



Polychaetes of Antarctic sublittoral in the proglacial zone (King George Island, South Shetland Islands)

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ABSTRACT: Ninety eight polychaete species were found in the shallow sublittoral of Admiralty Bay. The most abundant were *Leitoscoloplos kerguelensis*, *Tauberia gracilis*, *Ophelina syringopyge*, *Rhodine intermedia*, *Tharyx cincinnatus*, *Aricidea (Acesta) strelzovi*, *Apistobranchnus* sp., *Cirrophorus brevicirratu*s and *Microspio moorei*. Mean abundance of polychaetes was estimated at 120 ind./0.1m². As a result of cluster analysis several polychaete assemblages were distinguished. The highly specific assemblage with two characteristic species, *Scoloplos marginatus* and *Travisia kerguelensis*, from shallow areas with sandy bottom situated far from glaciers; a distinctly specific assemblage with *Apistobranchnus* sp. from poorly sorted sediments in the bottom areas situated on the slopes at the base of steep rubble shores; the richest and most diverse, highly specific polychaete assemblage from the central basin of the bay with *Tauberia gracilis* as the most characteristic species, as well as two assemblages from the bottom areas neighbouring glaciers and influenced by the intensive enrichment of very small grain-sized sediments with *Ophelina cylindricaudata* and *Tharyx cincinnatus*. Clear assemblages' arrangement was observed along the gradient: sand, silty sand, silt towards clay silt. Other important factors, supporting the proposed classification of assemblages and their character, include the sorting coefficient of the sediment (So) as well as the slope of the bottom. The between-habitat diversity of polychaete fauna is strongly connected with the phenomena occurring in the neighbouring terrestrial coastal areas.

Key words: Antarctica, Polychaeta, sublittoral, bottom sediments.

Introduction

The ecosystem of the Antarctic shelf and coastal zone has recently become the object of research recommended by the Scientific Committee of Antarctic Research. The question concerning the nature and importance of mutual impacts between land and sea is one of the most essential issues. Sedimentation and its effects seem to be the most important factors. The type of sediment is the parameter which

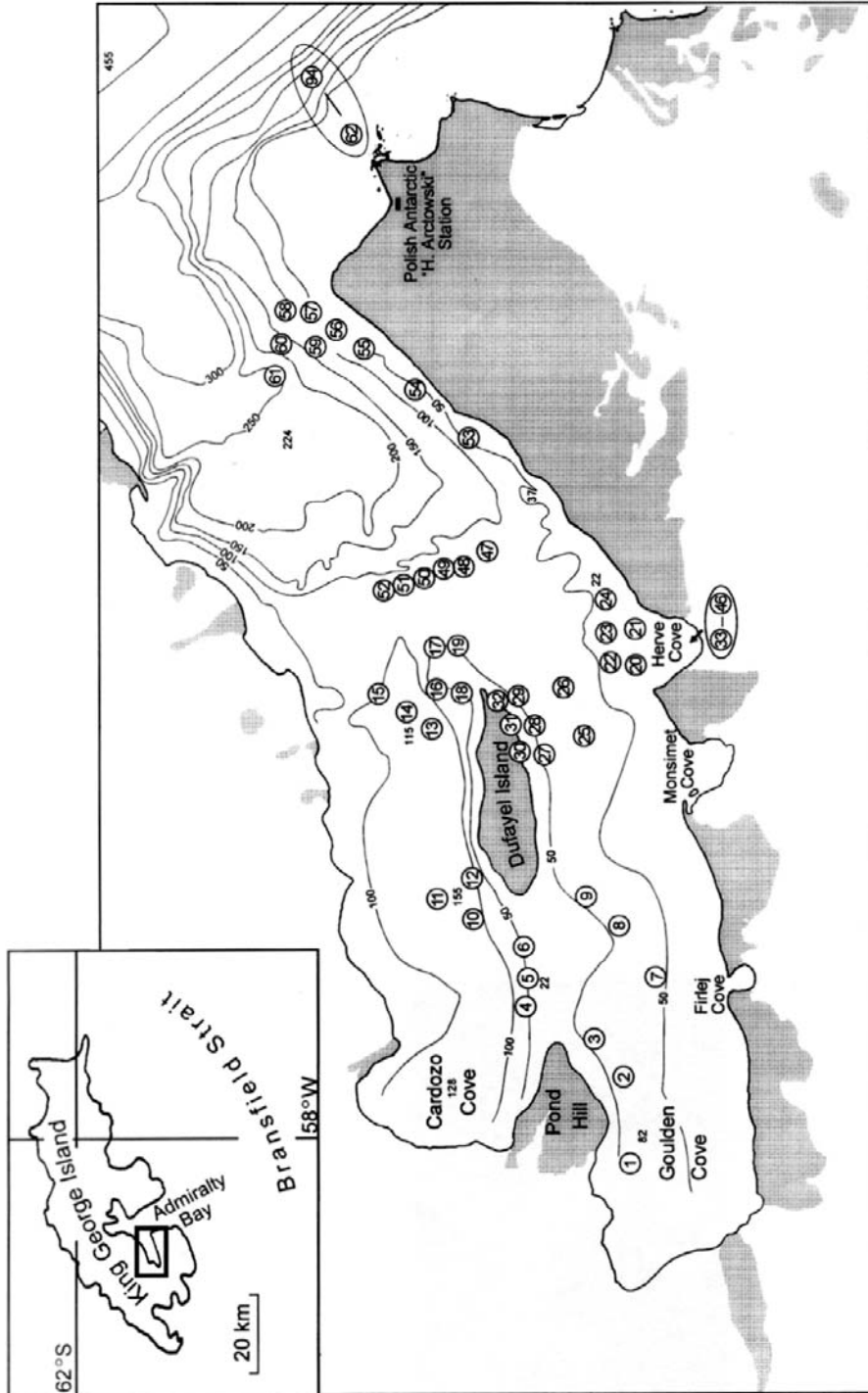


Fig. 1. Investigated area (Ezcurra Inlet and the part of central basin of Admiralty Bay) with the location of sampling stations (coastal areas free of glaciers are shaded).

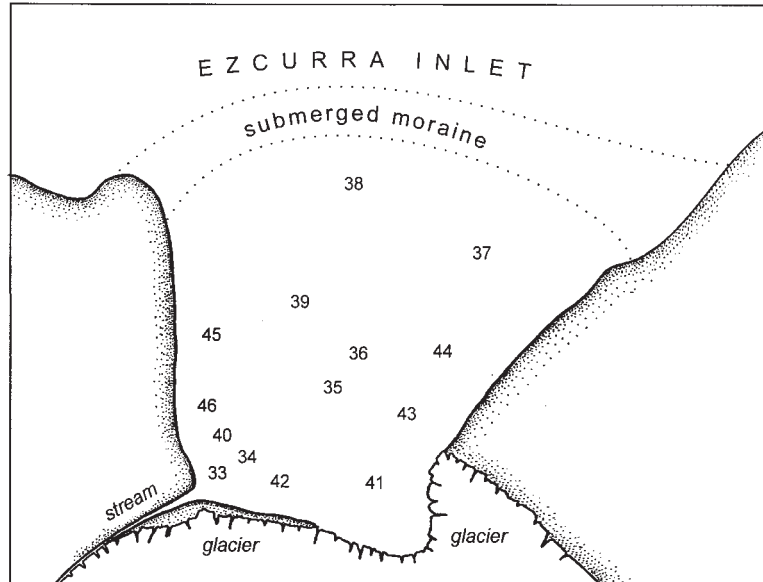


Fig. 2. Investigated area (Herve Cove), with the location of sampling stations (coastal areas free of glaciers are shaded).

essentially determines the character of soft bottom benthic communities (Thorson 1957, Gray 1974). Rhoads (1974) stressed that the relationship between sediment and fauna is crucial in explaining the benthic ecology.

Bottom sediments are most diverse in the coastal zone, which is related to the diversity of conditions in which sedimentation occurs. Hence, studies on the distribution of zoobenthos in that part of Antarctic shelf, taking into account the dynamism of processes which are different from those of the open ocean, deserves attention. This was pointed out by Dayton (1990) and Arntz and Gallardo (1994). So far very scarce initial information on the distribution and structure of the soft bottom Antarctic zoobenthos assemblages analysed against a background of the character of sediments originate from Hardy (1972), Richardson and Hedgpeth (1977) and Platt (1979). The description of polychaete assemblages in the shallow sandy and silty bottom sublittoral of Morbihan Bay (Kerguelen Islands) was presented by Duchêne (1984). In the Bransfield Strait Mühlenhardt-Siegel (1989) distinguished some assemblages of mollusks and ostracods connected with the character of bottom sediments.

It seems that increasing knowledge of the spatial distribution of sediment types may be a key for understanding local phenomena in the communities of the Antarctic benthic sublittoral. This problem was highlighted by pilot studies on zoobenthos distribution in Admiralty Bay (Jazdzewski *et al.* 1986, Siciński 1986). A more comprehensive analysis of this problem, as well as an attempt to elaborate a synthesis, constitute the main aims of the present study.

Study area, material and methods

The material was gathered in 1979–1988 in the course of several Polish Antarctic Expeditions of the Polish Academy of Sciences to the H. Arctowski Antarctic Station. The vast majority of the material was collected in 1985. Investigations covered Ezcurra Inlet and a part of the central basin of Admiralty Bay (Fig. 1). Material was collected in the shallow sublittoral down to the depth of 165 m, thus to the maximal recorded depth in the inner, western part of Ezcurra Inlet. This is the part of the bottom with the highest diversity and variability of environmental factors in the Admiralty Bay coastal zone.

Several authors have described the environment of Admiralty Bay. Detailed information on its hydrology and hydrography is given by Pruszek (1980), Samp (1980), Marsz (1983), Lipski (1987) and others. Intensive research activity of Belgian, Brazilian, German and Polish biologists in the bay area has been recently targeted by its designation as the key site for the SCAR Program Ecology of the Antarctic Sea-Ice Zone 1994–2004.

Suspended matter and sediments

Among the most important abiotic factors that determine conditions occurring at the sea bottom is the character and suspended matter content and the process of its sedimentation. The mean suspended matter content in the waters of the Southern Ocean ranges from 1 to 2 mg/dm³. The amount of suspended matter in the waters of Admiralty Bay exceeds several times those from open Antarctic waters (Pęcherzewski 1980). In Admiralty Bay, in particular in its coastal zone, surprisingly high fluctuations are recorded in the content of inorganic suspended matter, dependent on the season, region and distance from glacier. The lowest values, about 2.8 mg/dm³, were observed in winter in the central part of the bay. Very high amounts of mineral suspended matter, usually above 100 mg/dm³, were observed in summer in the front of glacier cliffs (Pęcherzewski 1980). Maximal values, amounting to almost 270 mg/dm³ were recorded in summer in a small lagoon, Herve Cove, close to the inflowing glacial stream (Figs 1 and 2). It is worth noting that the waters of Ezcurra Inlet, especially in its western part, are the richest in inorganic suspended matter. Moving from the western part of the Ezcurra Inlet to the central area of Admiralty Bay a sharp decrease in inorganic suspended matter content was observed (Fig. 3). It was calculated that about 2000 tons of mineral suspended matter is transferred daily from land to the bay in summer (Pęcherzewski 1980). Part of this amount is carried by surface current to the Bransfield Strait. Another part is spread very unevenly on the bottom of the bay.

