Bathymetry and bottom sediments off the
coast of Iceland.

John K. Hartsook

Hydrographic Office Mar 1950

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BATHYMETRY AND BOTTOM SEDIMENTS
OFF THE COAST OF ICELAND

by

John K. Hartsock

Washington, D.C.

Hydrographic office

March, 1950

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SECTION I. INTRODUCTION

General Statement

The purpose of this report is to present the results of a reconnaissance study of the bottom sediments and bathymetry off the coast of Iceland made during the winters of 1947-48, 1948-49, and 1949-50.

The report consists of (1) six British Admiralty hydrographic charts; (2) one index chart showing the location of the above; and (3) a written description and interpretation of the charts. The six hydrographic charts, ranging in scale from 1: 254,000 to 1:287,468, show the distribution of the various bottom types. They completely encircle Iceland, showing all of the coastline and the waters covering the surrounding submarine shelf. The index chart, scale 1:750,000, shows all of Iceland, the submarine shelf, and the submarine slope beyond the shelf. All charts were obtained through the courtesy of the U.S. Hydrographic Office.

The study is based primarily on the many notations on the charts showing the quality of the bottom ("s", "g", "cz", etc.). This is supplemented by information from the Sailing Directions (16) and numerous other readings. No bottom samples have been examined directly

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by the author. However, it is hoped that this report may be useful as a guide to future investigators in this field.

Beside the purely descriptive analysis of sediment distribution, an attempt has been made in places to interpret the geology of the seabottom from the submarine relief, from the pattern of the bottom types, and from the known geological history of the adjacent land.

In this report distances are measured in nautical miles. The latitude subdivisions along the sides of the charts may be used for a graphic scale, with each minute of latitude equalling one mile.

Types of Bottom

Six bottom types are portrayed on the charts. These are: sand, sand and mud, mud, rock, gravel, and coral. A diagonal overprint is used to indicate the presence of shells in any of the above types.

Since bottom notations are the chief source of information the authenticity of the bottom types outlined depends upon the accuracy of the notations. Shepard, in his report on the continental shelf sediments, written for the symposium, "Recent Marine Sediments"

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(26, p. 231) states that, although lacking in geological training, the hydrographer usually described the samples as reliably as a geologist would without microscopic examination. Sand and gravel are almost always determined accurately. The finer sediments, labelled "mud", may be interpreted geologically as silt and clay, sometimes containing a small proportion of sand. The term "ooze" when used on continental shelves is probably applied to "soft" liquid mud which resembles deep-sea ooze in appearance but is not of organic origin (19, p. 1019)."

Regarding rock bottom, in the passage from "Recent Marine Sediments" Shepard states the following:

"The term 'rocky' is generally based either on the finding of dents or scars on the sounding lead or on the presence of angular rock fragments in the sample. Such observations do not prove that ledge rock has been encountered, as both the scratches and the angular fragments could come from the presence of sporadic boulders carried out by ice or by vegetation rafts. On the other hand, where the report of rocky bottom is indicated by several observations from one area it appears unlikely that sporadic fragments could be the cause, and, therefore, one can be fairly confident that ledge rock crops out on the bottom."

Topographic Setting

The following descriptions of the topography and geology of Iceland are based on the works of Thoroddsen (25; also, 24, pp. 191, 194, 211, 213, 214-216), Törn

(10, pp.11,20), Gregory (8,p.139); and, Nielsen (17,p.277).

Topographically Iceland is a plateau fringed in places by coastal lowlands and trenched by long, narrow alluviated valleys. The lowlands are most extensive along the southeastern and southwestern coasts, where for convenience they are called in this report the southeastern lowland and the southwestern lowland. The long, narrow valleys, for the most part, trend northward from the interior and open into fjords indenting the northern coast.

The interior plateau is essentially an uninhabitable sand and lava desert, lying 700 to 1000 meters above sealevel. Rising 600 to 1000 meters above the southern portion of this plateau, and 1400 to 2000 meters above the southeastern and southwestern lowlands along the coast is a series of ice-capped, dome-shaped mountains. Where lowlands are lacking, as along the eastern and the northwestern coasts, the sea beats directly against the eroded cliffs of the plateau edge.

Connected to the northwestern corner of Iceland by a narrow neck of land is a triangular-shaped peninsula, whose coasts are deeply indented by fjords. The surface of this peninsula is a plateau averaging 800

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Journal of Management Studies, 1987, 20(6), 631-641

Over the last 10 years, we have been able to

The following table is intended to provide a general overview of the various types of information that can be obtained from a typical business plan. It is not intended to be a comprehensive list of all possible information, but rather a guide to the types of information that are typically included in a business plan.

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various other related can possibly rise to different positions

Source: U.S. Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business*, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2

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waters elevation above the sea. Its coastline is the cliffed plateau edge. For convenience this peninsula is called in this report the Northwestern Peninsula.

Geologic Setting

Iceland is a remnant of a volcanic plateau which, during early Tertiary times probably spanned the entire North Atlantic. This plateau is believed to have been broken up by block faulting and subsidence in the Miocene epoch which left Iceland an island with its coasts 25 to 50 miles further out on all sides than now. Other remnants of this plateau are the Faroe Islands, the islands of Mull and Skye off the western coast of Scotland, Antrim in northeastern Ireland, and the basalt region of eastern Greenland.

Subsidence continued through the Pliocene until the strand line was over 100 meters above the present strand line. Shell-bearing beds of sandstone, which correlate tentatively with the Pliocene Red Grap formation of England, were deposited at this high level. Apparently the island shelf was planed by wave action during this period of subsidence.

At the end of the Pliocene epoch the island was re-elevated until the sea had retreated beyond

the present 150-Fathom line. The submerged valleys which now extend outward from the main bays and fjords (see index sheet U.S. 3657) were cut at that time, when the shelf was exposed to subaerial erosion.

During the Pleistocene epoch the island subsided again until the strand line lay at about the same level as it did before; i.e. 100 meters or more above the present strand line. Again, as before, shell beds were deposited at the highest level. These date the time of maximum re-submergence as mid-Pleistocene. Since that time the land has been emerging, with hills long enough to permit the formation of several marine terraces.

In the Pleistocene epoch at least twice the entire island was covered by an ice sheet through which a few peaks projected, as in Greenland today. The ice covered the coastal lowlands and apparently extended past the present strand line, as large amounts of marine have been found at various places on the seabottom off the mouths of the fjords.

Volcanism, which was active during the early and middle part of the Tertiary, apparently ceased during the Pliocene epoch until the period of emergence at the end. It then broke forth, and during the Pleistocene a number of large volcanoes were active. This activity

has continued into Recent times.

The island is built mostly of basalt flows, with associated tuffs and breccias. Patches of lignite are scattered throughout the island, and gabbro is found along the southeastern coast. Interbedded in the basalt in places are a few clayey layers bearing plant remains of probable Miocene age. In some of these layers the carbonaceous material is abundant enough to form lignite. On the peninsula of Tjörnes, in northern Iceland, shell-bearing sandstones of Red Crag age mark the lowest limit of submergence. Extensive glacial moraines, some interbedded with basalt, occur in many places over the island. For the most part these are Pleistocene in age.

Bathymetric Setting

On Murray's chart showing the bathymetry of the North Atlantic (16, May 1) a submarine ridge several hundred miles wide and less than 300 fathoms deep, as compared with depths of 1000 fathoms or more on the adjacent bottom, extends from Greenland southward across the Atlantic Ocean to Scotland. Iceland is perched on this ridge at about its mid-point, and the Faeroe Islands, near the Scotland end. It presumably represents the submerged portion of the North Atlantic volcanic plateau mentioned on page 7.

Wandel's chart (9, Part 1, Plate 1), showing greater detail than Murray's, indicates a trough 800 fathoms deep cutting halfway through this ridge from the north between Iceland and Greenland, and, at the same place, another trough over 700 fathoms deep cutting into it from the south. The saddle between these two troughs lies from 300 to 400 fathoms deep. This saddle and part of the northern trough may also be seen in the northwest corner of the index chart in this report (2, 2.565).

As shown on Wandel's chart, southward from Iceland the bottom slopes gradually down to 275 fathoms about midway between Iceland and the Faeroe Islands, and remains at that depth until the incline up to the Faeroes is reached. Iwan (10, p.103) gives a southeast-northwest profile of this ridge which shows the deepest spot to be at the Faeroes end, at the base of the incline.

According to Hoggild (9, Part 3, Plate 1), this portion of the ridge southeast of Iceland is mantled with "gray, deep-sea clay", characterized in the text as "a generally rather rich and clean variety of clay of a grayish color." In view of the proximity of active volcanoes on Iceland this clay should contain a large proportion of volcanic material. André (1, p.470) states that a later bottom sediment chart by Hoggild indicates volcanic

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and covering the ridge. The ocean basins north and south of the ridge are floored with globigerina ooze.

Surrounding Iceland, and extending from the shore out to depths of from 100 to 150 fathoms is a discontinuous submarine platform. This is the equivalent of the continental shelves off the various continents, and in this report is called "the island shelf", or simply "the shelf". Accordingly, the submarine slope from the outer edge of the shelf down to the ocean basins on the north and south, or to the Greenland-Faeroe ridge on the east-southeast and west-northwest, is called "the island slope". Beeghly (9, Part 3, Plate 1) classifies the sediments covering the shelf as "shallow-water deposits", and it is mainly with these sediments that this report is concerned.

and covering the right. The lower portion of the right side of the page is blank.

SECTION II. DESCRIPTION OF CHARTS

B.A.2711 (approximate Scale 1:260,000)

General Statement

This chart shows the shelf off the southwest-ern coast and southern half of the western coast of Ice-land. It extends from the light of Myrdalsvik (Latitude 64 degrees 46 minutes N., Longitude 19 degrees W.) on the southern coast to the volcano called Snekfella (Latitude 64 degrees 46 minutes N., Longitude 23 degrees 43 minutes W.) on the north side of the bay, Faxaflói.

B.A.2960, on the east, extends to Longitude 19 degrees 46 minutes W., giving an overlap with this chart of about twenty-two miles of shoreline. Pertinent data occurring on either chart within this overlap have been transferred to the other in order to show all avail-able information on both charts. This practice has been followed with the remainder of the charts, also.

Extra data have been added from larger scale charts in the following places: on the shelf from shore- line to southern edge of the chart between the Thjórfá River and Myrdalsvik, from B.A.2964 (1:111,350); in the eastern half of Faxaflói, from B.A.1201 (approximately 1:87,450); and B.A.2729 (1:102,000).

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1991-1992

There have been some cases of malaria in the following places: on the left bank above
line to southern edge of the forest between the village
river and Khabarovsk, from N.A. 1908 (1:111,100); at the
western end of the island, from N.A. 1908 (1:111,100).

Presence of Shells in the Sediments

All sandy areas on this chart bear the bottom notation "fine sand and shells". Many of the areas of gravel and mud may also contain shells in greater or lesser degree. However, since the bottom notations make no mention of this the author has not indicated their presence in the gravel and mud.

The Shelf from Myrdalsvik to the Markarfljót River

The coast from Myrdalsvik to the mouth of the Markarfljót River is, for the most part, low and sandy, with the ice-capped mountains of Myrdalsjökull and Eyjafjalla Jökull rising abruptly from the plain at distances of from 2 to 3 miles inland. As seen on the index chart, S.A.565, the offlying shelf for about two-thirds of this distance between Myrdalsvik and the Markarfljót increases in depth fairly regularly out to 100 fathoms, about eight miles offshore. Beyond this depth the bottom drops rapidly to 500 fathoms or more in less than 3 miles. The "mud line", or boundary with the mud, has been placed approximately at the 100-fathom depth curve. This mud is Bowgild's gray, deep-sea clay (see page 10).

West of longitude 19 degrees 15 minutes E. the shelf is indented by Hafa Djúp. This is a submarine valley which, as shown by the greater sounding detail on S.A.2968, divides

1915 1916 1917 1918 1919 1920 1921 1922 1923 1924 1925 1926 1927 1928 1929 1930 1931 1932 1933 1934 1935 1936 1937 1938 1939 1940 1941 1942 1943 1944 1945 1946 1947 1948 1949 1950 1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054 2055 2056 2057 2058 2059 2060 2061 2062 2063 2064 2065 2066 2067 2068 2069 2070 2071 2072 2073 2074 2075 2076 2077 2078 2079 2080 2081 2082 2083 2084 2085 2086 2087 2088 2089 2090 2091 2092 2093 2094 2095 2096 2097 2098 2099 2100 2101 2102 2103 2104 2105 2106 2107 2108 2109 2110 2111 2112 2113 2114 2115 2116 2117 2118 2119 2120 2121 2122 2123 2124 2125 2126 2127 2128 2129 2130 2131 2132 2133 2134 2135 2136 2137 2138 2139 2140 2141 2142 2143 2144 2145 2146 2147 2148 2149 2150 2151 2152 2153 2154 2155 2156 2157 2158 2159 2160 2161 2162 2163 2164 2165 2166 2167 2168 2169 2170 2171 2172 2173 2174 2175 2176 2177 2178 2179 2180 2181 2182 2183 2184 2185 2186 2187 2188 2189 2190 2191 2192 2193 2194 2195 2196 2197 2198 2199 2200 2201 2202 2203 2204 2205 2206 2207 2208 2209 2210 2211 2212 2213 2214 2215 2216 2217 2218 2219 2220 2221 2222 2223 2224 2225 2226 2227 2228 2229 2230 2231 2232 2233 2234 2235 2236 2237 2238 2239 2240 2241 2242 2243 2244 2245 2246 2247 2248 2249 2250 2251 2252 2253 2254 2255 2256 2257 2258 2259 2260 2261 2262 2263 2264 2265 2266 2267 2268 2269 2270 2271 2272 2273 2274 2275 2276 2277 2278 2279 2280 2281 2282 2283 2284 2285 2286 2287 2288 2289 2290 2291 2292 2293 2294 2295 2296 2297 2298 2299 2300 2301 2302 2303 2304 2305 2306 2307 2308 2309 2310 2311 2312 2313 2314 2315 2316 2317 2318 2319 2320 2321 2322 2323 2324 2325 2326 2327 2328 2329 2330 2331 2332 2333 2334 2335 2336 2337 2338 2339 2340 2341 2342 2343 2344 2345 2346 2347 2348 2349 2350 2351 2352 2353 2354 2355 2356 2357 2358 2359 2360 2361 2362 2363 2364 2365 2366 2367 2368 2369 2370 2371 2372 2373 2374 2375 2376 2377 2378 2379 2380 2381 2382 2383 2384 2385 2386 2387 2388 2389 2390 2391 2392 2393 2394 2395 2396 2397 2398 2399 2400 2401 2402 2403 2404 2405 2406 2407 2408 2409 2410 2411 2412 2413 2414 2415 2416 2417 2418 2419 2420 2421 2422 2423 2424 2425 2426 2427 2428 2429 2430 2431 2432 2433 2434 2435 2436 2437 2438 2439 2440 2441 2442 2443 2444 2445 2446 2447 2448 2449 2450 2451 2452 2453 2454 2455 2456 2457 2458 2459 2460 2461 2462 2463 2464 2465 2466 2467 2468 2469 2470 2471 2472 2473 2474 2475 2476 2477 2478 2479 2480 2481 2482 2483 2484 2485 2486 2487 2488 2489 2490 2491 2492 2493 2494 2495 2496 2497 2498 2499 2500 2501 2502 2503 2504 2505 2506 2507 2508 2509 2510 2511 2512 2513 2514 2515 2516 2517 2518 2519 2520 2521 2522 2523 2524 2525 2526 2527 2528 2529 2530 2531 2532 2533 2534 2535 2536 2537 2538 2539 2540 2541 2542 2543 2544 2545 2546 2547 2548 2549 2550 2551 2552 2553 2554 2555 2556 2557 2558 2559 2560 2561 2562 2563 2564 2565 2566 2567 2568 2569 2570 2571 2572 2573 2574 2575 2576 2577 2578 2579 2580 2581 2582 2583 2584 2585 2586 2587 2588 2589 2590 2591 2592 2593 2594 2595 2596 2597 2598 2599 2600 2601 2602 2603 2604 2605 2606 2607 2608 2609 2610 2611 2612 2613 2614 2615 2616 2617 2618 2619 2620 2621 2622 2623 2624 2625 2626 2627 2628 2629 2630 2631 2632 2633 2634 2635 2636 2637 2638 2639 2640 2641 2642 2643 2644 2645 2646 2647 2648 2649 2650 2651 2652 2653 2654 2655 2656 2657 2658 2659 2660 2661 2662 2663 2664 2665 2666 2667 2668 2669 2670 2671 2672 2673 2674 2675 2676 2677 2678 2679 2680 2681 2682 2683 2684 2685 2686 2687 2688 2689 2690 2691 2692 2693 2694 2695 2696 2697 2698 2699 2700 2701 2702 2703 2704 2705 2706 2707 2708 2709 2710 2711 2712 2713 2714 2715 2716 2717 2718 2719 2720 2721 2722 2723 2724 2725 2726 2727 2728 2729 2730 2731 2732 2733

