

## 富山海湾湾口底質中の有孔虫遺骸群集

(底質研究その一)

石和田靖章\*

Résumé

### Foraminiferal Death Assemblages from the Mouth of Toyama-Bay (Studies on Recent Marine Sediments-No. 1)

by

Yasufumi Ishiwada

The paper is the preliminary report on the ecological studies of the recent foraminifera dredged at the mouth of Toyama Bay. A complete report will be offered after finishing the supplementary survey. Toyama Bay is under open sea condition, and in summer and autumn three water systems are developed being stratified; (See the table on p. 183) The lower Tsushima Current comes from the Pacific through shallow Tsushima straight and is a branch of the southern Kuroshio Current. The water mass peculiar to the Japan Sea fills the most of the Japan Sea (inland basin) and is autochthonous.

The death assemblages of benthonic foraminifera are grouped into four (A—D).

Assemblage A is typical "Kuroshio" fauna, the members of which are quite common in the Kuroshio district on the Pacific side, both recent and fossil.

Assemblage B has a transitional character from A to C, but is definitely characterized by predominance of some species of *Cassidulina*.

Assemblage C may be quite peculiar to the Japan Sea, both recent and fossil. Similar assemblage has not been found on the Pacific side even in the Oyashio under-current.

Assemblage D is remarkably different from the others. The cause of this faunal differentiation is not clear, but the effect of the oligo-oxygen water, such as in the

stagnant water mass of submarine valley, is possibly inferable.

The vertical distribution of assemblages well corresponds to water mass and its vicissitude, and not to the depth.

It may be necessary to take into account not only simple chemical-physical properties (such as temperature, salinity, dissolved oxygen etc.) but "water mass."

Therefore, in the shallower part where water systems are thin and many, the faunal differentiation is rapid and conspicuous. This is an important factor for the correlation of young formations in using fossil foraminifera, but at the same time this limitation may be one of the keys to analyse the evolutionary changes in the oil field of Japan.

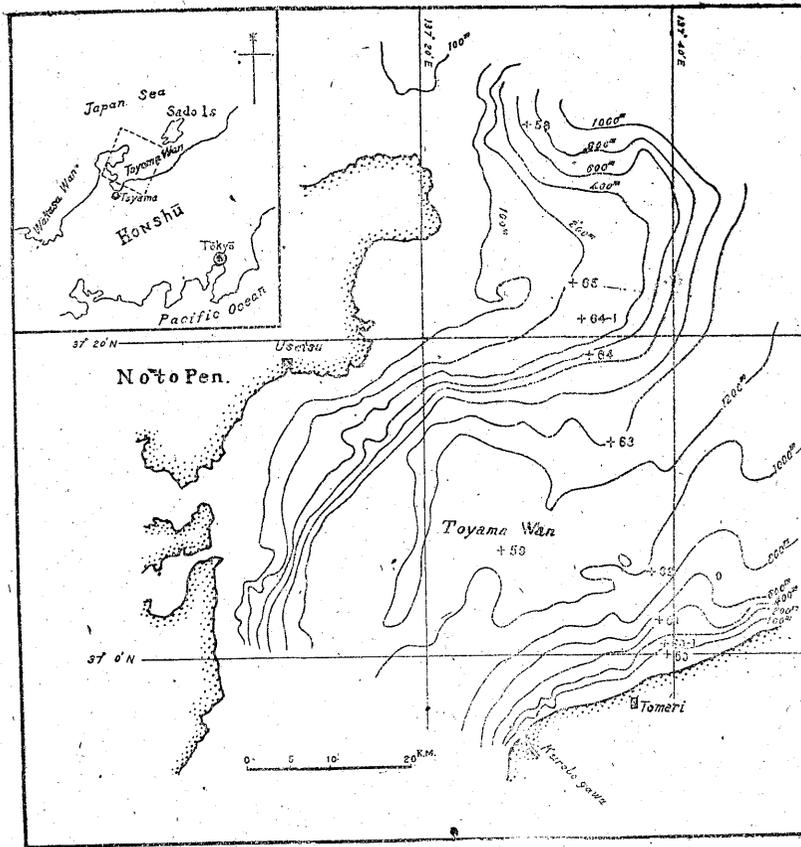
At stations 64-1 and 65 a great quantity of remains of planktonic foraminifera is deposited, where a distinct change of temperature-salinity relation, such as caused by coastal waters, is not observed on the surface layer. This anomaly of the deposition of planktonic foraminifera is a problem to be solved in future.

Individuals transported from their own living places do not occupy the dominant elements in any assemblages in the present cases.

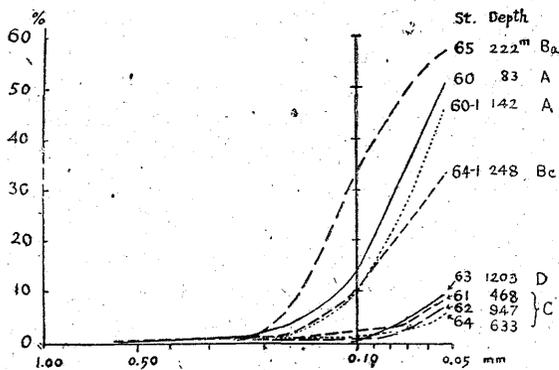
現世海底堆積物の研究は、層序学にとって極めて重要なものであるが、石油、ガスの開発にとつても重要な基礎研究である。地質調査所では石油課等に於いて漸く此の種の研究に手をぞめようとしているが、既に行われた調査の中、富山海湾の有孔虫概査の結果をことに報告する。なお石油会社の要望もあり、今後も日本海に重点を於いて、底質の各種研究を続行する方針である。又本海湾については、今秋、補足的再調査を実施するので、次回に更に詳しく報告したい。

底質研究に協同されている海上保安庁水路局の須田院次部長、中宮光俊海象課長、田山利三郎測量課長及び本調

\* 燃料部



第 1 図 等深線及び測点位置 Fig. 1. Bathymetric Chart and Stations



第 2 図 各地点底質粒度組織 Fig. 2. Cumulative curves of sediments

査の採泥，海象観測を担当した第四海洋丸船長佐藤孫七技官始め船員・観測班員の諸氏に深謝する。又本研究を奨め或は助言を与えられた天然資源局L.W.Stach, 帝国石油株式会社大炊御門経輝技師，東大日高孝次教授及び石油課金原均二技官，大山桂技官，小野映技官の諸賢に深く敬意を表する。