According to the data by Lipski (1987) water transparency related to suspended matter content ranges from 2 m in the fjords in summer to 32 m in the cen-

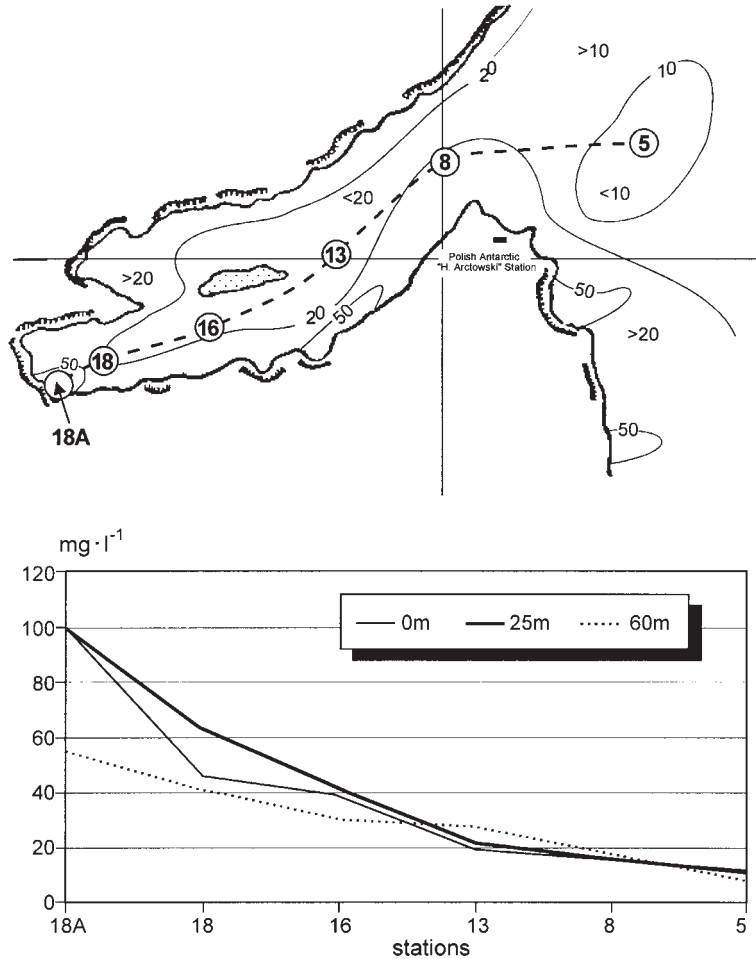


Fig. 3. Gradient of suspended matter content in the waters of Admiralty Bay (isolines denote amount of suspended matter in mg/dm^3 in the subsurface layer, according to Pęcherzewski, 1980).

tral area of the bay in winter. The latter value is equivalent to 2.5 mg of suspended matter per 1 dm^3 of water.

There are very scarce data of the Admiralty Bay bottom sediments distribution. Rudowski and Marsz (1996) claim that the thickness of the sedimented layer ranges from over a dozen to several dozen meters.

Samples of sediment together with its fauna, usually weighing from several to about a dozen kilograms, were collected with a Van Veen grab with a sampling area of 0.1 m^2 . Part of each sample, $400\text{--}600 \text{ cm}^3$, was separated for granulometric analysis and desiccated. The rest of the sample was sieved on a 0.5 mm mesh. Animals were then preserved in 7% neutralized solution of formaldehyde. 86 samples were collected in this way. In the shallow sublittoral, down to 30 m, with a com-

pact sandy bottom which was difficult to penetrate with the Van Veen sampler, 8 further samples were collected by divers with a “Tvärminne” bottom sampler (Kangas 1972) with a sampling surface of 565 cm². Station distribution and their numbers is presented in Fig. 1 and Fig. 2.

The Canberra Metric was employed to classify assemblages of Polychaeta.

$$C = \sum_{k=1}^n \frac{|x_i - x_j|}{(x_i + x_j)}$$

where:

C – Canberra Metric,

x_i – density of individuals of a given species in station “i”,

x_j – density of individuals of a given species in station “j”,

|| – absolute value,

n – total number of species.

Calculations were carried out using raw, non transformed data – the densities of 90 polychaete species in 94 stations (= samples) (Siciński 1998). Object grouping was done with a “flexible sorting” method using the coefficient of grouping efficiency “ β ” = –0.25.

In naming each distinguished Polychaeta assemblage, the name of its leading species (i.e. that one which obtained the highest result from multiplying its domination value by the value of degree of association index, DAI) was located besides its literal symbol. The DA index (Salzwedel *et al.* 1985) expresses the percentage of individuals of a given species recorded in a given station group (=assemblage) within the total number of specimens of that species in the overall study area.

Not all species recorded in the study area were considered in the analysis. Some species of the Cirratulidae family and Euclymeniinae subfamily were ignored. The specimens of these species are extremely delicate and only a small part of them were preserved well enough to enable identification, so they cannot be counted. Also the family Spirorbidae, abundantly represented in certain bottom areas, particularly in the shallows of the central bay area, were excluded from analysis, owing to the difficulties in precise determination of the whole spirorbid collection.

In some cases the Principal Component Analysis was employed in the present study. It served to ordinate 47 bottom sediment samples against their textural characters (Fig. 7) as well as to ordinate 9 distinguished polychaete assemblages against a background of some bottom characters (Fig. 8). The possibility to ordinate objects while simultaneously estimating their dependence on variables was also exploited (Digby and Kempton 1987, “biplot” option).

The following terms denoting species’ domination in assemblages were used throughout the study: dominants are species whose number constituted more than 5% of all specimens of all species composing an assemblage, subdominants are species with 2–5% of specimens, while influents are those which constituted

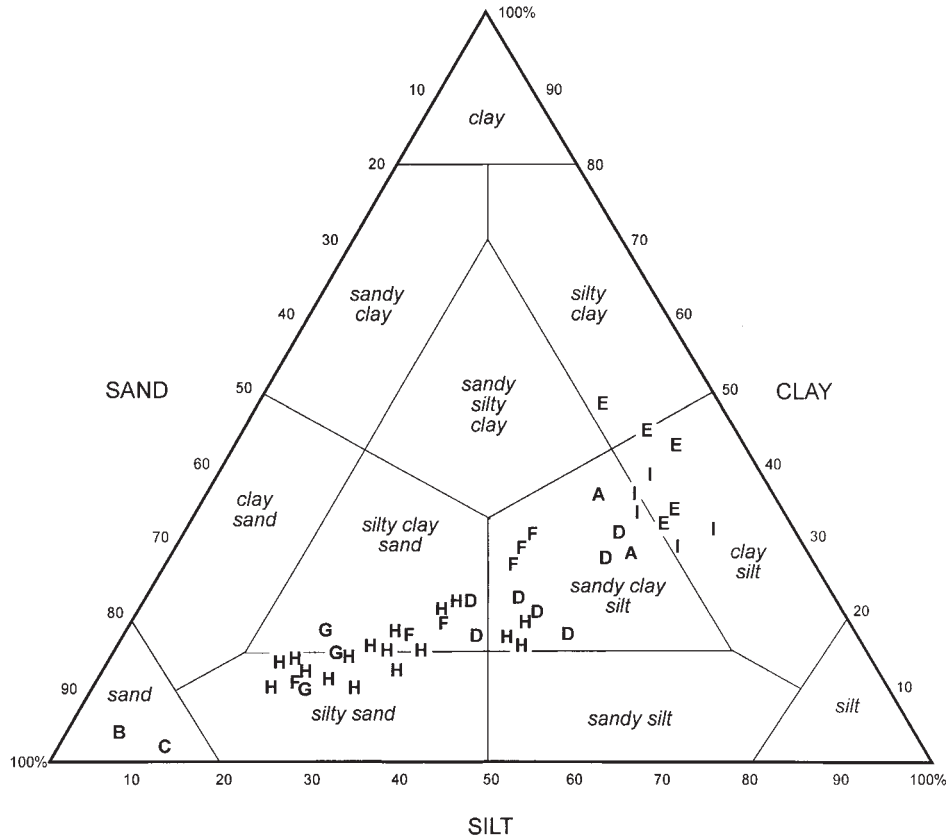


Fig. 4. Bottom sediments in 47 stations based on the proportion of sand, silt and clay. Stations are specified by the letter of the stations group (or polychaete assemblage) according to the dendrogram classification in Fig. 6.

1–2%. Remaining species, representing less than 1% of specimens, are considered accessory ones (Trojan 1975).

The presence and number of characteristic species, their frequency as well as the value of degree of association index (DAI) of dominants and subdominants (Table 1) were considered as criteria for specific character of distinguished assemblages. So, four categories of assemblages can be distinguished. An arbitrarily selected scale comprises nonspecific assemblages, weakly specific assemblages, fairly specific assemblages and highly specific assemblages.

In 47 of all 94 zoobenthos samples sediment was also collected for granulometric analysis carried out by the areometric method. Sediment was sieved out through a sieve with 1 mm mesh size. What remained on the sieve was the skeletal fraction. The other part, with grain diameter below 1 mm, was further sorted out. On the basis of obtained results cumulative curves of granulation were constructed, in which the contents of sand, silt and clay fractions were measured. The

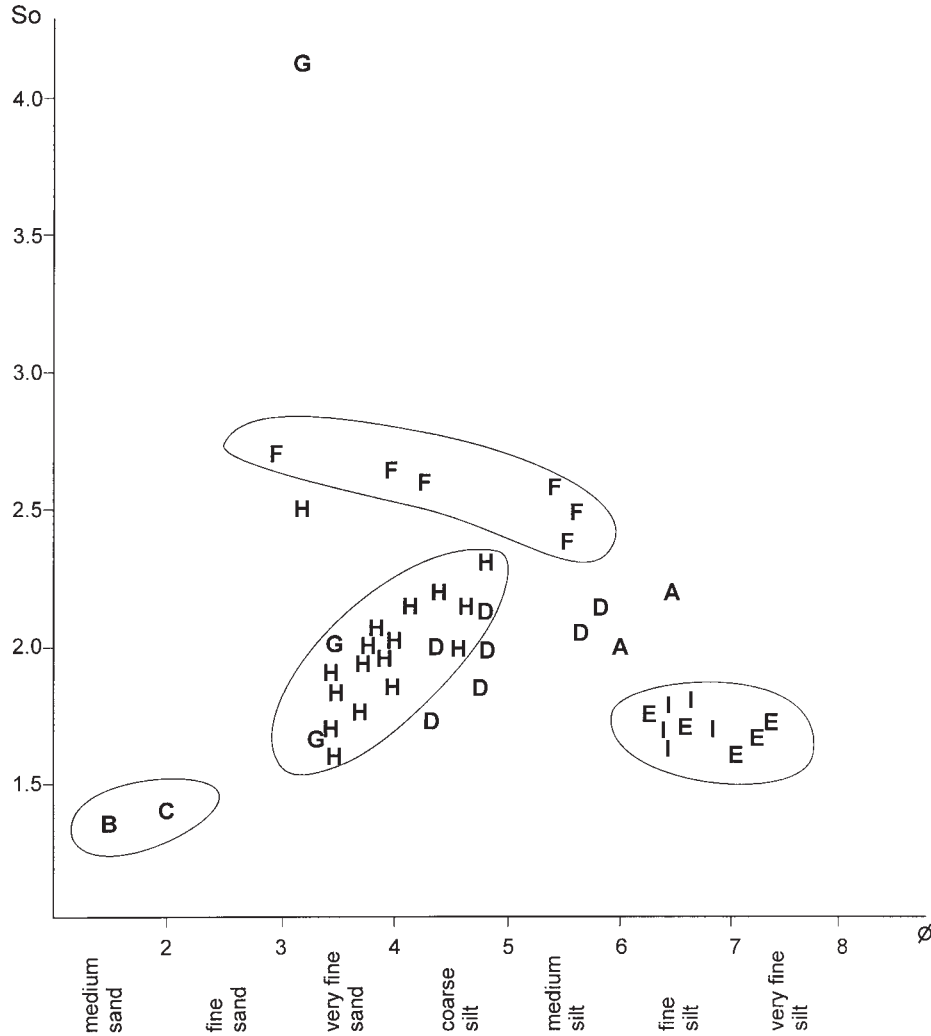


Fig. 5. The relationship between ϕ units and sorting coefficient (S_o) of bottom deposits in 47 stations.

respective results are presented in a triangular diagram (Fig. 4). The classification and nomenclature of sediments proposed by Shepard (1954) was accepted as particularly useful for weakly sorted sediments. From the cumulative curves the values of quartiles Q_1 (25%), Q_2 (50%) and Q_3 (75%) were also read and then employed to calculate the sorting coefficient (S_o) and median of grain diameter (Q_2), expressed subsequently in the units of $\phi = -\log_2 d$ (Krumbein 1934), where "d" is the median grain size expressed in millimeters. The sorting coefficient was calculated according to the formula: $S_o = Q_3/Q_1$. Values calculated in this way served to locate the 47 sediment samples in the coordinate system represented by the sorting coefficient and ϕ coefficient (Fig. 5).

