dry sample material were hydrolyzed in 6 N HCl for 22 hours in presence of nitrogen. The large amounts of inorganic salts were eliminated from the hydrolysis liquor by cation exchange resins, and the amino acids were freed

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\* Similar environmental circumstances have lead to sedimentation rates in the order of 15 to 20 cm per thousand years in deeps of the Red Sea (Ku, personal communication).

from the resin using 1.5 N  $\text{NH}_3$  as elution medium.

The quantitative analysis of the amino acids involved ion exchange chromatography using a high pressure (800 psi) automatic system. The amounts were calculated by a GE 225 computer. The computer read out sheets are included in the back of this report.

No major differences in the distribution of amino acids can be recognized between the three cores under investigation (Tables 4-6). The total yield in amino acids is within the same range, although the total concentration of combustible organic matter varies by a factor of two or three. Within a certain range, the amino acid content drops from a few hundred  $\mu\text{g/g}$  present in the upper two meters of burial to about 100  $\mu\text{g/g}$  at a depth greater than 5 meters.

The presence of hydroxyproline is of biochemical interest, since this amino acid is tied up in collagen-type proteins. The contributors of collagen are probably burrowing animals such as worms or organisms that contain collagen in mineralized tissues. The presence of  $\beta$ -alanine is a consequence of the microbial utilization of aspartic acid (decarboxylation) in the early stages of diagenesis. Ornithine is derived from arginine (urea cycle); most of the urea, however, has been destroyed during the acid hydrolysis; yet fair amounts can still be recognized. Small quantities of  $\alpha$ - and  $\gamma$ -aminobutyric acids can be recognized; they are principally derived from threonine and glutamic acid respectively. Traces of allo-isoleucine are present in all samples investigated.

In summary, the total amount of amino acids is only slightly reduced with depth of deposition. The original plankton material supplied to the sediment is diagenetically eliminated or modified rather rapidly and thoroughly through the action of microbes and burrowing animals. The activity of organisms in the sediments is reflected in the relative



high amounts of hydroxyproline,  $\beta$ -alanine, ornithine, and the aminobutyric acids.

Except for arginine which is eliminated almost instantaneously, no preferential gain or loss with depth of deposition can be observed for any of the original amino acids

in the 6 to 10 meters cored. Most of the amino acids are part of remains of burrowing animals, microorganisms, and the diagenetically generated heteropolycondensates.

Inasmuch as the proteinaceous fraction that can be recovered upon hydrolysis is generally

less than 5 per cent\* of the total organic matter (average 2 per cent) it can safely be

concluded that the bulk of the organic debris is present in the form of heteropolyconden-

sates which genetically can be considered the metabolic waste products of the living

population in the sediments. On the basis of the carbon isotope distribution of the com-

combustible organic matter, contributions from continentally derived organic debris must

be negligible.

It would be of some interest to study the distribution of amino acids in longer cores.

In the sediments of the Experimental Mohole (Rittenberg *et al.*, 1963), the amino acids

systematically decreased from a high of 350  $\mu\text{g/g}$  at the surface to a low of 15  $\mu\text{g/g}$  at

a depth of 170 meters. In the Indian Ocean sediments the deepest parts of all three cores

showed the lowest amino acid content, but the cores were too short to make any realistic

comparisons with the Experimental Mohole. Amino acid concentrations with depth

would be expected to vary in different parts of the ocean due to changes in the composition

of the near-surface organic matrix caused by the varying activities of burrowing animals

and microorganisms. In addition to the chemical data, there is ample microscopic

evidence of tracks of burrowing organisms in many of the Indian Ocean cores.

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\* The protein content in living plankton, microorganisms, and burrowing animals is generally in the order of 30 to 60 per cent (dry weight).



In contrast, two others sediment areas previously investigated, the basins off California (Rittenberg et al., 1963; Degens et al., 1963), and along a Bermuda-Woods Hole transect (in progress) do not show the amino acids that are waste products of the sediment organisms. Their amino acid distribution indicates less severe alteration of the surface organic matter compared to the Indian Ocean cores. There is a relatively high abundance of arginine, a lack of urea and hydroxyproline, and insignificant amounts of  $\beta$ -alanine and the aminobutyric acids. Also, the amino acid spectra of the sediments and plankton in the overlying waters are very similar, indicating only minor alteration by sediment organisms.

The organic productivity in the Arabian Sea where our piston cores originated is one of the highest in the world. The assimilation rate for carbon is greater than 1 gram per square-meter a day (Ryther et al., 1966) (Fig. 1). This is about ten times the production rate normally observed in the ocean. The physical and chemical reasons leading to the high productivity are related to the high level of inorganic nutrients and coastal upwellings. The yield of combustible organic matter in the underlying sediments is considerably less than would be expected from the high productivity. For example, the sediments of basins off California where productivity is lower have organic contents ranging from 2 to 11% with the average around 6% (Emery, 1960). It appears that most of the plankton in the Arabian Sea is either biologically recycled in the sea or rapidly consumed in the sediments by burrowing animals and organisms. In such an environment there would be a tendency to concentrate the more refractory organic compounds which conceivably could form hydrocarbons by thermal degradation at greater depths. Such conditions may have existed in the basins on the Arabian continent when the carbonate source beds of those fields were formed. In this case, however, a large evaporite basin later was formed to retain the oil in contrast to the open sea conditions of the Indian Ocean sediments.

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- Fig. 1 Chart of the Arabian Sea showing positions of piston cores PC 17, PC 18, and PC 19, and the general level of primary organic production (after Ryther et al., 1966), in grams of carbon assimilated per m<sup>2</sup>/day. No production data are available from the Persian Gulf and the western part of the Gulf of Aden.
- Fig. 2 Physiographic diagram (schematic) of the northern part of the Arabian Sea (after Heezen, 1964).



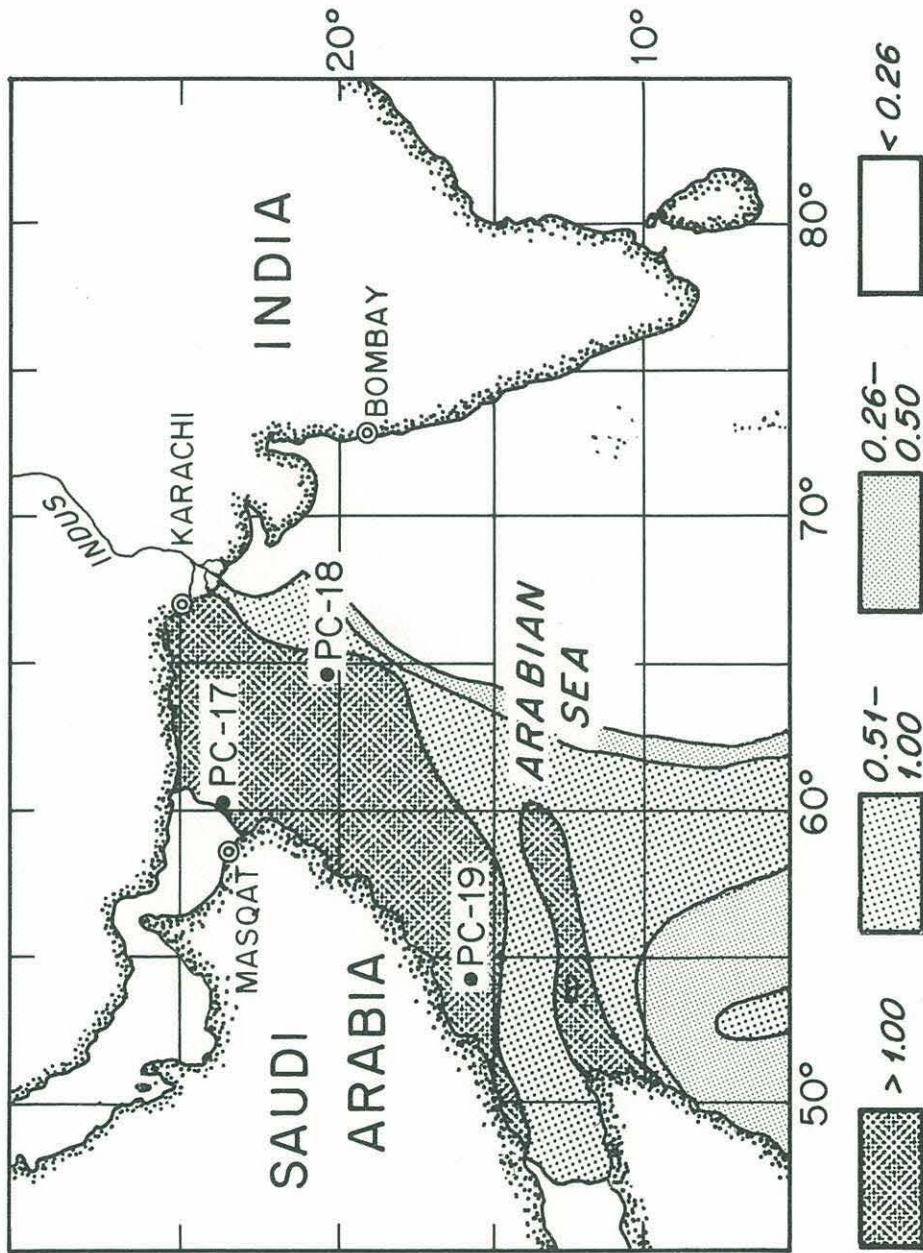


Fig. 1 Chart of the Arabian Sea showing positions of piston cores PC 17, PC 18, and PC 19, and the general level of primary organic production (after Ryther et al., 1966), in grams of carbon assimilated per m<sup>2</sup>/day. No production data are available from the Persian Gulf and the western part of the Gulf of Aden.