### I. 湾口附近の環境

#### (1) 地形

富山湾は日本海側に於ける本州最大の海湾で，湾口北部の能登半島東北端より東へ陸棚が張り出し台地状を呈し，その周縁は約300mの深度であるが，此の部分は海底地形・海流・陸地地形・河川等の関係より，bankに近い条件下にあると判断される。又この部分の陸棚斜面は湾内に向い8°~12°の

傾斜をなす。湾口南部本土側では，陸棚は30mの深さ迄発達し，以深は7°以下の傾斜を以て深度1,000m内外の広く且概ね平坦な湾底に達する。湾底には，湾口北部より中央に侵入する1,200~1,300mの深さの浅い蛇行する海底谷がある。

(2) 底質 300m以深の海底は泥質で，200m附近より急に粒度を増し，砂質泥，細砂に移るが，底質分布の状況は海図120号より判断されたい。なほ採泥点での篩分結果は第2図に示す。

(3) 海況 本海湾は全面的に外海水が侵入し，完全な内湾環境は湾奥の七尾湾以外に見られない。従つて本海湾湾口附近の海況は本州側中部日本海と略々同一である。日本海は外部と200m以浅の4海峡

水系 Water system	深度 m Depth	塩分 % Salinity	温度 °C Water temperature	pH	溶存酸素 cc/L dissolved O <sub>2</sub>
対島海流上層 upper Tsushima Current	0~20	33.00~34.10	28~22	8.4~8.2	5~6

第一躍層 1st spring (or discontinuous) layer

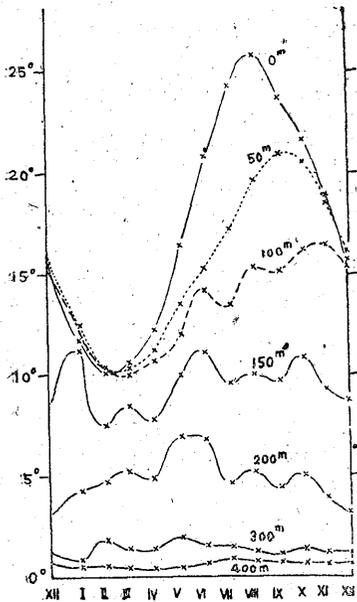
対島海流下層 lower Tsushima Current (中 枢 部)	50~150	34.40~34.50	20~10	8.3~8.2	5.5~7.0
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第二躍層 2nd spring layer

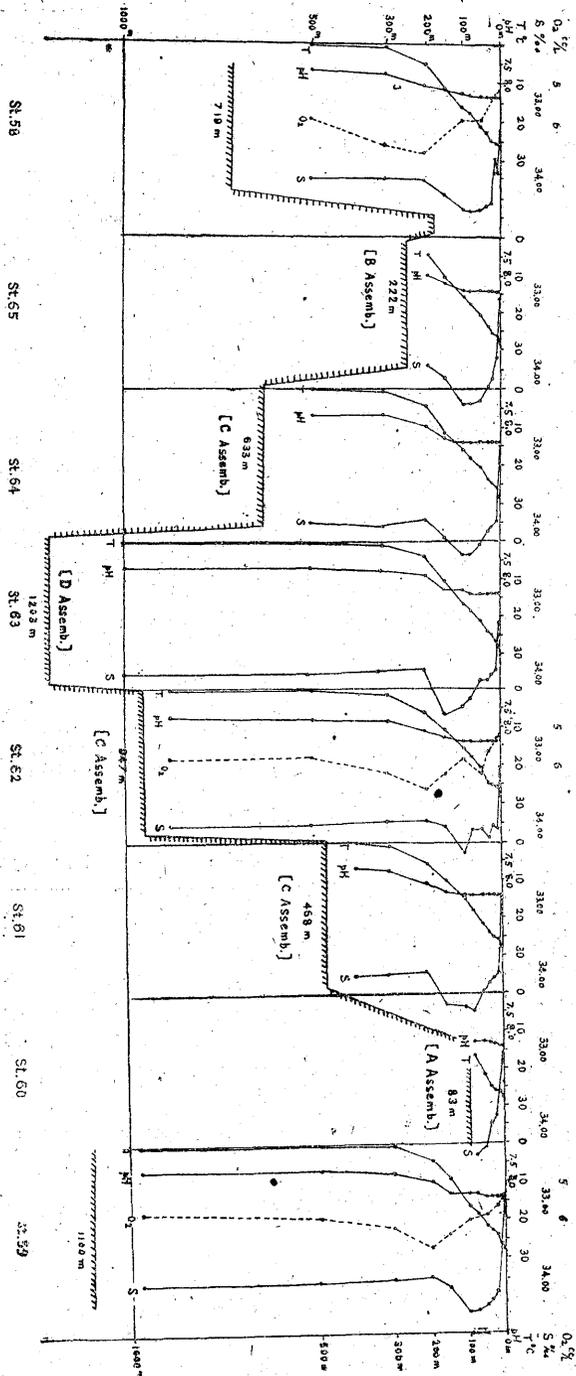
日本海固有水塊 Japan Sea peculiar water mass	250 <	34.00±	1~0	7.8~7.7	6.0~5.5
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を以て通じるのみの内海(海盆)である爲、その大部分が均質な日本海固有の冷水塊により占められ、対島海峡より流入する水系が強勢となる夏一秋季に表層に諸水系が層状に発達する。富山湾口の観測結果(第四海洋丸, 1948, 8月)より之等を簡単に表記すると:(第3図参照)

対島海流上層は黄海低塩分水と黒潮との混合水系といわれ、同下層は南方の黒潮の分枝で、対島海峡より侵入し、本州沿岸を北上して大部分津軽海峡より太平洋へ流出する。固有水塊は殆んど中立的垂直安定度を示し、極めて均質な水塊である。冬一春季はこれらの成層状態が不明瞭になる。温度・塩分のおよその年周変化は第4図より推察されたい。



