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FROM SURVEYS OF THE GEOMORPHOLOGY OF THE SHORES AND BOTTOM OF THE EZCURRA INLET

1. INTRODUCTION

Whilst the m.s. „Antoni Garnuszewski" was at anchor in the Ezcurra Inlet waters during the II Polish Antarctic Expedition organized by the Polish Academy of Sciences' Institute of Ecology (December 1977 — March 1978), surveys of the bathometry and geomorphology of the Ezcurra Inlet bottom and shores were carried out. The aim of this paper is to give a brief presentation of the results of the investigations.

Ezcurra Inlet constitutes the western branch of Admiralty Bay which is the largest on King George Island in the South Shetland Islands. Admiralty Bay, as the only large bay in this archipelago, has characteristic distinct features which permit it to be classified as a fiord. In the central part situated to the north of the entrance to the Bransfield Straits, Admiralty Bay branches out to form three distinct minor bays: Ezcurra Inlet, McKellar Inlet and Martel Inlet. The azimuth of the axial part of Admiralty Bay, at the extension of which McKellar Inlet is situated, is equal to 326°, the azimuth of the morphological axis of Ezcurra and Martel Inlets amounting to 55.5°. These directions are similar to those of the two main axes of the depressions, i.e. the bays and straits occurring in the central part of the South Shetland Islands (315° at $\sigma=8.03°$ and 53.6° at $\sigma=8.01°$), which gives rise to the assumption that Admiralty Bay system developed on tectonic foundations.

The Antarctic Pilot demarcates the boundary separating Ezcurra Inlet from the remaining basins of Admiralty Bay, as a line that connects Point Thomas with Denais Stack. The remaining boundaries of Ezcurra Inlet constitute the shore line. The length of Ezcurra Inlet within such boundaries outlined is about 8500 m, whereas the width at the entrance (at Point Thomas) is equal initially to about 2000 m, gradully widening in the central and western parts to reach 2500—2800 m. The water area of Ezcurra Inlet is about 19.2 km². The greatly elongated (1550 m in length, maximum width of 400 m), rocky and high Dufayel Island, the surface area of which amounts to 0.37 km², is situated in the western part of this inlet.

Sporadic bathometric surveys were carried out in Admiralty Bay waters as far back as the inter-war period [2], but more systematic studies were not conducted prior to 1945, those being British and Argentine. They were of a general preparatory character, however, only the Martel Inlet (Visca Anchorage) basin being investigated in greater detail [5].

Preliminary materials published so far which afford the forming of an opinion on the general image of the configuration of Ezcurra Inlet sea floor, are very superficial. The British navigation chart to a 1:100 000 scale gives 31 depth points, the same number being given in the American chart to a 1:50 000 scale [No. 6661]. The Argentine chart from 1957, to a 1 : 30 000 scale gives 66 points for this basin. This gives 1 point per 0.618 km² and 0.291 km², respectively, which enables the characterizing of only the most general features of the bottom relief, such as the shallowing of the inlet floor towards the west.

The geomorphological surveys of the shores embraced the whole area of the South Shetlands [1, 2], but they were naturally of preliminary or reconnaissance character, being restricted to selected sections. So far, such investigations have not been carried out on the shores of Ezcurra Inlet, which might perhaps be due to the lack of accumulative forms or coastal terraces which are generally objects of interest to geomorphologists.

2. RANGE AND METHODS OF INVESTIGATIONS, ACCURACY OF MEASUREMENTS

The investigations carried out during the summer season of 1977/78 comprised the charting of the shores and a bathometric-morphological survey of Ezcurra Inlet floor. The shores were charted by conventional geomorphological methods, i.e. by repeated tours along the inlet shore by motor boat, and coming in as close as safety permitted. Direct field observations were carried out at several places which were interesting because of their morphology and where it was possible to land.

The bathometric surveys covered the whole area of Ezcurra Inlet, but with various degrees of accuracy. The depths were measured by echosounding (a Krupp-Atlas vertical echosounder) carried out from a motor boat specially adapted for the purpose. Due to the lack of accurate charts with characteristic orientation points and the inability to install geodetic points from which to determine the position of the motor boat carrying out the soundings, radiolocation was employed to determine the position of measuring tacks. The well-calibrated TRN-524 navigational radar installed on board the m.s. „Antoni Garnuszewski" was used for this purpose. While sounding, the position of the motor launch (fitted with an effective radar reflector) with respect to the ship was determined every minute, the position of the anchored ship being determined relative to three points on the land every three minutes. All turns of the launch and terminations of the measuring profiles were signalled to the observational radar in advance, to establish the position of the sounding boat by radio on the UHF band.

The sounding carried out in this manner covered the area of Ezcurra Inlet from Point Thomas across to Dufayel Island. A bathometric map to a 1 : 18 520 scale (Fig. 2) was charted for this basin. As the accuracy of location of the survey points was equal to ± 0.1 of the cable-length (18.5 m), the application of a greater scale was not justified. On this map, the depths were not reduced to the lowest low water level. Together with the error in the measurement of depth by the echosounder employed, this gave a depth determination on the chart with an error of less than ± 2.2 m.