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THE SMALL BUSINESS ADMINISTRATION

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There are 24 schools in the district and 1000 teachers.

into two branches, one heading north toward the mouth of the Hærfliðt and the other heading north-northwest and north to a point a little over one mile east of Illidag, the easternmost of the Vestmannaeyjar Islands. The mud line reflects the bathymetry by swinging inland west of Longitude 19 degrees 45 minutes W. and shoaling to about fifty fathoms. It then curves south-westward and westward around the submarine ridge between the two branches of Hærfliðt, then northward and northward up the west branch, and finally runs off the chart a long the southeastward side of the submarine platform bearing the Vestmannaeyjar Islands. The shoaling of the mud line in Hærfliðt may be explained by the lack of sharp dropoff at the 100-fathom line such as obtains east of Longitude 19 degrees 45 minutes W.

Except for rocky areas at Myrdalavik and Portland, the strand between Myrdalavik and the Hærfliðt is bordered offshore by a belt of sandy bottom. For about half this distance the belt averages 2½ miles in width, and is bordered to the seaward by a belt of gravel 4 to 6 miles wide extending out to the mud line. West of Longitude 19 degrees 30 minutes W. the gravel belt tapers off rapidly and comes to an end. The sandy belt widens to 3 miles here, coming in direct contact with the zone of mud, then narrows again to 2 miles

north of the Vestmannaeyjar Islands. This sand is composed of volcanic rock and mineral particles. According to Thoroddsen (24, p. 244) quartz sand does not occur in Iceland.

Vestmannaeyjar Islands

The rocks on the Vestmannaeyjar Islands, and presumably on the submarine platform on which they lie, consist of basalt flows, tuffs, and breccias of post-Fleistocene age (23). Areas and patches of rock bottom surround the islands and form numerous shoals to their southwest, west, and east. Surrounding this group of rocky islands and shoals is an irregular-shaped area of gravel measuring 17 miles east-west and 15 miles northeast-southwest, the result of wave and current action plus probably some submarine vulcanism.

The author has shown a small zone of gravel extending west from the rocky shoal, Sandagrúnn, about five miles north of Heimsney, the largest island. This is based on a small but pronounced submarine ridge indicated by the soundings on B.A. 2968.

The Shelf From the Markarfljót River to Reykjanes

Northwest of the Markarfljót River the mountains give way to the great Southwestern Lowland, described on page 6. This lowland extends 40 miles along the coast to the Bight called Thorlák Red, just west of the

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Volcanic Islands

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mouth of the Ölfraa River. For about half this distance the strand consists of a barrier beach backed by lagoons and marshes and the alluvial expanse of the lowland. Northwest of the mouth of the Thjórsá River (Longitude 20 degrees 49 minutes W.) the coast is rock-fronted, with the zone of reefs and isolated rocks extending from $3/4$ to 1 mile offshore. These reefs represent the eroded edge of a post-Pleistocene basalt flow (24, p. 219).

From Thorisk Red 33 miles west to the end of the peninsula of Reykjanes the coast is, for the most part, rocky and steep, and is backed by low mountains. This entire region, including both lowland and peninsula, is subject to violent earthquakes and volcanic activity.

Except for shoaling connected with the Vestmannaeyjar Islands, depths offshore in this region increase slowly and fairly regularly southward to the limits of the chart. On S.A. 565 the shelf is seen to increase over three times in width as compared to its width east of the Vestmannaeyjar Islands. The 100-fathom curve runs westward roughly forty-five miles past Haimay before it again turns northward into a submarine valley called Selvogr Dyb on S.A. 2733 and Grindavíkur Djúp on S.A. 565. If depth curves are drawn every 25 fathoms or less around Selvogr Dyb they will outline a gentle but distinct tributary valley trending east-northeastward from the northeast

corner of the deep toward the south of the Ölfusá. This may indicate a tectonic or a pre-submergence drainage relationship between Selvogur Byg and the Southwestern Lowland.

With the exception of several large boulder zones, the bank between Hafi Djúp and Selvogur Byg is covered with sand and shells throughout the eastern half, opposite the lowland, and with gravel throughout the western half, south of the Reykjanes peninsula. The sand can, without doubt, be attributed to the many large glacial rivers (the Jöfall and Thverá, from Tindfjella Jökull and others; the Thjóræ, from Vatna Jökull and Mofa Jökull; the Ölfusá, from Lang Jökull) draining across the lowland.

The gravel is less easy to explain. Shepard (19, p. 1939) has advanced the hypothesis that areas of gravel far out on the continental shelves may be residual from the Pleistocene epoch, when much of the shelves was exposed to subaerial conditions, or at least more effective wave erosion, as a result of lowered sea level. In Iceland during the Pleistocene the relative sea level probably rose rather than fell. However, at the end of the Pliocene it did fall, so that in essence Shepard's explanation may account for the gravel south of the Reykjanes peninsula, as well as the gravel east of Hafi Djúp.

Geobotany South and West of Reykjanes

West of Selvogur Dyb lies Reykjanes Dyb, another submarine valley separated from Selvogur Dyb by a long, narrow submarine ridge. Cutting across the head of Reykjanes Dyb, and intruding into it in such a manner as to suggest it was formed later than the valley, is a high, narrow submarine ridge extending southwestward from Reykjanes. A line of shoals, reefs, and islets (Hlady, the Geirfuglesker, Hladyferhófi) marks the top of this ridge. It is interrupted by two channels over 100 fathoms deep; one, 7 miles southwest of Geirfuglesker in the Geirfuglesker, and the other, 7 miles south-southwest of Hladyferhófi.

Like the Reykjanes peninsula, this submarine ridge is the site of considerable volcanic activity. Flares and explosions have been reported at various times from the sea over this ridge, and several islands have appeared and disappeared within the historical period (14, p. 370; 22, pp. 501-512).

C. F. Wandel, in his report on the soundings taken by the Danish "Ingolf" expedition of 1875 (9, part 1, p. 19 and plate 1) describes the extension of the ridge to the southwest at least as far as latitude 36 degrees N. Later work by the German survey ship, the "Meteor", done

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From the first two cases (1) and (2), we have

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in 1930, points toward the possibility of a connection between the Reykjanes Ridge and the Middle Atlantic Ridge (6, p.348-349).

The author has shown gravel and sandy areas surrounding the reefs and islets and, to a great extent, covering the backbone of the ridge. Much of the gravel is placed on theory only, with the 50-fathom depth curve chosen arbitrarily as the boundary. It is believed that, as in the Vestmannaeyjar Islands, wave action upon the exposed rock plus submarine volcanism should produce considerable amounts of gravel.

Mud covers the seabottom in Salvogr Dyb and Reykjanes Dyb, on the low, narrow ridge between them, on saddles in the ridge extending southwestward from Reykjanes, and on the shelf as far as 11 miles north of Akayjarhöll. This is Hognild's gray, deep-sea clay.

Faxaflói. Bathymetry

Faxaflói is the wide, moderately deep bay between the Reykjanes peninsula on the south and the Snæfellsnes peninsula, which bears Snæfellsjökull, on the north.

The general slope of the bottom is from the north, east, and south toward Faxaflói Dyb (called Faxaflóidjúp on S.A.305), the submarine valley which heads into Faxaflói from the west. In the southern

half of Faxaflói the banks Vestfirðun, with least depth of 8 fathoms 1 foot (latitude 64 degrees 17 minutes N., Longitude 22 degrees 11 minutes W.), and Hyðrafirðun, with least depth of 8 fathoms (latitude 64 degrees 24.25 minutes N., Longitude 22 degrees 22 minutes W.), interrupt this general westward descent. In the northern part of the bay Húðagrunn, with least depth of 24 fathoms (latitude 64 degrees 34.5 minutes N., Longitude 22 degrees 51.1 minutes W.), rises 16 fathoms above the surrounding bottom. Numerous other shoals of small extent occur throughout the bay, imparting a differential relief of as much as 10 fathoms to the bottom. Two shallow Fjorde, Kvallfjörður and Borgarfjörður, indent the eastern shore of the bay.

Faxaflói represents a recently submerged low land (S.P. 139; 17, pp. 276, 281). The 10-fathoms depth curve outlines a shallow submarine valley, which commences 10 miles south of Hyðrafirðun, runs eastward and northward past Hyðrafirðun, then turns westward and opens up north of Vestfirðun. Depth curves on S.P. 1201 and S.P. 2723 show smaller submarine valleys continuing outward from the small bays and Fjorde, which indent the coast, and entering this main submarine valley from the east. These are highly suggestive of a now-submerged stream drainage system which at one time emptied westward into Faxaflói Bay.

If 5-fathom depth curves are drawn on the bottom in the remainder of Vaxsfjöldi well submarine valleys there also are seen to continue outward from shore indentations and open to the north and west toward Vaxsfjöldi Fyt.

Bottom conditions in Vaxsfjöldi

West of Longitude 23 degrees W. the bottom is covered by sand and shells, with a few scattered pebbles and areas of gravel. East of Longitude 23 degrees W. the pattern of sediment areas becomes more complex. Sand is still the predominant sediment. However, a large, irregularly-shaped area of gravel lies northwest of Sudavunga, probably extending farther south than the author has shown to include the previously mentioned 14-fathom sounding. A second area of gravel, roughly rectangular in outline, covers Vesturanga and Myrdavunga. A third area of gravel, averaging 1 mile in width, commences about 10 miles southwest of Vesturanga and extends the same distance or 20 miles just offshore from the west end of the Reykjanes peninsula.

The southern end of the main submarine valley south and west of Myrdavunga is filled with sand and shells about four miles west of that point. The southern boundary of this sand area has been placed arbitrarily at the 10-fathom depth curve. The strip of bottom between

It is a very small number of cases in the
history of the world which have been
the cause of serious concern to the
people of the world and have caused
them to be very much alarmed.

THE HISTORY OF THE WORLD

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long and complicated one, with a
great many different parts, and a
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this curve and the shore has been depicted as sandy on the basis of the sand-bottom symbols used on this chart and on B.A.3201.

East of Longitude 22 degrees 21 minutes W. the pattern of sediment zones is exceedingly complex, reflecting the greater detail portrayed on the large scale charts B.A.3201 and B.A.2729. If the portion of Faxafloei west of that meridian were shown on charts of comparable scale the pattern would probably be as involved as it is east of it.

An irregular belt of gravel 2 miles wide at its widest trends slightly east of north for 11 miles from Latitude 64 degrees 3.5 minutes N., Longitude 22 degrees 5 minutes W. past the mouth of Hornarfjörður and Skerfjafjörður to Latitude 64 degrees 14 minutes N., Longitude 22 degrees 4 minutes W. Here it joins at its midpoint a belt of gravel of similar width running east-west and lying partway across the mouth of Hvallfjörður. A smaller belt of gravel lies directly seaward the mouth of Hornarfjörður. These three gravel belts may represent morainal material deposited by glaciers formerly occupying the fjords, possibly prior to submergence of the region. The areas covered by them are not notice-

ally elevated above the surrounding bottom. However, the fact that the Banks Vestraeyra, Eydeyeyra, and Hvalaeyra are covered with gravel lends weight to the probability the bottom of Faxaflói may once have been subject to glacial deposition from the east. The three mounds could have been formed, in part at least, by the heaping together of debris from merging ice lobes, or by the deposition of debris from one or more lobes onto the sides and tops of pre-existing elevations. Following subsidence, current action would no doubt tend to winnow out the finer constituents from the surface of the moraine mounds and leave gravel as the dominant sediment. According to Thoroddsen's geological map (1957), glacial striae in the region surrounding Faxaflói all indicate ice motion from the north, east, and southeast into Faxaflói.

Glaciation may also be invoked to account for the overall complexity of patterns shown on B.A.3201 and B.A.2729, particularly north of Reykjavík (Latitude 64 degrees 4.7 minutes N., Longitude 21 degrees 56.7 minutes W.). Here the extremely varied and changing mixture of sand, gravel, mud, and rock conforms to the description of a typical seabottom off a glaciated coast, as given by Shepard (26,p.225).

The shoreline on the north, east, and south of Faxarflói is fringed with reefs of basalt and dolerite, which come from the hills and mountains of the region. Even the narrow lowland northwest of Borgarfjörður is skirted by a zone of reefs and rocky islets a mile wide. This same zone continues into Borgarfjörður along the northwest side for nearly half its length. It is matched on the southwest side by a similar zone, which extends into the fjord on equal distances.

Hvalfjörður, likewise, is fringed by rocky reefs. Unlike Borgarfjörður, however, which is sandy throughout its entire length and breadth, Hvalfjörður has a strip of mud bottom down its center from mouth to head. In the Sailing Directions (18, p. 395) the following description is given of Hvalfjörður:

"...There are a number of dangerous rocks in the fjord and in its approaches, particularly in the entrance and on the southern side of its outer stretch. Farther eastward the rocks lie close to shore. In the deeper parts of the fjord the bottom consists of sand and shells in the entrance and of mud farther in. In the shallower parts it is mostly rock, with mud, sand, and shells in some places."