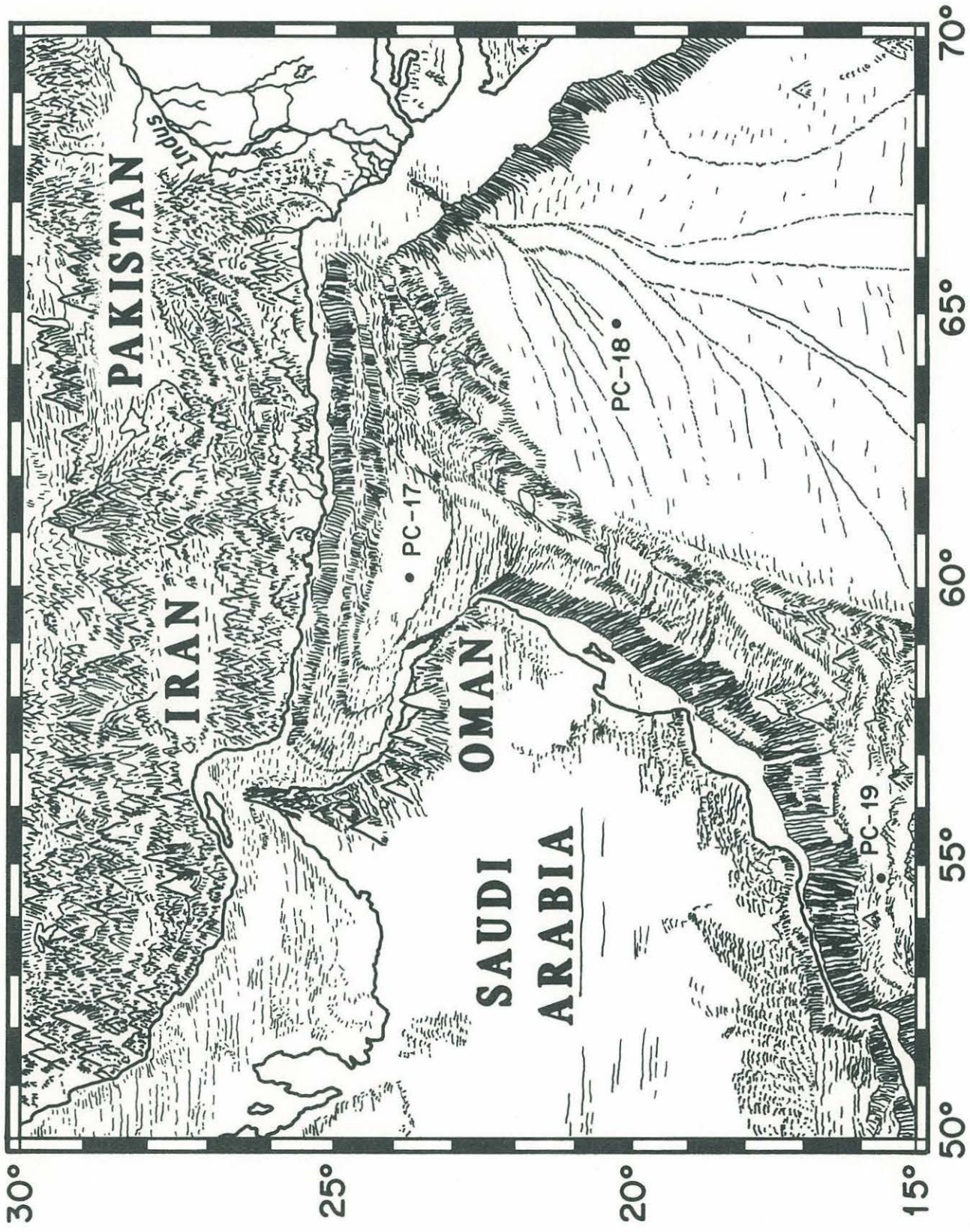


Fig. 2 Physiographic diagram (schematic) of the northern part of the Arabian Sea (after Heezen, 1964).

TABLE 1

## DISTRIBUTION OF ORGANIC MATTER, CALCITE AND STABLE ISOTOPES

PISTON CORE 17  
(Lat. 24°02'N; Long. 59°59'E; Depth 3341 m)

DEPTH cm	COMBUSTIBLE ORGANIC MATTER %	CALCITE %	CARBONATE $\delta^{18}\text{O}$	CARBONATE $\delta^{13}\text{C}$	ORGANIC MATTER $\delta^{13}\text{C}$
3-5	0.7	14.2	-7.0	-3.4	-19.8
5-10	0.2	15.1	-7.7	-3.9	
15-20	0.3	15.5	-6.7	-3.7	
20-25	0.3	15.2	-7.1	-3.4	
50-55	0.1	15.5	-7.3	-4.0	-20.2
100-105	0.1	14.2	-7.6	-5.6	
150-155	0.1	14.6	-6.1	-3.2	
200-205	0.6	14.4	-6.3	-3.4	
250-255	0.6	15.5	-7.5	-4.1	-20.4
300-305	0.5	16.1	-6.4	-3.6	
350-355	1.2	19.6	-2.1	-1.0	
400-405	0.5	14.5	-6.8	-3.4	-20.7
453-458	0.9	19.2	-4.3	-1.5	
500-505	0.4	14.8	-7.2	-3.7	
550-555	0.9	16.4	-2.7	-3.0	-20.9
600-605	0.6	17.3	-4.0	-2.0	
650-655	0.5	17.0	-6.3	-3.5	
675-680	0.7	25.1	-1.9	+0.8	-20.3



TABLE 2

## DISTRIBUTION OF ORGANIC MATTER, CALCITE AND STABLE ISOTOPES

PISTON CORE 18  
(Lat. 20°35'N; Long. 63°53'E; Depth 3338 m)

DEPTH cm	COMBUSTIBLE ORGANIC MATTER %	CALCITE %	CARBONATE $\delta^{18}\text{O}$	ORGANIC MATTER $\delta^{13}\text{C}$
4-10	0.9	42.2	-1.5	-18.9
50-55	1.1	52.1	-0.8	-19.3
100-105	1.0	41.7		
150-155	1.0	35.0		
200-205	1.0	45.5		
250-255	0.8	40.0	-1.3	-19.3
300-305	0.8	31.2		
350-355	0.8	50.9		
400-405	2.0	53.6		
450-455	1.0	50.0	-0.6	-20.0
600-605	0.8	45.9	-1.2	-19.5
650-655	0.9	39.2		
750-755	0.7	56.1	-0.7	-19.7
950-955	0.8	41.0	-0.2	-20.3
975-980	1.1	59.6		

TABLE 3

## DISTRIBUTION OF ORGANIC MATTER, CALCITE AND STABLE ISOTOPES

## PISTON CORE 19

(Lat. 16°14'N; Long. 54°45'E; Depth 2939 m)

DEPTH cm	COMBUSTIBLE ORGANIC MATTER %	CALCITE %	CARBONATE $\delta^{18}\text{C}^{13}$	ORGANIC MATTER $\delta^{13}\text{C}$
0-5	1.0	59.2	-1.0	-19.3
50-55	1.1	57.4	-1.0	-19.7
150-155	1.7	62.0		
250-255	1.0	47.6	-0.3	-20.3
400-405	2.8	61.4	-1.2	-19.6
450-455	2.9	44.7		
575-580	1.5	51.6		
650-655	1.9	48.7	-0.4	-19.6



TABLE 5

DISTRIBUTION OF AMINO ACIDS IN INDIAN OCEAN SEDIMENTS  
(in residues per 1000)

DEPTH (cm)	PISTON CORE 18 (Lat. 20°35'N; Long. 63°53'E; Depth 3338 m)																			TOTAL μg/g	GLUCOSAMINE μg/g	GALACTOSAMINE μg/g	
	OH-PRO	ASP	THR	SER	GLU	PRO	GLY	ALA	CYS	VAL	MET	ISO	LEU	TYR	PHE	β-ALA	ORN	LYS	HIS				ARG
4-10	15	34	61	85	85	67	265	136	8	27	4	25	26	2	4	58	24	49	13	2	195	14	9
50-55	40	68	62	59	58	64	206	122	69	67	6	34	46	7	14	tr.	30	37	9	1	381	25	24
100-105	12	78	68	48	65	64	208	127	21	73	8	32	40	3	12	17	16	92	17	-	158	15	10
150-155	13	32	64	46	79	72	203	124	10	76	6	39	58	8	21	54	26	55	12	1	409	40	23
200-205	7	78	67	57	68	69	235	137	3	78	6	34	45	5	12	41	13	42	3	1	294	22	18
250-255	25	60	57	79	61	54	141	156	1	75	4	34	46	5	12	53	59	52	20	5	321	49	34
300-305	28	73	65	35	56	56	207	131	7	76	2	29	39	2	9	61	45	65	12	1	319	41	26
350-355	23	93	67	34	72	52	210	126	2	82	3	37	49	2	8	41	31	64	5	1	226	33	17
400-405	tr.	93	62	43	75	81	177	115	8	73	7	45	60	8	21	37	31	56	7	1	846	70	46
650-655	tr.	128	73	40	86	71	171	116	3	77	4	37	60	4	18	24	18	63	5	1	229	41	27
750-755	tr.	108	65	50	47	54	218	131	3	71	4	31	45	5	11	63	22	59	8	6	110	5	3
950-955	22	81	61	42	59	75	171	113	7	70	6	37	48	6	11	58	41	84	10	-	162	25	15
975-980	tr.	104	58	42	59	48	227	143	5	88	2	38	51	2	8	56	10	21	38	-	118	13	18

TABLE 6

DISTRIBUTION OF AMINO ACIDS IN INDIAN OCEAN SEDIMENTS  
(in residues per 1000)

PISTON CORE 19

(Lat. 16°14'N; Long. 54°45'E; Depth 2939 m)

DEPTH (cm)	OH-PRO	ASP	THR	SER	GLU	PRO	GLY	ALA	CYS	VAL	MET	ISO	LEU	TYR	PHE	$\beta$ -ALA	ORN	LYS	HIS	ARG	TOTAL $\mu$ g/g	GLUCOSAMINE $\mu$ g/g	GALACTOSAMINE $\mu$ g/g
0-5	tr.	151	60	64	57	76	290	48	6	54	9	30	43	6	13	13	22	49	1	7	836	68	64
50-55	20	86	69	52	72	85	196	101	4	66	13	39	58	17	28	26	20	32	17	-	475	36	26
150-155	14	142	53	45	86	114	199	102	13	76	3	11	39	18	33	-	23	25	5	-	443	1	1
450-455	tr.	83	44	53	56	67	274	155	7	101	4	49	54	11	16	-	11	12	4	-	71	1	1
575-580	tr.	91	59	49	47	3	172	79	8	115	2	71	78	1	4	22	27	126	10	35	123	24	12





RUN NUMBER 1654A/1677B  
 SAMPLE PC17150-155  
 LOCALITY INDIAN OCEAN  
 TYPE SEDIMENT  
 FACTOR 0.346

ACID	AREA	MICROMOLES PER GRAM	MICROMOLES PER GRAM	RESIDUES PER 1000 TOTAL RESID.	MICROGRAMS PER GRAM	PERCENT CONCENTRATION	MICROGRAMS	NITROGEN PERCENT
CYSTEIC ACID	4643.	0.0169	0.0058	0.	0.	0.	0.	0.
TAURINE	0.	0.	0.	0.	0.	0.	0.	0.
METHIONINE SULFOXIDES	0.	0.	0.	0.	0.	0.	0.	0.
OH - PROLINE	2327.	0.0796	0.0275	9.61	3.6095	1.17	0.39	0.90
ASPARTIC ACID	84600.	0.3272	0.1131	39.50	15.0532	4.87	1.58	3.70
METHIONINE SULFONE	0.	0.	0.	0.	0.	0.	0.	0.
THREONINE	151600.	0.5595	0.1934	67.56	23.0406	7.46	2.71	6.33
SERINE	209100.	0.7894	0.2729	95.31	28.6769	9.28	3.82	8.93
GLUTAMIC ACID	114100.	0.4248	0.1469	54.29	21.6063	6.99	2.06	4.80
PROLINE	37720.	0.6415	0.2218	77.46	25.5318	8.26	3.10	7.25
GLYCINE	569800.	2.1305	0.7365	257.24	55.2899	17.90	10.31	24.09
ALANINE	281600.	0.9959	0.3443	120.25	30.6731	9.93	4.82	11.26
CYSTINE (HALF)	800.	0.0068	0.0024	2.28	0.7922	0.26	0.09	0.21
VALINE	135700.	0.4824	0.1668	58.25	19.5367	6.32	2.33	5.45
METHIONINE	25750.	0.0954	0.0330	11.51	4.9188	1.59	0.46	1.08
ISOLEUCINE	86670.	0.3093	0.1069	37.35	14.0271	4.54	1.50	3.50
LEUCINE	118300.	0.4281	0.1480	51.69	19.4130	6.28	2.07	4.84
DOPA	0.	0.	0.	0.	0.	0.	0.	0.
TYROSINE	26860.	0.1030	0.0356	12.43	6.4498	2.09	0.50	1.16
PHENYLALANINE	38060.	0.1489	0.0515	17.98	8.5034	2.75	0.72	1.68
BETA - ALANINE	53390.	0.3094	0.1070	37.36	9.5296	3.08	1.50	3.50
OH - LYSINE	0.	0.	0.	0.	0.	0.	0.	0.
ORNITHINE	8657.	0.0484	0.0167	5.85	2.218	0.72	0.47	1.09
LYSINE	48910.	0.2665	0.0921	32.17	13.4667	4.36	2.58	6.03
HISTIDINE	19960.	0.1334	0.0427	14.90	6.6211	2.14	1.79	4.19
ARGININE	0.	0.	0.	0.	0.	0.	0.	0.
TOTALS		8.2868	2.8648	1000.00	308.9515	100.00	42.80	100.00