Soundings were also carried out in the remaining western part of Ezcurra Inlet to the N and S of Dufayel Island and in the vicinity of Goulden and Cardozzo Coves, although they were not so thorough as in the eastern part. As the remaining areas of the inlet lay in the radiolocational shadow or the precision of measurement of position of the sounding launch was insufficient for cartographic purposes (even to such a small scale), the echograms obtained from this area were only used for the geomorphological interpretation of the floor image and no bathometric map was charted for this basin.

Geomorphological interpretation of the bottom image was carried out basing on the bathometric chart drawn up and on the complete set of echograms, also taking into account the relations between the waterside and underwater relief. Apart from analysis of the depth recording on the echograms, attention was also paid to the character of the echo which, in several cases, enabled a general description to be made of the type of bottom sediments.

3. GEOMORPHOLOGY OF THE SHORES

The total length of the Ezcurra Inlet coastline is 26 050 m, including that of Dufayel Island (3425 m). The shore line of the inlet is relatively poorly developed. Two larger bays, Cardozzo and Goulden Coves, are situated in the western part and separated from each other by a steep rocky peninsula. Three small bays lie on the southern shore of the inlet, these being from east to west: Herve, Monsimet and Firlej Coves. The latter was formed not long ago so it has not been marked in the 1957, 1965 and 1968 charts. Three poorly developed bays also exist on the northern coast of the inlet, N and NW from Jardine Peak in the Urbanek Crag sector. Comparison of the dimensions of these bays in the summer of 1977/78 with those marked in charts from 1965 indicates their enlargement due to the general deglaciation of this area which can be observed to-day in the region under discussion.

The slopes of Ezcurra Inlet are relatively steep. The height of its northern shores in some places exceeds 400 m, the southern slopes are lower, but in places still reach a height of 200 m above sea level. Characteristic of Ezcurra Inlet shores is the relatively high percentage of the shore line which is free of ice (see Fig. 1). The reasons for this vary. The southern shore of the inlet, from Point Thomas to the glacier front in the closure of Goulden Cove, is free of ice (except for the glacial falls running into Herve Cove, Monsimet Cove and Firlej Cove) owing to its warm sunny northern exposure. The shore line of Dufayel Island is free of ice since there is no possibility of the accumulation of snow, which could have converted into glacial ice in the course of time, on this steep and high island. The reason why the coasts of the peninsula separating Cardozzo Cove from Goulden Cove are ice-free is similar. The northern shores of Ezcurra Inlet contrast markedly with the southern ones. Although the sculpture of this area does not facilitate the development of glaciation, the cool southern exposure causes this region to be mostly covered with glaciers and glacial cascades among which only few nunataks protrude. The western shores in the closures of Goulden Cove and Cardozzo Cove are also formed by glacial ice.

The general description of the Ezcurra Inlet coastal line is that 57.8% of the shores are built of mineral formations and 42.2% — of glacial shores.

According to the classification by O. K. Leontev, L. G. Nikiforov and G. A. Safianov (1975), the shores of Ezcurra Inlet are in the initial stage of development — they have not been erroded by the action of the sea. Only small fragments constituting about 4% of the total shore line can be considered to be early-juvenile stages, characteristic of which is the partial abrasion of the edges of shores and slopes and the forming of simple accumulative, mainly covering forms. Such transformation of the shore line is the result of several factors.

1. The youth of the relief of the area — in the geological sense it is not long since this area was liberated from under the continental glacier, which was insufficient for the wave action to have been more effective.

2. The relative youth of the area due to the climatic regime — this basin remains frozen from the end of April to almost the end of October, at the same time the permanent shore ice persists in the western part of the inlet until the second decade of December, thus preventing shore-modelling wave processes. In summer a considerable amount of floating glacial ice is deposited on the shore or sinks to the bottom in the inshore zone, thus protecting the shore from the action of sea waves.

The limited dimensions of the basin which, even during the strongest winds (over 50 m s^{-1}), do not permit the waves to travel a longer distance which implies that the waves cannot attain greater dimensions (on the beach near Point Thomas, when winds blow from W for more than 24 hours with an average velocity of 22 $m \cdot s^{-1}$, the maximum height of waves reached a value of about 2.2 m). As a result, the energy of the wave field is not very high, therefore the undulation cannot cause any greater topographical sculpturing in such a relatively short time.

As regards a more detailed classification of the shores, the following types were distinguished in the area considered:

— Thermokarstic ice shores which develop under the influence of heat transferred by the sea water, and the movement of glaciers and glacial cascades. Such shores occur over a total length of 10980 m which constitutes 42.2% of the shore line. They are all shaped in the form of ice-cliffs reaching various heights from a dozen or so to more than 50 m. Two types of such shores can be distinguished — submerged glacial shores, the glacial foot of which is always submerged, thus being susceptible to constant thermal action of sea water and the activity of hydrostatic uplift forces (8 335 m in length, 32% of the total shore line length), and supported glacial shores, the glacial foot of which stands on mineral ground, the thermal action of sea water is limited to high water levels only (high-tide or even wave splashes during an incoming tide), with no hydrostatic uplift forces acting. This latter type occurs along 2 653 m, which constitutes 10.2% of the Ezcurra Inlet shore line.