The shoreline on the north, east, and south
of the island is fringed with reefs and coral
which rocks form the hills and mountains of the island.
Over the water looking southwest at the island
situated at a point at which the water is deep
this small island contains some vegetation along the
shoreline with few trees. The island is situated
on the southeast side of a larger one, which contains
the type of coral reef.

Vegetation, however, is absent from the
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N.A.2996 (Scale 1:267,418)

General Statement

This chart shows the shelf off the northern half of the western coast of Iceland, from Smeyfillanes to the northernmost point of the Northwestern Peninsula. N.A.2733, on the south, extends to latitude 64 degrees 50 minutes N., giving a 20-mile overlap with this chart. All pertinent data within this overlap, which consists of the northern half of Faxaflói, is portrayed on both charts.

Extra data from large scale plans have been made use of in the following places on the Northwestern Peninsula:

Dyre Fjord, from N.A.2998 (approximately 1:82,475)
Hespeyri Fjord, a tributary to Isæ Fjord and
Fokals Fjord from the north, from N.A.3000
(approximately 1:51,325)
Fatrix Fjord, from N.A.2999 (this section
1:26,870)
Sveinseyri anchorage, in Talskæ Fjord, from
N.A.2999 (1:9,830)
Flötayri anchorage, in Örnudalur Fjord, from
N.A.2999 (this section 1:12,035)
Sautile Fjord, a tributary to Isæ Fjord from
the south, from N.A.2999 (this section
1:30,000)
Hlíðudalur anchorage, on the south side of
Arnar Fjord, from N.A.2999 (this section
1:12,000)

Bathymetry in Hvaldí Fjord

This bay, roughly the same length from east to west as Faxaflói, and about two-thirds the width of

5-4-3075 (1941-1942)

General Remarks

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and the results of the work of the system
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Hexafloi, lies between the long, narrow peninsula of Snaefellnes, on the south, and the southern shore of the Northwestern Peninsula, on the north. At its inner end it divides into two branches, with Ryvass Fjord at the head of the southern branch and Gils Fjord at the head of the northern.

Like Hexafloi, Breidi Fjord is a submerged island (4, p. 139; 17, p. 270). Submergence is due to subsidence, probably along peripheral fractures with the intervening peninsula of Snaefellnes representing a suture, or structurally positive element (17, p. 270; 21, p. 264).

According to the indicated directions (11, p. 316), the land in this region is rising:

"There is reason to suppose that depths in Breidi Fjord are decreasing, both in the bay proper and in Ryvass Fjord and in the northern branch Fjord. The charts, which are based mainly on surveys made between the years 1896 and 1929, must not, therefore, be entirely relied upon. It appears that the land is rising, and in many places depths less than those shown on the charts may be found."

Iwan also describes this recent rise of the land (10, p. 103), as shown by uplifted wave-cut terraces. He points to evidence, likewise, of recent uplift to the extent of 10 meters in the fjords of the Northwestern Peninsula.

In Breiddi Fjord bathymetric relief is greater and steeper than in Fannfjöldi. For example: from the 15-fathom sounding at Latitude 65 degrees 5.3 minutes N., Longitude 23 degrees 11.2 minutes W. the bottom falls off northwestward to 120 fathoms in 1-3/4 miles; from the 14-fathom sounding at Latitude 65 degrees 15.4 minutes N., Longitude 23 degrees 8.6 minutes W. the bottom falls off southeastward to 73 fathoms in 1 1/2 miles.

Also, it shows a strong northwest-southeast alignment of relief elements not present in Fannfjöldi. Kalluálf, a comparatively narrow, steep-sided submarine valley opening to the southwest, runs up into Breiddi Fjord just northwest of Snæfellsjökull, at which point it reaches a depth of 180 fathoms. Twelve miles north of Snæfellsjökull the valley comes to an end. However, directly in line with it a series of annular, linear-shaped submarine basins, with intervening ridges, continues northeastward into the northern branch of Breiddi Fjord. This zone widens rapidly until it includes practically all of Breiddi Fjord northeast of the 20-fathom sounding off Snæfellsnes.

If 10-fathom depth curves are drawn throughout the Fjord they will bring out the character and extent of these submarine basins and ridges. They are prominent

on a much smaller scale of the basins and ridges occurrence on the continental shelf off the coast of southern California. It is believed they, together with part of Kolluall, represent grabens and horsts, as do the California submarine basins and ridges. The remarkably close spacing and consistent parallelism of faults necessary to form such basins, 1 to 2 miles wide and 5 to 10 miles long, is known to exist on land in many parts of the Southwestern Lowland (17, p. 277; 25).

Southeast of the basin-ridge zone lies a shallow coastal shelf 3 to 6 miles wide, enclosed between the 10-fathom depth curve and the northern shore of Shaw-Fallness. This coastal shelf extends from near Kolluallur (Latitude 64 degrees 55 minutes N., longitude 23 degrees 53 minutes W.) to the mouth of Hvenne Fjord. It bears a number of shoals, reefs, and small islands, all completely lacking the linear character of the basins and ridges northwest of them. In Lock's guidebook (13, p. 38) many of the islands and reefs are considered to be portions of submarine volcanoes.

Northwest of Kolluall, and of the basin-ridge zone for as far west as longitude 23 degrees 55 minutes W., the bottom rises in a smooth, flat curve more than 20 miles northward to the strand line. West of that meridian a

a shoal belt of reefs, islets, and generally level ground extends along the north side of Breiði Fjord to Gils Fjord. Bounded approximately by the 10-fathom depth curve on the south, the zone reaches a maximum width of over fifteen miles at longitude 23 degrees 50 minutes W.

From Gils Fjord it extends along the south-east side of Breiði Fjord's north branch to Hvamms Fjord. Here it "overlooks" the eastern end of the coastal shelf of Ungefærllan and forms a bar across the mouth of Hvamms Fjord which dries almost completely at low tide (10, pp. 328, 329).

The strait called Syd-Floi extends up the middle of the north branch of Breiði Fjord, narrowing to a tortuous channel as it approaches Gils Fjord at the head. The basin-ridge zone also continues up the north branch of Breiði Fjord to the head. It is apparently widened enough to include: (1) some of the rocky, shoal belt along the southern side of the north branch; (2) Syd-Floi, with an isolated shoal area of reefs and islets in its middle (latitude 65 degrees 18 minutes N.; longitude 23 degrees 30 minutes W.); and, (3) much of the rocky shoal belt along the northern side of the north branch. In short, it covers nearly the entire north branch of Breiði Fjord up to, and probably including, Gils Fjord.

The linear shape of many of the reef and islet groups along the northern side of Breiddi Fjord indicates the basin-ridge zone approaches to within at least five miles of the shore. Another system of faults with different orientation is known to exist on the adjacent land. However, hydrographic information is too scanty to place exactly the boundary between the system on land and the system in the fjord.

Bottom Sediments In Breiddi Fjord

Along the entire southwestern coast of Iceland, including Faxaflói, the sandy areas without exception contain shells (see B.L.2733), suggesting an environment favorable to the development of shell fish. This can probably be attributed to the ameliorating influence of the Irminger Current, a terminal branch of the Gulf Stream which flows westward along the south coast of Iceland, from about the longitude of the Vestmannaeyjar Islands, and northward along the west coast.

In Breiddi Fjord, however, from head to mouth and out to sea as far as the chart extends only a few shelly areas are found. The largest of these is about ten miles long by three miles wide and lies along the meridian of longitude 23 degrees W. at about latitude 65 degrees 20 minutes N. The author can offer no expla-

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planation for this absence of shells, except to suggest the possibility of an influx of cold, fresh water from the head, such as occurs in the fjords of the Northwestern Peninsula.

Sand is the dominant sediment off the mouth of Breiði Fjord. From the west edge of the snort eastward to longitude 24 degrees 8 minutes W. it covers the entire bottom except for a few scattered gravel patches of uncertain size and shape. The largest of these lies just west of the end of Snæfellsnes.

In Breiði Fjord sand covers much of the bottom. However, between longitude 24 degrees 8 minutes W. and 22 degrees 50 minutes W. a large, irregular-shaped area of gravel, 14 miles wide from north to south, occupies the middle of the fjord, mantling basins and ridges alike. There is nothing in the shape or location of this gravel area that is diagnostic of its origin. It may very well be coralline gravel, as the land on all sides of Breiði Fjord has been glaciated.

The belt of foul ground (see page 29) which borders the shore in the north branch of Breiði Fjord and extends across the mouth of Svinnu Fjord is indicated as rock bottom wherever rock symbols occur. Too little information is shown on the chart, however, to assume that the entire belt is rocky. There must be some channels, such as

the possibility of an attack on the island, and the possibility of an attack on the island, and the possibility of an attack on the island.

There are two main reasons why the world
of today is so different from the world
of yesterday. First, the world is so
large and so complex that it is impossible
to understand it all. Second, the world
is so rapidly changing that it is impossible
to keep up with it. These two factors
are the main reasons why the world
of today is so different from the world
of yesterday.

There was a small, dark, rectangular object, possibly a box or a bag, lying on the ground near the base of the tree. It was covered in a dark, possibly black, material, and it appeared to be made of a heavy, possibly metal, material. The object was oriented horizontally, with its longer side facing the viewer. It was located in the lower right quadrant of the image, near the base of the tree trunk. The ground around it was uneven and covered in grass and small plants. The object's surface was smooth, but it had some dark, possibly wet, patches on it. It was not clearly identifiable as a specific object, but it appeared to be something that had been placed or dropped on the ground.

The belt of total darkness (see page 47) which separates the clouds in the lower reaches of the atmosphere is observed at various heights in the tropics. It is believed that this belt is caused by the presence of a layer of dust or smoke in the atmosphere. The height of the belt varies from 10,000 to 20,000 feet. It is observed that the belt is more prominent in the tropics than in the temperate zones. It is also observed that the belt is more prominent in the winter than in the summer. It is believed that the belt is caused by the presence of a layer of dust or smoke in the atmosphere. The height of the belt varies from 10,000 to 20,000 feet. It is observed that the belt is more prominent in the tropics than in the temperate zones. It is also observed that the belt is more prominent in the winter than in the summer. It is believed that the belt is caused by the presence of a layer of dust or smoke in the atmosphere.

side Deep (Latitude 65 degrees 30 minutes N., Longitude 23 degrees 5 minutes W.), extending out from the small fjords in the coast which would contain sand or mud. For example, the channel in which the island, Steyer occurs (Latitude 65 degrees 22.5 minutes N., Longitude 23 degrees 54 minutes W.) probably contains sand at least as far north as a channel is indicated.

Syd-Fjæl and the channel extending northeastward to Gills Fjord are also shown as containing sand, even though no bottom notations occur northeast of a line through the island, Stegley (Latitude 65 degrees 11.5 minutes N., Longitude 22 degrees 50.5 minutes W.).

The coastal shelf off the north side of Unserfjælles is largely settled with sand and occasional patches of gravel. However, many of the shoals, and all of the offshore reefs and islet groups are rock. Rock also fringes the shore in some places, as at Krossnes (Latitude 64 degrees 58.5 minutes N., Longitude 23 degrees 22 minutes W.) and Skallabudir (Latitude 65 degrees 0.7 minutes N., Longitude 23 degrees 10.5 minutes W.).

Grundas Fjord (Latitude 64 degrees 57 minutes N., Longitude 23 degrees 17 minutes W.) and Kolgrefs Fjord (Latitude 64 degrees 57 minutes N., Longitude 23 degrees 8 minutes W.) contain mud in their central portions.

Axis Deep (latitude 65 degrees 30 minutes N., longitude 23 degrees 5 minutes W.), extending out from the small fjord in the coast which would contain sand or mud. For example, the channel in which the island, listed occurs (latitude 65 degrees 22.5 minutes N., longitude 23 degrees 34 minutes W.) probably contains sand at least as far north as a channel is indicated.

54-150 and the channel extending northward, with the axis fjord and also shown as containing sand, even though no bottom notations occur northwest of a line through the island, except (latitude 65 degrees 14.8 minutes N., longitude 23 degrees 30.3 minutes W.). The coastal shelf off the north side of the island is largely marked with sand and occasional patches of gravel. However, much of the island, and all of the offshore reefs and later groups are rock, coral, also fringes the shore in some places, as at latitude (latitude 65 degrees 18.3 minutes N., longitude 23 degrees 32 minutes W.) and Skallinavik (latitude 65 degrees 0.7 minutes N., longitude 23 degrees 19.3 minutes W.).

Gravner fjord (latitude 65 degrees 37 minutes N., longitude 23 degrees 17 minutes W.) and Skallinavik fjord (latitude 65 degrees 37 minutes N., longitude 23 degrees 2 minutes W.) contain mud in their central portions.

With the exception of a narrow belt of rock and sand along the shore, and some isolated rocky shoals in the western part, Mykja Fjord is floored with mud.

The Vestfirðir, Dalhryggur

Between Skarðsbiorg Huk (Latitude 66 degrees 30 minutes N., Longitude 24 degrees 32 minutes W.) and Rist Huk (Latitude 66 degrees 21.5 minutes N., Longitude 23 degrees 12 minutes W.) the western coast of the North-western Peninsula is deeply indented by numerous fjords, which are known collectively as the "Vestfirðir" or "Northwest Fjords". According to the Ballin, Greenland (1898, p. 338), the shores of these fjords "which run for considerable distances southward between high, steep coasts, are much indented by smaller fjords, separated by a series of low points, consisting of shingle and sand, which are the remains of the terminal moraines of the Ice Age."

All of the Vestfirðir have submarine valleys leading out from their mouths. Most of these come to an end before the 100-fathom depth curve is reached. However, Víkuráll, off Þorvík Fjord (or Þorvíkarsýður), and Þjóðáll, off Ís Fjord (or Ísgráfi), both reach depths of nearly two hundred fathoms (see U.S.S. 545). The

These valleys are believed to have been formed by subaerial erosion at the end of the Pliocene epoch, when the strand line was lower than at present. Bjørnli, however, may owe some of its depth to the fringing chain outline (see Fjerd [19, p. 80; 17, p. 276; 21, p. 266]).

Although in existence before Pleistocene glaciation commenced, the Vestfirfir received their present form by the glaciers which ground through them at that time. Like all typical glacial valleys the fjords are steep-walled and relatively flat-bottomed. Many of them contain closed basins separated from the outer depths by thresholds and rock bars.

The two southernmost of the Vestfirfis, Petris Fjord and Telken Fjord, contain basins of over thirty fathoms depth behind a common threshold lying at 19 fathoms. Arner Fjord, northwest of Telken Fjord, contains a steep-walled basin, reaching 60 fathoms, throughout much of its length; the threshold is 23 fathoms at its deepest. Dyre Fjord, northeast of Arner Fjord, likewise contains a basin, 37 fathoms at its deepest, lying behind an 16-fathom threshold. The deep in Ise Fjord, the largest of the Vestfirfir, reaches 80 fathoms; the threshold, 63 fathoms. Skotte Fjord, the fifth tributary in from the mouth of Ise Fjord, is 80 fathoms deep in the inner reaches but only 54 fathoms at its mouth.