第4図 (a) 水温年変化概略  
Fig. 4. a. Annual Variation of Temperature

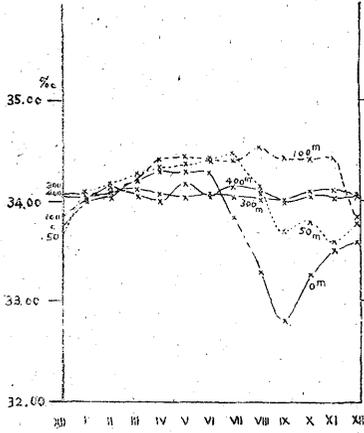


第3図 水温、塩分、pH及び溶存酸素垂直分布  
Fig. 3. Vertical Distribution of Temperature, Salinity, pH and dissolved Oxygen  
(Observation by No. 4 Kaiyō-Maru, Hydrographic Dept., on 11 Aug., 1948)

## II. 有孔虫遺骸群集

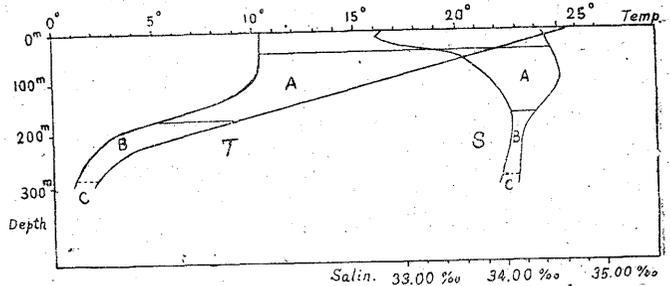
(1) 資料採取 採泥は1948年8月水路局測量船第四海洋丸(200t)に依り行われ、St. 62, 63, 64, 64-1は水路

部型採泥器、St. 60, 60-1, 61, 65は同船備付けの簡単な採泥



第4図 (b) 塩分年変化概略  
Fig. 4. b. Annual Variation of Salinity

器によつた。なお同時に通常海象観測も行われた。底質は一旦乾燥し、持帰つた上碎いて混合し、原則として40gr. 抽出し150メッシュ篩上で水洗し乾燥後四塩化炭素で浮選した。若し量の多い時は四分法で適当に減量し、白線を引いた方眼黒紙上に撒布し random order に選ばれた方眼から底棲型が100個体になる迄選別する。(各方眼毎に得られた数が著しく不均等と認められたら、撒布操作から繰返す)。此の様にして各種の標本に於ける相対頻度を求める。



第4図 (c) 水温、塩分年較差  
Fig. 4. c. Annual Range of Temperature & Salinity

第1表 底棲種百分率分布表

Table 1.

Percentage Distribution of Benthonic Foraminifera at the Mouth of Toyama Bay

	Assemblage	A		B		C			D
		Low. Tsushima Current	Spring Layer	Japan Sea peculiar Water Mass					
Station		60	60-1	65	64-1	61	64	62	63
Species	Depth in meter	83	142	222	248	468	633	947	1203
1 <i>Siphogenerina raphana</i> (PARKER & JONES)		51	11		1	2	1	1	2
2 <i>Bulimina marginata</i> d'ORBIGNY		18	47	13	9	3	2	3	2
3 <i>Bolivina robusta</i> H. B. BRADY		13	1	7	4	2			1
4 <i>Protonina difflugiformis</i> (H. B. BRADY)			10	2		4			4
5 <i>Haplophragmoides glomerata</i> BRADY			10			7	6	5	14
6 <i>Cassidulina yabei</i> ASANO & NAKAMURA				18	2				
7 <i>C. subglobosa</i> H. B. BRADY				7	6				
8 <i>C. californica</i> var. <i>japonica</i> ASANO & NAKAMURA				7	18		5	2	7
9 <i>Elphidium advenum</i> (CUSHMAN)		2		6	3				
10 <i>E. planum</i> HUSEZIMA & MARUHASI				5					
11 <i>Angulogerina</i> sp. 1				1	15	25	41	54	1
12 <i>Uvigerina peregrina</i> CUSHMAN					10		5	6	
13 <i>U. cfr. bifurcata</i> d'ORBIGNY						15	7	14	
14 <i>Trochammina japonica</i> sp. nov.						14	4	3	13
15 <i>Haplophragmoides trullissata</i> (BRADY)		3				12			13