— Weathered shores. This type has not been distinguished in previous classifications of shores, known to the author. These shores occur along the southern coasts of Ezcurra Inlet, from Point Thomas to Italia Valley, constituting a considerable part of the length of the Dufayel Island shore line. They are high and steep rubbly shores covered with rock rubble. The main role in the development of these shores is played by the processes of frost disintegration in the upper parts of a denuded slope. The effectiveness of the weathering process is so high that the supply of weathered material falling from the upper parts of slopes to the shore line exceeds the possibilities of it being carried away by wave action, either off shore or along the shores. As a result, the shore line is creeping towards the sea (this being additionally facilitated by the quick positive isostatic motion of land). The only effect of wave action is a narrow ledge formed on the shore line, the upper flexion of which is marked by high-tide levels, the lower — by the lowest low water. This type of shore constitutes a substantial percentage of the total shore line length in Ezcurra Inlet (972 m, 19.1% of the shore length), though its share of the Admiralty Bay shore line length is significantly less.

The rest of the shore line constitutes rocky shores with no features indicative of modelling by the sea, or by shores directly built by glacial accumulation — terminal or lateral moraines. The latter occur as small fragments in the western areas of Herve Cove, Monsimet Cove, in the surroundings of Firlej Cove and on the southern areas of the Goulden Cove shores.

Other coastal formations worthy of note are the ephemeral accumulative forms of the hooked spit type or shore ridges pressed to the shores. In the basins of Admiralty Bay, other than Ezcurra Inlet, they are much more widespread. Here, they occur in several places only, i.e., in the bays on the glacial shores in the northern part of the inlet (Urbanek Crag) and in Herve Cove. At present, such formations are created in the inshore area where there is an excess of rubble, least partially shaped, supplied by the fluvioglacial waters. These formations are mobile and change depending on the dimensions and direction of oncoming waves, their existence depending upon a continuous supply of new material. The retraction of the adjoining glacial walls, the cutting off of the glacial promontories behind which they are formed, or the shutting off of the outlet of fluvioglacial waters which supply the material to the coastal zone, will result in their rapid abrasion and elimination.

Two not very intense rubble streams act which dislodge the material in the zone between the lowest low water and highest high water levels, despite the poor dynamics of the shore line in the eastern part of Ezcurra Inlet. The material is dislodged along the northern shores from Denais Stack towards the south-west, by the swell which enters through Bransfield Straits and travels across Admiralty Bay. Along the southern shores of the bay, the material is dislodged by the rubble stream from Italia Valley to Point Thomas, where some is deposited, forming a small stony and then gravel-stony beach. The latter stream of rubble is active at the cost of the energy of waves generated by the mainly west and north-westerly winds from the western sector, which predominate here in the summer season.

In general, when analyzing the configuration of the shore formations and the morphology of the immediate hinterland of the shore line in the Ezcurra Inlet area, one can note a distinct regularity — on proceeding from the west to the east we find a systematically increasing degree of development of relief, which is visible as better sculpturing of the shore formations, as well as the gradual increase of the share of weathered formations. The same phenomenon is noticeable even in such a small area as Dufayel Island. This is related to the fact that the eastern part of the bay is older (in the sense of earlier release from the ice-cap), thus the weathering and the coastal processes acted longer and resulted in greater transformation of the relief, and what is essential in the case of shore-line processes, that in this part of the bay undulation, as the main sculpture-creating factor, is significantly greater than in the western part. Thanks to this, when studying this inlet only, conclusions can be reached as to the early evolutionary stages of the shores of the fiord which are gradually exposed from under the ice-cap.

4. BATHOMETRY AND GEOMORPHOLOGY OF THE BOTTOM

Ezcurra Inlet, taken as a whole, constitutes a U-shaped trough placed over the bottom of Admiralty Bay. The height of the sill separating the outlet of the Ezcurra Inlet bottom from the floor of Admiralty Bay area adjoining the outlet, is about 100—130 m. A trough threshold which divides the outlet of Ezcurra Inlet trough transversely, arises immediately from the upper parts of the sill, its lowest height as determined so far is about 35 m relative to the lowest parts of the bed adjoining it from the west. The trough threshold stretches approximately from Denais Stack to a point located about 1 km to the NE from Point Thomas. This means that as regards the morphology (the bottom relief), the glacial trough which forms the bay, exceeds the structural boundaries of Ezcurra Inlet.

Close behind the trough threshold, are the overdeepened parts of the bottom which constitute the area of occurrence of maximum depths in Ezcurra Inlet, attaining 282 m. Thus, the sculpture of the outlet part of Ezcurra Inlet is similar to the bathometric and geomorphological regularities commonly known in other fiords.