Rock bars are found across the mouths of Vest Fjord, Hjófi Fjord, and Reykjer Fjord, all tributaries of Ise Fjord. Suganda Fjord, just southwest of the mouth of Ise Fjord, has a shoal at its mouth which, according to Iwan (10, Figure 71), is an impassable rock bar.

Bottom Sediments in the Vestfirðir

Due to lack of data the author has theorized to a great extent in portraying bottom sediments in the Vestfirðir. However, enough annotations and symbols are shown on the chart and large scale plans to permit one finding in some of the fjords a pattern very typical of fjord sedimentation --namely, a belt of mud along the deeper, central portion, with belts of sand with some gravel and rock along the sides. Petrix Fjord, Ise Fjord, and Hesteyri Fjord definitely show this pattern. Dyra Fjord also shows it; however, the very deepest part of its basin is floored with sand while only the inner half, which is somewhat shallower, is floored with mud.

The mud shown in Talkeas Fjord is based solely on the likelihood that the enclosed basin, 10 fathoms deeper than the surrounding bottom, should be the site of accumulation of finer sediments. The mud shown at the upper end of the fjord, southeast of Sveinsayri, also is based on theoretical considerations. It is

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History of the...

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believed the inner reaches of a fjord, even if not particularly deep, may be the site of mud deposition if (1) the configuration of the shoreline gives some protection from waves and currents, and if (2) streams entering at the head do not carry heavy loads of coarse sediments. For the same reason mud has been shown in Ömunder Fjord, northeast of Dyre Fjord, even though no bottom notations appear on the chart or the large scale plan at that place. Mud is also shown in Suganda Fjord. In both this fjord and Ömunder Fjord a point of land or a shoal partially shuts off the inner portion.

Each of the mud zones described above in Talsne Fjord, Ömunder Fjord, and Suganda Fjord may, of course, have greater or lesser extent than shown. For example, the mud line in the upper end of Ömunder Fjord is placed arbitrarily along the outer edge of the area of sandy (stippled) bottom; no such area, however, is shown in Suganda Fjord, so mud has been shown as flooring the entire fjord up to the head.

Arnar Fjord has only one mud notation, located at its mouth. It is considered almost certain, though, that the mud zone extends throughout much of the fjord, flooring the steep-walled, branching deep that runs down its center.

believed the inner reaches of a fjord, even if not
entirely open, may be the site of an important
(1) the collection of the river water and
section from water and entrance, and (2) entrance
entirely at the head of the fjord heavy loads of coarse
sediments. For the same reason and has been shown in
Gundar fjord, northeast of Igloo fjord, even though the
entire collection system on the shore of the fjord would
plain at that place. But in this case it is shown in
in both this fjord and Gundar fjord a point of land
as a small partially closed off the inner portion.
Each of the two bays described above in
Igloo fjord, Gundar fjord, and Igloo fjord may
be shown, have greater or lesser and in this manner.
For example, the main line in the upper end of Gundar
fjord is placed vertically along the outer edge of
the area of heavy (unfilled) bottom; no such area,
however, is shown in Igloo fjord, no such area
shown as showing the entire fjord up to the head.
Igloo fjord has only one such section.
located at its mouth. It is considered almost entirely
closed, and the main section is shown in
of the fjord, showing the steep-walled, horizontal
that this was the main line.

Of the tributaries to Ise Fjord only the first, Skutla Fjord, contains enough data on the chart and plan to show sea bottom with assuredness. Alti Fjord, Seyla Fjord, and Rest Fjord are all unsurveyed, as no attempt has been made to outline the sediment pattern in them. It is quite probable that Rest Fjord contains considerable amounts of mud, since it is cut off from Ise Fjord by a shoal rock bar.

The deep basin in Skutu Fjord has been shown as floored with mud, although no sediment notations are present on the chart.

Mjori Fjord, Reykjar Fjord, and the head of Ise Fjord are unsurveyed. Mjori and Reykjar, like Rest Fjord, probably contain mud, since they bear rock bars across their mouths.

Veidileysa Fjord, east of Hesteyri Fjord, is assumed to have a mud bottom, since an enclosed basin is present and there are no shoals or projections of land to cut off one portion from the rest. Iona Fjord, Hrefna Fjord, and Lejru Fjord, southeast of Veidileysa Fjord, are all unsurveyed.

On the shelf northwest of the Vestfirðir the predominant sediment is sand and shells. There

On the west side of the river, the
river, which is about 100 feet wide,
flows in a southerly direction, and
is bounded by a low bank on the
west side, and a high bank on the
east side. The water is clear and
shallow, and the current is not
strong. The river is a good
place for fishing, and the
banks are covered with trees and
shrubs.

The river is a good place for
fishing, and the banks are covered
with trees and shrubs. The water
is clear and shallow, and the
current is not strong. The river
is a good place for fishing, and
the banks are covered with trees
and shrubs.

On the north side of the river,
the river, which is about 100 feet
wide, flows in a southerly direction,
and is bounded by a low bank on
the west side, and a high bank on
the east side. The water is clear
and shallow, and the current is not
strong. The river is a good place
for fishing, and the banks are
covered with trees and shrubs.

are, however, a number of oval-shaped patches and areas of gravel. The position of the largest of these opposite the mouths of Petrix Fjord, Talke Fjord, and Brye Fjord, and of a smaller one opposite the mouth of Ólafur Fjord and Sugunda Fjord suggests that they may be glacial moraines. However, like the gravel belts off the mouths of Hvalfjörður and Mergarfjörður in Faxaflói, these exercise no control over the bathymetry.

Although positive evidence is scarce, it would appear that the bottom sediments of the Vestfirðir are essentially devoid of shells. An arbitrary line, based on bottom notations, has been drawn between shelly and supposedly non-shelly bottom. This line cuts directly across Ísl Fjord at its mouth; it then continues west and south from Sugunda Fjord to Petrix Fjord at a distance of from 2 to 4 miles out from the fjord mouths.

One reason for the absence of shells could be the discharge of cold, fresh water into the fjords from the streams at their heads. Iwan (10, p. 34) reports that the comparatively warm oceanic waters have little effect in the bays and fjords of the western coast of Iceland. Also, according to the Coasting Directions 118, p. 310, in some of the Vestfirðir the outgoing surface current of fresh water is sufficient to stop tidal

currents 1 or 2 miles in from the mouth.

On the shelf outside the fjords shells are quite abundant. Attention is called to the numerous shell notations off the west end of the peninsula between Petrix Fjord and Breidil Fjord; also, in the vicinity of Nitr Huk and Strumness, north of the mouth of Isa Fjord. Thoroddsen (24,p.344) mentions quantities of decomposed mussel shells occurring as calcareous dust along the coast of the Northwestern Peninsula.

Judging by bottom notations on this chart and on BA.2977, the region of abundant shells is bounded on the northeast by a line running from latitude 66 degrees 27 minutes N., longitude 22 degrees W. northwestward to the edge of the chart. This sudden cessation of shells in the sediments may be apparent rather than real, since the "Ingolf" (9, Part 3, p.77) found a larger percentage of shells off the peninsula of Skagen (see B.A.3377) than anywhere else in Icelandic waters except west from North Cape. The use of a different technique in sounding and sample collecting by the ships surveying the north coast, or even the presence of different personnel among the hydrographers, could conceivably be responsible for the change.

However, the cessation of shells may be real.

currents I or 2 miles in from the shore.

On the north side, the water is shallow.

At the mouth of the river, the water is shallow.

Small fish are taken in the river and in the bay.

There is a small bay on the north side.

At the mouth of the river, the water is shallow.

Small fish are taken in the river and in the bay.

At the mouth of the river, the water is shallow.

Small fish are taken in the river and in the bay.

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Small fish are taken in the river and in the bay.

At the mouth of the river, the water is shallow.

Small fish are taken in the river and in the bay.

However, the season of shells may be long.

If so, it could possibly be due to the temperature of the Inranger Current falling below a certain critical point as it rounds the northwestern peninsula and sets to the east. Or, perhaps it could be attributed to the effect of drift ice from the Arctic Ocean. Quite often, in the spring of the year, this ice is carried by the East Greenland Current down to the vicinity of the Northwestern Peninsula. The main mass goes southwesterly through Denmark Strait, between Iceland and Greenland. Part, however, is frequently picked up by the Inranger Current and carried eastward along the northern coast of Iceland.

The western boundary of the zone of shelly bottom is not known. It has been shown as extending out to the edge of the chart, based on latest observations.

Occurrence of Coral Along the Northwestern Coast

The presence of coral in Patrix Fjord, in Byre Fjord, and on the shall coast of North Cape (latitude 66 degrees 40 minutes N., longitude 22 degrees 28 minutes E.) is noted by the author with particular interest. It is believed that this is living rather than fossil coral, even though it occurs, in one case, in cold fjord waters and, in the other, along a coast subject to severe ice blockades. Living forms of

colonial coral have been found in the cold waters of the Arctic sea along the Alentian arc (15,p.373), and also in the North Atlantic off the coast of northern Norway (3).

It is, of course, very possible that the Icelandic coral is, after all, fossil. If so, that occurring in the Fjorde could be no older than Pleistocene, as the fjords received their present forms then. The coral occurring out on the shelf east of North Cape could be either Pleistocene or late Tertiary.

B.A.2977 (Scale 1:261,260)

General Statement

This chart shows the western half of the northern coast of Iceland, including part of the North-western Peninsula. It extends from North Cape to Siglu Fjord (Latitude 66 degrees 10 minutes N., Longitude 18 degrees 55 minutes W.). B.A.2976 on the west overlaps with this chart along a north-south strip 111 miles long by 13 miles wide. All data within this overlap is shown on both charts. Also, more detailed information has been added in Hrute Fjordur from chart B.A.931 (scale 1:100,000 for entire chart; 1:20,000 for inner half), in Skagstrand harbor from plan B.A.3001 (scale approximately 1:10,000), and in Siglu Fjord from plan B.A.3001 (scale this section approximately 1:20,000).

Bathymetry Off the North Coast of Iceland

Off the northern coast of Iceland the bathymetry is characterized by a series of great north-trending deeps separated by banks which extend in places almost fifty miles out from the coast (see B.A.565). The deeps are continuous with fjords indenting the coast. The fjords, in turn, head in valleys which continue southward, trenching the interior highland (see page 6). The banks, outlined by the 100-fathom depth curve, lie off the peninsulas that separate the fjords.

REPORT OF THE

COMMISSIONER

OF THE

LAND OFFICE

IN RESPONSE TO A RESOLUTION

PASSED BY THE HOUSE OF REPRESENTATIVES

ON FEBRUARY 1, 1890

AND TO A RESOLUTION PASSED BY THE SENATE

ON FEBRUARY 1, 1890

ON FEBRUARY 1, 1890

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ON FEBRUARY 1, 1890

AND TO A RESOLUTION PASSED BY THE SENATE

As shown on B.A.565 the deeps and banks from west to east are: Ströndegrund (Strönda Grund on B.A.2977), Húnaflói Djúp (Húnaflói Deep on B.A.2977), Skaga Grund (Skaga Grund on B.A.2977), Skagafjardardjúp (Skaga Fjord Deep on B.A.2977), Fljóts Grund (Strömsa Flak on B.A. 2977), Eyjafjardaráll (Eyja Fjörðar Dyb on B.A.2978), Grimseyjargrund (Grimsey Flak on B.A.2978), Tjörnesgrund (Ma heyja Flak on B.A.2978), Axarfjardardjúp (Axar Fjörðar Dyb on B.A.2978), Blöttugrund (Melfaka Flak on B.A.2978), Thistilfjardardjúp (Thistil Fjörðar Dyb on B.A.2978), and Thistilfjörðar Grund (Hjóláan Banks on B.A.2978).

The deeps are fault troughs, formed, at least as far east as Eyja Fjörðar Dyb, by movements sometime during the Pleistocene epoch (17,p.277). The deeps east of Eyja Fjörðar Dyb apparently are related to recent faulting to be described later. Some of the western deeps may have been subjected to glacial scour in their inner portions as their corresponding fjords show evidence of glaciation.

In the fjords much of the former depth has been filled in by mud and silt from the large rivers and streams entering at their heads (25). Embayed basins and thresholds, such as occur in the Vestfirðir and in the fjords of the east coast, are practically lacking.

in the fjords of the north coast.

Stranda Grund, Bathymetry and Bottom Sediments

The easternmost of the banks, Stranda Grund, extends slightly over fifty miles northeastward from North Cape. Along its northern edge it is covered with mixtures of mud, sand, and gravel. Between this outer zone and North Cape the chief sediment is sand, continuous with the sand covering the shelf off the western coast of Iceland.

The entire southeastern half of Stranda Grund, from the coast out to the northeastern end of the bank, is covered with gravel, forming a great irregular-shaped belt paralleling Hunafloei Deep. A 10 to 15-mile wide zone of rocky reefs and shoals, called Strandsbrekar, extends almost completely across this gravel belt at its shoreward end.

Three shoal patches in the vicinity of Latitude 66 degrees 21 minutes N., Longitude 21 degrees 50 minutes W. bear mud notations. The author believes these may be of glacial origin. The sinusoid, esker-like ridges at Latitude 66 degrees 23 minutes N., Longitude 22 degrees 2 minutes W. and the enclosed basin of Drang All at Latitude 66 degrees 27 minutes N., Longitude 21 degrees 50 minutes W. likewise are features probably produced by glaciation.

IN THE COURT OF THE UNITED STATES FOR THE DISTRICT OF COLUMBIA

JOHN EDGAR HOOVER, Plaintiff,

vs.

JOHN EDGAR HOOVER, Defendant.

JOHN EDGAR HOOVER, Plaintiff,

vs.

JOHN EDGAR HOOVER, Defendant.

JOHN EDGAR HOOVER, Plaintiff,

vs.

JOHN EDGAR HOOVER, Defendant.

JOHN EDGAR HOOVER, Plaintiff,

vs.

JOHN EDGAR HOOVER, Defendant.

JOHN EDGAR HOOVER, Plaintiff,

vs.

JOHN EDGAR HOOVER, Defendant.

JOHN EDGAR HOOVER, Plaintiff,

vs.

JOHN EDGAR HOOVER, Defendant.

JOHN EDGAR HOOVER, Plaintiff,

vs.

JOHN EDGAR HOOVER, Defendant.

JOHN EDGAR HOOVER, Plaintiff,

vs.

JOHN EDGAR HOOVER, Defendant.

On the shelf just off the coast between North Cape and Steingrims Fjord there is not sufficient data to show the bottom sediments. It is, however, generally rocky and the coast is fringed with many reefs. The mud in Steingrims Fjord is based only on the presence of an enclosed basin reaching 31 fathoms in depth. It is not known whether this mud is continuous with the mud in Skagastrad Bay. Kolla Fjord, south of Steingrims Fjord, may very well contain mud also since it is nearly closed off by a rock bar across the mouth.