UREA	0.	0.	0.	0.	0.	0.	0.	0.
GLUCOSAMINE	43010.	0.2769	0.0957	17.1484	17.1484	5.47	1.34	3.16
GALACTOSAMINE	33750.	0.2167	0.0749	13.4218	13.4218	4.14	1.05	2.50
AMMONIA	0.	0.	0.	0.	0.	0.	0.	0.
TOTALS		0.2936	0.1706	30.5702	30.5702	9.11	45.19	108.65

TOTAL NITROGEN - MICROGRAMS



RUN NUMBER 1670A/1664B  
 SAMPLE PC17250-255  
 LOCALITY INDIAN OCEAN  
 TYPE SEDIMENT  
 FACTOR 0.335

ACID	AREA	MICROMOLES	MICROMOLES PER GRAM	RESIDUES PER 1000 TOTAL RESID.	MICROGRAMS PER GRAM	PERCENT CONCENTRATION	MICROGRAMS	NITROGEN PERCENT
CYSTEIC ACID	24640.	0.0895	0.0300	0.	0.	0.	0.	0.
TAURINE	12990.	0.0472	0.0158	0.	0.	0.	0.	0.
METHIONINE SULFOXIDES	0.	0.	0.	0.	0.	0.	0.	0.
OH - PROLINE	0.	0.	0.	0.	0.	0.	0.	0.
ASPARTIC ACID	61680.	0.2385	0.0799	53.06	10.6384	6.51	1.12	5.04
METHIONINE SULFONE	0.	0.	0.	0.	0.	0.	0.	0.
THREONINE	68308.	0.2521	0.0845	56.08	10.0633	6.16	1.18	5.33
SERINE	125592.	0.4741	0.1589	105.46	16.6961	10.21	2.22	10.02
GLUTAMIC ACID	81200.	0.3023	0.1013	67.25	14.9048	9.12	1.42	6.39
PROLINE	19760.	0.3361	0.1126	74.75	12.9650	7.93	1.58	7.10
GLYCINE	325800.	1.2182	0.4082	270.98	30.6443	18.75	5.71	25.74
ALANINE	152800.	0.5404	0.1811	120.21	16.1333	9.87	2.54	11.42
CYSTINE (HALF)	0.	0.	0.	24.43	4.4572	2.73	0.52	2.32
VALINE	69390.	0.2467	0.0827	54.87	9.6838	5.92	1.16	5.21
METHIONINE	14570.	0.0540	0.0181	12.00	2.6978	1.65	0.25	1.14
ISOLEUCINE	45490.	0.1623	0.0544	36.11	7.1366	4.37	0.76	3.43
LEUCINE	64180.	0.2322	0.0778	51.66	10.2090	6.25	1.09	4.91
DOPA	0.	0.	0.	0.	0.	0.	0.	0.
TYROSINE	14600.	0.0560	0.0188	12.45	3.3984	2.08	0.26	1.18
PHENYLALANINE	17920.	0.0701	0.0235	15.60	3.8809	2.37	0.33	1.48
BETA - ALANINE	0.	0.	0.	0.	0.	0.	0.	0.
OH - ALANINE	0.	0.	0.	0.	0.	0.	0.	0.
ORNITHINE	3056.	0.0171	0.0057	3.80	0.7569	0.46	0.16	0.72
LYSINE	27800.	0.1515	0.0508	33.69	7.4196	4.54	1.42	6.40
HISTIDINE	5514.	0.0341	0.0114	7.59	1.7730	1.08	0.48	2.16
ARGININE	0.	0.	0.	0.	0.	0.	0.	0.
TOTALS		4.5224	1.5154	1000.00	163.4584	100.00	22.20	100.00
UREA	0.	0.	0.	0.	0.	0.	0.	0.
GLUCOSAMINE	14480.	0.0932	0.0312	5.962	5.5962	0.44	0.44	0.44
GALACTOSAMINE	2999.	0.0193	0.0065	1.1561	1.1561	0.09	0.09	0.09
AMMONIA	0.	0.	0.	0.	0.	0.	0.	0.
TOTALS							22.73	22.73

TOTAL NITROGEN - MICROGRAMS

RUN NUMBER 1679A/1676B  
 SAMPLE PC17350-355  
 LOCALITY INDIAN OCEAN  
 TYPE SEDIMENT  
 FACTOR 0.407

ACID	AREA	MICROMOLES	MICROMOLES PER GRAM	RESIDUES PER 1000 TOTAL RESID.	MICROGRAMS PER GRAM	PERCENT CONCENTRATION	MICROGRAMS	NITROGEN PERCENT
CYSTEIC ACID	3800.	0.0138	0.0056	0.	0.	0.	0.	0.
TAURINE	0.	0.	0.	0.	0.	0.	0.	0.
METHIONINE SULFOXIDES	0.	0.	0.	0.	0.	0.	0.	0.
OH - PROLINE	0.	0.	0.	0.	0.	0.	0.	0.
ASPARTIC ACID	108761.	0.4206	0.1713	77.20	22.7950	9.17	2.40	7.03
METHIONINE SULFONE	0.	0.	0.	0.	0.	0.	0.	0.
THREONINE	165310.	0.6101	0.2484	111.99	29.5939	11.90	3.48	10.20
SERINE	102711.	0.3877	0.1579	71.17	16.5922	6.67	2.21	6.48
GLUTAMIC ACID	142260.	0.5296	0.2157	97.22	31.7311	12.76	3.02	8.86
PROLINE	16180.	0.2752	0.1120	50.51	12.9002	5.19	1.57	4.60
GLYCINE	294600.	1.1015	0.4485	202.19	33.6716	13.54	6.28	18.42
ALANINE	219600.	0.7767	0.3163	142.56	28.1752	11.33	4.43	12.99
CYSTINE [HALF]	0.	0.	0.	1.81	0.4876	0.20	0.06	0.17
VALINE	69220.	0.2461	0.1002	45.17	11.7385	4.72	1.40	4.12
METHIONINE	10960.	0.0406	0.0165	7.45	2.4660	0.99	0.23	0.68
ISOLEUCINE	40010.	0.1428	0.0581	26.21	7.6274	3.07	0.81	2.39
LEUCINE	72250.	0.2614	0.1065	47.99	13.9654	5.62	1.49	4.37
DOPA	0.	0.	0.	0.	0.	0.	0.	0.
TYROSINE	10100.	0.0387	0.0158	7.11	2.8568	1.15	0.22	0.65
PHENYLALANINE	12880.	0.0504	0.0205	9.25	3.3896	1.36	0.29	0.84
BETA - ALANINE	18960.	0.1099	0.0447	20.17	3.9862	1.60	0.63	1.84
OH - LYSINE	0.	0.	0.	0.	0.	0.	0.	0.
ORNITHINE	9094.	0.0509	0.0207	9.33	2.7368	1.10	0.58	1.70
LYSINE	58640.	0.3195	0.1301	58.64	19.0180	7.65	3.64	10.69
HISTIDINE	11050.	0.0683	0.0278	12.54	4.3176	1.74	1.17	3.43
ARGININE	815.	0.0082	0.0033	1.50	0.5790	0.23	0.19	0.55
TOTALS		5.4519	2.2200	1000.00	248.6281	100.00	34.09	100.00
UREA	0.	0.	0.	0.	0.	0.	0.	0.
GLUCOSAMINE	38480.	0.2477	0.1009		18.0716		1.41	
GALACTOSAMINE	36960.	0.2373	0.0966		17.3132		1.35	
AMMONIA	0.	0.	0.		0.		0.	
TOTAL NITROGEN - MICROGRAMS							36.85	



RUN NUMBER 1694A/1685B  
 SAMPLE PC17453-458  
 LOCALITY INDIAN OCEAN  
 TYPE SEDIMENT  
 FACTOR 0.580

ACID	AREA	MICROMOLES	MICROMOLES PER GRAM	RESIDUES PER 1000 TOTAL RESID.	MICROGRAMS PER GRAM	PERCENT CONCENTRATION	MICROGRAMS	NITROGEN PERCENT
CYSTEIC ACID	2997.	0.0109	0.0063	0.	0.	0.	0.	0.
TAURINE	1389.	0.0050	0.0029	0.	0.	0.	0.	0.
METHIONINE SULFOXIDES	0.	0.	0.	0.	0.	0.	0.	0.
OH - PROLINE	0.	0.	0.	0.	0.	0.	0.	0.
ASPARTIC ACID	25300.	0.0978	0.0567	31.82	7.5533	3.77	0.79	2.68
METHIONINE SULFONE	0.	0.	0.	0.	0.	0.	0.	0.
THREONINE	61540.	0.2271	0.1317	73.88	15.6932	7.83	1.84	6.21
SERINE	44020.	0.1662	0.0964	54.05	10.1295	5.06	1.35	4.55
GLUTAMIC ACID	36040.	0.1342	0.0778	43.65	11.4509	5.71	1.09	3.67
PROLINE	14350.	0.2440	0.1416	79.38	16.2975	8.13	1.98	6.68
GLYCINE	183700.	0.6869	0.3984	223.42	29.9082	14.93	5.58	18.79
ALANINE	101100.	0.3576	0.2074	116.31	18.4772	9.22	2.90	9.78
CYSTINE (HALF)	3100.	0.0265	0.0154	12.75	2.7534	1.37	0.32	1.07
VALINE	67290.	0.2392	0.1388	77.81	16.2548	8.11	1.94	6.54
METHIONINE	5102.	0.0189	0.0110	6.15	1.6352	0.82	0.15	0.52
ISOLEUCINE	35630.	0.1272	0.0738	41.36	9.6755	4.83	1.03	3.48
LEUCINE	44060.	0.1594	0.0925	51.86	12.1314	6.05	1.29	4.36
DOPA	0.	0.	0.	0.	0.	0.	0.	0.
TYROSINE	8563.	0.0328	0.0190	10.68	3.4501	1.72	0.27	0.90
PHENYLALANINE	13770.	0.0539	0.0312	17.52	5.1620	2.58	0.44	1.47
BETA - ALANINE	12591.	0.0730	0.0423	23.74	3.7708	1.88	0.59	2.00
OH - LYSINE	0.	0.	0.	0.	0.	0.	0.	0.
ORNITHINE	11390.	0.0637	0.0369	20.72	4.8828	2.44	1.03	3.49
LYSINE	45490.	0.2478	0.1438	80.62	21.0154	10.49	4.03	13.56
HISTIDINE	7560.	0.0468	0.0271	15.21	4.2077	2.10	1.14	3.84
ARGININE	5857.	0.0587	0.0340	19.08	5.9273	2.96	1.91	6.42
TOTALS		3.0775	1.7851	1000.00	200.3761	100.00	29.68	100.00
UREA	0.	0.	0.	0.	0.	0.	0.	0.
GLUCOSAMINE	18020.	0.1160	0.0673	0.	12.0550	0.	0.94	0.94
GALACTOSAMINE	9100.	0.0584	0.0339	0.	6.0721	0.	0.47	0.47
AMMONIA	630100.	2.8673	1.6632	0.	28.2740	0.	23.28	23.28
TOTALS							54.38	54.38