16	<i>Astrononion stellatum</i> CUSHMAN & EDWARDS					5	3	4
17	<i>Bolivina decussata</i> BRADY				2	5		
18	<i>Cibicides lobatulus</i> (WALKER & JACOB)					1	2	5
19	<i>Quinqueloculina venusta</i> KARRER					1	2	13
20	<i>Reophax scorpiurus</i> MONTFORT	1						8
21	<i>Ammosphaeroidina grandis</i> CUSHMAN	4	1					
22	<i>Bolivina subspinescens</i> CUSHMAN	3	1		2			
23	<i>Trochammina</i> cfr. <i>squamata</i> PARKER & JONES	2						
24	<i>Loxostoma karverianum</i> (BRADY)	2						
25	<i>Nonion manpukuziensis</i> OTUKA	1						
26	<i>Elphidium fabum</i> (FICHTEL & MOLL)	1						
27	<i>Haplophragmoides</i> sp. 1	1				1		
28	<i>Streblus ketieniensis</i> ISHIZAKI	1	1					
29	<i>Eggerella scabra</i> (WILLIAMSON)		2					
30	<i>Lagena striata strumosa</i> REUSS		2					
31	<i>Reophax</i> sp.		2					
32	<i>Protonina crassa</i> HADA		2					
33	<i>Entosolenia marginata</i> (WALKER & BOYS)		1		4	1		1
34	<i>Textularia abbreviata</i> , CUSHMAN 1911		1					
35	<i>Cibicides pseudoungerianus</i> (CUSHMAN)		1	3	1	4		
36	<i>Ammodiscus incertus</i> d'ORBIGNY		1					
37	<i>Guttulina pacifica</i> (CUSHMAN & OZAWA)		1	1				
38	<i>Haplophragmoides canariensis</i> d'ORBIGNY		1					
39	<i>Pullenia sphaeroides</i> (d'ORBIGNY)		1					
40	<i>P. bulloides</i> (d'ORBIGNY)			4	1			
41	<i>Bulimina aculeata</i> d'ORBIGNY			3				
42	<i>Globobulimina pacifica</i> CUSHMAN			3	4			
43	<i>Bolivina</i> sp. 3			3	1			
44	<i>Cibicides refulgens</i> MONTFORT			3	2			
45	<i>Elphidium jenseni</i> (CUSHMAN)			2				
46	<i>Eponides karsteni</i> (REUSS)			2	2			
47	<i>Reussella spinulosa</i> (REUSS)			1	2			
48	<i>Guttulina yabei ovale</i> CUSHMAN & OZAWA			1				
49	<i>Polymorphina charlottensis</i> CUSHMAN			1				
50	<i>Discorbis orbicularis</i> TERQUEM			1				
51	<i>Quinqueloculina curta</i> var.			1				
52	<i>Patellinella inconspicua</i> (BRADY)			1	3			
53	<i>Siphogenerina dimorpha</i> (PARKER & JONES)			1				
54	<i>Cassidulina orientale</i> CUSHMAN			1	1		1	
55	<i>Planulina wuellerstorffi</i> (SCHWAGER)			1				
56	<i>Anomalina grosserugosa</i> (GÜMBEL)				2			
57	<i>Pullenia quinqueloba</i> (REUSS)				1			
58	<i>Virgulina complanata</i> EGGER				1		2	2
59	<i>Epistomina elegans</i> (d'ORBIGNY)				1			
60	<i>Unigerina pseudoampullacea</i> ASANO				1			
61	<i>Buliminella elegantissima</i> (d'ORBIGNY)				1			
62	<i>Cibicides</i> cf. <i>pseudoungerianus</i> (CUSHMAN)					3		
63	<i>Haplophragmoides subglobosa</i> SARS					2		
64	<i>H.</i> sp.					1		

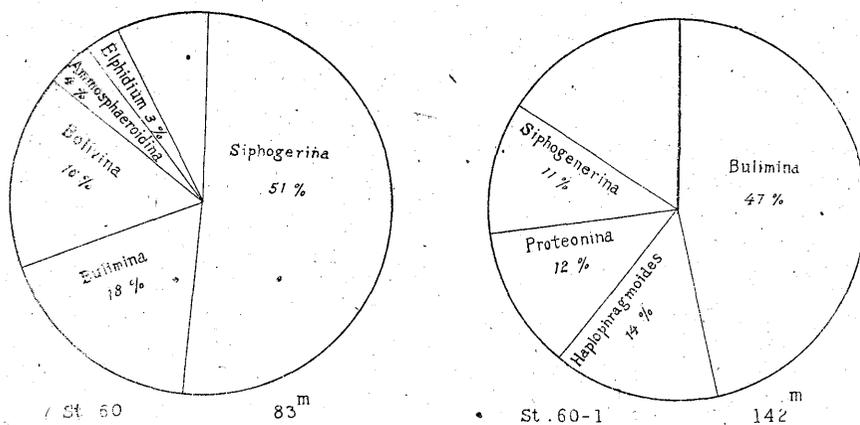
65	<i>Trochammina</i> <i>cf.</i> <i>globigeriniformis</i> (PARKER & JONES)					1			
66	<i>Cassidulina</i> sp.					1			
67	<i>Entosolenia</i> <i>globosa</i> (MONTAGU)						3		
68	<i>Cassidulina</i> <i>laevigata</i> d'ORBIGNY						3	2	4
69	<i>Lagena</i> <i>elongata</i> (EHRENBERG)						2		
70	<i>Nonionella</i> <i>globosa</i> sp. nov.						2		
71	<i>Reophax</i> sp.						1		
72	<i>Bolivina</i> <i>cf.</i> <i>seminuda</i> CUSHMAN						1		
73	<i>Lagena</i> <i>hexagona</i> WILLIAMSON						1		
74	<i>Pyrgo</i> <i>murrhyna</i> (SCHWAGER)								2
75	<i>Trochammina</i> <i>inflata</i> (MONTAGU)								2
76	<i>Cassidulina</i> <i>kasiwazakiensis</i> HUSEZ. & MARUH.								2
77	<i>Lagena</i> <i>distoma</i> PARKER & JONES								1
78	<i>Uvigerina</i> <i>tenistriata</i> REUSS								1
79	<i>Haplophragmoides</i> sp.								1
Quantity of dry sample (grams)		40	40	40	40	13	40	20	20

(1) Percentage is determined by 100 individuals drawn by random sampling

(2) Position:

Station	Latitude	Longitude	Depth
60	37° 00'.1 N	137° 39' 2 E	83 m
60-1	00.8	38.9	142
61	02.8	38.6	468
62	05.4	37.8	947
63	13.4	34.2	1203
64	18.6	32.4	633
64-1	21.1	32.2	248
65	23.3	31.8	222

Sampling carried out on 11 Aug. 1948 by No. 4 Kaiyō-Maru



第 5 図  
Fig. 5. Generic Composition of Assemblage A

(2) 底棲型遺骸群集

第 1 表に示された所より 8 地点の群集は 4 類に分ち得る。

A 群 *Siphogeneria raphana*—*Bulimina marginata* Assemblage

註) Fig. 5 の St. 60 で *Siphogenerina* は *Siphogenerina* の誤り。

産地 St. 60 (83m)

St. 60-1 (142m)

水系 対島海流下層

底質 砂質泥—泥質砂

大吹御門経輝氏に依

れば(註) 本海湾北方の

柏崎沖陸棚上にあつて

は、本群は 40m より出

現し、特に後種は 50m

以深より優勢になつて

くるといふ。本海湾の

観察を併せ見るに、後

種の分布は前種に比べ、

更に下位にズレるので

あろう。これら優占、優

註) 以下「柏崎沖」については:

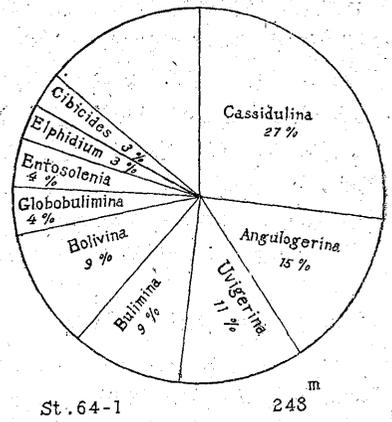
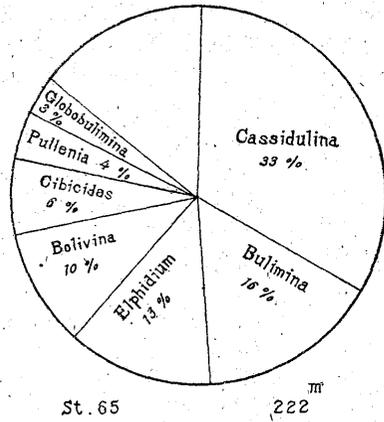
1) Rep't. Comm. Treatise Marine Ecol. Paleocool. 1947-1948 pp. 104-110 (Dec. 1948)

2) Geol. Rep't Teikoku Oil Co., No. 1182 (Mar. 1949, MS) (in Japanese)

勢種に附随し, *Bolivina robusta*, *B. subspinescens*, *Loxostoma karreianum*, *Nonion manpukuensis*, *Strebbis ketienziensis*, が伴うが, 何れも太平洋側黒潮水域沿岸浅所に多く発見せられ, 又太平洋側関東以南の新生代地層に少からず発見される。此の群集は対島海流の弱化する北海道西岸, 寒暖両水系の頻繁に消長する銚子以北の沿岸には見られない。

B 群 *Cassidulina* Assemblage (transitional)

産地 St. 65 (222m) St. 64-1 (248m)



第 6 図

Fig. 6. Generic Composition of Assemblage B

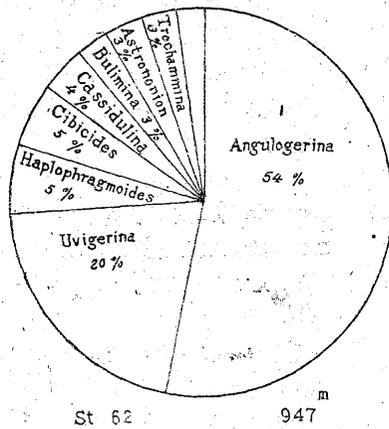
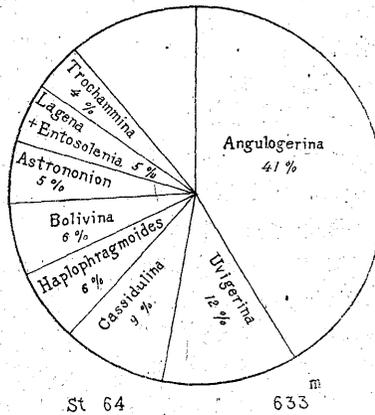
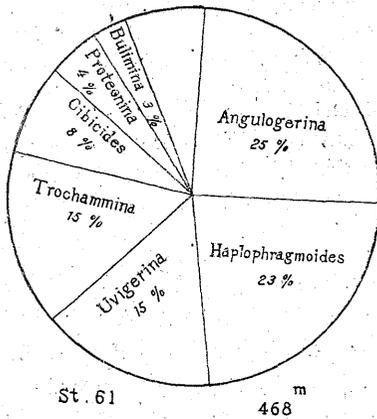
水系 第二躍層

底質 砂質泥

*Cassidulina* の諸種の相対量が著しく多いことで特徴

付けられるが, 本属以外の構成を見ると, 対島海流下層中の群集と, 下位の固有水塊中の群集との遷移的性質を示す。*Cassidulina* の中特に著しいのは, *C. yabei* と *C. californica* var. *japonica* で, 特に後者は直径 1mm を超える大形のものも少くない。前者の現生は未だ報ぜられていないが, 灰爪層, 脇本層, 瀬棚層より得た *C. yabei* と殆んど区別しがたい。

*Cassidulina* 属と共に, 本層にのみ特有ではないかと思われる種に, *Elphidium planum*, *Globobulimina pacifica*, *Polymorphinidae*, *Quinqueloculina curta* var. (灰爪層に産するもの), 等があるが何れも頻度が小さく確言し得ない。



第 7 図

Fig. 7. Generic Composition of Assemblage C

浅野清氏に依る若狭海湾浦島礁の“200m 附近の第二群”が本群に当ると推定されるが、分布表が定性的である爲、これも確言し得ない。本群集に類似せるものは、灰爪層、腕本層などより発見せられるが、同等なものではない。太平洋側の現生、化石両群集共未だ類似するものは報ぜられてない。

C 群 *Angulogerina*—*Uvigerina* Assemblage

産地 St. 61 (468m) St. 62 (947m) St. 64 (633m)

水系 日本海固有水塊

底質 泥

*Angulogerina* sp. 1. を主軸とし、*Uvigerina* の二種を亜優勢種として伴う。その他 *Trochammina japonica*, *Astronomion stellatum*, *Quinqueloculina venusta* が本群中に始めて発現してくる。今迄の所、越後油田の西山層より類似群集が発見される外、太平洋側では、化石にも又現生でも(親潮潜流・太平洋固有水塊上部) 発見されていない。

D 群 Arenaceous forms Assemblage

産地 St. 63 (1203m)

水系 日本海固有水塊  
但し海底谷壁の上部に位置する

底質 泥

上位とは僅に 250m の深度差であるが、群集は急変する。過半が砂質殻有孔虫に占められ、石灰質殻のものは *Quinqueloculina venusta* のみが稍著しい。本種は他の St. では少い。海底谷壁の上部に位置しているが、この様に砂質殻型が優勢になる事と海況との関係は不明である。1936 の神戸海洋気象台春風丸 St. 12 (37° 14' 3

N-137° 36' 5 E) の観測は、この海底谷中に僅に入っているが、谷の内外では水温に差はなく、 $SiO_2$ ,  $P_2O_5$  が谷内で不連続に高い値を示している。 $O_2$  の観測は欠けている。