Hunafloei Deep, Bathymetry and Bottom Sediments

This great deep, lying between Stranda Grund and Skege Grund, reaches depths of over two hundred fathoms near its outer end. The 100-fathom depth curve, bounding the deep, runs unbroken as far south as latitude 66 degrees N. while isolated basins over 100 fathoms deep continue 47 miles farther south. An isolated submarine ridge, rising from 20 to 50 fathoms above the surrounding bottom, lies at latitude 66 degrees 11 minutes N., longitude 20 degrees 55 minutes W. This ridge may owe its origin to the faulting which formed Hunafloei Deep.

For the most part Hunafloei Deep is floored with mud. a few patches and areas of sand, gravel, and

 

mixed sand and mud occur throughout its length. The mud is Boeggild's gray, deep-sea clay (9, Part 3, Plate 2).

Hunaflói Deep runs southward up into Skagastrand Bay, between the Northwestern Peninsula and the peninsula of Skagen. This, in turn, bifurcates into Hrute Fjordur on the west and Huna Fjord on the east.

A narrow isthmus, measuring 4 miles in width and 228 meters in maximum height above sealevel, separates Bitru Fjord, west of the mouth of Hrute Fjordur, and Gile Fjord, at the head of Breidi Fjord. If this isthmus were not present the Northwestern Peninsula would be an island. The orientation of Bitru Fjord and Kolla Fjord suggests that the inferred northeast-trending fault system of Breidi Fjord (see page 28) may cut across the isthmus and intersect or merge with the system outlining Hrute Fjordur and Hunaflói Deep.

The mud in Hunaflói Deep is shown as extending southward to the mouth of Hrute Fjordur. This is considered to be a continuous belt following the channel that runs into Hrute Fjordur.

A second, narrower belt of mud lies along the axis of the inner half of Hrute Fjordur. The sandy areas on either side of this belt, and possibly the belt itself, contains shells, in contrast to the Vestfirðir (see page 38). One possible explanation for this may be that the

deeply inset inner portion of the fjord is to some extent protected from the Arctic drift ice which frequently besets the northern coast. Also, no icy glacial streams pour their waters into Hrute Fjordur as they do in some of the Vestfirðir; the stream entering the upper end of Hrute Fjordur heads in a small lake in the highlands 10 miles to the south (25).

Rock fringes the eastern and western shores of Hrute Fjordur, both at the mouth of the fjord and halfway back toward the head.

Mid Fjord, east of Hrute Fjord, contains no bottom notations on the chart. The author has shown a belt of mud along its axis at the mouth, based on the presence of a 60-fathom enclosed basin.

The mud zone of Hunaflói Deep is lobate to a limited extent toward Huna Fjord. The mud line is shown running along the eastern side of a gentle trough heading into Huna Fjord. It swings northward opposite the point of land called Vatnasnes, then southward again into Hrute Fjordur. A band of gravel 3 to 4 miles wide flanks this lobe of mud on the east and south.

Sand, with some rock and a few patches of mud, floors Huna Fjord proper. The amount of sediments delivered to Huna Fjord by the numerous streams emptying

The first thing I noticed when I stepped out of the plane was the cold, crisp air. It felt like a blanket. The ground below was a mix of brown and green, with some small patches of snow. I walked for a few minutes, feeling the texture of the earth under my feet. The sun was low in the sky, casting a warm glow over the landscape. I saw some small buildings in the distance, and a few people walking around. It felt like I had reached a new world.

into it is considerable. According to Bisiker (4,p.192), the Slandá, which enters from the east, is one of the largest rivers in Iceland; it drains from two glaciers, Lang Jökull and Hof Jökull, in the interior, and carries much silt in the form of rock flour. Thoreddsen's geological map (25) shows an extensive alluvial fill in the valleys at the head and on the east side of the fjord.

Skaga Grund, Bathymetry and Bottom Sediments

The bank, Skaga Grund, extends more than forty miles north-northeastward from Skagen peninsula. It is about twenty miles wide near the coast and tapers to about ten miles wide at the outer end.

The pattern of bottom sediments on Skaga Grund is remarkably symmetrical with respect to the plan and east-west profile of the bank. A belt of sand varying from 3 to 7 miles wide, lies along the eastern and northern coasts of the Skagen peninsula. Seaward of this a belt of gravel, 3 to 8 miles wide, extends entirely across the bank, from Hunafliði Deep to Skaga Fjord Deep, forming a crude V pointing northward. From the apex of this V a narrower belt of gravel, 3 to 4 miles wide, extends northward along the shoalest portion of the bank to within 7 miles of its end. The author believes this gravel, as well as the gravel on Stranda Grund and in Skagestrand

There is no doubt that the
the British people have been
regard to the future of the
and the future of the world.
and the future of the world.
and the future of the world.
and the future of the world.

It is about twenty miles east of the coast and is about ten miles wide at the outer end.

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See also a note by the author, *ibid.* 1979, 103.

[illegible]

2. Salmon, and broil with oil billboard not and

is 4 miles to west and north. In addition, potential 4 above

Bay, may be residual from a former time of lowered sea-level.

Irregular-shaped belts of sand lie on either side of the north-trending central gravel belt, covering the remainder of the bank except for the outer end where mud is the predominant sediment. The sand belts, in turn, are flanked by the mud of Hunsfjörð Deep and Skage Fjord Deep. Two isolated, linear-shaped areas of sand extend north-northeastward along the eastern and western sides of the bank at its outer end.

Skage Fjord Deep, Bathymetry and Bottom Sediments

This deep is well-defined out to about latitude 66 degrees 27 minutes N., reaching 150 fathoms there. The isolated submarine ridges lie in the vicinity of latitude 66 degrees 20 minutes N. The easternmost of these rises 45 fathoms above the channel east of it, while the westernmost rises from 10 to 30 fathoms above the surrounding bottom. They may be due to faulting, especially the westernmost, which is linear-shaped, or they may possibly be due to glacial deposition.

Skage Fjord Deep is floored with mud southward to latitude 66 degrees 5 minutes N. Flanking it on the east, along the edge of Strømmen Flak, is a belt of sand from 1½ to 6 miles wide. Strømmen Flak itself is covered, for the most part, with gravel, thus continuing

may be essential from a number of points of view.

Topographical features of area are of great importance in the study of the history of the area and the development of the area. The area is of great importance in the study of the area and the development of the area. The area is of great importance in the study of the area and the development of the area. The area is of great importance in the study of the area and the development of the area.

Geographical Features of Area

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the remarkable symmetry of pattern observed in Munsflói Deep and Skaga Grund.

Bottom Sediments in Skaga Fjord

Skaga Fjord Deep runs up into Skaga Fjord to the south. A north-trending belt of mud is shown lying in the western part of the fjord, following the channel there. Its exact extent to the north is unknown. Intervening between it and the mud of Skaga Fjord Deep, further to the north, is a zone of gravel which connects on the east with the gravel of Straumnes Flak.

The chief sediment throughout the remainder of Skaga Fjord, i.e. in the eastern half, at the head, and in a coastal strip along the western side, is probably sand. One possible exception may be the channel shown by soundings to run up the east side of the fjord; this may contain some mud, although none has been shown on the chart.

It is certain that a great amount of sand and silt has been, and is being, emptied into Skaga Fjord. On Thoroddsen's map (25) the river entering at the head of the fjord is shown to drain from Hofe Jökull in the interior. Also, all streams entering from the east head in valleys below small local glaciers in the highlands between Skaga Fjord and Myje Fjord. The large alluvial

The remarkable symmetry of pattern observed in the
large and small forms.

THE LITTLE WHITE TIGER

The little white tiger is a small tiger.

The colour. A north-facing side of the tiger is
in the western part of the tiger, following the general
trend. The tiger is a small tiger.

There is a small tiger between it and the large tiger, but
to the north, is a small tiger which connects it
with the tiger of the tiger.

THE LITTLE WHITE TIGER

of the tiger, i.e. in the eastern half, of the tiger,
and in a small tiger along the western side, is a
small tiger. The possible exception may be the tiger.

known by accident to be of the tiger of the tiger;
this is a small tiger, although there are some small
tigers.

It is certain that a great number of small tigers

are in the tiger, and in being, a small tiger, or
the tiger is a small tiger from the tiger in the tiger.

Also, all tigers are small tigers, from the tiger in
valleys below small tigers in the tiger in the tiger.

fill in the valleys at the head and along the eastern side indicates that Skaga Fjord at one time extended farther south and that smaller, tributary fjords opened into it from the east(25).

Occurrence of Coral along the Western Half of
The Northern Coast

B.A.2977 shows coral notations in three localities: (1) at Strandsbreker, on Strande Grund; (2) in Hrute Fjord; and (3) off the northern and eastern coasts of the Skagen peninsula. No data are available for determining whether or not these are living coral forms. As previously mentioned, colonial coral has been found living in cold-water environment in other parts of the world. It may therefore occur along this coast also.

will in the valleys at the head and along the eastern
side of the range. The range is of the same
height as the other ranges, and the same
at the head of the range.

THE RANGE OF THE MOUNTAINS

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also.

B.A.2978 (Approximate Scale 1:261,260)

General Statement

This chart shows the eastern half of the northern coast of Iceland, extending from Siglu Fjord to Njerseds Viði, 45 miles south-southeast of Þorlákinn and to the outer extremity of the Langanes peninsula.

The overlap with B.A.2977 on the west consists of a north-south strip only two miles wide. More detailed information in Siglu Fjord and in Myja Fjord has been obtained from plan B.A.3001 (approximate scale this section 1:20,000) and chart B.A.3488 (scale 1:90,000) respectively.

Pattern of Bottom Sediments Off the Eastern Half Of the Northern Coast of Iceland

The outstanding feature on this chart, as on B.A.2977, is the series of north-trending deeps and banks-- seaward continuations of the large fjords and broad peninsulas which characterize the northern coast.

In the western half of the chart these deeps and banks control the sedimentation, giving rise to the same rudely symmetrical pattern observed on B.A.2977; i.e. mud flooring the deeps and gravel, flanked by sand, covering the banks. East of Akur Fjörður Dyb, however, deeps and banks alike are, to a great extent, covered with sand. The several patches of mud in Thistil Fjörður Dyb, Thistil

Fjord, and Langenes Dyb, and the patches and areas of gravel on Melrakke Flak, Kjølsen Banke, and Langenes Flak suggest that the symmetrical pattern of sediments formerly existed here also, but has been masked by a great flood of sand.

Sylja Fjardar Dyb and Sylja Fjord, Bathymetry and Bottom Sediments

Sylja Fjardar Deep merges with Haganes Deep and Skage Fjord Deep to the west (see B.A.2977 and B.A.565) and is bounded on the east by Grimsey Flak. It reaches depths of over two hundred fathoms north of latitude 66 degrees 22 minutes N. Like the other deeps to the west, it is floored with sand.

Sylja Fjardar Dyb runs up into Sylja Fjord, which, in turn, heads in a long, narrow valley trenching the interior highlands for a distance of almost thirty-five miles south of the fjord head. According to Nielsen (17,p.277), this depression, extending from the interior far out to sea, is probably a fault trough formed during the Pleistocene epoch.

The pattern of bottom sediments in Sylja Fjord is similar to the pattern in other large fjords. Sand floors all of the deeper portion continuously from head to mouth. This is flanked on either side by narrow belts of sand covering most of the shallower portions.

The shoreline throughout much of its length is rocky and fringed with reefs.

Sandy and stony deltas have been built out into the Fjord from the mouths of several of the streams, as the Fjnoski, the Horgi, and the stream entering at the fjord head, south of Akureyri. The sand and gravel flooring Olafa Fjord, near the mouth of Eyja Fjord, and extending out into the main fjord is undoubtedly derived from the stream at its head. The spit called Oddeyri, north of Akureyri, is a partially-submerged terminal moraine reworked by tidal currents (10, p. 81).

Griasey Flak, Bathymetry and Bottom Sediments

This bank reaches over thirty miles to seaward from the peninsula between Eyja Fjord and Skjelfandi. This peninsula for convenience will be called the Gjögur peninsula after the northernmost point on it.

Extending northward along its backbone, from shore to outer end, is an irregular belt of gravel ranging from 2½ miles to 10 miles wide. Along either side of this gravel lie belts of sand from 1 to 3 miles wide.

Post-Pleistocene Subsidence

A great belt of downfaulting intersects the northern coast of Iceland between the Gjögur peninsula and the western end of the Langanes peninsula. Subsidence

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has taken place since the end of the Pleistocene epoch, and the belt is marked by active volcanism and frequent earthquakes. Reaching the coast from the south, it continues northward into the sea, and occasionally submarine volcanic eruptions shake the coastal region. (24, p. 229).

North of Grimsøy Fisk the gravel-covered Merir Bank and Groves Bank, as well as the island of Grimsøy, may be recent volcanic accumulations. They are close enough to the seaward extension of the belt of subsidence to be in the zone of marginal faulting and attendant volcanism. In 1865 volcanic activity was reported at the island of Sandreyjar, north of the Tjörnes peninsula. (22, p. 511).

Suess describes this belt of subsidence as follows (21, p. 265):

" Its western edge is continued from the north along the western border of the Skál-fandi fjord, and thence for a distance of 150 kilometers towards the south as a steep basaltic cliff rising 500-600 meters above the bottom of the trough. The eastern edge runs along the base of the peninsula of Lenganes. Skál-fandi fjord, Husevik, Tjörnes, Axar fjord, and Thistil fjord lie within the subsidence. In this region earthquakes are of frequent occurrence. The downthrown band is traversed....by numerous fissures which strike north and south, parallel to the margins of the fault trough. They separate lofty horsts from deep fault troughs; hot springs and volcanoes accompany their course like beads on a thread; great lava floods have proceeded from them."

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This belt of subsidence can be traced southward to the center of Iceland, and from there southwestward to the southwest coast, where it forms the great Southwestern Lowland described previously. The zone of crustal weakness along the northwestern side of the trough in southern Iceland is represented by the volcanic peninsula of Reykjanes and its submarine extension to the southwest. The southeastern boundary is represented by the volcanoes, Tindfjallajökull and Mykjafjallajökull, and the volcanic islands of the Vestmannaeyjar.

Skjálfandi Dyb, Bathymetry and Bottom Sediments

This deep, lying between Grimsey Flak on the west and Maneyjar Flak on the east, reaches depths of 300 fathoms or more near its outer end. It is floored with mud, which in places is consolidated enough to warrant a "hard" classification by the hydrographers. This is portrayed by Hoeghild (9, Part 3, Plate 1) as gray, deep-sea clay.

The belt of mud in Skjálfandi Dyb extends southward through the bay of Skjálfandi to within 3 miles of the bay head. The remainder of the bottom is covered with sand which is continuous with the sand of Grimsey Flak and Maneyjar Flak.

The river, Skjálfanda Flot, which flows into

This lake of abundance was the first thing
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the head of Ekjálíendi, heads at the northwestern edge of the ice sheet Vatna Jökull, 100 miles to the south. Accordingly, its waters deliver great amounts of glacial silt to the sea, as well as sand and pumice derived from the volcanic region through which it flows.

Meneyjar Flak, Bathymetry and Bottom Sediments

This bank extends 28 miles northward from the peninsula of Tjörnes.