The bottom configuration of Ezcurra Inlet divides it into two distinctly different parts. The eastern part of the inlet situated east of Jardine Peak constitutes a typical deep trough, the bottom of which slopes down from 150 to 270 m. The waterside slopes of the valley become the slopes of the submerged part with no marked deflection of profile on the shore line. Elements of the accumulative glacial relief which are preserved and readable on echograms occur on the bottom — they are median and lateral moraines (see Fig. 3).

Characteristic of the part of Ezcurra Inlet situated to the west of Jardine Peak traverse and embracing the central and western parts of the inlet, is its much greater complexity of relief. This part is much more shallow. Its bottom is separated from the deep eastern part of Ezcurra Inlet by a slope with an inclination close to that of the slopes of the trough, the depth of which rises from 150 to 80 m. The bottom of this area forms a plane built of ductile clay with stones lying at a depth of 70—85 m where there are convex formations in which concave formations have taken shape. Characteristic of the morphology of this plane is the occurrence of relief exhibiting features of glacial aggradation. Among well-marked convex formations, rising above the mean level of the bottom, the sculpture of the bed is relatively uneven, hummocky, but changes in level are not very great and amount to 2—5 m. Among these small formations, small depressions without outflow, i.e., small closed kettles the bottom of which lay lower than the surrounding areas of the inlet bottom and with diameters of the order of from several tens of to several score metres (sometimes greater), were found in a dozen or so places. It is considered likely that the origin of these depressions may be associated with an irregularity in the accumulation of glacial material, perhaps a certain role in their formation was played by the thermokarstic processes — blocks of dead ice melting under the subaquatic conditions, then buried in the glacial deposits and burdened by the frozen morainal material.

Convex formations protrude from the surface of this plane (85, 70 m), these having been well-studied in the area between Dufayel Island and the above-mentioned slope separeting the shallow and deep parts of the inlet. They are generally ridge formations oriented almost transversely with respect to the morphological axis of Ezcurra Inlet. The greatest of these three ridges surmounts the upper part of the slope (see Figs. 2 and 3). Similar formations adjoin the southern slopes of the Ezcurra Inlet trough between Herve Cove and Jardine Peak. The relative height of these formations ranges from a dozen or so to 25 m. The whole of the morphometric relations of these formations permits us to interpret them as recessive terminal moraines which were most likely formed subaquatically. Relief of a similar character stretches farther to the west, along the southern shores of Ezcurra Inlet from Goulden Cove to the southern shores of Dufayel Island.

North of Dufayel Island, up to the middle of Cardozzo Cove, the configuration of the Ezcurra Inlet bottom is different. In this area, the bed of the inlet is markedly deeper as compared with the 85 to 70 m discussed previously, and forms a closed, deep basin the maximum depth of which, as determined by the author, amounts to 155 m. The slopes of