Results

Sediments.—Bottom sediments of Admiralty Bay are composed of randomly allocated clastic materials of various fractions transported to the bay mostly by glacial and subglacial streams and originating both from the abrasion of shores as well as from the melting of drifting icebergs. In terms of grain-size structure the sediments are sands, silty-sands, silty-clay-sands, sandy-clay-silts and clay-silts (Fig. 4). In terms of median particle diameter expressed by phi (ϕ) units, the sediments represent the whole range of possibilities, starting from medium sand and ending with very fine silt (Fig. 5). Sediments are poorly and very poorly sorted; they usually contain a considerable amount of very coarse sand, gravel and stones.

Classification of assemblages.—The most general division of the dendrogram distinguishes two clusters of stations (Fig. 6). Cluster “X”, large and internally very diversified, comprises various areas of Ezcurra Inlet in the whole depth range of this basin as well as shallower (4–40 m) stations of the central bay basin. Cluster “Y” is almost exclusively composed of stations located in the central part of the bay, at depths from 45 to 150 m. This most general classification of the 94 stations indicates some distinctions of polychaete fauna in the Ezcurra Inlet as compared with polychaete assemblages of the central bay area. This also indicates a general biocenotic difference between the shallow coastal zone as compared with deeper sublittoral areas.

In 70 stations of the cluster “X” there were recorded 72 species whereas in only 24 stations of the cluster “Y” as many as 81 species have been found. Mean species number per 1 m² of bottom area was 34 in cluster “Y”, while only 10 in cluster “X”. Another noticeable difference is the twice higher mean polychaete density in cluster “Y” than in cluster “X”: 203 (± 92 SD) and 92 (± 84 SD) specimen/0.1 m², respectively (both means differ at a significance level $\alpha = 0.001$). Both clusters differ also in their lists of dominant species (if we ignore eurytopic species, which are common for both areas). In deeper parts of the central bay area (cluster “Y”) these dominant species were *Aricidea strelzovi*, *Cirrophorus brevicirratu*s and *Asychis amphiglypta*, whereas in the area of Ezcurra Inlet and in shallow stations of the central part of the bay (cluster “X”) the characteristic group of dominants consisted of *Tharyx cincinnatus*, *Microspio moorei* and *Apistobranchnus* sp.

A more detailed division of the dendrogram (Fig. 6) distinguishes 9 station groups. Such a division seems to be the most suitable taking into account the possibilities of its plausible interpretation against a background of the pattern of the bottom deposits distribution.

The differences in polychaete density in given assemblages was estimated at the significance level $\alpha = 0.05$. Low densities of polychaetes in assemblages “C”, “E” and “D” (60 ± 46 SD, 30 ± 26 SD and 28 ± 18 SD ind./0.1m² respectively) do not differ significantly. The high mean densities in assemblages “F” and “I” (136 ± 97 SD and 133 ± 90 SD ind./0.1m² respectively) are also not so much different. Fi-

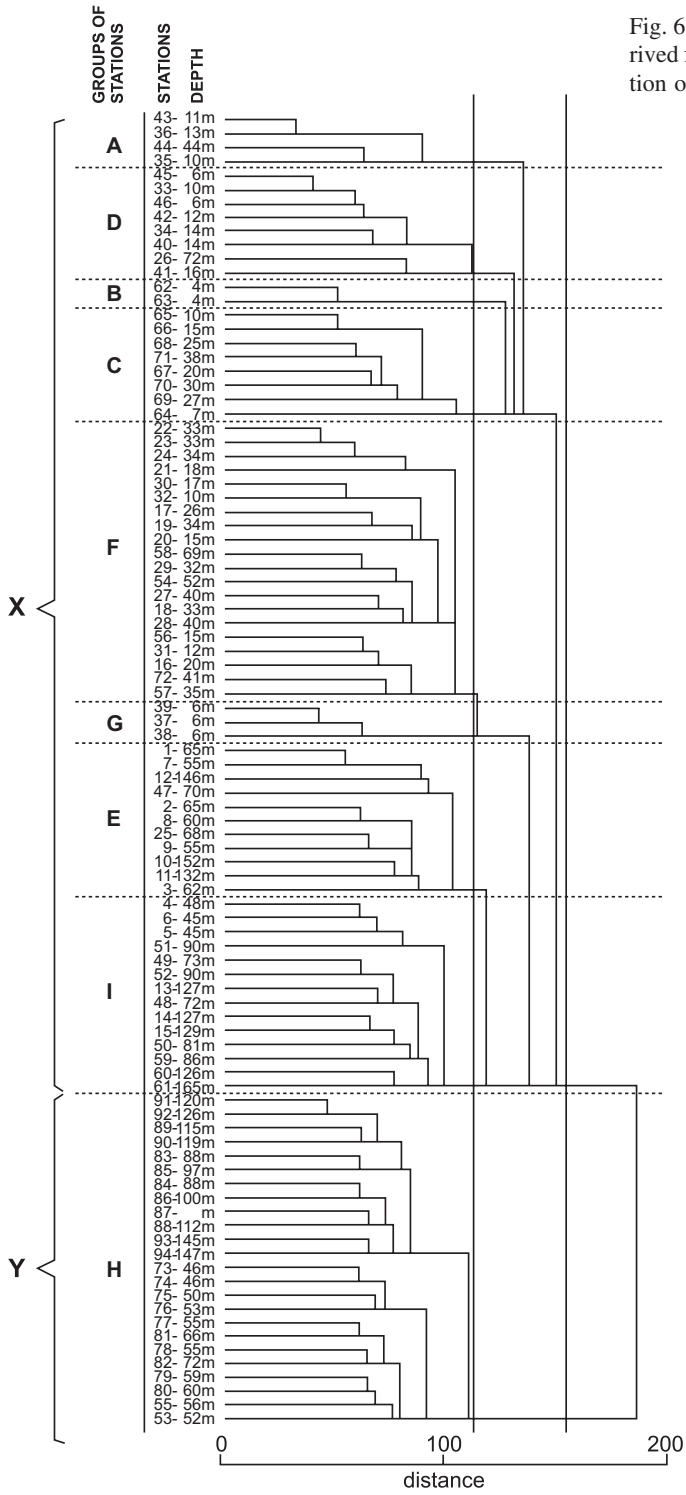


Fig. 6. Dendrogram of stations derived from the abundance distribution of 90 polychaete species (explanations in text).

nally, assemblage “H”, with the highest recorded mean polychaete density ($203 \pm 92\text{SD ind./}0.1\text{m}^2$), differs in this respect from all other assemblages. Due to the low number of data, differences between assemblages “A”, “B” and “C” and others were not tested.

The species density, dominance values, frequency and degree of association index in the assemblages (= groups of stations) are presented in Table 1.

Polychaete assemblages of each of the above distinguished station clusters may be characterized as follows:

Stations of cluster “A” comprise the eastern part of Herve Cove, at depths of 4 to 13 m. This part of the lagoon possesses an extremely poor polychaete fauna, composed of only three species caught in only a few specimens each (Table 1). The only constant species there was the eurytopic *Leitoscoloplos kerguelensis*. In this case one cannot characterize in biocenological terms a polychaete assemblage of this group of stations. It is presumed that the polychaetes were accidentally carried into the area from adjacent areas. The reason for this poverty may be the oxygen deficiency occurring in bottom sediments and in the water layer at the bottom.

Stations of cluster “B” represent the shallowest areas of the sublittoral of the central basin of the bay. Only two polychaete species, *Microspio moorei* and *Capitella capitata*, the former being a conspicuous dominant, were recorded there. A very high mean polychaete density of about 100 specimens/ 0.1 m^2 was observed.

Assemblage “C” (“*Scoloplos marginatus*”) consisted of 22 polychaete species which were recorded in the shallow area of the sublittoral of central basin at depths of 7 to 40 m. The assemblage is characterized by a low species richness. *Capitella capitata*, *Travisia kerguelensis* and *Scoloplos (L.) marginatus* form a group of absolutely constant species. The latter two are also highly associated with this cluster of stations, i.e. with the shallowest sublittoral of the central basin of the bay. 96% of all specimens of *S. (L.) marginatus* captured in the study area originate from this group of stations. A high degree of association with the bottom area in question was also presented by *Orbinia* sp. and *Brania rhopalophora*. Due to the high domination values important elements of this assemblage were eurytopic *Ophelina syringopyge*, *Rhodine intermedia* and *Leitoscoloplos kerguelensis* as well as moderately eurytopic species: *Cirrophorus brevicirratus*, *Microspio moorei* and *Spiophanes tcherniai* (Table 1). Assemblage “C” should be considered as a highly specific one. This is due to the presence and high density of such a constant and characteristic species as *Scoloplos (L.) marginatus*, *Travisia kerguelensis* and *Orbinia* sp.

Poor **assemblage “D” (“*Microspio moorei*”)**, from the south-western part of Herve Cove (Table 1), is composed of only 11 species of Polychaeta. The most characteristic, important in term of domination value (37.7%), constancy (87.5%) as well as the degree of association index DAI (almost 28%) was there *Microspio moorei*. This assemblage is not very specific. The presence of *M. moorei* demonstrates some affinities to the shallow water assemblages “B” and “C” of the central bay area.

Table 1
Biocentical indices values of polychaete species in particular groups of stations (explanations in text).