TOTAL NITROGEN - MICROGRAMS

RUN NUMBER 1661A/16588  
 SAMPLE PC17575-580  
 LOCALITY INDIAN OCEAN  
 TYPE SEDIMENT  
 FACTOR 0.355

ACID	AREA	MICROMOLES	MICROMOLES PER GRAM	RESIDUES PER 1000 TOTAL RESID.	MICROGRAMS PER GRAM	PERCENT CONCENTRATION	MICROGRAMS	NITROGEN PERCENT
CYSTEIC ACID	5930.	0.0215	0.0077	0.	0.	0.	0.	0.
TAURINE	3680.	0.0134	0.0048	0.	0.	0.	0.	0.
METHIONINE SULFOXIDES	0.	0.	0.	0.	0.	0.	0.	0.
OH - PROLINE	0.	0.	0.	0.	0.	0.	0.	0.
ASPARTIC ACID	67840.	0.2623	0.0932	86.30	12.4097	10.31	1.31	8.05
METHIONINE SULFONE	0.	0.	0.	0.	0.	0.	0.	0.
THREONINE	42330.	0.1562	0.0555	51.39	6.6140	5.49	0.78	4.80
SERINE	37170.	0.1403	0.0499	46.16	5.2407	4.35	0.70	4.31
GLUTAMIC ACID	72880.	0.2713	0.0964	89.26	14.1880	11.78	1.35	8.33
PROLINE	14550.	0.2474	0.0879	81.40	10.1249	8.41	1.23	7.60
GLYCINE	197400.	0.7381	0.2623	242.81	19.6919	16.36	3.67	22.66
ALANINE	109600.	0.3876	0.1378	127.52	12.2731	10.19	1.93	11.90
CYSTINE (HALF)	0.	0.	0.	9.34	1.2216	1.01	0.14	0.87
VALINE	69290.	0.2463	0.0875	81.03	10.2556	8.52	1.23	7.56
METHIONINE	5794.	0.0215	0.0076	7.06	1.1378	0.95	0.11	0.66
ISOLEUCINE	33910.	0.1210	0.0430	39.81	5.6422	4.69	0.60	3.72
LEUCINE	41100.	0.1487	0.0529	48.93	6.9337	5.76	0.74	4.57
DOPA	0.	0.	0.	0.	0.	0.	0.	0.
TYROSINE	8725.	0.0334	0.0119	11.00	2.1539	1.79	0.17	1.03
PHENYLALANINE	11050.	0.0432	0.0154	14.22	2.5381	2.11	0.22	1.33
BETA - ALANINE	0.	0.	0.	0.	0.	0.	0.	0.
OH - LYSINE	0.	0.	0.	0.	0.	0.	0.	0.
ORNITHINE	6280.	0.0351	0.0125	11.55	1.6495	1.37	0.35	2.16
LYSINE	24770.	0.1349	0.0480	44.39	7.0114	5.82	1.34	8.29
HISTIDINE	3846.	0.0238	0.0085	7.82	1.3116	1.09	0.36	2.19
ARGININE	0.	0.	0.	0.	0.	0.	0.	0.
TOTALS		3.0463	1.0827	1000.00	120.3977	100.00	16.21	100.00
UREA	0.	0.	0.	0.	0.	0.	0.	0.
GLUCOSAMINE	12800.	0.0824	0.0293	5.2466	5.2466	4.41	0.41	2.66
GALACTOSAMINE	6332.	0.0407	0.0144	2.5888	2.5888	2.14	0.20	1.33
AMMONIA	629000.	2.8623	1.0173	17.2937	17.2937	14.24	14.24	9.11
TOTALS				TOTAL NITROGEN - MICROGRAMS			31.06	







RUN NUMBER 1653A/1652B  
 SAMPLE PC184-10  
 LOCALITY INDIAN OCEAN  
 TYPE SEDIMENT  
 FACTOR 0.349

ACID	AREA	MICROMOLES	MICROMOLES PER GRAM	RESIDUES PER 1000 TOTAL RESID.	MICROGRAMS PER GRAM	PERCENT CONCENTRATION	NITROGEN MICROGRAMS	PERCENT
CYSTEIC ACID	3220.	0.0117	0.0041	0.	0.	0.	0.	0.
TAURINE	0.	0.	0.	0.	0.	0.	0.	0.
METHIONINE SULFOXIDES	0.	0.	0.	0.	0.	0.	0.	0.
OH - PROLINE	2300.	0.0787	0.0275	15.06	3.6058	1.85	0.38	1.36
ASPARTIC ACID	45820.	0.1772	0.0619	33.91	8.2402	4.23	0.87	3.07
METHIONINE SULFONE	0.	0.	0.	0.	0.	0.	0.	0.
THREONINE	86966.	0.3210	0.1121	61.42	13.3588	6.86	1.57	5.56
SERINE	118164.	0.4461	0.1559	85.36	16.3790	8.42	2.18	7.73
GLUTAMIC ACID	119800.	0.4460	0.1558	85.35	22.9285	11.78	2.18	7.73
PROLINE	20700.	0.3520	0.1230	67.37	14.1613	7.28	1.72	6.10
GLYCINE	370000.	1.3834	0.4834	264.74	36.2868	18.65	6.77	23.98
ALANINE	200600.	0.7095	0.2479	135.77	22.0841	11.35	3.47	12.30
CYSTINE [HALF]	3619.	0.0309	0.0108	7.52	1.6641	0.86	0.19	0.68
VALINE	39180.	0.1393	0.0487	26.65	5.7011	2.93	0.68	2.41
METHIONINE	5943.	0.0220	0.0077	4.21	1.1478	0.59	0.11	0.38
ISOLEUCINE	37250.	0.1329	0.0464	25.44	6.0932	3.13	0.65	2.30
LEUCINE	51800.	0.1874	0.0655	35.87	8.5913	4.41	0.92	3.25
DOPA	0.	0.	0.	0.	0.	0.	0.	0.
TYROSINE	3230.	0.0124	0.0043	2.37	0.7839	0.40	0.06	0.21
PHENYLALANINE	5206.	0.0204	0.0071	3.90	1.1756	0.60	0.10	0.35
BETA - ALANINE	21886.	0.3007	0.1051	57.54	9.3602	4.81	1.47	5.21
OH - LYSINE	0.	0.	0.	0.	0.	0.	0.	0.
ORNITHINE	22110.	0.1236	0.0432	23.66	5.7095	2.93	1.21	4.29
LYSINE	47180.	0.2570	0.0898	49.19	13.1294	6.75	2.51	8.91
HISTIDINE	10950.	0.0677	0.0237	12.96	3.6712	1.89	0.99	3.52
ARGININE	886.	0.0089	0.0031	1.70	0.5401	0.28	0.17	0.62
TOTALS		5.2289	1.8270	1000.00	194.6119	100.00	28.22	100.00
UREA	0.	0.	0.	0.	0.	0.	0.	0.
GLUCOSAMINE	35440.	0.2281	0.0797	0.	14.2814	0.	1.12	0.
GALACTOSAMINE	22260.	0.1429	0.0499	0.	8.9472	0.	0.70	0.
AMMONIA	475800.	2.1652	0.7565	0.	12.8608	0.	10.59	0.
TOTAL NITROGEN - MICROGRAMS							40.62	

RUN NUMBER 1655A/1656B  
 SAMPLE PC1850-55  
 LOCALITY INDIAN OCEAN  
 TYPE SEDIMENT  
 FACTOR 0.315

ACID	AREA	MICROMOLES	MICROMOLES PER GRAM	RESIDUES PER 1000 TOTAL RESID.	MICROGRAMS PER GRAM	PERCENT CONCENTRATION	MICROGRAMS	NITROGEN PERCENT
CYSTEIC ACID	8584.	0.0312	0.0098	0.	0.	0.	0.	0.
TAURINE	205600.	0.7475	0.2351	0.	0.	0.	0.	0.
METHIONINE SULFOXIDES	0.	0.	0.	0.	0.	0.	0.	0.
OH - PROLINE	12720.	0.4352	0.1369	40.39	17.9525	4.71	1.92	3.72
ASPARTIC ACID	188200.	0.7278	0.2289	67.53	30.4696	8.00	3.20	6.21
METHIONINE SULFONE	0.	0.	0.	0.	0.	0.	0.	0.
THREONINE	179900.	0.6640	0.2088	61.61	24.8781	6.53	2.92	5.67
SERINE	167200.	0.6312	0.1985	58.57	20.8644	5.48	2.78	5.39
GLUTAMIC ACID	168700.	0.6281	0.1976	58.28	29.0670	7.63	2.77	5.36
PROLINE	40520.	0.6891	0.2168	63.94	24.9557	6.55	3.03	5.88
GLYCINE	592300.	2.2146	0.6966	205.50	52.2944	13.72	9.75	18.91
ALANINE (HALF)	370800.	1.3114	0.4125	121.69	36.7499	9.65	5.78	11.20
VALINE	209100.	0.7433	0.2338	69.22	28.4190	7.46	3.28	6.37
METHIONINE	18860.	0.6988	0.2220	68.98	27.3915	7.19	3.27	6.35
ISOLEUCINE	101600.	0.3626	0.1141	6.48	3.2780	0.86	0.31	0.60
LEUCINE	137600.	0.4979	0.1566	33.65	14.9618	3.93	1.60	3.10
DOPA	0.	0.	0.	46.20	20.5455	5.39	2.19	4.25
TYROSINE	19200.	0.0736	0.0232	0.	0.	0.	0.	0.
PHENYLALANINE	39670.	0.1552	0.0488	6.83	4.1950	1.10	0.32	0.63
BETA - ALANINE	0.	0.	0.	14.40	8.0645	2.12	0.68	1.33
OH - LYSINE	0.	0.	0.	0.	0.	0.	0.	0.
ORNITHINE	57470.	0.3214	0.1011	29.82	13.3603	3.51	2.83	5.49
LYSINE	73740.	0.4017	0.1264	37.28	18.4738	4.85	3.54	6.86
HISTIDINE	15900.	0.0983	0.0309	9.12	4.7991	1.26	1.30	2.52
ARGININE	546.	0.0055	0.0017	0.51	0.2996	0.08	0.10	0.19
TOTALS		10.8095	3.4001	1000.00	381.0196	100.00	51.58	100.00
UREA	3250.	0.1199	0.0377		2.2652		1.06	
GLUCOSAMINE	69730.	0.4489	0.1412		25.2967		1.98	
GALACTOSAMINE	67310.	0.4322	0.1359		24.3560		1.90	
AMMONIA	369700.	1.6824	0.5292		8.9962		7.41	
TOTALS							63.92	