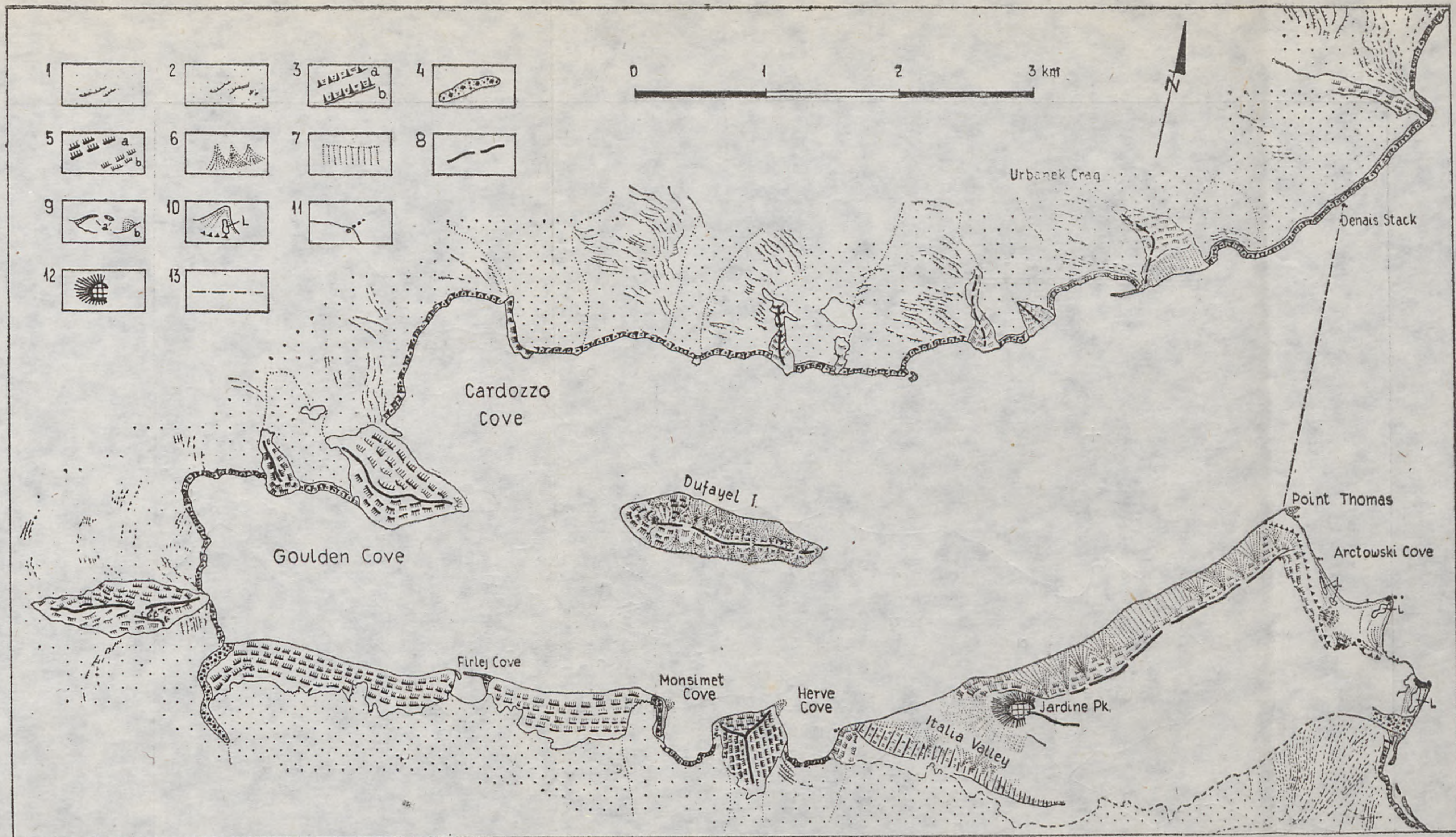

Fig. 1. Geomorphological map of the shores of Ezcurra Inlet. The outline of the shore was drawn from aerial pictures taken during III Polish Antarctic Expedition of the Polish Academy of Sciences' Institute of Ecology in 1978/79; state as in January 1979. — Definition of symbols: frozen areas: *1* — leading glaciers and glacial cascades with main systems of cracks; *2* — glaciers with systems of crevices; *3* — glacial shores, *a* — ice-cliffs with a submerged foot, *b* — propped ice cliffs; *4* — terminal moraines; *5* — steep rocky shores, *a* — with distinct signs of roche moutonee, *b* — strongly weathered with numerous weathering residues; *6* — rubble talus; *7* — relatively even rubble slopes; *8* — ridge lines; *9* — formations of marine accumulation, *a* — ephemeral waterside formations of a sand-bank or stony shoals, *b* — submerged ephemeral accumulative formations; *10* — solid accumulative formations built of successively rising shore ridges bound by dead cliffs from the side of higher parts of the land, with lagoon lakelets (*L*), and constituting a coastal terrace; *11* — abrasional island mountains; *12* — volcanic neck; *13* — boundary of the Ezcurra Inlet basin according to *The Antarctic Pilot*, 1973.

Rys. 1. Mapa geomorfologiczna wybrzeży fiordu Ezcurra. Zarys linii brzegowej opracowano na podstawie zdjęć lotniczych wykonanych w czasie III Polskiej Ekspedycji Antarktycznej Instytutu Ekologii PAN w 1978/79; stan w styczniu 1979 r. — Objaśnienie znaków: obszary zlodowacone: *1* — lodowce wyprowadzające i lodospady z głównymi systemami szczelin; *2* — lodowce i występujące w nich systemy szczelin; *3* — brzegi lodowe, *a* — klify lodowe o stopie zanurzonej, *b* — klify lodowe podparte; *4* — moreny czołowe; *5* — brzegi strome, skaliste, *a* — noszące ślady wyraźnego zmutonizowania, *b* — silnie zwietrzałe, z licznymi formami wietrzennymi; *6* — stożki osypiskowe; *7* — względnie równe stoki osypiskowe; *8* — linie grzbietowe, granie; *9* — formy akumulacji morskiej, *a* — efemeryczne nadwodne formy typu kos i kamienistych łach, *b* — podwodne efemeryczne formy akumulacyjne; *10* — stałe formy akumulacyjne zbudowane z kolejno podnoszących się wałów brzegowych, ograniczone od strony wyższych partii lądu przez martwe klify, z jeziorkami lagunowymi (*L*), tworzące terasę brzegową; *11* — ostańce abrazyjne; *12* — nek wulkaniczny; *13* — granica fiordu Ezcurra według *The Antarctic Pilot*, 1973.