Species	mean density (ind./0.1 m ²)	domination [%]	frequency [%]	maximal density (ind./0.1 m ²)	DAI
Group "A"					
<i>Leitoscoloplos kerguelensis</i> (McIntosh, 1885)	3.3	72.2	100.0	8	0.6
<i>Rhodine intermedia</i> Arwidsson, 1911	0.8	16.7	50.0	2	0.3
<i>Capitella capitata</i> (Fabricius, 1780)	0.5	11.1	25.0	2	1.6
Group "B"					
<i>Microspio moorei</i> (Gravier, 1911)	98.0	98.5	100.0	99	63.8
<i>Capitella capitata</i> (Fabricius, 1780)	1.5	1.5	50.0	3	2.4
Group "C", assemblage "<i>Scoloplos marginatus</i>"					
<i>Ophelina syringopyge</i> (Ehlers, 1901)	11.0	18.5	62.5	64	5.9
<i>Scoloplos marginatus</i> (Ehlers, 1897)	8.8	14.7	87.5	38	95.9
<i>Capitella capitata</i> (Fabricius, 1780)	6.5	10.9	100.0	10	42.3
<i>Rhodine intermedia</i> Arwidsson, 1911	4.8	8.0	75.0	12	4.1
<i>Cirrophorus brevicirratu</i> s Strelzov, 1973	4.3	7.1	37.5	26	10.0
<i>Leitoscoloplos kerguelensis</i> (McIntosh, 1885)	3.6	6.1	62.5	14	1.3
<i>Microspio moorei</i> (Gravier, 1911)	3.4	5.7	25.0	21	8.8
<i>Spiophanes tcherniai</i> Fauvel, 1950	3.3	5.5	50.0	15	37.1
<i>Travisia kerguelensis</i> McIntosh, 1885	3.1	5.3	100.0	7	80.6
<i>Orbinia</i> sp.	2.4	4.0	62.5	8	82.6
<i>Brania rhopalophora</i>	1.9	3.2	62.5	7	60.0
<i>Aglaophamus ornatus</i> Hartman, 1967	1.5	2.5	75.0	4	5.5
<i>Apistobranchnus</i> sp.	1.4	2.3	50.0	5	3.1
<i>Neanthes kerguelensis</i> (McIntosh, 1885)	1.0	1.7	37.5	6	16.0
<i>Sphaerodoropsis</i> sp.	0.8	1.3	37.5	4	7.9
<i>Exogone heterosetosa</i> McIntosh, 1885	0.8	1.3	62.5	2	15.4
<i>Eteone sculpta</i> Ehlers, 1897	0.5	0.8	25.0	3	100.0
<i>Polycirrus kerguelensis</i> (McIntosh, 1885)	0.3	0.4	25.0	1	66.7
<i>Notalia picta</i> (Kinberg, 1866)	0.1	0.2	12.5	1	11.1
<i>Genetyllis polyphylla</i> (Ehlers, 1897)	0.1	0.2	12.5	1	2.2
<i>Ophryotrocha notialis</i> (Ehlers, 1908)	0.1	0.2	12.5	1	7.7
<i>Lumbrineris magalhaensis</i> (Kinberg, 1865)	0.1	0.2	12.5	1	1.1
Group "D", assemblage "<i>Microspio moorei</i>"					
<i>Microspio moorei</i> (Gravier, 1911)	10.5	37.7	87.5	30	27.4
<i>Leitoscoloplos kerguelensis</i> (McIntosh, 1885)	10.3	36.8	75.0	54	3.7
<i>Ophelina syringopyge</i> (Ehlers, 1901)	2.4	8.5	87.5	5	1.3
<i>Maldane sarsi antarctica</i> Arwidsson, 1911	1.8	6.3	12.5	14	5.4
<i>Apistobranchnus</i> sp.	0.9	3.1	25.0	4	2.0
<i>Lumbrineris magalhaensis</i> (Kinberg, 1865)	0.8	2.7	12.5	6	6.7
<i>Aglaophamus ornatus</i> Hartman, 1967	0.6	2.2	50.0	2	2.3

<i>Ophryotrocha notialis</i> (Ehlers, 1908)	0.4	1.3	12.5	3	23.1
<i>Rhodine intermedia</i> Arwidsson, 1911	0.1	0.4	12.5	1	0.1
<i>Aricidea (Allia) antarctica</i> Hartmann-Schröder and Rosenfeldt, 1988	0.1	0.4	12.5	1	0.6
<i>Ephesiella</i> sp. 1	0.1	0.4	12.5	1	16.7
Group “E”, assemblage “<i>Ophelina cylindricaudata</i>”					
<i>Leitoscoloplos kerguelensis</i> (McIntosh, 1885)	10.4	33.9	72.7	57	9.6
<i>Ophelina syringopyge</i> (Ehlers, 1901)	5.7	18.8	45.5	25	4.2
<i>Tharyx cincinnatus</i> (Ehlers, 1908)	3.5	11.6	63.6	13	6.9
<i>Ophelina cylindricaudata</i> (Hansen, 1878)	3.0	9.8	54.5	17	29.5
<i>Aricidea (Allia) antarctica</i> Hartmann-Schröder and Rosenfeldt, 1988	2.8	9.2	54.5	13	17.7
<i>Aglaophamus ornatus</i> Hartman, 1967	1.5	5.1	63.6	4	7.8
<i>Pista patriciae</i> Hartmann-Schröder and Rosenfeldt, 1989	1.0	3.3	18.2	10	20.0
<i>Maldane sarsi antarctica</i> Arwidsson, 1911	0.8	2.7	36.4	4	3.5
<i>Tauberia gracilis</i> (Tauber, 1879)	0.7	2.4	27.3	4	0.4
<i>Lumbrineris magalhaensis</i> (Kinberg, 1865)	0.5	1.5	27.3	3	5.6
<i>Amphicteis gunneri</i> (Sars, 1835)	0.2	0.6	18.2	1	4.4
<i>Harmothoe spinosa</i> Kinberg, 1855	0.1	0.3	9.1	1	2.4
<i>Neosabellides elongatus</i> (Ehlers, 1912)	0.1	0.3	9.1	1	4.2
<i>Amphitrite kerguelensis</i> McIntosh, 1876	0.1	0.3	9.1	1	2.0
<i>Perkinsiana antarctica</i> (Kinberg, 1867)	0.1	0.3	9.1	1	2.4
Group “F”, assemblage “<i>Apistobranthus</i>”					
<i>Leitoscoloplos kerguelensis</i> (McIntosh, 1885)	39.5	29.1	100.0	102	35.3
<i>Ophelina syringopyge</i> (Ehlers, 1901)	38.8	28.5	80.0	183	51.5
<i>Tauberia gracilis</i> (Tauber, 1879)	21.6	15.9	50.0	176	23.8
<i>Apistobranthus</i> sp.	13.7	10.1	65.0	102	78.3
<i>Rhodine intermedia</i> Arwidsson, 1911	10.0	7.4	75.0	75	21.3
<i>Sphaerodoropsis</i> sp.	2.6	1.9	35.0	44	68.4
<i>Aglaophamus ornatus</i> Hartman, 1967	2.5	1.9	80.0	7	23.5
<i>Tharyx cincinnatus</i> (Ehlers, 1908)	2.3	1.7	30.0	25	8.0
<i>Brada villosa</i> (Rathke, 1843)	0.7	0.5	35.0	6	35.9
<i>Capitella capitata</i> (Fabricius, 1780)	0.6	0.4	10.0	10	9.8
<i>Barrukia cristata</i> (Willey, 1902)	0.6	0.4	35.0	2	13.3
<i>Aricidea (Allia) antarctica</i> Hartmann-Schröder and Rosenfeldt, 1988	0.4	0.3	15.0	6	4.6
<i>Nicomachine</i> gen. sp.	0.4	0.3	20.0	4	40.0
<i>Lumbrineris magalhaensis</i> (Kinberg, 1865)	0.3	0.2	15.0	2	5.6
<i>Travisia kerguelensis</i> McIntosh, 1885	0.3	0.2	5.0	5	16.1
<i>Amphicteis gunneri</i> (Sars, 1835)	0.2	0.1	10.0	3	8.9
<i>Cirrophorus brevicirratu</i> s Strelzov, 1973	0.2	0.1	10.0	2	0.9
<i>Exogone</i> sp.	0.1	0.1	10.0	1	3.0
<i>Lumbriclymenella robusta</i> Arwidsson, 1911	0.1	0.1	10.0	1	3.1
<i>Spiophanes tcherniai</i> Fauvel, 1950	0.1	0.1	10.0	1	2.9
<i>Amphitrite kerguelensis</i> McIntosh, 1876	0.1	0.1	10.0	1	4.0
<i>Lanicides bilobata</i> (Grube, 1877)	0.1	0.1	10.0	1	40.0

<i>Scoloplos marginatus</i> (Ehlers, 1897)	0.1	0.1	10.0	1	2.7
<i>Exogone heterosetosa</i> McIntosh, 1885	0.1	0.1	10.0	1	5.1
<i>Ophryotrocha notialis</i> (Ehlers, 1908)	0.1	0.1	5.0	2	15.4
<i>Neanthes kerguelensis</i> (McIntosh, 1885)	0.1	*	5.0	1	2.0
<i>Syllides articulatus</i> Ehlers, 1897	0.1	*	5.0	1	7.7
<i>Chaetozone</i> sp.	0.1	*	5.0	1	1.0
<i>Praxillella kerguelensis</i> (McIntosh, 1885)	0.1	*	5.0	1	20.0
<i>Exogone heterosetoides australis</i> Hartmann-Schröder and Rosenfeldt 1988	0.1	*	5.0	1	1.4
<i>Ampharetinae</i> gen. sp.	0.1	*	5.0	1	33.3
<i>Scalibregma inflatum</i> Rathke, 1843	0.1	*	5.0	1	33.3
<i>Sphaerodoropsis arctowskyensis</i> Hartmann-Schröder and Rosenfeldt, 1988	0.1	*	5.0	1	2.4
<i>Asychis amphiglypta</i> (Ehlers, 1897)	0.1	*	5.0	1	0.5
<i>Pista patriciae</i> Hartmann-Schröder and Rosenfeldt 1989	0.1	*	5.0	1	1.8
Group “G”, assemblage “Rhodine intermedia”					
<i>Rhodine intermedia</i> Arwidsson, 1911	165.0	78.1	100.0	210	52.8
<i>Leitoscoloplos kerguelensis</i> (McIntosh, 1885)	28.7	13.6	100.0	66	3.8
<i>Amphicteis gunneri</i> (Sars, 1835)	9.3	4.4	100.0	14	62.2
<i>Capitella capitata</i> (Fabricius, 1780)	3.3	1.6	100.0	5	8.1
<i>Barrukia cristata</i> (Willey, 1902)	2.3	1.1	66.7	4	8.4
<i>Aglaophamus ornatus</i> Hartman, 1967	1.3	0.6	100.0	2	1.8
<i>Brada villosa</i> (Rathke, 1843)	0.7	0.3	33.3	2	5.1
<i>Ophelina syringopyge</i> (Ehlers, 1901)	0.3	0.2	33.3	1	0.1
<i>Spiophanes tcherniai</i> Fauvel, 1950	0.3	0.2	33.3	1	1.4
Group “H”, assemblage “Tauberia gracilis”					
<i>Tauberia gracilis</i> (Tauber, 1879)	45.6	22.5	100.0	146	60.1
<i>Leitoscoloplos kerguelensis</i> (McIntosh, 1885)	37.5	18.4	100.0	135	40.1
<i>Aricidea (Acesta) strelzovi</i> Hartmann-Schröder and Rosenfeldt 1990	15.8	7.8	100.0	66	99.7
<i>Ophelina syringopyge</i> (Ehlers, 1901)	15.6	7.7	91.7	37	24.9
<i>Cirrophorus brevicirratu</i> s Strelzov, 1973	12.0	5.9	79.2	58	84.8
<i>Asychis amphiglypta</i> (Ehlers, 1897)	7.4	3.7	75.0	33	82.5
<i>Rhodine intermedia</i> Arwidsson, 1911	7.5	3.7	100.0	24	19.1
<i>Aglaophamus ornatus</i> Hartman, 1967	4.5	2.2	100.0	10	50.2
<i>Aricidea (Allia) antarctica</i> Hartmann-Schröder and Rosenfeldt, 1988	3.9	1.9	70.8	23	53.1
<i>Maldane sarsi antarctica</i> Arwidsson, 1911	3.6	1.8	45.8	25	33.9
<i>Myriochele wilsoni</i> (Blake, 1984)	3.0	1.5	45.8	25	88.8
<i>Exogone heterosetoides australis</i> Hartmann-Schröder and Rosenfeldt, 1988	2.5	1.3	54.2	19	84.7
<i>Chaetozone</i> sp.	2.5	1.2	70.8	14	62.5
<i>Apistobranchus</i> sp.	2.3	1.1	33.3	20	16.0
<i>Amphitritinae</i> gen. sp.	2.3	1.1	29.2	31	96.6
<i>Lumbriclymenella robusta</i> Arwidsson, 1911	2.3	1.1	62.5	18	84.4
<i>Exogone</i> sp.	2.1	1.0	37.5	10	76.1