It bears two rocky shoal patches: Manðreyjar (Latitude 66 degrees 17.5 minutes N., Longitude 17 degrees 7 minutes E.) and Kyjersbrekke (Latitude 66 degrees 19.5 minutes N., Longitude 17 degrees 8 minutes E.). Gravel surrounds these shoals and extends along the backbone of Meneyja Flak in discontinuous belts and patches to within 10 miles of the northern end of the bank. The gravel surrounding Manðreyjar, and perhaps the gravel further north also, is believed to have resulted from submarine volcanism. Gravel skirts the northern coast of the Tjörnes peninsula, forming a 1½-mile wide band. This can probably be attributed to wave erosion on the rocky coast.

Axar Fjorder Dyb and Axar Fjord, Bathymetry and Bottom Sediments

Lying between Meneyja Flak and Melrakke Flak, this deep trends north-northwestward from Axar Fjord. It apparently coalesces with Ekjálíendi Dyb about

From the various points already noted, it is evident that the results of the study are well in line with the general theory of the origin of the language.

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thirty-five north of Tjörnes, and the combined deeps continue northwestward from there.

Nowhere does Axar Fjardar Dyb attain the depths of Skjálfraði Dyb or the other great deeps to the west. At Latitude 66 degrees 40.5 minutes N., Longitude 16 degrees 57 minutes E. a sounding of 154 fathoms marks the deepest spot so far measured; several soundings of 144 fathoms occur south of here.

Three discontinuous belts of mud occur in Axar Fjord and Axar Fjardar Dyb. The numerous "stiff clay" and "hard" notations in these belts indicate that the sediment is probably Scorgsild's gray, deep-sea clay.

A slightly shoaler tongue of sand, 7 miles wide, crosses Axar Fjardar Dyb, separating the largest of the above belts of mud from the mud in the outer portion of the deep. This sand, which is of a part with the sand of Hænuyja Flak and Melrekin Flak, is obviously a sill, cutting across a previously continuous belt of mud running up the deep.

The remainder of Axar Fjardar Dyb and Axar Fjord is covered with sand and a little gravel.

The Jökulá River, which empties into Axar Fjord, flows from Vatna Jökull in the interior through a region of active vulcanism, like the Skjálfraði Flak,

it is therefore heavily laden with sand and silt which is discharged into the sea. Thoroddsen (22,p.506) cites one instance in 1717 when large quantities of pumice were carried to the sea from an eruption in the interior.

Bathymetry of the Shelf from Melrakke Flak to Langanes Flak

The bank, Melrakke Flak, extends 30 miles northwestward from the peninsula of Melrakke Aljetta. It averages about fifteen miles in width.

Thistil Fjardar Dyb, between Melrakke Flak on the southwest and Kjölsen Bank on the east, trends northward and northwestward from Thistil Fjord. A greatest depth of 185 fathoms is shown at Latitude 66 degree 47.25 minutes N., Longitude 16 degree 7 minutes E. Most of the bottom, however, lies no deeper than 130 fathoms.

North-trending Kjölsen Bank lies, partially isolated, 25 miles north of the Langanes peninsula. It bears a least depth of 49 fathoms at Latitude 66 degree 42.5 minutes N., Longitude 15 degree 4.5 minutes E.

Langanes Dyb, between Kjölsen Bank on the west and Langanes Flak on the south, trends northeastward from a point about ten miles south-southeast of Kjölsen Bank. The greater part of its floor lies between 110 and 140 fathoms.

The bank, Langanes Flak, extends over thirty

miles northwestward from the Langesnes peninsula. It averages about twenty miles wide throughout the greater part of its length. Soundings show a north-trending submarine valley, tributary to Langesnes Dyb, cutting half-way across its width 15 miles northeast of Pontrinn.

Bottom Sediments from Melrekkas Flak to Langesnes Flak

Sand is the predominant sediment covering the banks and deeps from Melrekkas Flak to Langesnes Flak. However, as mentioned before, the presence of discontinuous patches and areas of gravel on the banks, as on Gjålees Bank, and of mud in the deeps, as in Thistil Fjorder Dyb and Thistil Fjord, suggests that most of this sand is a relatively recent mantle covering an older sedimentation pattern similar to the one now existing west of Åker Fjorder Dyb.

Gravel covers the bottom of the northern and western sides of the Melrekkas Hjelte peninsula and completely surrounds the Langesnes peninsula for distances up to 13 miles out from shore. This gravel is no doubt derived locally from the basalt and tuff outcropping in cliffs at various points along the coast. The unusual width and continuity of the gravel zones suggests increased wave and current action over a wider area of outcrop during a former time of lowered sea-level. Also,

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it is possible that peak ice in recent times has played a part in distributing the gravel, as Melrakkv Sljetta and Langenes both are frequently subjected to severe ice blockades in the spring of the year (24,p.270; 18,p.67).

In general, the gravel zones are somewhat shoaler than the adjacent sandy zones. In one place (Latitude 66 degrees 25.5 minutes N., Longitude 15 degrees 33 minutes E.) a slightly shoaler bar of gravel intrudes into and partially cuts off sand- and mud-filled Thistil Fjord. It would appear that the gravel was deposited later than the sand, thereby indicating that gravel movement may be going on at the present time, or, at least, quite recently.

Bathymetry Off the Northeastern Coast of Iceland

The bathymetry off the northeastern coast of Iceland is characterized by alternating deeps and banks, much the same as those occurring off the northern coast, as shown on B.A.2965, these deeps and banks, from northwest to southeast, are: Langenadbjúp (Langenes Dyb on B.A.2978), Langenesgrunn (Langenes Flak on B.A.2978), Bekkefjardardjúp (Bakke Flói Dyb on B.A.2378), Vopnufjardargrunn (No name on B.A.2978), Hórsadalbjúp (Hjersdal Flói Dyb on B.A.2978), Glettinga nesgrunn (No name on B.A.2978), and Seydisfjardardjúp (No name on B.A.2978).

The deeps were probably cut by subaerial erosion when the shelf was completely exposed at the end of the Pliocene. As far as the author is aware, faulting has played no part in their formation. Some deepening may have been accomplished by glacial excavation during the Pleistocene epoch, however.

Bakke Fløi Dyb and Vopne Fjord, Bathymetry and Bottom Sediments

Bakke Fløi Dyb extends northeastward from the bay, Bakke Fløi. Its greatest measured depth, 208 fathoms, falls outside H.A.2978, on which chart most of the bottom lies between 110 and 150 fathoms. At its shoreward end the deep turns southward toward Vopne Fjord, while a smaller branch shown by the soundings continues southwestward and runs up into Bakke Fløi.

Much of Bakke Fløi Dyb is floored with mud, particularly the deeper central portions. It is not certain if this mud forms a continuous belt, as shown on the chart, since sediment notations are widely separated. Sand covers the slopes on the northwestern side of the deep, and the slopes and part of the bottom on the southeastern side.

The shoreward end of Bakke Fløi Dyb is, to a great extent, surrounded by gravel. The boundary between gravel and mud on the eastern side of the southward extension of the deep, at about latitude 66 degrees 7 min-

utes N., Longitude 14 degrees 23 minutes W., has been placed along the bottom of a pronounced break in slope, where the bottom falls off to the west over 50 fathoms in 1 mile.

This gravel is probably continuous with the gravel surrounding Langenes Flak. It also extends to the south and east, covering most of the bank called Vopne-fjardargrunn on B.A.565.

The large areas of sand in Bakka Flói and in Vopna Fjord, 20 miles to the south-southeast, have very likely been deposited from the streams entering at their heads.

The bottom for 2 miles to seaward from the peninsula southeast of Bakka Flói is rocky. Likewise, rock bottom extends more than five miles outward from the peninsula between Vopna Fjord and Hjóreds Flói.

Hjóreds Flói and Hjóreds Flói Dyb, Bathymetry and Bottom Sediments

Hjóreds Flói, southeast of Vopna Fjord, and Hjóreds Flói Dyb are seaward extensions of two long, narrow valleys which commence in the interior and merge into one lowland just before reaching the sea. The Jökullsa and the larger Fljót rivers, which flow through the valleys, both head in Vatna Jökull. Both valleys

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are extensively alluviated (25), and the lower Fijot throughout much of its length forms a deep, narrow lake the bottom of which lies 34 meters below sea level (24,p.210).

These valleys are partially-filled glacial troughs, and the common lowland at their lower end is presumably a coalescing delta of which the sandy area in Njårads Flob represents the seaward extension. The outward edge of this advancing wedge of sand is marked approximately by the 100-fathom depth curve. In Njårads Flob Dyb, outlined by the 100-fathom curve, sand is the predominant sediment.

Occurrence of Coral Along the Western Half of the Northern Coast

Coral is shown on B.A.2976 in six separate localities. (1)Two patches occur about three miles offshore, west of the mouth of Lyja Fjord. (2)One patch occurs just offshore on the northeastern side of the Hjør peninsula, east of Lyja Fjord. (3)Two patches occur near the head of Talsvil Fjord, and (4)one out in the middle of the embayment between the peninsulas of Melrakke Hjelte and Langenes at Latitude 66 degrees 27 minutes N., Longitude 13 degrees 6 minutes E. (5)One patch occurs on the south end of Hjørnes Hakk, at Latitude

 

Latitude 66 degrees 59.5 minutes N., Longitude 15 degrees 6 minutes E. (6) A number of patches and reefs are distributed along the Langesund peninsula on both sides--some near shore and others up to eight miles offshore.

The extensive development of coral around Langesund is particularly worthy of note, since this peninsula, together with Halsfjella Sletta and North Cape, is subject to severe drift ice blockades more often than any other points along Iceland's coast.

B.A.2979 (Scale 1:254,000)

General Statement

This chart shows the waters off the eastern coast of Iceland, from Hjerøda Flói to the Vestrahorn peninsula. Overlap with B.A.2775 on the northwest consists of a strip measuring 34 miles east-west and 6 miles north-south. This common area includes only the southeastern edge of Hjerøda Flói, the remainder of the overlap falling on land.

Extra detail has been added from the following large-scale plans: B.A.2330 (1:36,580), covering Seyðis Fjord and Lofsundar Fjord; B.A.1535 (1:32,590), covering both branches of Hjófi Fjord; B.A.1550 (approximately 1:40,650), covering Heydar Fjord and Vaskrud Fjord; and, B.A.1636 (approximately 1:31,000), covering Særa Fjord.

Character of the Eastern Coast

This section of Iceland's coast, like the Northwestern Peninsula and the western part of the northern coast, is mountainous and indented with numerous fjords. Many of these fjords are matched offshore by submarine valleys which extend outward across the shelf and form deeps, as off the northern coast.

However, unlike the northern coast, the land valleys at the heads of the fjords do not extend long distances inland. Here the drainage divide lies nowhere

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more than thirty-five miles is from the extremities of the intervening peninsulas (25), while it is often more than one hundred miles is from the extremities of the north-coast peninsulas.

The eastern fjords, and corresponding deeps, also differ from the northern fjords and deeps in that they owe their origin solely to subaerial erosion, which took place at the end of the Pliocene epoch. As far as is known, no faulting is involved in their depression.

Glacial excavation during the Pleistocene epoch has deepened many of the fjords, producing enclosed basins and well-developed thresholds. These basins, like the basins of the Northwestern Peninsula fjords, are the sites of accumulation of fine sediments. The muds are typical of the stinking, black fjord muds usually produced under conditions of stagnation (20, p. 84).

The Shoal Between Hjerøds Fløi and Sandvik, Bathymetry And Bottom Sediments

Hjerøds Fløi and Hjerøds Fløi Dyb, enclosed by the 100-fathom depth curve, appear at the top of the chart. A belt of mud is shown lying in the deep and overlapping somewhat onto the bank south of it. This mud is continuous with the mass of mud in Hjerøds Fløi Dyb shown on B.A. 2978.

South of Hjerøds Fløi Dyb the bank called

 

Glettinganesgrunn (see S.A.565), as outlined by the 100-fathom depth curve, reaches over forty miles eastward from the coast, narrowing from 20 miles in width at the shoreward end to a point at the outer end. South of it the deep, Seyðisfjardardjúp, with the floor lying, for the most part, between 110 and 140 fathoms, extends eastward from Seyðisfjörður, or Seyðis Fjörð. A long, narrow, unnamed bank extending eastward from the vicinity of Hjófi Fjörð bounds Seyðisfjardardjúp on the south.

From Hjerads Flói to Sandvík (latitude 65 degrees 5.5 minutes N., longitude 13 degrees 32 minutes W.) sand is the predominant sediment, covering deeps and banks alike. However, areas of gravel occur locally on the banks. One area, measuring 16 miles east-west by 10 miles north-south, occupies the west central portion of Glettinganesgrunn. Another area, measuring 9 miles east-west by 4 miles north-south, lies on the bank south of Seyðisfjardardjúp. One small area of mud of unknown size lies in Seyðisfjardardjúp.

The coast, both in the fjords and on the intervening peninsulas, is fringed by reefs, while isolated rocks and patches of rock bottom occur at various distances offshore. Gravel covers the bottom for 6 miles out from the peninsula between Seyðis Fjörð and Hjófi Fjörð.

Seydis Fjord and Mjófi Fjord, Bathymetry and
Bottom Sediments

Two large fjords, Seydis Fjord and Mjófi Fjord, indent this section of the coast. In Seydis Fjord an enclosed basin reaching 50 fathoms in depth is separated from equivalent depths on the shelf by a threshold nearly twenty fathoms shoaler, located outside the Fjord mouth.

Seydis Fjord is floored with mud, except for a narrow strip of sand along the shore. This mud extends out into the open sea almost as far as the head of Seydis-fjardardjúp.

Mjófi Fjord, likewise, is floored with mud except for a narrow strip of sand along the shore. This mud extends into the southern branch of Mjófi Fjord, called Norðfjardarflói on S.A.1539. Here it is flanked by sand on both sides, and the sand, in turn, by a continuous strip of rock bottom skirting the shore. The bottom notations on S.A.1539 show a continuous band of rock bottom across the mouth of Mjófi Fjord, middle one of three small fjords at the head of Norðfjardarflói. The soundings, however, show no particular evidence of a threshold ridge here.

Heydar Fjord, Bathymetry and Bottom Sediments

Between Sandvík and Öaru Fjord (Latitude 64 degrees 40 minutes N., Longitude 21 degrees 15 minutes W.) the coast is indented by five fjords. From north-

THE LIFE OF THE LATE
JOHN R. KELLY

Two large types, capital letters and small letters, are used in this section of the work. The capital letters are used in the title and in the names of the persons mentioned in the text. The small letters are used in the text and in the names of the persons mentioned in the text. The capital letters are used in the title and in the names of the persons mentioned in the text. The small letters are used in the text and in the names of the persons mentioned in the text.

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east to southwest these are: Heyder Fjord, Faskrud Fjord, Ståvar Fjord, Breiddals Vik, and Beru Fjord.