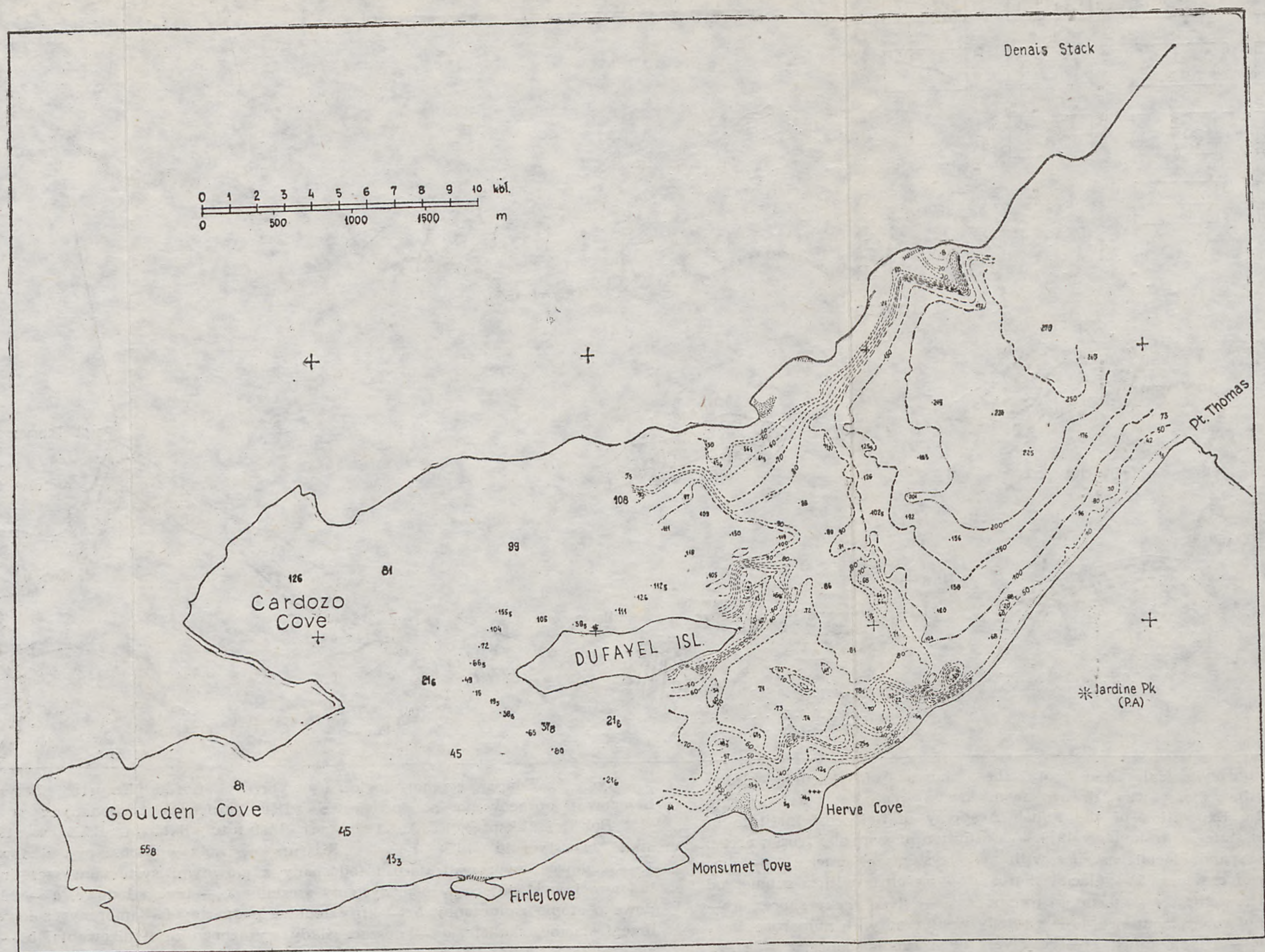

Fig. 2. Bathometric map of Ezcurra Inlet. Bathometry of the eastern part of the inlet drawn up from soundings carried out by the author during II Polish Antarctic Expedition of the PAS' Institute of Ecology. From 250 to 100 m isobaths are indicated every 50 m, in shallows — every 10 m. Shore line according to the radiolocational image of 22 January 1978. Depths in the western part of the inlet are indicated with larger numbers and coast line according to American navigation chart No. 6661.

Rys. 2. Mapa batymetryczna fiordu Ezcurra. Batymetria wschodniej części zatoki opracowana na podstawie sondażu autora wykonanego w czasie II Polskiej Ekspedycji Antarktycznej Instytutu Ekologii PAN-u. Izobaty od 250 do 100 m co 50 m, płyciej co 10 m. Linia brzegowa według zdjęcia radiolokacyjnego; stan 22 stycznia 1978. Głębokości w zachodniej części fiordu oznaczone większymi cyframi i linia brzegowa według amerykańskiej mapy nawigacyjnej nr 6661.