<i>Tharyx cincinnatus</i> (Ehlers, 1908)	2.1	1.0	41.7	17	8.9
<i>Genetyllis polyphylla</i> (Ehlers, 1897)	1.9	0.9	41.7	21	97.8
<i>Amphitrite kerguelensis</i> McIntosh, 1876	1.8	0.9	87.5	5	88.0
<i>Barrukia cristata</i> (Willey, 1902)	1.8	0.9	62.5	9	53.0
<i>Capitella capitata</i> (Fabricius, 1780)	1.8	0.9	33.3	26	35.0
<i>Spiophanes tcherniai</i> Fauvel, 1950	1.7	0.8	54.2	6	58.6
<i>Neanthes kerguelensis</i> (McIntosh, 1885)	1.7	0.8	58.3	10	80.0
<i>Orbinia (Phylo) minima</i> Hartmann-Schröder and Rosenfeldt, 1990	1.5	0.7	50.0	8	94.6
<i>Harmothoe spinosa</i> Kinberg, 1855	1.4	0.7	58.3	9	78.6
<i>Perkinsiana antarctica</i> (Kinberg, 1867)	1.0	0.5	29.2	9	57.1
<i>Lumbrineris magalhaensis</i> (Kinberg, 1865)	0.8	0.4	58.3	4	22.2
<i>Euchone pallida</i> Ehlers, 1908	0.8	0.4	37.5	3	57.6
<i>Trichobranchus glacialis antarcticus</i> Hesse, 1917	0.8	0.4	29.2	5	100.0
<i>Sphaerodoropsis</i> sp.	0.8	0.4	29.2	9	23.7
<i>Exogone obtusa</i> Hartmann-Schröder and Rosenfeldt, 1988	0.7	0.3	16.7	9	73.9
<i>Sphaerodoropsis arctowskyensis</i> Hartmann-Schröder and Rosenfeldt, 1988	0.7	0.3	12.5	11	38.1
<i>Thelepus cincinnatus</i> (Fabricius, 1780)	0.7	0.3	25.0	6	80.0
<i>Anaitides patagonica</i> (Kinberg, 1866)	0.6	0.3	37.5	3	93.8
<i>Exogone heterosetosa</i> McIntosh, 1885	0.6	0.3	29.2	5	35.9
<i>Pista patriciae</i> Hartmann-Schröder and Rosenfeldt, 1989	0.5	0.3	25.0	6	21.8
<i>Sphaerodoropsis parva</i> (Ehlers, 1913)	0.5	0.3	12.5	6	35.1
<i>Ophelina cylindricaudata</i> (Hansen, 1878)	0.5	0.3	20.8	6	11.6
<i>Austroalaenilla setobarba</i> (Monro, 1930)	0.5	0.2	33.3	3	57.1
<i>Syllides articulatus</i> Ehlers, 1897	0.5	0.2	33.3	3	92.3
<i>Nicomachine</i> gen. sp.	0.5	0.2	4.2	12.	60.0
<i>Sphaerosyllis hirsuta</i> Ehlers 1897	0.5	0.2	20.8	6	85.7
<i>Phyllocomus crocea</i> Grube, 1877	0.5	0.2	33.3	3	100.0
<i>Neosabellides elongatus</i> (Ehlers, 1912)	0.5	0.2	33.3	3	45.8
<i>Oriopsis</i> sp.	0.4	0.2	29.2	2	90.9
<i>Notalia picta</i> (Kinberg, 1866)	0.3	0.2	29.2	2	88.9
<i>Brania rhopalophora</i> (Ehlers, 1897)	0.3	0.2	16.7	3	32.0
<i>Ampharete kerguelensis</i> McIntosh, 1885	0.3	0.1	20.8	3	100.0
<i>Ophryotrocha notialis</i> (Ehlers, 1908)	0.3	0.1	20.8	2	53.8
<i>Thelepidetes koehleri</i> Gravier, 1911	0.3	0.1	12.5	4	100.0
<i>Streblosoma</i> sp.	0.3	0.1	12.5	5	87.5
<i>Octobranthus sexlobatus</i> Hartmann-Schröder and Rosenfeldt, 1989	0.3	0.1	8.3	5	100.0
<i>Amphicteis gunneri</i> (Sars, 1835)	0.3	0.1	16.7	3	13.3
<i>Terebellides stroemi kerguelensis</i> McIntosh, 1885	0.3	0.1	16.7	2	50.0
<i>Autolytus charcoti</i> Gravier, 1906	0.3	0.1	16.7	3	85.7
<i>Ephesiella</i> sp. 1	0.2	0.1	16.7	2	83.3
<i>Artacama proboscidea</i> Malmgren, 1866	0.2	0.1	16.7	1	100.0
<i>Flabelligera mundata</i> Gravier, 1906	0.2	0.1	8.3	3	100.0

<i>Orbinia</i> sp.	0.2	0.1	12.5	2	17.4
<i>Pygospio</i> <i>dubia</i> (Monro, 1930)	0.1	0.1	4.2	3	100.0
<i>Lanicides bilobata</i> (Grube, 1877)	0.1	0.1	12.5	1	60.0
<i>Glycera kerguelensis</i> McIntosh, 1885	0.1	0.1	8.3	2	60.0
<i>Ephesiella</i> sp. 2	0.1	*	4.2	2	100.0
<i>Ceratonereis</i> (<i>Compositia</i>) <i>antarctica</i> Hartmann-Schröder and Rosenfeldt, 1988	0.1	*	8.3	1	100.0
<i>Ampharetinae</i> gen. sp.	0.1	8	8.3	1	100.0
<i>Pherusa kerguelarum</i> (Grube, 1877)	0.1	*	8.3	1	100.0
<i>Laonice weddellia</i> Hartman, 1978	0.1	*	8.3	1	100.0
<i>Austrophyllum charcoti</i> (Gravier, 1911)	*	*	4.2	1	100.0
<i>Scoloplos</i> (<i>Leodamas</i>) <i>marginatus</i> (Ehlers, 1897)	*	*	4.2	1	1.4
<i>Scalibregma inflatum</i> Rathke, 1843	*	*	4.2	1	33.3
<i>Capitella perarmata</i> (Fabricius, 1780)	*	*	4.2	1	100.0
<i>Eucranta mollis</i> (McIntosh, 1876)	*	*	4.2	1	100.0
<i>Flabelligera</i> sp. 2	*	*	4.2	1	100.0
<i>Tharyx fusiformis</i> Monro, 1939	*	*	4.2	1	100.0
<i>Notomastus latericeus</i> Sars, 1851	*	*	4.2	1	100.0
<i>Nicomache</i> sp.	*	*	4.2	1	33.3
<i>Travisia kerguelensis</i> McIntosh, 1885	*	*	4.2	1	3.2
<i>Praxillella kerguelensis</i> (McIntosh, 1885)	*	*	4.2	1	20.0
<i>Terebella ehlersi</i> Gravier, 1906	*	*	4.2	1	33.3
Group "I", assemblage "Tharyx cincinnatus"					
<i>Tharyx cincinnatus</i> (Ehlers, 1908)	30.6	23.0	85.7	74	76.2
<i>Tauberia gracilis</i> (Tauber, 1879)	20.4	15.4	64.3	164	15.7
<i>Leitoscoloplos kerguelensis</i> (McIntosh, 1885)	16.4	12.3	92.9	66	10.2
<i>Ophelina syringopyge</i> (Ehlers, 1901)	13.1	9.9	64.3	73	12.2
<i>Maldane sarsi antarctica</i> Arwidsson, 1911	10.5	7.9	92.9	42	57.2
<i>Ophelina cylindricaudata</i> (Hansen, 1878)	4.7	3.5	50.0	35	58.9
<i>Lumbrineris magalhaensis</i> (Kinberg, 1865)	3.8	2.8	92.9	9	58.9
<i>Aricidea</i> (<i>Allia</i>) <i>antarctica</i> Hartmann-Schröder and Rosenfeldt, 1988	3.0	2.3	42.9	13	24.0
<i>Asychis amphiglypta</i> (Ehlers, 1897)	2.6	2.0	35.7	19	17.1
<i>Chaetozone</i> sp.	2.5	1.9	21.4	19	36.5
<i>Pista patriciae</i> Hartmann-Schröder and Rosenfeldt, 1989	2.2	1.7	50.0	8	56.4
<i>Sphaerodoropsis arctowskyensis</i> Hartmann-Schröder and Rosenfeldt, 1988	1.8	1.3	50.0	6	59.5
<i>Sphaerodoropsis parva</i> (Ehlers, 1913)	1.7	1.3	21.4	19	64.9
<i>Brada villosa</i> (Rathke, 1843)	1.6	1.2	50.0	9	59.0
<i>Rhodine intermedia</i> Arwidsson, 1911	1.5	1.1	71.4	5	2.2
<i>Barrukia cristata</i> (Willey, 1902)	1.5	1.1	50.0	8	25.3
<i>Aglaophamus ornatus</i> Hartman, 1967	1.4	1.0	64.3	4	8.8
<i>Perkinsiana antarctica</i> (Kinberg, 1867)	1.2	0.9	35.7	10	40.5
<i>Exogone heterosetosa</i> McIntosh, 1885	1.2	0.9	35.7	7	43.6
<i>Cirrophorus brevicirratu</i> s Strelzov, 1973	1.1	0.8	28.6	6	4.4
<i>Euchone pallida</i> Ehlers, 1908	1.0	0.8	57.1	4	42.4

<i>Exogone</i> sp.	1.0	0.8	28.6	5	20.9
<i>Neosabellides elongatus</i> (Ehlers, 1912)	0.9	0.6	28.6	7	50.0
<i>Exogone heterosetoides australis</i> Hartmann-Schröder and Rosenfeldt, 1988	0.7	0.5	28.6	4	13.9
<i>Austroalaenilla setobarba</i> (Monro, 1930)	0.6	0.5	35.7	4	42.9
<i>Myriochele wilsoni</i> (Blake, 1984)	0.6	0.5	35.7	3	11.3
<i>Harmothoe spinosa</i> Kinberg, 1855	0.6	0.4	42.9	2	19.0
<i>Lumbriclymenella robusta</i> Arwidsson, 1911	0.6	0.4	14.3	5	12.5
<i>Exogone obtusa</i> Hartmann-Schröder and Rosenfeldt, 1988	0.4	0.3	28.6	3	26.1
<i>Terebellides stroemi kerguelensis</i> McIntosh, 1885	0.4	0.3	35.7	2	50.0
<i>Amphicteis gunneri</i> (Sars, 1835)	0.4	0.3	28.6	2	11.1
<i>Thelepus cincinnatus</i> (Fabricius, 1780)	0.3	0.2	21.4	2	20.0
<i>Amphitrite kerguelensis</i> McIntosh, 1876	0.2	0.2	14.3	2	6.0
<i>Polynoidae</i> gen. sp. X	0.2	0.2	14.3	2	100.0
<i>Praxillella kerguelensis</i> (McIntosh, 1885)	0.2	0.2	14.3	2	60.0
<i>Apistobranchnus</i> sp.	0.1	0.1	14.3	1	0.6
<i>Orbinia (Phylo) minima</i> Hartmann-Schröder and Rosenfeldt 1990	0.1	0.1	7.1	2	5.4
<i>Amphitritinae</i> gen. sp.	0.1	0.1	14.3	1	3.4
<i>Sphaerosyllis hirsuta</i> Ehlers 1897	0.1	0.1	7.1	2	14.3
<i>Glycera kerguelensis</i> McIntosh, 1885	0.1	0.1	14.3	1	40.0
<i>Brania rhopalophora</i> (Ehlers, 1897)	0.1	0.1	14.3	1	8.0
<i>Terebella ehlersi</i> Gravier, 1906	0.1	0.1	7.1	2	66.7
<i>Nicomache</i> sp.	0.1	0.1	14.3	1	66.7
<i>Autolytus charcoti</i> Gravier, 1906	0.1	0.1	7.1	1	14.3
<i>Flabelligera</i> sp. 1	0.1	0.1	7.1	1	100.0
<i>Anaitides patagonica</i> (Kinberg, 1866)	0.1	0.1	7.1	1	6.3
<i>Parougia furcata</i> ? (Hartman, 1953)	0.1	0.1	7.1	1	100.0
<i>Capitella capitata</i> (Fabricius, 1780)	0.1	0.1	7.1	1	0.8
<i>Hauchiella tribullata</i> (McIntosh, 1869)	0.1	0.1	7.1	1	100.0
<i>Aricidea (Acesta) strelzovi</i> Hartmann-Schröder and Rosenfeldt, 1990	0.1	0.1	7.1	1	0.3
<i>Streblosoma</i> sp.	0.1	0.1	7.1	1	12.5
<i>Scalibregma inflatum</i> Rathke, 1843	0.1	0.1	7.1	1	33.3
<i>Polynoidae</i> gen. sp. Y	0.1	0.1	7.1	1	100.0
<i>Oriopsis</i> sp.	0.1	0.1	7.1	1	9.1
<i>Neanthes kerguelensis</i> (McIntosh, 1885)	0.1	0.1	7.1	1	2.0
<i>Polycirrus kerguelensis</i> (McIntosh, 1885)	0.1	0.1	7.1	1	33.3

* less than 0.1.