RUN NUMBER 1669A/1663B  
 SAMPLE PC18100-105  
 LOCALITY INDIAN OCEAN  
 TYPE SEDIMENT  
 FACTOR 0.354

ACID	AREA	MICROMOLES	MICROMOLES PER GRAM	RESIDUES PER 1000 TOTAL RESID.	MICROGRAMS PER GRAM	PERCENT CONCENTRATION	MICROGRAMS PERCENT	NITROGEN PERCENT
CYSTEIC ACID	14380.	0.0522	0.0185	0.	0.	0.	0.	0.
TAURINE	6842.	0.0249	0.0088	0.	0.	0.	0.	0.
METHIONINE SULFOXIDES	1038.	0.0038	0.0014	0.	0.	0.	0.	0.
OH - PROLINE	1416.	0.0485	0.0171	12.26	2.2472	1.43	0.24	1.07
ASPARTIC ACID	79800.	0.3086	0.1091	78.08	14.5277	9.22	1.53	6.84
METHIONINE SULFONE	0.	0.	0.	0.	0.	0.	0.	0.
THREONINE	72600.	0.2679	0.0948	67.80	11.2893	7.16	1.33	5.94
SERINE	50690.	0.1914	0.0677	48.42	7.1127	4.51	0.95	4.24
GLUTAMIC ACID	69280.	0.2579	0.0912	65.26	13.4226	8.51	1.28	5.72
PROLINE	14920.	0.2537	0.0897	64.20	10.3327	6.55	1.26	5.63
GLYCINE	220100.	0.8230	0.2911	208.24	21.8514	13.86	4.08	18.25
ALANINE	141600.	0.5008	0.1771	126.72	15.7806	10.01	2.48	11.10
CYSTINE [HALF]	2470.	0.0211	0.0075	20.90	3.5390	2.24	0.41	1.83
VALINE	80540.	0.2863	0.1013	72.45	11.8637	7.53	1.42	6.35
METHIONINE	7227.	0.0268	0.0095	7.65	1.5957	1.01	0.15	0.67
ISOLEUCINE	35730.	0.1275	0.0451	32.27	5.9165	3.75	0.63	2.83
LEUCINE	43700.	0.1581	0.0559	40.01	7.3371	4.65	0.78	3.51
DOPA	0.	0.	0.	0.	0.	0.	0.	0.
TYROSINE	2574.	0.0099	0.0035	2.50	0.6324	0.40	0.05	0.22
PHENYLALANINE	12170.	0.0476	0.0168	12.05	2.7819	1.76	0.24	1.06
BETA - ALANINE	11365.	0.0659	0.0233	16.67	2.0755	1.32	0.33	1.46
OH - LYSINE	0.	0.	0.	0.	0.	0.	0.	0.
ORNITHINE	11400.	0.0638	0.0225	16.13	2.9801	1.89	0.63	2.83
LYSINE	66450.	0.3620	0.1280	91.60	18.7195	11.87	3.59	16.05
HISTIDINE	10730.	0.0664	0.0235	16.79	3.6417	2.31	0.99	4.41
ARGININE	0.	0.	0.	0.	0.	0.	0.	0.
TOTALS		3.9680	1.4035	1000.00	157.6474	100.00	22.34	100.00
UREA	0.	0.	0.	0.	0.	0.	0.	0.
GLUCOSAMINE	37660.	0.2437	0.0862	15.44	15.4444	1.21	1.21	1.21
GALACTOSAMINE	24980.	0.1604	0.0567	10.16	10.1640	0.79	0.79	0.79
AMMONIA	0.	0.	0.	0.	0.	0.	0.	0.
TOTAL NITROGEN - MICROGRAMS							24.34	24.34





RUN NUMBER 1681A/1678B  
 SAMPLE PC18200-205  
 LOCALITY INDIAN OCEAN  
 TYPE SEDIMENT  
 FACTOR 0.394

ACID	AREA	MICROMOLES	MICROMOLES PER GRAM	RESIDUES PER 1000 TOTAL RESID.	MICROGRAMS PER GRAM	PERCENT CONCENTRATION	MICROGRAMS	NITROGEN PERCENT
CYSTEIC ACID	3709.	0.0135	0.0053	0.	0.	0.	0.	0.
TAURINE	2229.	0.0081	0.0032	0.	0.	0.	0.	0.
METHIONINE SULFOXIDES	3576.	0.0132	0.0052	0.	0.	0.	0.	0.
OH - PROLINE	1443.	0.0494	0.0195	7.20	2.5516	0.87	0.27	0.68
ASPARTIC ACID	138900.	0.5371	0.2117	78.38	28.1752	9.59	2.96	7.36
METHIONINE SULFONE	0.	0.	0.	0.	0.	0.	0.	0.
THREONINE	125300.	0.4624	0.1823	67.48	21.7097	7.39	2.55	6.33
SERINE	103510.	0.3908	0.1540	57.02	16.1833	5.51	2.16	5.35
GLUTAMIC ACID	125400.	0.4669	0.1840	68.12	27.0707	9.22	2.58	6.40
PROLINE	27740.	0.4718	0.1859	68.84	21.4054	7.29	2.60	6.46
GLYCINE	431400.	1.6130	0.6357	235.36	47.7211	16.25	8.90	22.09
ALANINE	265200.	0.9379	0.3696	136.86	32.9311	11.21	5.17	12.85
CYSTINE (HALF)	0.	0.	0.	2.55	0.8350	0.28	0.10	0.24
VALINE	149800.	0.5325	0.2099	77.70	24.5862	8.37	2.94	7.29
METHIONINE	8062.	0.0299	0.0118	6.10	2.4589	0.84	0.23	0.57
ISOLEUCINE	64700.	0.2309	0.0910	33.69	11.9374	4.06	1.27	3.16
LEUCINE	84620.	0.3062	0.1207	44.68	15.8302	5.39	1.69	4.19
DOPA	0.	0.	0.	0.	0.	0.	0.	0.
TYROSINE	8556.	0.0328	0.0129	4.79	2.3422	0.80	0.18	0.45
PHENYLALANINE	20220.	0.0791	0.0312	11.54	5.1500	1.75	0.44	1.08
BETA - ALANINE	47940.	0.2778	0.1095	40.54	9.7548	3.32	1.53	3.81
OH - LYSINE	0.	0.	0.	0.	0.	0.	0.	0.
ORNITHINE	15690.	0.0877	0.0346	12.80	4.5700	1.56	0.97	2.40
LYSINE	52280.	0.2848	0.1123	41.56	16.4099	5.59	3.14	7.80
HISTIDINE	3850.	0.0238	0.0094	3.47	1.4559	0.50	0.39	0.98
ARGININE	895.	0.0090	0.0035	1.31	0.6154	0.21	0.20	0.49
TOTALS		6.8587	2.7030	1000.00	293.6941	100.00	40.28	100.00
UREA	0.	0.	0.	0.	0.	0.	0.	0.
GLUCOSAMINE	49340.	0.3176	0.1252		22.4264		1.75	
GALACTOSAMINE	38630.	0.2480	0.0977		17.5133		1.37	
AMMONIA	0.	0.	0.		0.		0.	
TOTALS							43.40	







RUN NUMBER 1798A/1747B  
 SAMPLE PC18 300-305  
 LOCALITY INDIAN OCEAN  
 TYPE SEDIMENT  
 FACTOR 0.654

ACID	AREA	MICROMOLES PER GRAM	MICROMOLES PER GRAM	RESIDUES PER 1000 TOTAL RESID.	MICROGRAMS PER GRAM	PERCENT CONCENTRATION	MICROGRAMS PERCENT	NITROGEN PERCENT
CYSTEIC ACID	5232.	0.0190	0.0124	0.	0.	0.	0.	0.
TAURINE		0.	0.	0.	0.	0.	0.	0.
METHIONINE SULFOXIDES		0.	0.	0.	0.	0.	0.	0.
OH - PROLINE	3655.	0.1251	0.0818	28.36	10.7218	3.36	1.14	2.49
ASPARTIC ACID	83790.	0.3240	0.2118	73.47	28.1956	8.85	2.97	6.46
METHIONINE SULFONE		0.	0.	0.	0.	0.	0.	0.
THREONINE	77710.	0.2868	0.1875	65.03	22.3359	7.01	2.63	5.72
SERINE	40330.	0.1522	0.0995	34.52	10.4602	3.28	1.39	3.04
GLUTAMIC ACID	66520.	0.2477	0.1619	56.16	23.8220	7.47	2.27	4.94
PROLINE	14650.	0.2491	0.1629	56.49	18.7534	5.88	2.28	4.97
GLYCINE	243800.	0.9116	0.5960	206.70	44.7393	14.04	8.34	18.18
ALANINE	164100.	0.5804	0.3794	131.60	33.8039	10.60	5.31	11.58
CYSTINE (HALF)	2080.	0.0178	0.0116	7.12	2.4861	0.78	0.29	0.63
VALINE	93860.	0.3337	0.2181	75.66	25.5555	8.02	3.05	6.66
METHIONINE	1998.	0.0074	0.0048	1.68	0.7218	0.23	0.07	0.15
ISOLEUCINE	56190.	0.1292	0.0844	29.29	11.0769	3.48	1.18	2.58
LEUCINE	47350.	0.1713	0.1120	38.85	14.6947	4.61	1.57	3.42
DOPA		0.	0.	0.	0.	0.	0.	0.
TYROSINE	2460.	0.0094	0.0062	2.14	1.1171	0.35	0.09	0.19
PHENYLALANINE	9905.	0.0388	0.0253	8.79	4.1851	1.31	0.35	0.77
BETA - ALANINE	46665.	0.2704	0.1768	61.32	15.7520	4.94	2.48	5.39
OH - LYSINE		0.	0.	0.	0.	0.	0.	0.
ORNITHINE	35530.	0.1987	0.1299	45.05	17.1676	5.39	3.64	7.93
LYSINE	52470.	0.2859	0.1869	64.82	27.3216	8.57	5.23	11.40
HISTIDINE	8566.	0.0330	0.0346	12.01	5.3738	1.69	1.45	3.17
ARGININE	416.	0.0042	0.0027	0.94	0.4745	0.15	0.15	0.33
TOTALS		4.4156	2.8868	1000.00	318.7591	100.00	45.89	100.00

UREA 0.  
 GLUCOSAMINE 53880.  
 GALACTOSAMINE 34150.  
 AMMONIA 712400.  
 TOTAL NITROGEN - MICROGRAMS 80.74

RUN NUMBER 1800A/1746B  
 SAMPLE PC18 350-355  
 LOCALITY INDIAN OCEAN  
 TYPE SEDIMENT  
 FACTOR 0.594

ACID	AREA	MICROMOLES	MICROMOLES PER GRAM	RESIDUES PER 1000 TOTAL RESID.	MICROGRAMS PER GRAM	PERCENT CONCENTRATION	MICROGRAMS	NITROGEN PERCENT
CYSTEIC ACID	2435.	0.0088	0.0053	0.	0.	0.	0.	0.
TAURINE	0.	0.	0.	0.	0.	0.	0.	0.
METHIONINE SULFOXIDES	0.	0.	0.	0.	0.	0.	0.	0.
OH - PROLINE	2325.	0.0796	0.0472	23.31	6.1946	2.74	6.1946	2.10
ASPARTIC ACID	81860.	0.3166	0.1880	92.75	25.0190	11.06	2.63	8.37
METHIONINE SULFONE	0.	0.	0.	0.	0.	0.	0.	0.
THREONINE	61490.	0.2269	0.1348	66.50	16.0524	7.10	1.89	6.00
SERINE	30370.	0.1146	0.0681	33.59	7.1543	3.16	0.95	3.03
GLUTAMIC ACID	65730.	0.2447	0.1453	71.70	21.3796	9.45	2.03	6.47
PROLINE	10340.	0.1759	0.1044	51.53	12.0219	5.32	1.46	4.65
GLYCINE	192000.	0.7179	0.4263	210.35	32.0011	14.15	5.97	18.98
ALANINE (HALF)	121400.	0.4294	0.2550	125.80	22.7136	10.04	3.57	11.35
VALINE	78440.	0.2788	0.1656	1.86	0.4556	0.20	0.05	0.17
METHIONINE	2316.	0.0086	0.0051	81.70	19.3977	8.58	2.32	7.37
ISOLEUCINE	35380.	0.1263	0.0750	2.51	0.7599	0.34	0.07	0.23
LEUCINE	46060.	0.1667	0.0990	37.00	9.8355	4.35	1.05	3.34
DOPA	0.	0.	0.	48.84	12.9829	5.74	1.39	4.41
TYROSINE	2113.	0.0081	0.0048	0.	0.	0.	0.	0.
PHENYLALANINE	7148.	0.0280	0.0166	2.37	0.8715	0.39	0.07	0.21
BETA - ALANINE	24338.	0.1410	0.0838	8.19	2.7431	1.21	0.23	0.74
OH - LYSINE	0.	0.	0.	41.33	7.4617	3.30	1.17	3.73
ORNITHINE	18810.	0.1052	0.0625	0.	0.	0.	0.	0.
LYSINE	39860.	0.2172	0.1290	30.82	8.2549	3.65	1.75	5.56
HISTIDINE	2646.	0.0164	0.0097	63.63	18.8513	8.34	3.61	11.48
ARGININE	484.	0.0048	0.0029	4.79	1.5076	0.67	0.41	1.30
TOTALS		3.4154	2.0281	1000.00	226.1597	100.00	31.44	100.00