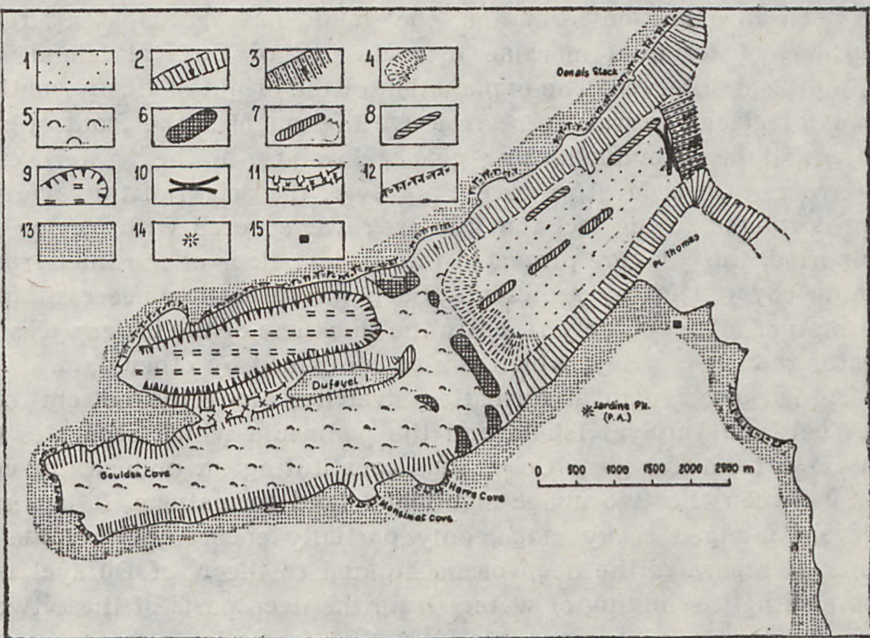

Fig. 3. Geomorphological sketch of the Ezcurra Inlet floor. Definition of symbols: *1* — bottom of the deep part of the inlet; *2* — trough slopes; *3* — slope of the bench separating Ezcurra Inlet and Admiralty Bay floors; 4 — slope of bench separating the deep parts of Ezcurra Inlet trough bottom from its shallow part (85, 70 m); *5* — shallow water level (85, 70 m) with a hummocky relief indicating features of glacial aggradation; *6* — terminal moraines; *7* — median moraines, *8* — lateral moraines; *9* — overdeepening in the NW part of Ezcurra Inlet floor (depths reaching 155 m) with steep slopes and uneven bottom; *10* — threshold surmounting the bench between Ezcurra Inlet floor and Admiralty Bay; *11* — rocky ridge connecting Dufayel Island and the rocky peninsula; *12* — ice cliffs; *13* — land and glacial areas; *14* — Jardine Peak; *15* — Polish Antarctic Station.

Rys. 3. Szkic geomorfologiczny dna fiordu Ezcurra. Objaśnienie znaków: *1* — dno części głębokowodnej; *2* — stoki doliny żłobowej; *3* — stok stopnia odzielającego dno fiordu od dna Zat. Admiralicji; *4* — stok stopnia oddzielającego głębokowodne partie dna doliny żłobowej fiordu od jego części płytkowodnej (poziomu —85, —70 m); *5* — poziom płytkowodny (—85, —70 m) o rzeźbie drobnopagórkowatej, wykazującej cechy zasypania glacjalnego; *6* — moreny czołowe; *7* — moreny środkowe; *8* — moreny boczne; *9* — przegłębienie w dniu NW części fiordu (głębokości do —155 m) o stromych stokach i nierównym dnie; *10* — próg wieńczący stopień między dnem fiordu a Zat. Admiralicji (najprawdopodobniej muton); *11* — grzbiet skalny łączący wyspę Dufayel z półwyspem skalnym; *12* — klify lodowe; *13* — obszary lądowe i zlodowacone; *14* — Jardine Peak; *15* — Polska Stacja Antarktyczna im. Henryka Arctowskiego.

this deep are steep, its bottom also exhibits considerable irregularities of the order of 20—30 m. The origin of this deep is not known — if it had been an exaration formation, one should have anticipated larger dimensions of terminal moraine to occur NE of Dufayel Island, which has not been observed. The explanation of the origin of this formation by means of glacial exaration is attractive inasmuch as the front of a very active and fast-moving leading glacier lies just in the western closure of Cardozzo Cove. Most probably, however, the origin of this overdeepening is related to the fact that the area was covered with ice for a longer period, this having protected the present floor of the inlet from becoming covered up by sediments. Such interpretation neccessitates the assumption that relatively recently the thickness of the ice-cap was much greater than it is today, which is also confirmed by other data.

A marked structural formation stretches along the bottom of the inlet between Dufayel Island and the peninsula which separates Goulden Cove from Cardozzo Cove, thus constituting an underwater connexion between the two above-mentioned land formations. It is a relatively sharp-edged rocky ridge, only partially covered with loose sediments. It separates the deep basin situated to the N of Dufayel Island, thus making the mixing of waters from the deep parts of these two sections of Ezcurra Inlet impossible. A similar formation also occurs on the NE extension of Dufayel Island but this one is additionally surrounded by median moraines.

Acknowledgements

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Z BADAŃ NAD GEOMORFOLOGIĄ BRZEGÓW I DNA FIORDU EZCURRA

Streszczenie

Artykuł referuje główne wyniki badań przeprowadzonych w trakcie II Polskiej Ekspedycji Antarktycznej organizowanej przez Instytut Ekologii PAN na wodach fiordu Ezcurra.