Assemblage “E” (“*Ophelina cylindricaudata*”) in the western, inner part of Ezcurra Inlet, at depths of 55 to 150 m, consists of 16 species of Polychaeta. The dominant group consisted of common eurytopic species: *Leitoscoloplos kerguelensis*, *Ophelina syringopyge* and *Aglaophamus ornatus*, as well as of species more characteristic of that assemblage: *Tharyx cincinnatus*, *Aricidea antarctica*

and *Ophelina cylindricaudata*. The latter with an almost 10% domination in the assemblage, also displays relatively high values of association degree (Table 1). Species richness is low in this assemblage. It should be considered nonspecific. There are no characteristic species there and the main dominants are eurytopic species. The relatively high abundance of *Tharyx cincinnatus* and *Ophelina cylindricaudata* indicates that the polychaete fauna of these areas constitutes a de-generated form of assemblage “I”, also from Ezcurra Inlet.

Assemblage “F” (“*Apistobranchnus*”) occurs in the shallowest stations (10–40 m) of the middle areas of Ezcurra Inlet and several stations from the outflow regions of the fjord. As much as 35 species of Polychaeta were encountered there (Table 1). Besides eurytopic species, *Leitoscoloplos kerguelensis* and *Ophelina syringopyge*, the dominant and constant group consisted of *Tauberia gracilis*, *Apistobranchnus* sp. and *Rhodine intermedia*, which formed together 91% of the whole assemblage. First of all *Apistobranchnus* sp., but also the less abundant *Sphaerodoropsis* sp. belong to the highly associated species with this group of stations. The vast majority of the assemblage is formed by accessory species. Due to the presence of abundant, constant and much associated *Apistobranchnus* sp. assemblage “F” from the shallower areas of Ezcurra Inlet should be considered fairly specific. Characteristic species are absent.

Only three stations, located at the entrance to Herve Cove (Fig. 2), formed cluster “G”, which is inhabited by a specific polychaete **assemblage (“*Rhodine intermedia*”)** consisted of a low number of species (9) dominated by the mass occurrence of *Rhodine intermedia*, (almost 80% of the assemblage) (Table 1). Strong domination and conspicuous, very high polychaete density were its most significant features. The second in dominance was *Leitoscoloplos kerguelensis*. The subdominants were: *Amphicteis gunneri*, *Capitella capitata* and *Barrukia cristata*. *Amphicteis gunneri* together with *Rhodine intermedia* showed a relatively high degree of association with the discussed station group (Table 1). The assemblage “G” may be considered as fairly specific.

Polychaetes from the central basin of the bay (**assemblage “H”, “*Tauberia gracilis*”**) form the richest of the distinguished assemblages. Within the dominant group, besides such eurytopic species as *Leitoscoloplos kerguelensis* and *Ophelina syringopyge*, constant elements, namely: *Tauberia gracilis*, *Aricidea strelzovi* and *Cirrophorus brevicirratu*s were also noticeable while among subdominants there were *Asychis amphiglypta* and *Aricidea antarctica*, which, as species of a high degree of association with the discussed station cluster, constitute the most typical, characteristic components. Many constant elements of the assemblage, with a similarly high degree of association, are recruited also from influents and accessory species (*Myriochele wilsoni*, *Lumbriclymenella robusta*, *Exogene heterosetoides australis* and many others) (Table 1). Assemblage “H” of the central area of the bay, 35 to 150 m in depth, is a most specific one. A total of 81 polychaete species was recorded there, of which 18 were observed exclusively in this station group. The degree of association of the next 24 species was higher than 75%, while that of

the subsequent 16 was higher than or equal to 50%. This was the richest and most diverse of all distinguished assemblages.

Stations of cluster "I" (assemblage "*Tharyx cincinnatus*") were located along the whole length of Ezcurra Inlet, in a depth range of 45 to 165 m. The most characteristic species in terms of dominance (above 30%), being absolutely constant and highly associated (DA index – about 76%), was *Tharyx cincinnatus*. Other similarly distinguishable species were such subdominants as *Ophelina cylindricaudata* and *Lumbrineris magalhaensis*. Such subdominants as *Chaetozone* sp., *Aricidea antarctica* and *Tauberia gracilis* are also worth mentioning as important but only in terms of density. Eurytopic *Leitoscoloplos kerguelensis* and *Ophelina syrnopyge* also belonged to the dominant group. The polychaete assemblage was formed by 57 species, of which only 5, captured as single individuals, were noticed exclusively in this station group (Table 1). Assemblage "I" may be recognized as fairly specific due to the presence of *Tharyx cincinnatus*, which was the first dominant occurring in considerable abundance with a high, above 75%, association degree. Other dominant species with considerable association degree in the discussed group of stations were *Ophelina cylindricaudata* and *Lumbrineris magalhaensis*.

Polychaeta assemblages versus sediment types.—The distribution of points in Fig. 4, which represent sediment samples, reveals distinct tendencies. The points are marked with symbols of polychaete assemblages that were distinguished in the process of classification (dendrogram, Fig. 6). The points form an elongated cloud along the gradient congruent with directionally changing sediment type. Its beginning consists of stations of sandy bottom, inhabited by assemblages "B" and "C". Further to the right, after the discernable discontinuity, there are stations of the bottoms formed of silty sand, silty clay sand and sandy clay silt, inhabited by assemblages "H", "G", "D" and "A". Between them, mosaicwise and irregularly, stations of assemblage "F" are situated. Next to them are station clusters "I" and "E" with mostly clay silty bottom. Thus, an ordination of the distinguished station clusters (dendrogram, Fig. 6) along the gradient: sand-silty sand-silt towards clay silt, is observed. Such an arrangement is disturbed by less regularly distributed stations of cluster "F". The above presented facts are congruent and justify the assumed classification of stations on the basis of polychaete fauna distribution (dendrogram, Fig. 6). They also indicate that the division is connected somehow with the character of sediments.

More clear relations between sediment type and distinguished station clusters inhabited by specific polychaete assemblages, may be observed in another diagram (Fig. 5). Tendencies in the distribution of points in the system of coordinates represented by the sorting coefficient (So) and phi (ϕ) units may be described as follows: stations of clusters "B" and "C" of the upper sublittoral of the central bay basin are sandy bottom ones. Stations of cluster "H" have bottoms covered with very fine sand and coarse silt. In this cluster fairly high fluctuations of sorting coefficient (So), ranging from 1.5 to 2.5, are observed. Shallow water station clusters

“A” and “D” from the Herve Cove lagoon, with bottoms covered with coarse-, medium- and fine silt, are located between cluster “H” on one side, and clusters “I” and “E” on the other side. Stations of group “E” and “I”, with bottoms of fine- and very fine silt, constitute a single distinct cluster. The situation of cluster “F” is interesting, in terms of index ϕ similar to the distribution of cluster “H” bottom sediments from fine sand to medium silt. Note however, that sediments in cluster “F” are weakly sorted, which is conspicuously different from all the other stations.

The arrangement of sediment samples in the coordinate system of the two first main components is presented in Fig. 7, where, in addition to points of 47 sediment samples, vectors of variables are marked to present mutual dependencies. A strong connection with the vector describing the contents of fine fractions in the sediments is indicated in station clusters “I” and “E”. On the opposite extreme stations “B” and “C” indicate a strong correlation with the vector of sand content. A fairly significant correlation is displayed with the same vector by most stations of assemblage “H”. Stations cluster “F” correlate first of all with the vectors of a high degree of sediment heterogeneity (amount of skeletal fraction, sorting coefficient). Finally, note that the stations located close to the coordinate system’s center do not correlate with any vector. These are mainly stations of cluster “D” from Herve Cove, located near the glacier stream. Such a lack of clear connections (sediments are weakly defined) is also observed in a part of the deeper (100–150m) stations of cluster “H” of the central bay area.

The arrangement of the nine distinguished polychaete assemblages in relation to the analysed bottom parameters is presented in Fig. 8. Arithmetic means of variable values of each assemblage were adopted (Table 2). Information concerning biomass originates from the unpublished data of the present author and partly from data applied in studies on zoobenthos in Admiralty Bay (Jażdżewski *et al.* 1986, Jażdżewski *et al.* 1991, Siciński *et al.* 1996). The organic content in the sediment certainly belongs to the most important parameters in the benthic ecology. However, there are no data of that kind in the existing literature on Admiralty Bay. Instead of this the zoobenthos biomass as a function of organic content was here adopted. Another aim of the presented analysis is detecting relations between the distinguished polychaete assemblages and averaged values of factors. Bottom slope (Table 2) in the case of assemblages “A”, “D” and “G” could be calculated only in a very approximate manner since there is no detailed map of Herve Cove, the lagoon in which the above described assemblages were detected.

Cluster “H” of the deeper (46–165 m) central basin and “F” from the mean depths (10–70 m) of Ezcurra Inlet (Fig. 8) is related to several factors such as the presence of stones, considerable bottom slope, high values of zoobenthos biomass, considerable content of skeleton fraction in sediment and high values of sorting coefficient (sediments are poorly sorted, extremely in the case of assemblage “F”). Taking into account the bottom character, cluster “H” is particularly strongly related to the considerable bottom slope and presence of dropstones. On the other

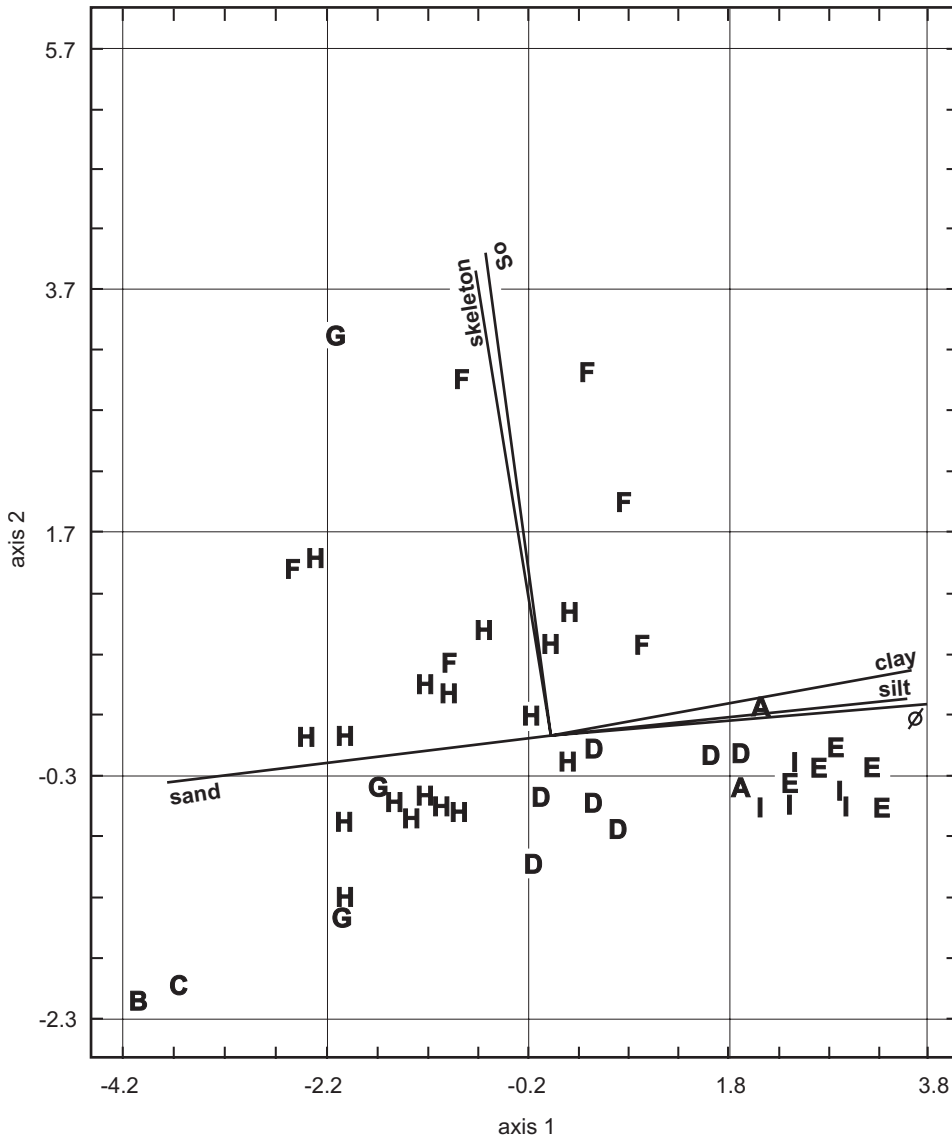


Fig. 7. Ordination of 47 sediment samples on the two first principal components on the basis of 6 sediment features (biplot, explanations in text).