Heyder Fjord is a flat-bottomed trough 2 miles wide and 13 miles long. It reaches its greatest depth, 106 fathoms (Latitude 64 degrees 57.25 minutes N., Longitude 13 degrees 36 minutes E.), at the outer end. East of this the bottom becomes shallower, and a threshold separates the depths of the fjord from equivalent depths on the shelf outside. Soundings indicate that a submarine valley continues outward from the mouth of the fjord. As it crosses the shelf it increases in size and depth to form the deep, Heyderfjardarajúp (see B.A.5551), which indents the edge of the shelf.

The 50-fathom sounding 1 1/2 miles south-southeast of the inlet, Soetu Skar, marks the deepest point on the threshold. The gravel patch occurring at this point suggests the threshold may be covered in part with moraine material.

Halfway in toward the head of Heyder Fjord a smaller branch, called Laki Fjord, joins it from the northwest. Depths in Laki Fjord are no greater than 35 fathoms (shown on B.A.1550), as compared to depths of 62 to 77 fathoms in the adjacent part of Heyder Fjord. Laki Fjord is a "submerged hanging valley." Like Heyder Fjord, it contains an enclosed basin. This basin is

separated from the depths of Heyder Fjord by a threshold which is 10 fathoms or more shallower than the basin.

In the outer half of Heyder Fjord sand and mud floor the deeper portions. The shallower portions on either side of this are covered with sand, while some of the shoreline is rock-fringed.

The inner half of Heyder Fjord is floored with sand, while narrow strips of rock probably skirt the shore. Laki Fjord is floored largely with sand and mud.

Faskrud Fjord, bathymetry and bottom sediments

Faskrud Fjord, south of Heyder Fjord, averages 1 mile in width and 7 miles in length. Like Heyder Fjord, it contains an enclosed basin behind an outer threshold. The basin floor lies for the most part between 40 and 50 fathoms, the deepest part being near the outer end. The threshold lies at 44 fathoms.

Bottom notations on B.A. 1550 show that a mile-wide band of rock bottom, coinciding with the threshold, extends completely across the mouth of Faskrud Fjord, and to the northwest, north, and northeast extends in many places this width. It narrows to the outer end of the peninsula north of Faskrud Fjord, extending several miles into both Faskrud Fjord and Heyder Fjord.

In some places in Faskrud Fjord rock bottom fringes the shoreline, while in others a narrow strip

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of sand lies along the shore. Sand also covers the bottom of the enclosed basin for a distance of almost two miles west from the western edge of the rock threshold. However, by far the greater part of the bottom is covered with mud.

Stöðvar Fjord and Breiddals Vik. Bathymetry and Bottom Sediments

Stöðvar Fjord and Breiddals Vik, the two small indentations south of Faskrud Fjord, are comparatively shallow. Stöðvar Fjord reaches 30 fathoms at the deepest, while most of Breiddals Vik lies above 25 fathoms. A submarine valley heading into Breiddals Vik contains a hole 68 fathoms deep; this, however, lies just outside the bay.

Both Stöðvar Fjord and Breiddals Vik have sand bottoms. In Breiddals Vik a zone of rocks and rocky islets up to one mile wide skirts the entire southeastern shore, while separate reefs extend the same distance into the bay from the northern shore. The linear shape of these reefs suggests they may be submerged dikes, such as occur to the southeast in Seru Fjord.

Seru Fjord. Bathymetry and Bottom Sediments

Seru Fjord, the southernmost of the fjords in this section, averages 1½ miles in width and extends 11 miles inland. Unlike the fjords just described, Seru Fjord has no single enclosed basin behind a pronounced

threshold. Throughout most of its length a series of small basins separated by somewhat shallower portions characterizes the bottom. The deepest parts of the basins are marked by: the 42-fathom sounding at Latitude 64 degrees 44.75 minutes N., Longitude 14 degrees 25.5 minutes E.; the 33-fathom sounding at Latitude 64 degrees 43.4 minutes N., Longitude 14 degrees 24 minutes E.; the 30-fathom sounding at Latitude 64 degrees 42.25 minutes N., Longitude 14 degrees 22.75 minutes E.; the 14-fathom at Latitude 64 degrees 41.25 minutes N., Longitude 14 degrees 19.25 minutes E.; the 35-fathom sounding at Latitude 64 degrees 40.75 minutes N., Longitude 14 degrees 18.5 minutes E.; and the 31-fathom sounding at Latitude 64 degrees 40.4 minutes N., Longitude 14 degrees 18.5 minutes E. The portions of bottom between basins are from 3 to 14 fathoms shallower than the basins.

This bathymetric irregularity is believed to be due to the effect of numerous basalt dikes which traverse the rocks in this region (27, p. 26). These dikes are particularly numerous in the outer half of the fjord. Here they form linear-shaped reefs and rocky shoals extending from both shores out into the fjord. On S.S. 1036 the landward portions, striking northwesterward, are also shown. The linear-shaped reefs and islands between the end of the Djupavogr peninsula, south of Seru Fjord, and the

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island of Papay, 4 miles to the southeast of the peninsula, are undoubtedly due to the effect of dikes also. The pattern of sediments in Beru Fjord is the same as that in the other large fjords to the north. Mud covers the greater part of the fjord bottom, while strips of sand skirt much of the shore.

On the shelf outside the fjord lies an irregularly shaped area of sand, measuring 5½ miles east-west by 2½ miles north-south. This is separated from the mud in the fjord by 2 miles of sandy bottom.

As with the other fjords, a submarine valley continues outward from Beru Fjord. It crosses the shelf, increasing in size to become the deep, Berufjardarall (see B.A.565).

The Shelf between Sandvik and Hamars Fjord, Bottom Sediments

In the section north of Sandvik the shelf was largely covered by sand, with only a few isolated areas of gravel. South of Sandvik, however, gravel predominates over sand. Commencing about ten miles east-southeast from Sandvik, a continuous belt of gravel 7 to 10 miles wide trends southward for about nine miles. It then turns sharply to the southwest and trends in this direction for about fifty miles, decreasing to 6 miles in width at the southwestern end. At a point 17 miles southwest of where it makes the sharp turn the width suddenly decreases

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to 3½ miles and immediately increases again. Just beyond this point it is joined by another belt of gravel of equal width, approaching from the east and southeast. The author cannot account for this great amount of gravel except to suggest that it may have been formed by wave erosion on rocky terrain exposed on the shelf, or at least brought within wave base, when the sea-level was lowered at the end of the Pliocene epoch.

Sand mantles the shelf east of this gravel for as far as the shelf extends. A belt of sand 3 to 6 miles wide also intervenes between the gravel and the coast southwest of Reydar Fjord.

Two large areas in which the sediments, sand and gravel alike, contain shells occur on the shelf here. One of these, shaped roughly like an isosceles triangle with the east-west altitude measuring 12 miles and the north-south base, 7 miles, lies offshore just north of Reydar Fjord. The other, irregular-shaped, area, measuring 17 miles northwest-southeast by 16 miles east-west, commences at the rock threshold of Faskrud Fjord and extends southward and southwestward almost to Horn Fjord. South of this a number of patches and shell areas of shelly bottom are scattered over the shelf.

Numerous reefs and rocky shoals are found on the shelf at varying, and sometimes considerable, distances

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and I am sure that the above information is correct and that the same is being furnished to the proper authorities for their consideration.

The large amount of money that was paid for the purchase of the land, and the fact that the land was purchased for a large sum of money, is a strong indication that the land was purchased for a large sum of money.

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Offshore. Examples of these are: Diana Bodí (Latitude 63 degrees 3.5 minutes N., Longitude 13 degrees 12.5 minutes W.), Nyibodí (Latitude 64 degrees 50.25 minutes N., Longitude 13 degrees 26 minutes W.), Saggur (Latitude 64 degrees 48.25 minutes N., Longitude 13 degrees 25.5 minutes W.), Hvalekukur (Latitude 64 degrees 36.25 minutes N., Longitude 13 degrees 17 minutes W.), Yztibodí (Latitude 64 degrees 35 minutes N., Longitude 14 degrees 3 minutes W.), and others.

The coincidence of most of these rocks with the belts of gravel previously described lends weight to the hypothesis that the gravel was obtained by wave erosion on rocky terrain when the sea level was lowered. The rocks would therefore represent unproduced stacks and ledges.

The abnormal magnetic variation noted at Diana Bodí and other places along the coast attests to the ferrous nature of the basic rocks underlying the shelf.

The Coastline between Hæmars Fjord and Vestrahorn

In Hæmars Fjord and Alfta Fjord, southwest of Þeru Fjord, no information is available as to the nature of the bottom sediments. A sand bar 6 miles long has been built completely across the mouth of Alfta Fjord and part-way across the mouth of Hæmars Fjord. This is the first of a series of great offshore bars and storm beaches fringing the southeastern, southern, and southwestern

coasts of Iceland.

Just outside this bar lies an oval area of rock bottom, measuring 5 miles long parallel to the bar and $2\frac{1}{2}$ miles wide. Another area of reefs and rock bottom extends $2\frac{1}{2}$ miles to seaward from the point, Hvalnes, about ten miles south of Alfis Fjord. According to Thoroddsen's geological map (25), the rock composing the point is liperite. Presumably, therefore, the rocks composing the offshore reefs is likewise liperite.

Eleven and one half miles southwest of Hvalnes lies another, smaller area of rock bottom off the northeastern side of the promontory, Vestrahorn. Thoroddsen's map (25) shows gabbro here.

From Hvalnes an offshore bar extends southwestward to Vestrahorn. Two embayments are enclosed behind it. Lons Fjord (as shown on B.A.2980) is apparently shut off completely, while Lapa Fjord is nearly so. No information is available on the nature of the bottom sediments in these bays.

The Shelf between Hamsa Fjord and Vestrahorn, Bottom Sediments

With certain exceptions, to be given below, sand covers the greater portion of the shelf in this section. A number of patches and small areas of shelly bottom occur scattered throughout sand and gravel zones alike.

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The long belt of gravel described on page 74 extends southwestward to a point 7 miles southeast of Hvalnes. As previously mentioned, a belt of sand bottom intervenes between this gravel and the shore, except where rock bottom occurs. A small, linear-shaped area of gravel, 9 miles long by $2\frac{1}{2}$ miles wide, lies offshore 30 miles east of Hvalnes.

Commencing 7 miles southeast of the bar across Alta Fjord, an S-shaped belt of mud and ooze trends southeastward, eastward, and again southeastward for almost twenty-five miles. It averages about three miles wide in the section nearest shore, swells to twice this width in the middle section, and tapers again to about three miles wide in the section farthest from shore. This last section lies in the trough of Norrørdetall, marked by the 106-fathom and 108-fathom soundings at Latitude 64 degrees 15.6 minutes N., Longitude 13 degrees 29.5 minutes W. and Latitude 64 degrees 20.8 minutes N., Longitude 13 degrees 35.5 minutes W. respectively. The middle section occupies a gentle tributary submarine valley indicated by the 83-fathom and 73-fathom soundings at Latitude 64 degrees 19.5 minutes N., Longitude 13 degrees 44.75 minutes W. and Latitude 64 degrees 19.75 minutes N., Longitude 13 degrees 58.75 minutes W. respectively.

Two smaller areas of ooze lie several miles north of this belt, while a number of scattered patches of both

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mud and ooze lie in the gravel zone still further north.

Another belt of mud and ooze, comparable in size to the belt southeast of Alfta Fjord, commences 3 1/2 miles southeast of Hvalnes. This belt trends southwestward past Vestrahorn, and is continued on N.E. 70° E.

It is not known whether the ooze is organic or simply a flocculent, watery mixture of inorganic material. Pertinent to this question, Treasler (5, pp. 99-100) mentions at least three cold-water forms of ostracode that occur off Iceland.

Occurrence of Coral Along the Eastern Coast

Coral is shown on this chart in single patches at eight localities. These are as follows: (1) 5 miles eastward from the southern edge of Björæðs Flói; (2) 2 miles offshore, halfway between Björæðs Flói and Myrdi Fjord; (3) close in to shore, halfway between the mouth of Myrdi Fjord and the tip of Sandvík; (4) 3 miles south-southeast of Sandvík; (5) 10 miles eastward from the mouth of Myrdi Fjord; (6) 17 miles east-southeastward from the mouth of Myrdi Fjord; (7) the northern side of the mouth of Faxrud Fjord; (8) 1 mile east-northeast of the island, Papey, off the mouth of Berufjord.

It is not known if this is living or fossil coral.

B.A. 2980 (approximate scale 1:100,000)

General Statement

This chart shows the waters off the southeastern and southern coasts of Iceland, from the Vestrehorn peninsula to the section of shoreline south of the volcano, Eyjafjella fkrull. The area portrayed includes the island shelf and the island slope out to depths of over eight hundred fathoms.

B.A. 2979 overlaps into the northeastern corner, forming a rectangle measuring 15 miles east-west by 12 miles north-south. About nineteen miles of shoreline, including the Vestrehorn peninsula, are shown in this common area.

As previously mentioned, B.A. 2980 and B.A. 2733, to the west, have about twenty-two miles of shoreline in common. B.A. 2980, however, extends 28 miles further south than B.A. 2733.

Extra data have been added to Hornafjörður (Latitude 64 degrees 15 minutes N., Longitude 15 degrees 12 minutes W.) from plan B.A. 1235 (scale 1:14,870), and to the shelf between Reykis Dyk and the western edge of the sheet from chart B.A. 2968 (scale 1:111,350).

Character of the Southeastern and Southern Coasts

In the southeastern and southern coastal region the mountains retreat and a coastal plain up to

fifteen miles in width, consisting of sandy and gravelly flats, takes their place. This is the Southeastern Lowland, mentioned on page 6. Great offshore bars, bordered by marshes and lagoons, form the skjalvillings. Lewis (12, p.438) describes them as follows:

" ...More than 200 miles of the southern shores of Iceland consist of a great offshore bar. The mountains of the hinterland reach the shore at only two points-- Portland, south of Myrdals-jökull, and the Vestur Horn. Elsewhere the great embankments of sand and shingle enclose wide areas of lagoon, marshland and gravel flats. Numerous rock outcrops are incorporated in the embankment, frequently forming nodal points from which the beaches recede in sweeping curves both to the east and west."

Bathymetry Off the Southeastern and Southern Coasts

From the bank, Breiddals Grunn (see A.R.565), opposite Herufjörður, or Heru Fjord, southwest to the eastern side of the submarine valley, Reynis Djúp, or Reynis Dyb, the shelf narrows from over forty miles in width to less than ten. It is indented by six large submarine valleys which, in each case, cause the 100-fathom depth curve to swing in halfway or more across the shelf. From northeast to southwest these are Herufjörðardall, Þámadjúp, Hornafjörður Djúp, Breidamarkurajúp, Skeldur Djúp, and Reynis Djúp.

These submarine valleys run up toward fjords, or toward portions of the coast where fjords or embayments

previously existed and have since been filled in.

Like the east-coast deeps, they are believed to have been eroded subaerially by streams crossing the shelf when the shelf was bared at the end of the Tertiary epoch. As far is known, faulting is not responsible for their existence.