(3) 浮遊性型遺骸について註記

第 2 表 浮遊性有孔虫遺骸量

Table 2 Proportion of the planktonic foraminifera for the benthonic remains (=100)

位置 Station	60	60-1	61	64	62	63
深度 Depth (m)	83	142	468	633	947	1203
<i>Globigerina bulloides</i>	23	7	0	48	22	10
<i>G. dubia</i>	1	7	0	27	0	5
<i>Globigerinoides rubra</i>	1	0	0	0	0	4
<i>Sphaeroidina bulloides</i>	2	7	0	0	0	0
<i>Globigerina pachyderma</i>	0	3	7	19	7	24
<i>G. dutertrei</i>	0	2	0	4	7	10
Total	27	26	7	98	36	53
水系 Water system	対島海流下層 Lower Tsushima Cur.		日本海固有水塊 Japan Sea peculiar water mass			

St. 64-1 (248m) 及び St. 65 (222m) では浮遊性遺骸量が夥しいので本表から省略

(At Sts. 64-1 and 65 enormous quantity of the planktonic remains (mostly *Globigerina bulloides*) is deposited, so that the relative abundance of them is more than 10 times as much as the benthonic forms.)

第 2 表に各産地毎に得られた浮遊性遺骸の底棲型 100 個体に対する相対頻度値を示した。St. 65 と St. 64-1 が除外されているのは、これら地点の遺骸量が余りに著しく、底棲型遺骸の相対量が非常に小さかつた爲である。F. L. Parker (註) は米国東岸陸棚上で浮遊性遺骸量が急変することに対して、小規模な水系混合により水温・塩分の分布が急変し、これが遺骸量の急変に関係する様だと説いている。St. 65, St. 64-1 附近では必ずしも此様な関係は認められず、両地点の異常堆積の原因は未だ速断し得ない。

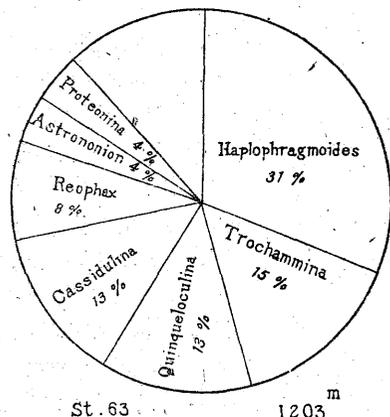
なお *Globigerina pachyderma* と *G. dutertrei* とは Cushman 等に依り冷水性底棲型とされているが、便宜上ここに扱つた。両種は第 2 表の如く、冷水塊中に大抵多いといえそうである。

III. 要約

頭書の如く、結論的推論は成可く控える事とし、第 3 表に結果の概要を表記する

ただ、二、三附言すれば、

Parker (文献表) pp. 234-236



第 8 図  
Fig. 8. Generic Composition of Assemblage D

第 3 表 要 約 表  
Table 3 Summary of Result

	Assemblage	位置 St. No.	深 度 Depth	水 温 Temperature	塩 分 Salinity	水 系 Water system	底 質 Bottom sediments	距 岸 Distance fr. coast	備 考
A	<i>Siphogenerina raphana</i>	60	83 m	17~ 10°C	33.7 ~34.5%	対島海流下層 Lower Tsushima Current (Kuroshio)	砂質泥 sandy mud	2.7 km	
	<i>Bulimina marginata</i>	60-1	142 m	12~7°C				3.6 km	
B	+ <i>Bulimina marginata</i>	65	222 m	7~3°C		第 2 躍層附近 Second spring Layer	泥質砂 Silty sand	17 km	沿岸水の 影響殆どなく、 地形、底 質等から 確に近い 条件と思 われる
	<i>Cassidulina</i> + <i>Angulogerina</i> ~ <i>Uvigerina</i>	64-1	248 m					20 km	
C	<i>Angulogerina</i> sp. 1	61	468 m	0~1°C	34.1±0.1%	日 本 海 固 有 水 塊 Water mass peculiar to Japan Sea	Silt ~ Clay	6.7 km	
	+ { <i>Uvigerina peregrina</i> <i>U. cf. bifurcata</i>	64	633 m					25 km	
		62	947 m					12.5 km	
D	<i>Haplophragmoides glomerata</i> <i>H. trullissata</i> <i>Trochammina japonica</i> <i>Quinqueloculina venusta</i>	63	1203 m					29 km	海底谷 壁 上 部

- 1° A~C 群は性質に於て越後油田の和南津、灰爪、西山の諸層より産する代表的化石群に類似している。
- 2° 群集の differentiation は、主として水系に依存している様に見え深度に依らない。従つて水系が薄く、多い浅海・沿岸では群集は複雑で、逆に例えば日本海固有水塊の如き均質な水塊中では水平・垂直共に広く同一型が分布する。
- 3° 1°, 2° より油田に於ける有孔虫による対比は、背斜部と向斜部、沖と周縁等の場合では相当慎重を要することが判る。但し此の制約は、逆に油田の evolutionary change 解析の重要な鍵の一つにもなる。
- 4° 殻の運搬が常に問題になるが、今日の例では、海流流向・地形等によつて相当「混入」「落ち込み」が認められるけれども、これら外來者が大きな相対頻度を占めている所はなかつた

DESCRIPTIONS AND NOTES ON  
SOME SPECIES

Genus *Labrospira* HÖGLUND, 1947  
*Labrospira* sp. 1  
Figs. 1 a, b

Test circular in side view, nearly involute on both sides; sutures rather indistinct, very

slightly depressed, straight to the peripheral margin; chambers not lobulate, usually 8 in the last formed whorl; wall coarsely arenaceous but smoothly finished, yellow-brown coloured; aperture an elongate opening with slight lip just above the inner margin on the apertural face.

Diameter up to 0.65 mm; thickness up to 0.40 mm.

LOCALITIES:

St. 60 (83 m) Lower Tsushima Current (Kuroshio proper). Rare.

St. 61 (468 m) Water mass peculiar to Japan Sea. Individuals rarely obtained at this station seem to be transported from the upper places in Tsushima Current.