hand, cluster “F” correlates more strongly with the content of skeleton fraction and poorly sorted bottom deposits. Smaller stones that are typical of cluster “F” may originate from the high and steep rubble shores (“rubble talus” by Marsz, 1983) of Ezcurra Inlet and Dufayel Island. A moderate correlation with the above discussed vectors is also displayed by assemblage “G”. Note that this assemblage is the only one that shows a certain, moderate, connection with as many as six factors (Fig. 8).

Table 2
Mean values of some bottom character coefficients and the mean zoobenthos wet weight (g/0.1m²) in 9 polychaete assemblages (stones content is showed here in the scale range from 0 to 4).

Assem- -blage	Sediment						Zoobenthos wet weight (+/- SD)	Slope	Stones
	skeleton %	sand	% silt	clay	ϕ	So			
A	6	20	48	32	6.2	2.0	8 (5) n=4	2	0
B	1	90	7	3	1.5	1.4	9 n=1	10	0
C	2	85	12	3	2.0	1.4	180 (81) n=6	10	2
D	4	34	45	21	4.9	2.0	153 (276) n=7	20	1
E	9	14	52	34	6.6	1.7	83 (49) n=8	2	0
F	38	44	34	22	4.6	2.6	720 (650) n=12	30	3
G	11	62	24	14	3.3	2.6	880 (117) n=3	15	2
H	20	54	31	15	3.9	2.0	1150 (1066) n=15	50	4
I	10	12	50	38	6.9	1.7	910 (780) n=5	25	2

A very unequivocal position in terms of the factors analysed here is occupied by assemblages “B” and “C”, which are closely related to flat, sandy bottoms, where sediment is very well sorted. This is indicated by a strong positive correlation with the vector determining the content of sand and strong negative correlation with the other vectors.

A strong positive correlation with vectors describing the participation of fine grain fraction in sediment (silt and clay) is showed by assemblage “I” as well as by assemblage “E” and “A”. The latter two, however, in contrast to assemblage “I”, display a decisive negative correlation with the vectors describing the degree of sorting of the sediment (they are well sorted ones), content of skeleton fraction, bottom slope and zoobenthos biomass.

The location of points representing shallow water assemblages “A”, “D” and “G” seems interesting from view point of the present discussion. They are located in direct vicinity, in a very small area, only about a dozen hectares, of Herve Cove (Fig. 2). This indicates to the huge diversity of environmental conditions in the bottom of the shallowest sublittoral of Admiralty Bay. These three polychaete assemblages, together with shallow water assemblage “B” from the central basin of the bay, are poorest in terms of species richness. The most conspicuous example is the poverty of polychaetes in eastern Herve Cove (assemblage “A”). It may be assumed with considerable confidence that in the partially isolated, glacier-bordered Herve Cove lagoon factors other than the character of sediments play the most important role in shaping the image of bottom fauna. The freshwater inflow and abundance of mineral suspended matter carried by glacier streams should be mentioned as the most important factors in regard to station group “D” and oxygen deficit in regard to station group “A”.

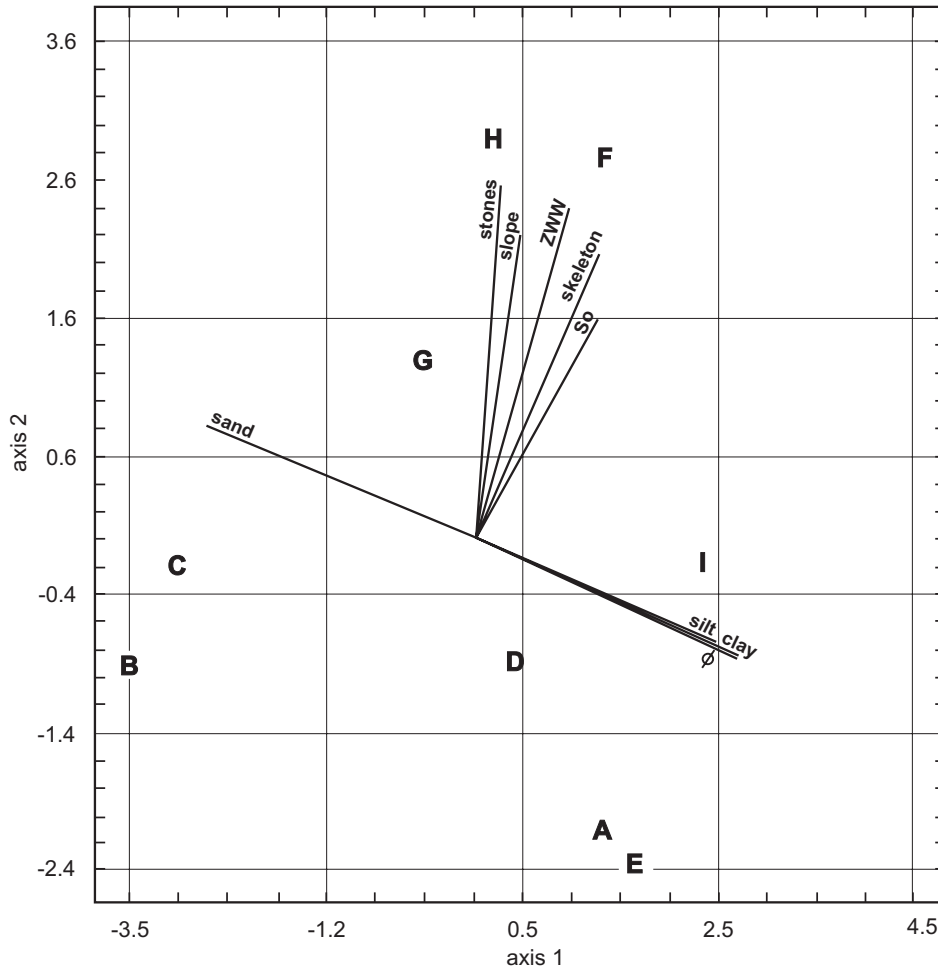


Fig.8. Ordination of 9 distinguished polychaete assemblages on the two first principal components on the basis of 9 bottom features (explanations in text).

Discussion

The author has limited the discussion to the Antarctic bibliography.

An attempt to compare assemblages of Antarctic polychaetes.—The existing literature on the subject does not supply much information. Due to diverse sampling techniques and various methods of data analysis and presentation, existing publications diminish the precision of comparisons. Another difficulty is the insufficient knowledge of the taxonomy of Antarctic Polychaeta. It is possible that numerous species that are variously named in different studies are actually the same species. Another problem is lack of raw data in ecological or quasi-ecological studies. Despite this it must be stressed that there are some conspicuous similari-

ties of the presently distinguished assemblages of polychaetes to certain other assemblages that were previously recorded in various Antarctic regions.

When comparing the obtained results with existing literature data, Richardson and Hedgpeth's (1977) study from Arthur Harbor (Anvers Island) deserves particular attention. This is especially true concerning the situation revealed in Ezcurra Inlet. Both water basins possess identical lists of dominant species. The dominants are *Leitoscoloplos kerguelensis*, *Ophelina syringopyge*, *Rhodine intermedia*, *Tharyx cincinnatus*, *Tauberia gracilis* and *Apistobranchnus* sp. (Richardson and Hedgpeth 1977 report the species *Apistobranchnus typicus* in their study). Similarities between Arthur Harbour and Ezcurra Inlet assemblages are clearly visible. Certain assemblages of Arthur Harbor were dominated by *Apistobranchnus*, as is the case in the cluster "F" from Ezcurra Inlet, while in another assemblage of Arthur Harbor *Tharyx cincinnatus* occupies the first position, analogously to clusters "I" and "E" presented in this study. From the data contained in Table 1 of Richardson and Hedgpeth (1977) it follows that two station clusters from Arthur Harbor have different sediment types. In one, with *Apistobranchnus typicus* as the leading form, sandy silt dominates, while in the other, with *Tharyx cincinnatus*, silt or clay silt. Also note that the latter were observed at greater depths (50–75 m), in local depressions (overdeep areas) of Arthur Harbor, hence in places particularly susceptible to intensive cumulation of fine grain sediment fractions, and thus well sorted towards the silt and clay fraction. A similar situation occurs in the case of clusters "E" and "I" from Ezcurra Inlet. In Arthur Harbor, the polychaete fauna with *Apistobranchnus typicus* domination occurs at shallower depths (15–43 m) and, which is worth stressing, on bottom slopes, and not in its depressions. An astonishing analogy to cluster "F" from Ezcurra Inlet, and thus in stations recorded mainly on the trough slopes, is here observed. Note that in Arthur Harbor there are no assemblages similar to those that were recorded in the sandy bottom of central Admiralty Bay (assemblages "B", "C" and "H"). From the data presented by Richardson and Hedgpeth (1977) it follows that such a type of sediment does not occur at all in Arthur Harbor. Also earlier publications from Arthur Harbor (Lowry 1975) indicated its significant faunistic similarity to Ezcurra Inlet polychaetes. A comparison of faunas of these two basins, presented in the studies by Jazdzewski *et al.* (1986), Jazdzewski and Siciński (1993) and Błazewicz and Jazdzewski (1995), was carried out on the basis of analyse of the fauna of a fairly limited part of Ezcurra Inlet, i.e. from transect III (see Siciński 1986). As a result, they represent the location of cluster "F", which was presently distinguished on the basis of Polychaeta distribution. The above cited studies on the bottom fauna of this part of Ezcurra Inlet indicate that the specificity of their assemblages concerns not only polychaetes but also other groups of benthic invertebrates and zoobenthos as a whole. It seems that the bottom fauna of Arthur Harbor is the most similar just to that cluster of Ezcurra Inlet. A significant exception is "assemblage E" of Richardson and Hedgpeth (1977) from the shallows of Hero Inlet, dominated by *Rhodine lovenii* (= *Rhodine intermedia* according to the suggestion of Hartmann-Schröder and Rosenfeldt, 1989). This feature makes it resemble assemblage "G" from inner slopes

of a moraine separating Herve Cove from Ezcurra Inlet. The abundance of sea anemone *Edwardsia* sp. and a mollusc *Yoldia eightsi* in Hero Inlet and in the outlet area of Herve Cove (Siciński *et al.* 1996) still more strongly underlines the faunistic similarity of these both shallowest parts of Arthur Harbor and of Ezcurra Inlet.