ACID	AREA	MICROMOLES	MICROGRAMS	NITROGEN
UREA	0.	0.	0.	0.
GLUCOSAMINE	47620.	0.3065	32.6125	2.55
GALACTOSAMINE	25340.	0.1627	17.3095	1.35
AMMONIA	657100.	2.9902	30.1850	24.86
TOTALS				60.20



RUN NUMBER 1794A/1764B  
 SAMPLE PC 18 400-405  
 LOCALITY INDIAN OCEAN  
 TYPE SEDIMENT  
 FACTOR 0.558

ACID	AREA	MICROMOLES	MICROMOLES PER GRAM	RESIDUES PER 1000 TOTAL RESID.	MICROGRAMS PER GRAM	PERCENT CONCENTRATION	MICROGRAMS	NITROGEN PERCENT
CYSTEIC ACID	10790.	0.0392	0.0219	0.	0.	0.	0.	0.
TAURINE	0.	0.	0.	0.	0.	0.	0.	0.
METHIONINE SULFOXIDES	0.	0.	0.	0.	0.	0.	0.	0.
OH - PROLINE	0.	0.	0.	0.	0.	0.	0.	0.
ASPARTIC ACID	319600.	1.2359	0.6894	93.03	91.7578	10.83	9.65	8.42
METHIONINE SULFONE	0.	0.	0.	0.	0.	0.	0.	0.
THREONINE	223000.	0.8230	0.4591	61.95	54.6863	6.46	6.43	5.61
SERINE	151700.	0.5727	0.3194	43.11	33.5694	3.96	4.47	3.90
GLUTAMIC ACID	266100.	0.9907	0.5526	74.57	81.3053	9.60	7.74	6.75
PROLINE	63660.	1.0827	0.6039	81.49	69.5275	8.21	8.45	7.37
GLYCINE	629400.	2.3533	1.3127	177.14	98.5437	11.64	18.38	16.03
ALANINE	430800.	1.5236	0.8499	114.69	75.7148	8.94	11.90	10.38
CYSTINE (HALF)	9900.	0.0847	0.0472	8.48	7.6155	0.90	0.88	0.77
VALINE	271800.	0.9662	0.5390	72.73	63.1394	7.46	7.55	6.58
METHIONINE	25400.	0.0941	0.0525	7.08	7.8288	0.92	0.73	0.64
ISOLEUCINE	166700.	0.5949	0.3319	44.78	43.5325	5.14	4.65	4.05
LEUCINE	219400.	0.7339	0.4428	59.76	58.0929	6.86	6.20	5.41
DOPA	0.	0.	0.	0.	0.	0.	0.	0.
TYROSINE	26600.	0.1020	0.0569	7.68	10.3063	1.22	0.80	0.69
PHENYLALANINE	72640.	0.2842	0.1585	21.39	26.1865	3.09	2.22	1.94
BETA - ALANINE	84570.	0.4901	0.2734	36.89	24.3562	2.88	3.83	3.34
OH - LYSINE	0.	0.	0.	0.	0.	0.	0.	0.
ORNITHINE	72970.	0.4081	0.2276	30.72	30.0820	3.55	6.37	5.56
LYSINE	136400.	0.7431	0.4145	59.94	60.9977	7.16	11.61	10.12
HISTIDINE	15590.	0.0964	0.0538	7.26	8.3444	0.99	2.26	1.97
ARGININE	1743.	0.0175	0.0097	1.31	1.6963	0.20	0.55	0.48
TOTALS		13.2962	7.4166	1000.00	846.8833	100.00	114.65	100.00

UREA	0.	0.	0.3861	0.	0.	0.	0.	0.
GLUCOSAMINE	106100.	0.6958	0.3861	0.	69.5438	0.	5.43	0.
GALACTOSAMINE	71590.	0.4586	0.2564	0.	45.9376	0.	3.59	0.
AMMONIA	607700.	2.7654	1.5425	0.	26.2233	0.	21.60	0.
TOTALS							145.27	



RUN NUMBER 1799A/17668  
 SAMPLE PC18 650-655  
 LOCALITY INDIAN OCEAN  
 TYPE SEDIMENT  
 FACTOR 0.932

ACID	AREA	MICROMOLES	MICROMOLES PER GRAM	RESIDUES PER 1000 TOTAL RESID.	MICROGRAMS PER GRAM	PERCENT CONCENTRATION	MICROGRAMS PERCENT	NITROGEN PERCENT
CYSTEIC ACID	2463.	0.0089	0.0083	0.	0.	0.	0.	0.
TAURINE	0.	0.	0.	0.	0.	0.	0.	0.
METHIONINE SULFOXIDES	0.	0.	0.	0.	0.	0.	0.	0.
OH - PROLINE	0.	0.	0.	0.	0.	0.	0.	0.
ASPARTIC ACID	71160.	0.2752	0.2565	128.43	34.1354	14.85	3.59	11.74
METHIONINE SULFONE	0.	0.	0.	0.	0.	0.	0.	0.
THREONINE	42240.	0.1559	0.1453	72.76	17.3074	7.53	2.03	6.65
SERINE	22800.	0.0841	0.0802	40.17	8.4300	3.67	1.12	3.67
GLUTAMIC ACID	49700.	0.1850	0.1724	86.36	25.3725	11.04	2.41	7.89
PROLINE	8930.	0.1519	0.1415	70.88	16.2987	7.09	1.98	6.48
GLYCINE	98100.	0.3668	0.3419	171.19	25.6628	11.16	4.79	15.64
ALANINE	70250.	0.2485	0.2316	115.96	20.6293	8.97	3.24	10.60
CYSTINE (HALF)	0.	0.	0.	2.99	0.7233	0.31	0.08	0.27
VALINE	46650.	0.1658	0.1546	77.40	18.1065	7.88	2.16	7.07
METHIONINE	2110.	0.0078	0.0073	3.65	1.0866	0.47	0.10	0.33
ISOLEUCINE	22310.	0.0796	0.0742	37.16	9.7344	4.23	1.04	3.40
LEUCINE	35410.	0.1281	0.1194	59.80	15.6655	6.81	1.67	5.47
DOPA	0.	0.	0.	0.	0.	0.	0.	0.
TYROSINE	2480.	0.0095	0.0089	4.44	1.6055	0.70	0.12	0.41
PHENYLALANINE	9670.	0.0378	0.0353	17.66	5.8245	2.53	0.49	1.61
BETA - ALANINE	9019.	0.0523	0.0487	24.39	4.3399	1.89	0.68	2.23
OH - LYSINE	0.	0.	0.	0.	0.	0.	0.	0.
ORNITHINE	6820.	0.0381	0.0355	17.80	4.6976	2.04	1.00	3.25
LYSINE	24770.	0.1349	0.1258	62.98	18.3866	8.00	3.52	11.51
HISTIDINE	1563.	0.0097	0.0090	4.51	1.3978	0.61	0.38	1.24
ARGININE	316.	0.0032	0.0029	1.48	0.5138	0.22	0.17	0.54
TOTALS		2.1452	1.9993	1000.00	229.9152	100.00	30.59	100.00
UREA	0.	0.	0.	0.	0.	0.	0.	0.
GLUCOSAMINE	37730.	0.2429	0.2264	0.	40.5557	0.	3.17	3.17
GALACTOSAMINE	25150.	0.1615	0.1505	0.	26.9641	0.	2.11	2.11
AMMONIA	625200.	2.8451	2.6516	0.	45.0765	0.	37.12	37.12
TOTAL NITROGEN - MICROGRAMS							72.99	72.99

RUN NUMBER 1818A/1814B  
 SAMPLE PC18 750  
 LOCALITY INDIAN OCEAN  
 TYPE SEDIMENT  
 FACTOR 0.474

ACID	AREA	MICROMOLES	MICROMOLES PER GRAM	RESIDUES PER 1000 TOTAL RESID.	MICROGRAMS PER GRAM	PERCENT CONCENTRATION	MICROGRAMS	NITROGEN PERCENT
CYSTEIC ACID	2266.	0.0082	0.0039	0.	0.	0.	0.	0.
TAURINE	0.	0.	0.	0.	0.	0.	0.	0.
METHIONINE SULFOXIDES	0.	0.	0.	0.	0.	0.	0.	0.
OH - PROLINE	0.	0.	0.	0.	0.	0.	0.	0.
ASPARTIC ACID	58920.	0.2278	0.1080	107.66	14.3808	13.04	1.51	9.66
METHIONINE SULFONE	0.	0.	0.	0.	0.	0.	0.	0.
THREONINE	37030.	0.1367	0.0648	64.57	7.7199	7.00	0.91	5.80
SERINE	27920.	0.1054	0.0500	49.80	5.2524	4.76	0.70	4.47
GLUTAMIC ACID	26710.	0.0994	0.0472	46.99	6.9379	6.29	0.66	4.22
PROLINE	6693.	0.1138	0.0540	53.78	6.2143	5.64	0.76	4.83
GLYCINE	123400.	0.4614	0.2188	218.01	16.4248	14.90	3.06	19.57
ALANINE	78610.	0.2780	0.1318	131.36	11.7453	10.65	1.85	11.79
CYSTINE (HALF)	0.	0.	0.	2.79	0.3386	0.31	0.04	0.25
VALINE	42100.	0.1497	0.0710	70.72	8.3141	7.54	0.99	6.35
METHIONINE	2074.	0.0077	0.0036	3.63	0.5434	0.49	0.05	0.33
ISOLEUCINE	18650.	0.0666	0.0316	31.45	4.1404	3.76	0.44	2.82
LEUCINE	26330.	0.0953	0.0452	45.02	5.9268	5.38	0.63	4.04
DOPA	0.	0.	0.	0.	0.	0.	0.	0.
TYROSINE	3007.	0.0115	0.0055	5.45	0.9905	0.90	0.08	0.49
PHENYLALANINE	6196.	0.0242	0.0115	11.45	1.8989	1.72	0.16	1.03
BETA - ALANINE	22850.	0.1324	0.0628	62.57	5.5945	5.07	0.88	5.62
OH - LYSINE	0.	0.	0.	0.	0.	0.	0.	0.
ORNITHINE	8239.	0.0461	0.0218	21.77	2.8875	2.62	0.61	3.91
LYSINE	22980.	0.1252	0.0594	59.16	8.6791	7.87	1.66	10.62
HISTIDINE	2809.	0.0174	0.0082	8.21	1.2782	1.16	0.35	2.21
ARGININE	1189.	0.0119	0.0056	5.63	0.9837	0.89	0.32	2.02
TOTALS		2.1188	1.0047	1000.00	110.2511	100.00	15.66	100.00
UREA	0.	0.	0.	0.	0.	0.	0.	0.
GLUCOSAMINE	8721.	0.0561	0.0266	0.	4.7696	0.	0.37	0.
GALACTOSAMINE	5857.	0.0376	0.0178	0.	3.1950	0.	0.25	0.
AMMONIA	901400.	4.1019	1.9451	0.	33.0673	0.	27.23	0.
TOTAL NITROGEN - MICROGRAMS							43.51	