This species is similar to BRADY'S figure in Challenger Report. (PL. 34 figs. 8 a, b)

Genus *Trochammina* PARKER & JONES, 1860  
*Trochammina japonica* sp. nov.  
Figs. 2 a-c.

Test free, trochoid spiral, periphery broadly rounded, umbilical area in the ventral side deeply depressed; chambers 5 or 6 in

the final whorl, inflated and slightly lobulate; sutures indistinct in the early stages, depressed, not curved, and oblique to the inner margin on the dorsal side but perpendicular to the periphery on the ventral side; wall rather coarsely arenaceous, but smoothly finished, cement white to brownish; aperture semi-circular opening at the base of the ventral side of the chamber.

Diameter=0.38 mm thickness=0.20 mm

Holotype from St. 62 (947 m)

#### LOCALITIES:

St. 61 (468 m), St. 62 (947 m), St. 63 (1203 m) and St. 64 (633 m) all in the water mass peculiar to Japan Sea. Rare to common.

Genus *Nonionella* CUSHMAN, 1926

*Nonionella globosa* sp. nov.

Figs. 3 a-c

Test acorn-shaped, asymmetrical, periphery rounded, dorsal side with chambers ending at the umbilical area, on ventral side involute and umbilical end of the last-formed chamber broadly extending beyond umbilicus with about 5 short fingers; sutures distinct, slightly depressed, nearly straight, oblique to the peripheral margin; wall smooth, thin, hyaline, finely perforate; aperture narrow slit at the base of the apertural face.

Length=0.42 mm; breadth=0.24 mm; thickness=0.22 mm

Holotype from St. 64 (633 m)

#### LOCALITIES:

St. 64 (633 m) Water mass peculiar to Japan Sea. Rare.

St. 65 (222 m) & St. 64-1 (248 m) Second spring layer. Very rare.

This is characterized by its peculiar acorn-shaped test and finger-like lobelets at the umbilical region on the ventral side.

Genus *Bulimina* d'ORBIGNY, 1826

*Bulimina marginata* d'ORBIGNY

Fig. 4.

*Bulimina marginata*, H. B. BRADY, Rep Voy. Challenger, Zoology, Vol. 9, 1884, P. 405, pl. 51, figs 3-5

— CUSHMAN, Bull. 71, U. S. Nat. Mus. pt. 2 1911, P. 83, text-figs. 136 a, b, — CUSHMAN & PARKER, Prof Paper 210-D, U. S. Geol. Surv. 1947, p. 119, pl. 28, figs. 5, 6, — Ikari, Suisangaku Zasshi, No. 30, 1927, p. 3, pl. 1, fig. 7.

*Bulimina aculeata*, HADA, Sci. Rep. Tōhoku Imp. Univ. (Biol.) Vol. 6, 1934, p. 127, text-fig. 84.

Holotype described from recent material from Italy.

#### FOSSIL OCCURENCE:

Pliocene and Quaternary (warm water) deposits on the Pacific side of Honshū. Plio-Pleistocene Setana formation in Hokkaidō.

#### ECOLOGY:

South of Japan, 345 fms: off Japan, 258 and 440 fms.: South of Okinawa, 1075 m: Southwestern North Pacific, 860m: Tosa-wan (Shikoku) 91-349 m (Kuroshio Current): Onagawa-wan (Miyagi Pref.) 31 m: Misaki (Kanagawa Pref.) less than 10 fms.: Off Kashiwazaki, 38 m (rare) 51 m (common) 64-88 m+(abundant): Toyama-Bay, 83 m (common) 142 m (abundant) 222 m (common) 248m-1203m (rare, possibly transported from shallower part)

Genus *Angulogerina* CUSHMAN, 1927

*Angulogerina* sp. I

Figs. 5 a, b, 6

Test about twice as long as broad, the broadest part nearly in the middle, triangular in transverse section, the periphery lobulate and rounded especially in the early stages; chambers distinct and inflated; sutures distinct and depressed; wall ornamented with longitudinal costae on all except last-formed chambers in the adult, finely perforate; aperture with very short tubular neck and phialine lip.

Length=ca. 0.4 mm: diameter=ca. 0.2 mm

#### LOCALITIES:

St. 65 (222 m) second spring layer (rare), St. 64-1 (248 m) second spring layer (common), St. 61 (468 m) St. 64 (633 m) and St. 62 (947 m) water mass peculiar to Japan Sea (abundant), St. 63 (1203 m) same water as preceding system (stagnant water mass?) (rare)

Genus *Cassidulina* d'ORBIGNY, 1826  
*Cassidulina yabei* ASANO & NAKAMURA

Fig. 10

*Cassidulina yabei*, ASANO & NAKAMURA, Jap. Jour. Geol. Geogr. Vol. 14, Nos. 3-4, 1937, p. 145, pl. 14, figs. 1 a, b.

Holotype described from Pliocene Setana formation, Hokkaido.

FOSSIL OCCURENCE:

Common in the Pliocene deposits on the Japan Sea side.

LOCALITIES:

Recent material has not been recorded by this time. Toyama-Bay. St. 65 (222 m) second spring layer (common) St. 64-1 (248 m) same as preceding one. (rare)

*Cassidulina californica* CUSHMAN & HUGHES  
var. *japonica* ASANO & NAKAMURA  
Figs. 11 a, b.

*Cassidulina japonica*, ASANO & NAKAMURA, Jap. Jour. Geol. Geogr. Vol. 14, Nos. 3-4, 1937, p. 144, pl. 13, figs. 1, 2, text-figs. 2 a, b.

Holotype described from recent material from Urashima Bank, Wakasa-wan, Japan Sea. (200m±)

The present specimens are considerable as the topotypes. Although the original figures and description show distinct differences from *C. californica*, it may be adequate to treat this japonic species as a variety of *C. californica* from the comparison between the present specimens and the Californian fossil specimens.

The variety is distinguishable from the species by having more acute periphery of the final chamber and very slightly less globular test.

Pliocene species recorded under the name *C. japonica*, which may be ancestor of the variety, from oil field on the Japan Sea side, is hardly distinguished from *C. californica*.