A satisfactory comparison of the polychaete assemblages of Admiralty Bay with the rich polychaete fauna inhabiting the bottom of Chile Bay (Greenwich Island), which was investigated by Gallardo *et al.* (1988) is difficult. This is due to the fact that on the one hand the presence of such dominants as *Maldane sarsi antarctica* or *Asychis amphiglypta* in Chile Bay resembles the assemblage "H" from the central basin of Admiralty Bay, while on the other hand, the presence of such dominants as *Tharyx cincinnatus*, *Rhodine intermedia* and *Lumbrineris magalhaensis* resembles a related assemblage "I" from Ezcurra Inlet. A comparison is also obstructed by the fact that the analysis of the Chile Bay fauna concerns all the material collected within a wide depth range, from 33 to 355 m.

From the data by Wägele and Brito (1990) it follows that in Martel Inlet, a northern branch of Admiralty Bay, a dominant of total zoobenthos was *Tharyx cincinnatus*, a leading species in this study, first of all in assemblage "I", but also "E" from Ezcurra Inlet.

The composition of the dominant species group from Terra Nova Bay (Gambi *et al.* 1997) is totally different from the relations observed in Admiralty Bay. Noteworthy however is a strong (27%) domination of *Tharyx cincinnatus* in polychaete fauna of Terra Nova Bay, similarly as in the assemblage "I" from Ezcurra Inlet.

There are some similarities between the polychaete fauna of Admiralty Bay and Morbihan Gulf (Kerguelen Islands). The latter was investigated by Duchêne (1984), who determined 69 polychaete species in the soft bottom between 18 and 80 m depths. The number of species common to both discussed areas is 31, which, considering the remarkable remoteness of the areas and their quite different localization seems to be a quite high number. Kerguelen Islands are located on the border of Antarctic and Subantarctic waters, within or at the edge of the Antarctic Convergence. The cited study lacks data on species abundance or at least species domination values. Hence, the presented comparisons are not precise. Despite this, a particular similarity of the presently distinguished assemblage "C" to the polychaete fauna of Morbihan Gulf can be noted. *Scoloplos marginatus* and *Travisia kerguelensis* constitute the most characteristic species of the above mentioned assemblage of shallow Admiralty Bay sublittoral, with a sandy bottom. In Morbihan Gulf both these species are numerous and common. Another interesting faunistic coincidence between Morbihan Gulf and Admiralty Bay has to be noted. Chardy *et al.* (1976) in Morbihan Gulf, in well sorted sand down to 20 m in depth, distinguished a taxocene dominated by *Microspio moorei* (of a density reaching 5000 specimens/m²), *Travisia kerguelensis* and *Scoloplos marginatus*. These three dominant species indicate that we are dealing with a taxocene that is almost identical with assemblages "B" and "C" from the sandy bottom of the shallowest sublittoral of the central Admiralty Bay basin. A comparison with Duchêne's

(1984) results indicates that 15 of 22 species recorded in assemblage "C" are species that are also present in Morbihan Gulf. Most of them, such as *Microspio moorei*, *Spiophanes tcherniai*, *Aglaophamus ornatus*, *Leitoscoloplos kerguelensis*, *Capitella capitata*, *Brania rhopalophora* and *Ophelina syringopyge*, for example, were dominant and constant elements of the assemblage "C".

A conspicuous similarity is revealed while comparing Hardy's data (1972) from Borge Bay (Signy Island, South Orkneys) with certain assemblages determined in Admiralty Bay. In the shallowest sublittoral, at depths from 6 to 10 m, on well sorted fine sand, *Microspio moorei* was, besides *Aglaophamus virginis*, the only common species among polychaetes that burrowed sediment. A similar situation was observed in assemblage "B", from shallow stations of the central Admiralty Bay area, on similar bottom deposits. The polychaete fauna of the other shallow (down to 35 m) areas covered with poorly sorted sediment dominated by sand and fairly large content of pebbles and stones in Borge Bay (Hardy, 1972) reveals a considerable similarity to the assemblage "C" from the central basin of Admiralty Bay. This indicates a very similar composition of dominants, which comprises such species as *Aglaophamus virginis* (it may actually be *Aglaophamus ornatus*), *Leitoscoloplos kerguelensis*, *Rhodine intermedia*, *Capitella capitata* and *Scoloplos marginatus*.

The above discussion indicates to a certain regularity. Part of distinguished assemblages of the shallower sublittoral of Admiralty Bay, such as assemblages "I", "E" and "F" from Ezcurra Inlet, shows clear similarities to the polychaete assemblages from Arthur Harbor (Anvers Island) described by Richardson and Hedgpeth (1977), to the faunas of Martel Inlet (Admiralty Bay, King George Island) (Wägele and Brito 1999) or of Terra Nova Bay (Ross Sea) (Gambi *et al.* 1997). Other assemblages, mainly "B" and "C", from the shallowest sublittoral of the central Admiralty Bay basin, clearly resemble the assemblages of sandy bottom of Morbihan Gulf (Kerguelen Island) and the polychaete fauna from Borge Bay (Signy Island). A certain similarities in the shallow water polychaete fauna from the central Admiralty Bay and sandy areas of King Edward Cove (South Georgia) (Platt, 1979) and Davis Sea (Averincev 1982) were pointed out by Siciński and Janowska (1993).

In the present classification of polychaete assemblages in the investigated part of Admiralty Bay attention was paid to the separateness of polychaete faunas of certain bottom areas of Ezcurra Inlet as compared with the central bay area. This fact was already reported. Siciński (1986), while analysing the distribution of Polychaeta in three selected transects discussed the peculiarity of the fauna of the shallowest sublittoral of the third transect, located in Ezcurra Inlet. In that bottom area a group of species dominated by *Rhodine intermedia*, *Tharyx cincinnatus*, *Apistobanchus* sp. and *Tauberia gracilis*, together with eurytopic *Leitoscoloplos kerguelensis* and *Ophelina syringopyge* was encountered. In general this resembles the presently distinguished assemblage "F". The peculiarity of the bottom fauna of shallow stations in Ezcurra Inlet (Section III) concerns not only poly-

chaetes, but also Crustacea–Peracarida (particularly Cumacea and Tanaidacea) and Oligochaeta, which was pointed out by Jażdżewski *et al.* (1986). The explanation of the causes for this separateness on the basis of the presence of fine sediment alone (Błażewicz and Jażdżewski 1995) seems to be a certain oversimplification. The results of the present study indicate that the problem of assemblage diversity in the area of Ezcurra Inlet is more complex. This is because in the area of the shallowest stations of the third transect (Section III in the studies by Jażdżewski *et al.* 1986 and Błażewicz and Jażdżewski 1995) we have to do with a sediment type of sorting coefficient that is the lowest in the whole study area (deposits are very poorly sorted), and which, in addition, are characterized by a high content of skeletal fraction. Very high density values of *Apistobranchnus* sp. (Polychaeta), *Eudorella splendida* (Cumacea) and, according to Błażewicz and Jażdżewski (1996) – *Peraeospinosus* sp. A and *Nototanais dimorphus* (Tanaidacea) – support the thesis that there is a high specificity of the benthos community in this area, defined here on the basis of analysis of the polychaete fauna (assemblage “F”). A relation between the character of this zoobenthos assemblage and the very low sorting degree of sediment seems obvious.

The character of the zoobenthos of other Ezcurra Inlet areas is a result of rapid sedimentation of the finest mineral suspended matter fractions of glacial origin, as was provisionally suggested by Siciński (1994). The polychaete assemblages in Ezcurra Inlet, such as the non-specific assemblage “E” or fairly specific assemblage “I” (both from the bottom covered with sediments dominated by silt and clay fractions) are the effect of such kind of rapid sedimentation.

Assemblages of Polychaeta and the bottom and shores morphology.—The mosaic structure of polychaete assemblages in the shallow sublittoral presented here clearly contradicts the uniformity of physico-chemical water features in the area. Yet, it should be stressed that a significant exception is the amount of mineral suspended matter in the water column and, as was earlier proved, diversity of bottom sediments of the studied Admiralty Bay sector. The data by Pęcherzewski (1980) indicate clearly a gradient of mineral suspended matter occurring along the main axis of Ezcurra Inlet, which is followed by the diversity in sedimentation intensity and in related differences in bottom sediments with the finest fraction dominating in the inner part of Ezcurra Inlet. This may explain the differences in the structure of polychaete assemblages (Siciński 1986 and present results) and zoobenthos in general (Jażdżewski *et al.* 1986, Jażdżewski and Siciński 1993) in Ezcurra Inlet in comparison to the assemblages in central Admiralty Bay. The diversity of assemblages determined in the fjord cannot however be explained by the gradient of mineral suspended matter and rate of its sedimentation alone. The data by Marsz (1983, 1996) and Rudowski and Marsz (1996) concerning the configuration and morphology of the bottom and shores in the study area constitute an important source of information useful in a further explanation of the results obtained.

The complicated configuration of Ezcurra Inlet bottom and diversified shore line of the study area is reflected in the diversity of polychaete assemblages. Thus the assemblage “E” distinguished here comprises stations localized in two local depressions of the western Ezcurra Inlet, which constitute areas of shallow bottom, filled with “ductile clay” (Marsz 1983). Both depressions are separated by a submarine ridge connecting Pond Hill with Dufayel Island. This could be the reason why the stations 4, 5 and 6 (Fig. 1) located on this ridge, despite their proximity, did not form a cluster with stations localised in the areas of the depressions. This could be caused by the diverse sedimentation intensity and indicates how local differences in bottom configuration may affect the formation of assemblages of bottom fauna. Rudowski and Marsz (1996) point out differences in the sedimentation which covers that ridge as compared with those in close proximity. Assemblages “A” and “D” were recorded in Herve Cove, which appeared as a result of a glacier’s retreat and isolated from the Ezcurra Inlet water by a submerged moraine (Siciński *et al.* 1996). Another feature of the environmental situation occurring in the lagoon is the intensive inflow of fresh water and very large amount of mineral suspended matter in the water of the lagoon. Finally, it is characterised by a very rapid sedimentation rate. These factors clearly affect the character of the bottom fauna (Siciński *et al.* 1996) of these rather peculiar habitats. The very specific assemblage “F” was recorded on trough walls of a considerable bottom slope. It seems that bottom sediments are shaped there by two factors, which would also explain their weak sorting degree. Stations of cluster “F” are usually located at the foot of high and steep shores with rubble (“rubble talus” by Marsz, 1983). Marsz (1996) calls to the production of large amounts of rock waste of diverse granulometric composition in such places. Considerable steepness of the shores and the bottom cause easier transport of this waste to the sea. Such a process is observed, for example, at the foot of Dufayel Island and in numerous ice-free places of the Ezcurra Inlet shores. In such areas the characteristic assemblage “F” was found. A clear heterogeneity of granulometric composition of sediments is accelerated by the inflow of the smallest sediment fractions from the glaciers surrounding the fjord. Finally, assemblages “B”, “C” and “H” are related to the areas of trough slopes of the central basin of the bay. The adjoining shore fragment constitutes a cumulating terrace of complicated genesis described by Marsz (1996). This stabilised environment is of a quite different character than that of typical fjords with unstable shoreline zones occurring in Ezcurra Inlet. From the above it follows that there is a dissimilarity of this deposits in bottom area of Admiralty Bay, and, as a consequence, differences of polychaete assemblages and zoobenthos in general (Jazdzewski and Siciński 1993). This particularly concerns the shallowest areas with bottoms covered with relatively well sorted sand. The differences in bottom fauna assemblages of areas adjoining glaciers on the one hand and bottom areas remote from their impacts on the other were pointed out by Siciński and Janowska (1993).

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