A smoothly curved zone may be outlined connecting the outer edges of the banks between the valleys, from the southern tip of Breiðadalir Grunn to Keynir Djúp. In this zone the bottom drops off rapidly toward the southeast and south to sub-oceanic depths: 70 fathoms to 432 fathoms in 5 miles at Latitude 63 degrees 58 minutes N., Longitude 13 degrees 45 minutes W.; 11½ fathoms to 575 fathoms in 5 miles at Latitude 63 degrees 25 minutes N., Longitude 16 degrees 5 minutes W.; 86 fathoms to 369 fathoms in 3 miles at Latitude 63 degrees 17 minutes N., Longitude 17 degrees 20 minutes W.

This curved zone is sub-parallel to the curved zone of faulting which cuts across Iceland from north to southeast. The two zones converge gradually toward the southwest, coming together at the Vestmannaeyjar Islands. Can the shelf off southeastern Iceland be bounded by a zone of faulting?

The smoothness of the curves connecting the outer facets of the banks, plus the fact that the bottom

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drops off over four hundred feet per mile, lends weight to the possibility of faulting, or at least downwarping, here. Such subsidence fits in with the process believed to have submerged the Thulean Plateau and converted Iceland into an island (see page 7).

Source of Sediments Off the Southeastern and Southern Coasts

(1) Glacial outwash. The mountains at the inner edge of the coastal plain bear extensive ice fields, which send lobes down every available valley. Streams flowing from these lobes carry tremendous quantities of mud, sand, and gravel across the coastal plain to the sea. It has been estimated (28,p.74) that the sediment carried out by a single sub-glacial stream on the coast of Greenland, which is comparable to the southern Icelandic coast, amounts to over 15,000 tons per day. The quantity of sediment delivered to the sea by the stream in one year would thus total $5\frac{1}{2}$ million tons!

Thoroldsen describes this sedimentation in the following passages(24,p.206):

" Almost all Icelandic glaciers rest on soft rocks (tuff and breccia) upon which erosive action is very active; therefore, the Icelandic glacier-rivers carry down an immense amount of rock in the form of mud, sand, gravel, and blocks of stone; for this reason they are hardly ever found entering fjords or deep bays, these having become filled up in cases where they formerly so entered."

(2) Glacier Bursts. In addition to normal deposition from glacial streams, catastrophic deposition from "glacier-bursts" or "glacier torrents" periodically adds to the shoreline and offshore sediments.

The great ice fields rest on active volcanoes. When an eruption occurs floods of water bearing volcanic debris and ice sweep down over the coastal lowland to the sea. Skeidararsandr and Myrdalsandr are particularly subject to these floods although they occur elsewhere along this section of the coast.

Thoroddsen describes these floods as follows

(24, p. 201):

" Peculiar to Iceland are the so-called 'glacier-torrents' (Jökull-blaup). When the glaciers by the eruption of volcanoes hidden under the ice, are broken to pieces and melt, the large stretches of land beneath them are inundated by a roaring sea of dirty water with swirling icebergs. Such catastrophes may cause great changes in the surface features of the surrounding country, as the waterfloods often carry along with them an incredible quantity of gravel and rocky blocks. In this way the volcano of Hattis especially has caused considerable changes--the course of rivers are constantly changed, the smaller fjords have been filled up even within historic times, and several large parishes and districts have been destroyed...Minor glacier-bursts are also occasionally due to lakes and rivers, which have been dammed by glaciers, suddenly breaking through their barriers and inundating the district."

also, Thordarson cites three instances when deposition from glacial bursts formed dry land where previously over fifteen fathoms of water existed (22, pp. 503, 505, 510).

According to witnesses, when an eruption under Vatna Jökull sent a glacial burst down the Skeiðará River (east of Longitude 17 degrees W.) in 1934 the river increased to ten times the volume of its summer flow within one week (2, p. 16). Two days afterward the burst reached its maximum; huge icebergs sailed downstream and out to sea, while tremendous crashing noises were heard from the glacier.

According to the Sailing Directions (18, p. 498), in 1916 the eruption of Eðlutsagi, above Myrdalsandur, resulted in a 4-mile stretch of coast at the hill, Hlíðirahófi, being advanced seaward a distance of 1 mile.

(3) Windblown Sand. The shelf off the southeastern and southern coasts of Iceland is subject to a third type of deposition from the adjacent land. Windblown dust and sand from the clayey, sandy flats of the coastal lowland, from weathered tuff formations in the mountains, and from volcanic eruptions are spread probably in no small amounts over the seafloor. Volcanic dust from eruptions of Icelandic volcanoes sometimes is carried

by winds completely across the Atlantic Ocean to Europe (24,p.223), while dust whipped up by windstorms on the land has been known to fall on vessels in mid-Atlantic (24,p.243).

Therefore, if noticeable amounts of this dust are carried such great distances, much larger amounts, containing coarser constituents, must be deposited over the nearby shelf. Accordingly, the Sailing Directions reports fine sand in Skeidars Dyb, or Skeidars Djúp, which has been blown out from Skeidarsármur (18, p.493).

(a) Pumice. Large amounts of pumice are delivered to the sea by streams flowing through areas of volcanic activity, by glacier bursts, and directly by submarine eruptions. This occurs off other coasts as well as off the southern and southeastern.

According to Thordarson (22,pp.504,505), eruptions of Hekla (western edge of S.A.3983, on latitude 64 degrees N.) have produced pumice in amounts great enough to be transported by currents to the Faeroe Islands. As previously mentioned, in 1717 large quantities of pumice from a volcano in the interior was carried to Amer Fjord on the northern coast by the Jökull River (22,p.506). In 1783 pumice from a submarine eruption off Reykjavik covered the sea for a distance of 150 to 225 kilometers (22,p.508).

Although no specific examples are given of the

Although no specific examples are known of by the author, it is to be expected that agitation by ocean waves would shatter the glassy cells or much of this pumice, causing it to sink to the bottom as fine to coarse sand.

(5) Volcanic bombs. It is likely also that volcanic bombs and other, larger fragments of ejecta are frequently contributed to the sediments on the shelf. These fragments have been known to be blown far from the point of eruption. In 1910 a bomb ejected from Hekle killed a man 45 kilometers away (24, p. 223); in 1766, from the same volcano a bomb the size of a man's fist was hurled entirely across Iceland to the northern coast, 165 kilometers away!

Bottom Sediments Off the Southeastern Coast

Sand of Longitude 15 degrees 5 minutes W. sand is by far the most abundant sediment. It mantles much of the shelf from shore to outer edge, covering submarine valleys as well as banks.

This sand originates mostly from the numerous rivers which here deposit tremendous amounts of sediment derived normally from glacial erosion or catastrophically from glacier bursts. The presence of windblown sand in Skaidars Dyb has already been mentioned. Some sand also may be derived from pumice, as previously described.

Sand evidently has also been transported down the island slope to mingle with deep-sea sediments. Its exact extent, however, is uncertain. The sediment distribution chart of the "Ingolf" expedition (9, Part 3, Plate 1) shows deep-sea clay in the vicinity of the 747-fathom sounding south of Skeldere Dyb, at latitude 62 degrees 59.5 minutes N., Longitude 17 degrees 6 minutes W. (on B.A. 2980). However, the numerous notations of fine sand mixed with clay or coarse sand southwest of Skeldere Dyb indicate that here much sand from the shelf must have moved into this deeper region.

On this section of the shelf, after sand, gravel is the next most abundant sediment. Large areas of gravel occupy the central and outer portions of each of the banks between submarine valleys, and in Jökulsa Dyb and Hornafjardar Dyb they even lap down into the valleys themselves. A large area of gravel extends 15 miles out from shore on Eyre Bugt, the inner portion of the bank between Jökulsa Dyb and Hornafjardar Dyb. Another smaller area lies across the head of Hornafjardar Dyb, and numerous patches are scattered over the shelf from shore to outer edge.

It is believed most of this gravel is residual from a former period of lowered sealevel. Some patches, especially those near shore, may be the result of deposition

from glacier bursts.

Mud and ooze are present in several places on the shelf. From the southwestern corner of M.A.2979 the area of mud and ooze described on page 79 extends onto this chart to a position 5 miles off Vestrahorn. At that position it is 8 miles wide. Another belt 10 miles long and from $1\frac{1}{4}$ to $2\frac{3}{4}$ miles wide lies completely across the shoreward extension of Jökulsa Dyb. A number of patches of these finer sediments are scattered over the inner half of the shelf. As previously stated, it is not known whether this ooze noted off the eastern and southeastern coasts is organic in nature or merely a hydrographer's term for watery mud.

Rock bottom is found infrequently off this section of the coast. What there is occurs mostly as small shore reefs or small, isolated rocks not far from shore. In addition, rock outcrops sometimes are incorporated into the barrier beach.

Reefs and patches of rock bottom are found off Vestrahorn; off the mouth of Hörnerfjörður, west of Vestrahorn; at several places off the coast between Hörnerfjörður and Ingólfshöfði, 47 miles to the southwest; and, off Ingólfshöfði. Between Ingólfshöfði and Myrdalavík, 67 miles to the west-southwest, no rock is shown on the chart. This stretch of shore bounds a series of extensive sandy lowland tracts: Skeldararsandur, Brunasandur, Medalland-

sandr, and Myrdalesandr. A number of large, glacial rivers empty into the sea here, depositing enough sand apparently to bury any pre-existing rocky prominences.

The 79-fathom shoal in Skeidare Dyb may have bare rock exposed in it, although none is shown on the chart. Also, the two shoal areas of 65 fathoms each just east of the mouth of the same deep may be marked in places by rock.

Occurrence of Coral Off the Southeastern Coast

Only one sediment notation showing the presence of coral is found on this chart. It lies at latitude 64 degrees 4.75 minutes N., Longitude 14 degrees 39 minutes W., southeast of Vestrahorn. As the notation indicates, enough sand was present with the coral to warrant mention by the hydrographer.

Sediments Off the Southern Coast

The shoreline and shelf west of the blight of Myrdalesvik is shown on B.A.2733 and has been described in pages 13 and 14 of this report. The following description of the shoreline and shelf in this area supplements the previous description.

West of Longitude 13 degrees 8 minutes W. the shelf is largely covered with gravel. A continuous belt extends from that meridian westward to the edge of the chart, occupying the outer two-thirds of the shelf.

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The only interruption to this belt occurs at Skapte Dyb, where a semi-elliptical area of fine sand, measuring 7 miles northeast-southwest by 1 1/2 miles east-west, occupies the floor of the valley. Although the chart does not show it, this sand may very well be continuous with the coastal sand.

At latitude 63 degrees 25.8 minutes N., longitude 17 degrees 34 minutes E., within the overlap zone with S.A. 2733, a 19-fathom sounding bearing a gravel notation appears on this chart but fails to appear on either S.A. 2733 or S.A. 2968. Surrounding depths, as shown on S.A. 2968, range from 39 to 46 fathoms. This sounding, if correct, represents a sudden, local rise in the bottom of over twenty fathoms. Speculation on its origin suggests either an isolated rock hill, disregarding the gravel notation, or possibly a glacial feature, such as a kame deposit.

A belt of sand bottom 2 to 5 miles wide lies between the above gravel belt and the strand line. From Skapte Dyb westward this sand, and probably the gravel also, is mixed with shells. It has been seen that this admixture of shells characterizes most of the shelf sediments off the southern and western coasts, in contrast to the shelf sediments off the northern and eastern coasts.

The sand line from Skapte Dyb westward to the

edge of the chart has been placed at the 100-fathom depth curve, on the basis of the sharp dropoff south of it. The narrow tongue of mud shown entering the southeastern corner of Meynis Dyb follows a narrow trough between the 97-fathom shoal and the western side of the valley.

In this stretch of coast rock bottom is definitely shown only at Portland and at Keynledrangur, just east of Myrdalavik. At both of these points rocky reefs extend one-half mile or more from shore, representing the truncated base of rock hills fronting the coast.

B.L. 585 shows a sand notation at the 29-fathom sounding southeast of Meynis Dyb. However, it is believed the shoal represented here, as well as the 77-fathom shoal in the southwestern corner of Meynis Dyb, may have rock exposed in it.

SECTION III. CONCLUSIONS

From the data presented in the preceding pages a number of conclusions may be drawn concerning the bathymetry and bottom sediments immediately surrounding Iceland.

1. Quantitatively sand is the most important bottom sediment on the shelf. It predominates over other sediments off the western, southern, eastern, and eastern half of the northern coasts.

Mineralogically it is entirely volcanic in content, and has been derived from glacial, stream, and wind erosion of volcanic rocks or else directly from volcanic eruptions. Quartz sand is not known in Iceland.

2. Gravel is the next most important bottom sediment after sand, covering large areas off all coasts from the shore to the outer edge of the shelf. Its probable sources, in order of importance, are: (1) residual from a period of lowered sea level, with resultant wave erosion and probable stream erosion on rock exposed on the shelf; (2) wave erosion on the present rocky coast; (3) submarine volcanism; and (4) Pleistocene glaciation on the shelf.

3. Off the western half of the northern coast sedimentation is controlled by a series of north-trending deeps and banks, with mud flooring the deeps and gravel,

SECTION 12

From the data presented in the preceding section it is evident that the general character of the section is that of a typical volcanic section. The section is composed of a series of volcanic rocks, the most important of which are the basaltic andesites, the andesites, the dacites, the rhyolites, and the tuffs. The section is also characterized by the presence of a large number of volcanic cones, the most important of which are the cones of Mount St. Helens, Mount Rainier, and Mount Hood.

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flanked symmetrically by belts of sand, covering the banks.

4. Shells in the sediments are most abundant off the western coast and off the western half of the southern coast. Apparently the shelf off the northern coast is almost devoid of shells. This variation may be due to the effect of the Irminger Current, a branch of the Gulf Stream which circles Iceland in a clockwise direction.

5. Several belts of fine sediment termed "coke" on the charts lie on the shelf off the southeastern coast. It is not known if this is organic or inorganic.

6. Bottom notations indicate the presence of coral along all coasts except the southern coast and the southern half of the western coast. It occurs inside the fjords, on the open coast close to shore, and at considerable distances offshore, out on the shelf.

It is not definitely known whether this is living or fossil coral. Despite the cold-water environment, it may very well be living, since living colonial forms have been found in cold waters in other parts of the world.

7. The shelf off all coasts is trampled by wide, deep submarine valleys which continue outward from the fjords and bays indenting the coasts. These valleys,

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at least off the eastern and southern coasts, are the result of subaerial erosion at the end of the Pliocene epoch, when the shelf was leveled out to what is now the 154-fathom depth curve. Off the northern and western coasts Tertiary and quaternary faulting have undoubtedly been responsible for some of the depth of the valleys.

8. The island shelf off the southeastern and southern coasts is probably bounded along the outer edge by a zone of faulting or downwarping.

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1. The first part of the document is a list of names and addresses, which are arranged in a columnar fashion. The names are written in a cursive script, and the addresses are written in a more formal, printed style. The list includes names such as "John Doe", "Jane Smith", and "Robert Johnson", along with their respective addresses in various cities and states.
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