Ezcurra, o powierzchni ok. 19,2 km^2, stanowi typowy fiord wykształcony w głębokiej „U"-kształtnej dolinie żłobowej. Linia brzegowa fiordu ma długość ok. 26 km. Brzegi lodowe stanowią 42,2% ogólnej długości brzegów, pozostałą długość linii brzegowej tworzą brzegi zbudowane z utworów skalnych lub produktów ich wietrzenia. Brzegi południowe fiordu są w znacznej większości zbudowane z utworów skalnych; podobnie wolne od lodów są w całości brzegi wyspy Dufayel. Można to wytłumaczyć działaniem czynnika topoklimatycznego i oddziaływaniem rzeźby terenu. Brzegi północne i zachodnie tworzą strome klify lodowe, poprzerywane jedynie niewielkimi fragmentami nunataków.

Brzegi zbudowane z utworów skalnych i produktów wietrzenia skał nie wykazują znaczącego przekształcenia przez procesy falowe, znajdują się w stadium inicjalnym. Tylko około 4% linii brzegowej można zaliczyć do stadium wczesnej młodości, charakteryzującego się częściową obróbką brzegów przez abrazję i wykształceniem prostych form akumulacyjnych. Na uwagę zasługuje występowanie typu brzegu nie wyróżnionego w dotychczasowych klasyfikacjach, który nazwano brzegiem zwietrzelinowym. Są to wysokie i strome brzegi osypiskowe, pokryte rumowiskiem skalnym. W rozwoju tych brzegów główną rolę odgrywają procesy dezintegracji mrozowej, działające głównie w wyższych partiach stoku obnażonego. Efektywność procesów wietrzennych jest tak duża, że dostawa materiału zwietrzelinowego, osypującego się z górnych partii stoku na linię brzegową, przekracza możliwości odtransportowania tegoż materiału przez procesy brzegowe. W rezultacie linia brzegowa przemieszcza się w stronę wody, czemu dodatkowo pomaga szybki pozytywny izostatyczny ruch lądu. Jedynym efektem działania procesów falowych jest wytwarzająca się na linii brzegowej półka o niewielkiej szerokości, której górny załom wyznaczają wysokie stany wody przepływu, a dolny załom najniższa niska woda. Ten rodzaj brzegów zajmuje we fiordzie Ezcurra znaczny odsetek długości linii brzegowej (19,1%), ciągnąc się od Point Thomas do Italia Valley i na znacznych przestrzeniach wokół Dufayel Island (zob. mapę 1).

Występujące w Ezcurra drobne efemeryczne formy typu kos i kamienistych wysepek zawdzięczają swoje istnienie dostawie materiału fluwioglacjalnego do strefy brzegowej. Potoki lodowcowe wnosząc ten materiał do strefy brzegowej powodują występowanie nadmiaru rumowiska w strefie dennej, wymuszając lokalnie dodatni bilans brzegu.

Wybrzeża fiordu Ezcurra wykazują rozwój w kierunku z zachodu na wschód, zarówno w stopniu wykształcenia form brzegowych (nieznaczny), jak i w stopniu przeobrażenia wyższych partii stoków przez wietrzenie (bardzo wyraźny). Wiąże się to zarówno ze zróżnicowaniem wieku doliny lodowcowej (wschodnia część starsza),

jak i wzrostem natężenia procesów morfotwórczych ku wschodowi (głównie falowanie, wiatry).

Jak wykazały pomiary batymetryczne i badania morfologii dna, Ezcurra stanowi dolinę żłobową, zawieszoną nad niższą doliną żłobową w Admiralty Bay. Próg oddzielający dno fiordu od dna Admiralty Bay jest bardzo stromy, jego wysokość wynosi 100—130 m; tuż powyżej progu występuje rygiel doliny. Dno w najgłębszej partii fiordu leży na głębokości 282 m.

Pod względem batymetrycznym i geomorfologicznym Ezcurra dzieli się na dwie wyraźne różne części. Część wschodnia, położona na E od trawersu Jardine Peak (zob. mapy 2 i 3), stanowi typową, głęboką dolinę żłobową, z dobrze zachowanymi i czytelnymi na echogramach formami akumulacji glacjalnej — morenami środkowymi i bocznymi w dnie. W tej części fiordu dno ma od —150 do —270 m.

Część środkową i zachodnią dna fiordu zajmuje rzeźba stosunkowo nierówna, drobnopagórkowata z „zagłębieniami bezodpływowymi", leżąca w przedziale głębokości od —85 do —70 m, wykazująca wyraźne cechy zasypania glacjalnego. Ponad ten poziom wznoszą się wały o wysokości względnej od kilkunastu do dwudziestu kilku metrów, ułożone w poprzek doliny, które interpretowane są jako moreny czołowe, wyznaczające jakieś stadium recesyjne.

Na granicy obu tych stref batymetrycznych (150—270 m ppm i 85—70 m ppm) występuje stromy stok.

W NW części fiordu, na północ od wyspy Dufayel i w Cardozzo Cove, występuje w dnie izolowane, dużych rozmiarów przegłębienie, którego maksymalne dotychczas stwierdzone głębokości osiągają 155 m. Geneza tego zagłębienia wiąże się najprawdopodobniej z dłuższym zaleganiem w tym miejscu lodu, który chronił te partie dna przed zasypaniem przez osady glacjalne odkładające się subakwatycznie.

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