RUN NUMBER 1793A/1765B  
 SAMPLE PC 18 950-955  
 LOCALITY INDIAN OCEAN  
 TYPE SEDIMENT  
 FACTOR 0.677

ACID	AREA	MICROMOLES	MICROMOLES PER GRAM	RESIDUES PER 1000 TOTAL RESID.	MICROGRAMS PER GRAM	PERCENT CONCENTRATION	MICROGRAMS	NITROGEN PERCENT
CYSTEIC ACID	5537.	0.0201	0.0136	0.	0.	0.	0.	0.
TAURINE	0.	0.	0.	0.	0.	0.	0.	0.
METHIONINE SULFOXIDES	0.	0.	0.	0.	0.	0.	0.	0.
OH - PROLINE	1337.	0.0457	0.0310	21.75	4.0589	2.51	0.43	1.90
ASPARTIC ACID	44200.	0.1709	0.1156	81.24	15.3926	9.51	1.62	7.10
METHIONINE SULFONE	0.	0.	0.	0.	0.	0.	0.	0.
THREONINE	34630.	0.1278	0.0865	60.75	10.3010	6.37	1.21	5.31
SERINE	23360.	0.0882	0.0597	41.92	6.2702	3.87	0.84	3.67
GLUTAMIC ACID	33090.	0.1232	0.0834	58.56	12.2638	7.58	1.17	5.12
PROLINE	9220.	0.1568	0.1061	74.53	12.2145	7.55	1.49	6.52
GLYCINE	96410.	0.3605	0.2439	171.34	18.3096	11.31	3.41	14.98
ALANINE	67090.	0.2373	0.1605	112.78	14.3026	8.84	2.25	9.86
CYSTINE (HALF)	0.	0.	0.	6.85	1.1804	0.73	0.14	0.60
VALINE	41240.	0.1466	0.0992	69.68	11.6205	7.18	1.39	6.09
METHIONINE	3550.	0.0131	0.0089	6.25	1.3272	0.82	0.12	0.55
ISOLEUCINE	21620.	0.0772	0.0522	36.68	6.8484	4.23	0.73	3.21
LEUCINE	27820.	0.1007	0.0681	47.85	8.9351	5.52	0.95	4.18
DOPA	0.	0.	0.	0.	0.	0.	0.	0.
TYROSINE	3360.	0.0129	0.0087	6.12	1.5791	0.96	0.12	0.54
PHENYLALANINE	5790.	0.0227	0.0153	10.77	2.5318	1.56	0.21	0.94
BETA - ALANINE	21170.	0.1227	0.0830	58.32	7.3955	4.57	1.16	5.10
OH - LYSINE	0.	0.	0.	0.	0.	0.	0.	0.
ORNITHINE	15600.	0.0872	0.0590	41.47	7.8008	4.82	1.65	7.25
LYSINE	32520.	0.1772	0.1199	84.21	17.5245	10.83	3.36	14.73
HISTIDINE	3040.	0.0188	0.0127	8.94	1.9737	1.22	0.53	2.34
ARGININE	0.	0.	0.	0.	0.	0.	0.	0.
TOTALS		2.1095	1.4273	1000.00	161.8302	100.00	22.79	100.00
UREA	0.	0.	0.	0.	0.	0.	0.	0.
GLUCOSAMINE	31950.	0.2057	0.1392		24.9320		1.95	
GALACTOSAMINE	19750.	0.1268	0.0858		15.3722		1.20	
AMMONIA	90860.	0.4135	0.2798		4.7558		3.92	
TOTAL NITROGEN - MICROGRAMS							29.85	



RUN NUMBER 1817A/1813B  
 SAMPLE PC18 975  
 LOCALITY INDIAN OCEAN  
 TYPE SEDIMENT  
 FACTOR 0.481

ACID	AREA	MICROMOLES	MICROMOLES PER GRAM	RESIDUES PER 1000 TOTAL RESID.	MICROGRAMS PER GRAM	PERCENT CONCENTRATION	MICROGRAMS	NITROGEN PERCENT
CYSTEIC ACID	4075.	0.0148	0.0071	0.	0.	0.	0.	0.
TAURINE	0.	0.	0.	0.	0.	0.	0.	0.
METHIONINE SULFOXIDES	0.	0.	0.	0.	0.	0.	0.	0.
OH - PROLINE	0.	0.	0.	0.	0.	0.	0.	0.
ASPARTIC ACID	60480.	0.2339	0.1124	103.99	14.9639	12.70	1.57	9.38
METHIONINE SULFONE	0.	0.	0.	0.	0.	0.	0.	0.
THREONINE	35330.	0.1304	0.0627	57.98	7.4664	6.34	0.88	5.23
SERINE	25020.	0.0945	0.0454	42.00	4.7713	4.05	0.64	3.79
GLUTAMIC ACID	35470.	0.1321	0.0635	58.72	9.3396	7.93	0.89	5.30
PROLINE	6303.	0.1072	0.0515	47.66	5.9324	5.03	0.72	4.30
GLYCINE	136400.	0.5100	0.2452	226.77	18.4040	15.62	3.43	20.46
ALANINE	91050.	0.3220	0.1548	143.18	13.7905	11.70	2.17	12.92
CYSTINE (HALF)	0.	0.	0.	4.71	0.6172	0.52	0.07	0.43
VALINE	55920.	0.1988	0.0956	88.39	11.1947	9.50	1.34	7.98
METHIONINE	1110.	0.0041	0.0020	1.83	0.2948	0.25	0.03	0.16
ISOLEUCINE	23820.	0.0850	0.0409	37.80	5.3606	4.55	0.57	3.41
LEUCINE	31840.	0.1152	0.0554	51.23	7.2653	6.17	0.78	4.62
DOPA	0.	0.	0.	0.	0.	0.	0.	0.
TYROSINE	1120.	0.0043	0.0021	1.91	0.3740	0.32	0.03	0.17
PHENYLALANINE	4523.	0.0177	0.0085	7.87	1.4052	1.19	0.12	0.71
BETA - ALANINE	21815.	0.1264	0.0608	56.22	5.4143	4.59	0.85	5.07
OH - LYSINE	0.	0.	0.	0.	0.	0.	0.	0.
ORNITHINE	3994.	0.0223	0.0107	9.93	1.4189	1.20	0.30	1.79
LYSINE	8832.	0.0481	0.0231	21.40	3.3814	2.87	0.65	3.86
HISTIDINE	13970.	0.0864	0.0415	38.41	6.4438	5.47	1.74	10.40
ARGININE	0.	0.	0.	0.	0.	0.	0.	0.
TOTALS		2.2532	1.0831	1000.00	117.8385	100.00	16.77	100.00
UREA	0.	0.	0.	0.	0.	0.	0.	0.
GLUCOSAMINE	23350.	0.1503	0.0723		12.9454		1.01	
GALACTOSAMINE	32010.	0.2055	0.0988		17.7010		1.38	
AMMONIA	689400.	3.1372	1.5081		25.6369		21.11	
TOTAL NITROGEN - MICROGRAMS							40.28	

RUN NUMBER 1016A/1542B  
 SAMPLE PC19 0-5  
 LOCALITY INDIAN OCEAN  
 TYPE SEDIMENT  
 FACTOR 1.031

ACID	AREA	MICROMOLES PER GRAM	MICROMOLES PER GRAM	RESIDUES PER 1000 TOTAL RESID.	MICROGRAMS PER GRAM	PERCENT CONCENTRATION	NITROGEN MICROGRAMS PERCENT
ACETIC ACID	55800	0.0656	0.0677	0.00	0.00	0.00	0.00
TAURINE	18070	0.00	0.00	0.00	0.00	0.00	0.00
METHIONINE SULFOXIDES	4477	0.0166	0.0171	0.00	0.00	0.00	0.00
OH - PROLINE	0	0.00	0.00	0.00	0.00	0.00	0.00
ASPARTIC ACID	285100	1.1025	1.1367	150.94	151.2913	18.09	15.91
METHIONINE SULFONE	0	0.00	0.00	0.00	0.00	0.00	0.00
THREONINE	118900	0.4388	0.4524	60.08	53.8935	6.44	6.33
SERINE	123190	0.4650	0.4795	63.67	50.3864	6.02	5.83
GLUTAMIC ACID	112520	0.4189	0.4319	57.35	63.5453	7.60	5.25
PROLINE	32810	0.5580	0.5753	76.39	66.2333	7.92	6.99
GLYCINE	567100	2.1204	2.1861	290.30	164.1127	19.62	30.61
ALANINE	99290	0.3512	0.3620	48.08	32.2545	3.86	4.40
CYSTINE (HALF)	0	0.00	0.00	6.44	5.8702	0.70	0.59
VALINE	109900	0.3907	0.4028	53.49	47.1877	5.64	4.90
METHIONINE	13250	0.0491	0.0506	8.77	9.8520	1.18	0.92
ISOLEUCINE	60910	0.2174	0.2241	29.76	29.4000	3.51	2.72
LEUCINE	87750	0.3175	0.3274	43.47	42.9451	5.13	4.58
DOPA	0	0.00	0.00	0.00	0.00	0.00	0.00
TYROSINE	12210	0.0448	0.0483	6.41	8.7442	1.05	0.59
PHENYLALANINE	24812	0.0971	0.1001	13.29	16.5327	1.98	1.22
BETA - ALANINE	16660	0.0966	0.0995	13.22	8.8684	1.06	1.21
OH - LYSINE	0	0.00	0.00	0.00	0.00	0.00	0.00
ORNITHINE	28640	0.1602	0.1651	21.93	21.8231	2.61	4.62
LYSINE	65936	0.3592	0.3704	49.18	54.1433	6.47	10.37
HISTIDINE	768	0.0047	0.0049	0.65	0.7598	0.09	0.21
ARGININE	4812	0.0482	0.0497	6.60	8.6558	1.03	2.78
TOTALS		7.3245	7.5515	1000.00	836.4991	100.00	115.15
							100.00