LOCALITIES:

St. 65 (222 m) (common) and St. 64-1 (248 m) (more common) both second spring layer. St. 64 (633 m), St. 62 (947 m) and St. 63 (1203 m) all in the water mass peculiar to Japan Sea (rare to common)

*Cassidulina kasiwazakiensis*

HUSEZIMA & MARUHASI

*Cassidulina kasiwazakiensis* HUSEZIMA & MARUHASI, Jour. Sigen Ken Vol. 1, No. 3, 1944, p. 399, pl. 34, figs. 13 a-c.

Holotype described from Pliocene Haizume formation, Niigata Oil field.

This species is closely related to *C. norcrossi* CUSHMAN (Smithsonian Misc. Coll. Vol. 89, No. 9, p. 7, pl. 2, figs. 7a-c, described from off NE. Greenland)

FOSSIL OCCURENCE:

Haizume and Nishiyama formations in Niigata Oil field (Pliocene) Koetoi formation in Hokkaidō (Pliocene)

LOCALITY:

Recent material has not been recorded by this time.

Toyama-Bay: St. 63 (1203 m) (water mass peculiar to Japan Sea. (rare))

[主要文献]

Check list of bibliography excluding foot notes

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- (4) Z. Yasui: "Density currents in the mouth of Toyama-wan and Suruga-wan" Jour. Oceanogr. Vol. XII, No. 3, pp. 459-463, 1940.

Ecology

- (1) Y. Hada: "Notes on the recent foraminifera from Mutsu Bay"

## EXPLANATION OF THE PLATE

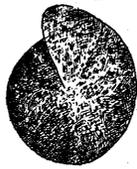
Figures

1	a, b	<i>Labrospira</i> sp. 1	× 33	St. 60
2	a, b, c	<i>Trochammina japonica</i> sp. nov. Holotype	× 66	St. 62
3	a, b, c	<i>Nonionella globosa</i> sp. nov. Holotype	× 66	St. 64
4		<i>Bulimina marginata</i> d'ORBIGNY	× 66	St. 60
5	a, b	<i>Angulogerina</i> sp. 1 (megalospheric form)	× 66	St. 61
6		<i>Angulogerina</i> sp. 1 (megalospheric form)	× 66	St. 64
7		<i>Virgulina complanata</i> EGGER	× 66	St. 63
8		<i>Uvigerina peregrina</i> CUSHMAN	× 66	St. 64
9		<i>Uvigerina</i> cfr. <i>bifurcata</i> d'ORBIGNY	× 66	St. 64
10		<i>Cassidulina yabei</i> ASANO & NAKAMURA	× 66	St. 65
11	a, b	<i>Cassidulina californica</i> CUSHMAN & HUGHES		
		<i>var. japonica</i> ASANO & NAKAMURA	× 33	St. 65.
12		<i>Cassidulina laevigata</i> d'ORBIGNY	× 33	St. 62

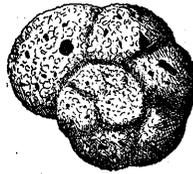
RECENT FORAMINIFERA FROM TOYAMA-WAN ISHIWADA



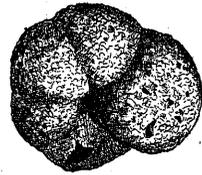
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1b



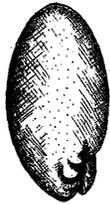
2a



2b



3a



3b



3c



2c



4



5a



6



8



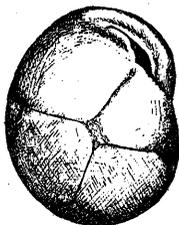
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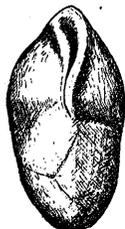
7



5b



11a



11b



12



9

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Note: On the detail of the oceanographic observations, see "Pub. No. 981, Hydrogr. Bull. Spec. No. March, 1950 pp. 59-61."

553, 44: 065 : 550. 8 (521. 14) : 622. 1

秋田縣太良鉾山鉛亜鉛鉾床調査報告 主として 14 号鑛に就いて

伊 藤 昌 介\*

Résumé

The Lead-Zinc Deposits of the Daira Mine, Akita Prefecture, with Special Reference to No. 14 Vein

by  
Shōsuke Itō.

1. The lead and zinc deposits of the Daira Mine, Akita Prefecture, occur in the so-called "Tertiary Green Tuff" in the north eastern district of Japan. Daira deposits are of the epithermal fissure filling vein type and the faulted vein type.

2. About twenty veins are known, and three fissure filling veins and two faulted veins have been newly found in this research. The fissure filling veins are parallel each other, and their strikes are about E-W. The faulted vein, being of little worth, are made genetically in bedding slip. In general, the faults run about 45° to the direction of the fissure veins. Those facts show that the fault was produced along the maximum shearing plane by compression from east and west, and the fissure was made by the tension vertical to the compression.

3. The lower limit of the main crystallized parts of lead and zinc ores in each vein are laid on the same level, about 300

meters above sea-level. Their depth calculated to be about 150 meters. The writer wants to call this parts "the crystallized zone of lead and zinc ores." The maximum length of veins is measured 150 meters and average width is about 10 cm.

4. The ore shoots in the veins are found under the foot wall of lower angle faults.

5. The principal ore minerals are zinc blend, galena, associated with some pyrite and chalcopyrite. There are a few gangue minerals, i. e., calcite, quartz, clay material, chlorite. Rhodochrosite and mangano-calcite are rarely found.

6. The alteration of country rocks is predominant in carbonatization, chloritization and kaolinization all over the neighbourhood of the deposits. Silicification is relatively weak.

7. The proved and probable ore reserves estimated are given in the following table:

proved ore	1.5 × 10 <sup>4</sup> t.....grade (Cu 0.65% Pb 3.30% Zn 7.65%)
probable ore	1.9 × 10 <sup>4</sup> t.....grade (Cu 0.43% Pb 1.30% Zn 5.78%)

8. The result of this investigation can be concluded as follows: the existence of hidden veins can be supposed to exist by the genetic mechanism of vein system. The