UREA 0.00  
 GLUCOSAMINE 56848.00  
 GALACTOSAMINE 54256.00  
 AMMONIA 39728.00  
 TOTAL NITROGEN - MICROGRAMS 128.07



RUN NUMBER 1792A/1790B  
 SAMPLE PC 19 3-5  
 LOCALITY INDIAN OCEAN  
 TYPE SEDIMENT  
 FACTOR 0.501

ACID	AREA	MICROMOLES	MICROMOLES PER GRAM	RESIDUES PER 1000 TOTAL RESID.	MICROGRAMS PER GRAM	PERCENT CONCENTRATION	MICROGRAMS	NITROGEN PERCENT
CYSTEIC ACID	13600.	0.0494	0.0247	0.	0.	0.	0.	0.
TAURINE	0.	0.	0.	0.	0.	0.	0.	0.
METHIONINE SULFOXIDES	0.	0.	0.	0.	0.	0.	0.	0.
OH - PROLINE	4756.	0.1627	0.0815	19.66	10.6848	2.25	1.14	1.81
ASPARTIC ACID	183500.	0.7096	0.3553	85.74	47.2902	9.96	4.97	7.89
METHIONINE SULFONE	0.	0.	0.	0.	0.	0.	0.	0.
THREONINE	155700.	0.5746	0.2877	69.43	34.2738	7.22	4.03	6.39
SERINE	113300.	0.4277	0.2142	51.68	22.5054	4.74	3.00	4.76
GLUTAMIC ACID	159800.	0.5949	0.2979	71.89	43.8278	9.23	4.17	6.62
PROLINE	41440.	0.7048	0.3529	85.16	40.6264	8.55	4.94	7.84
GLYCINE	433400.	1.6205	0.8114	195.80	60.9102	12.83	11.36	18.02
ALANINE	235700.	0.8336	0.4174	100.72	37.1846	7.83	5.84	9.27
CYSTINE [HALF]	0.	0.	0.	4.27	2.1456	0.45	0.25	0.39
VALINE	154400.	0.5489	0.2748	66.32	32.1957	6.78	3.85	6.10
METHIONINE	28610.	0.1059	0.0530	12.80	7.9155	1.67	0.74	1.18
ISOLEUCINE	89450.	0.3192	0.1598	38.57	20.9680	4.42	2.24	3.55
LEUCINE	133400.	0.4827	0.2417	58.33	31.7060	6.68	3.38	5.37
DOPA	0.	0.	0.	0.	0.	0.	0.	0.
TYROSINE	36560.	0.1402	0.0702	16.93	12.7153	2.68	0.98	1.56
PHENYLALANINE	58870.	0.2303	0.1153	27.83	19.0500	4.01	1.61	2.56
BETA - ALANINE	36500.	0.2115	0.1059	25.56	9.4359	1.99	1.48	2.35
OH - LYSINE	0.	0.	0.	0.	0.	0.	0.	0.
ORNITHINE	29570.	0.1654	0.0828	19.98	10.9424	2.30	2.32	3.68
LYSINE	48840.	0.2661	0.1332	32.15	19.4768	4.10	3.73	5.92
HISTIDINE	22980.	0.1421	0.0712	17.17	11.0407	2.32	2.99	4.74
ARGININE	0.	0.	0.	0.	0.	0.	0.	0.
TOTALS		8.2902	4.1509	1000.00	474.8952	100.00	63.03	100.00
UREA	0.	0.	0.	0.	0.	0.	0.	0.
GLUCOSAMINE	62480.	0.4022	0.2014	0.	36.0805	0.	2.82	0.
GALACTOSAMINE	45250.	0.2905	0.1455	0.	26.0635	0.	2.04	0.
AMMONIA	738300.	3.3597	1.6822	0.	28.5977	0.	23.55	0.
TOTAL NITROGEN - MICROGRAMS							91.44	



RUN NUMBER 1545A/1543B  
 SAMPLE PC 19 150-155  
 LOCALITY INDIAN OCEAN  
 TYPE SEDIMENT  
 FACTOR 0.553

0.0000 0.0001 0.0000 0.0000  
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ACID	AREA	MICROMOLES	MICROMOLES PER GRAM	RESIDUES PER 1000 TOTAL RESID.	MICROGRAMS PER GRAM	PERCENT CONCENTRATION	MICROGRAMS PER CENT	NITROGEN PERCENT
TAURINE	5214.	0.0189	0.0105	0.	0.	0.	0.	0.
CYSTEIC ACID	0.	0.	0.	0.	0.	0.	0.	0.
TAURINE	0.	0.	0.	0.	0.	0.	0.	0.
METHIONINE SULFOXIDES	0.	0.	0.	0.	0.	0.	0.	0.
OH - PROLINE	2899.	0.0992	0.0549	14.27	7.1958	1.62	0.77	1.35
ASPARTIC ACID	25610.	0.9904	0.5479	142.46	72.9205	16.47	7.67	13.46
METHIONINE SULFONE	0.	0.	0.	0.	0.	0.	0.	0.
THREONINE	98910.	0.3650	0.2019	52.51	24.0557	5.43	2.83	4.96
SERINE	82350.	0.3109	0.1720	44.72	18.0728	4.08	2.41	4.22
GLUTAMIC ACID	160000.	0.5957	0.3295	85.69	48.4839	10.95	4.61	8.09
PROLINE	46460.	0.7901	0.4371	113.66	50.3237	11.36	6.12	10.74
GLYCINE	370100.	1.3838	0.7655	199.06	57.4679	12.98	10.72	18.81
ALANINE	199700.	0.7063	0.3907	101.60	34.8086	7.86	5.47	9.60
CYSTINE (HALF)	8736.	0.0747	0.0413	12.70	5.9139	1.34	0.68	1.20
VALINE	148600.	0.5283	0.2922	75.99	34.2353	7.73	4.09	7.18
METHIONINE	5430.	0.0201	0.0111	2.89	1.6598	0.37	0.16	0.27
ISOLEUCINE	20610.	0.0736	0.0407	10.58	5.3378	1.21	0.57	1.00
LEUCINE	75290.	0.2724	0.1507	39.19	19.7710	4.46	2.11	3.70
DOPA	0.	0.	0.	0.	0.	0.	0.	0.
TYROSINE	33130.	0.1270	0.0703	18.27	12.7305	2.87	0.98	1.73
PHENYLALANINE	58380.	0.2284	0.1264	32.86	20.8722	4.71	1.77	3.10
BETA - ALANINE	0.	0.	0.	0.	0.	0.	0.	0.
OH - LYSINE	0.	0.	0.	0.	0.	0.	0.	0.
ORNITHINE	28901.	0.1616	0.0894	23.25	11.8162	2.67	2.50	4.39
LYSINE	32340.	0.1762	0.0975	25.34	14.2490	3.22	2.73	4.79
HISTIDINE	5588.	0.0346	0.0191	4.97	2.9663	0.67	0.80	1.41
ARGININE	0.	0.	0.	0.	0.	0.	0.	0.
TOTALS		6.9572	3.8487	1000.00	442.8809	100.00	56.99	100.00

UREA	0.	0.	0.	0.	0.	0.	0.	0.
GLUCOSAMINE	1260.	0.0081	0.0045	0.	0.8039	0.	0.	0.06
GALACTOSAMINE	1140.	0.0073	0.0040	0.	0.7255	0.	0.	0.06
AMMONIA	29310.	0.1334	0.0738	0.	1.2543	0.	1.03	1.03
TOTALS								
TOTAL NITROGEN - MICROGRAMS							58.14	58.14





RUN NUMBER 1606A/1600B  
 SAMPLE PC 19 575-580  
 LOCALITY INDIAN OCEAN  
 TYPE SEDIMENT  
 FACTOR 0.355

ACID	AREA	MICROMOLES	MICROMOLES PER GRAM	RESIDUES PER 1000 TOTAL RESID.	MICROGRAMS PER GRAM	PERCENT CONCENTRATION	MICROGRAMS	NITROGEN PERCENT
CYSTEIC ACID	9619.	0.0349	0.0124	0.	0.	0.	0.	0.
TAURINE	0.	0.	0.	0.	0.	0.	0.	0.
METHIONINE SULFOXIDES	0.	0.	0.	0.	0.	0.	0.	0.
OH - PROLINE	0.	0.	0.	0.	0.	0.	0.	0.
ASPARTIC ACID	68970.	0.2667	0.0948	90.88	12.6164	10.23	1.33	7.11
METHIONINE SULFONE	0.	0.	0.	0.	0.	0.	0.	0.
THREONINE	47160.	0.1741	0.0619	59.31	7.3686	5.97	0.87	4.64
SERINE	38410.	0.1450	0.0515	49.41	5.4155	4.39	0.72	3.87
GLUTAMIC ACID	36850.	0.1372	0.0488	46.75	7.1738	5.82	0.68	3.66
PROLINE	563.	0.0096	0.0034	3.26	0.3918	0.32	0.05	0.26
GLYCINE	135500.	0.5066	0.1801	172.64	13.5170	10.96	2.52	13.52
ALANINE [HALF]	65500.	0.2317	0.0823	78.94	7.3347	5.95	1.15	6.18
VALINE	94580.	0.3362	0.1195	8.53	1.0772	0.87	0.12	0.67
METHIONINE	1800.	0.0067	0.0024	114.57	13.9988	11.35	1.67	8.97
ISOLEUCINE	58230.	0.2078	0.0739	2.27	0.3535	0.29	0.03	0.18
LEUCINE	63250.	0.2289	0.0813	70.82	9.6887	7.85	1.03	5.54
DOPA	0.	0.	0.	77.99	10.6705	8.65	1.14	6.11
TYROSINE	680.	0.0026	0.0009	0.	0.	0.	0.	0.
PHENYLALANINE	2710.	0.0106	0.0038	0.89	0.1679	0.14	0.01	0.07
BETA - ALANINE	11130.	0.0645	0.0229	3.61	0.6225	0.50	0.05	0.28
OH - LYSINE	0.	0.	0.	21.98	2.0423	1.66	0.32	1.72
ORNITHINE	14495.	0.0811	0.0288	0.	0.	0.	0.	0.
LYSINE	67770.	0.3692	0.1312	27.62	3.8073	3.09	0.81	4.32
HISTIDINE	4827.	0.0299	0.0106	125.82	19.1831	15.55	3.67	19.70
ARGININE	10118.	0.1013	0.0360	10.17	1.6461	1.33	0.45	2.39
TOTALS		2.9445	1.0465	1000.00	123.3496	100.00	18.65	100.00
UREA	0.	0.	0.	0.	0.	0.	0.	0.
GLUCOSAMINE	59460.	0.3827	0.1360	0.	24.3723	0.	1.90	0.
GALACTOSAMINE	28710.	0.1843	0.0655	0.	11.7378	0.	0.92	0.
AMMONIA	43670.	0.1987	0.0706	0.	1.2007	0.	0.99	0.
TOTALS							22.46	

TOTAL NITROGEN - MICROGRAMS

Woods Hole Oceanographic Institution  
Reference No. 68-4

DATA ON THE DISTRIBUTION OF STABLE ISOTOPES AND AMINO ACIDS  
IN INDIAN OCEAN SEDIMENTS by Egon T. Degens and John H. Hunt.  
13 pages, February 1968. Grant GP-4904.

1. Indian Ocean
  2. Stable Isotopes
  3. Amino Acids
- I. Degens, Egon T.
  - II. Hunt, John H.
  - III. GP-4904

This card is UNCLASSIFIED.

$C^{13}/C^{12}$  and  $n^{15}/n^{16}$  ratios were determined on the carbonate fraction of a series of cores from the Indian Ocean and compared with amino acid composition and mineralogy of the sediments. Sediments in the Oman Basin appear to be detrital whereas those in the Arabian Sea are largely from the Indus River. Changes in  $O^{18}/O^{16}$  ratios correlated with pluvial periods. Amino acid distributions appeared to be related to the activity of benthic organisms.

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