"ISLAY: A Study in Island Geography".

with 5 Maps.
19 Sketch Maps, Diagrams, Graphs.
22 Plates.
6 Tables.

Additional Papers:

1. "The Vegetation of the Cumbrae Islands and of South Bute".

2. "The Shore Vegetation of Wigtownshire".

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NOTE:

The work embodied in these papers is based on personal observation in the field.

In the case of Islay, the 6 inch Ordnance Survey sheets were checked and revised in the field. All parts of the island were traversed and observations recorded on the spot.

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1. Introduction.

The economic possibilities of an island depend, to a very great extent, on the evolution of the land forms which characterise it. Some islands are peaks of submerged mountain ranges, and so are characterised by high relief, steepness of slopes, and the very severe limitation or entire absence of those lowland areas of fertility that have the potentiality of agricultural exploitation. Such islands are usually scantily peopled: the restrictions that are incidental, as a rule, to island environment are, in their case, most pronounced.

On the other hand, there are islands which, in comparison with neighbouring and geographically similar mainland areas, sustain a dense population. These, frequently rising from a continental shelf have, as a rule, gentle slopes and low-lying areas - economic assets conferred by their geological history. Evolved from a much-denuded land, perhaps from a peneplane by faulting and subsidence, uplifted or tilted, modified in their land forms by processes that result, they possess those broad alluvial lowlands that form a suitable habitat for human settlement and economic development. Each is a geographical unit, for its boundary is the sea. Its restriction of space, its limited resources, its intensively 'sea' climate, its isolation, confer upon it an individuality,

and make it a field of inquiry for the geographer into those factors of environment that, incidental to island form, operate in such a way as frequently to demand from the island dweller an intense utilisation of its limited resources.

For such an inquiry the island of Islay, off the western seaboard of Scotland, affords a suitable field. The suitability of this island is the more marked when it is recognised that the island unites several topographical features each of which is the main relief feature in one or other of the Hebridean Islands. For example, it has the lowland areas that correspond to Lewis; its highest relief is of the mountain type though not so high as that of Harris and Jura. True, it differs in geological constitution from Mull and Skye but these have a super-imposed relief. Like practically all the islands it possesses peninsular parts that have a relief of their own. Here, then, there is heterogeneity: it would be of interest and profit to inquire into the origin and evolution of its varied relief forms for these play a determining part in the human geography of the island. In addition, such an inquiry would be of interest in relation to the evolution of the Hebridean Archipelago as a whole. Thereafter, it is incumbent on the geographer to study the surface phenomena of the island - its edaphic conditions, and climatic factors; to estimate the effects of both in their control of natural vegetation and agriculture; to follow the adaptation in method of exploitation of natural resources; to consider the consequent distribution and well-being of a people on whom

the limiting factors of the island environment are so persistently operative; and finally to analyse the effects on human saturation of the land when economic considerations give an impetus to emigration and when the dual exploitation of land and sea is severed.

It is from considerations such as these that the geographer will arrive at a knowledge of the fundamental factors of environment that are of paramount importance in geographic control, and are isolated, and their influence clarified, in the limited extent of an island.

In this connection it is interesting to note that other isolated human settlements, for example the oasis - an island in the desert of sand or stone (1) - and little settlements in high valleys among the mountains form natural units, like islands, not "rudimentary forms of human establishments" but types advanced in civilisation. In these the operation of environmental factors is intensified, and the degree of perfection of exploitation achieved is determined by the conditions that in themselves are so unfavourable. "Geographical conditions impose perfection with an inexorable exigency" (1).

2. Land Forms

A westerly outlying part of the county of Argyll, Islay is

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(1) Chapters VI and VII.

(1) P.498 - "Les conditions géographiques imposaient avec une inexorable exigence la perfection".

one of the main islands of the Inner Hebrides. It lies between latitude 55° 56'N. and 55° 34'N., and longitude 6°W (approx) to 6°31'W; that is, it extends 25 miles from north to south and 20 miles from east to west. But it is deeply indented by two arms of the sea, Lochindaal, fully 6 miles long, and Loch Gruinart about 5 miles, which reduce the area of land within this rectangle to approximately 240 square miles, but which increase the length of shore to fully 120 miles. The surface is diversified; the island presents flat shore-lands, gentle slopes, and a high loch-studded upland area in the east with many valleys. (Plate I). On the south and south-east are many small islands and numerous skerries. The western shores are bold and rugged (Plates 2 and 3), and, on the east, a high rock-face overlooks the Sound of Islay.

To the observer in the field the landscape reveals a certain pattern in which straight-line features are conspicuous (Fig. I and Plate I), both in the higher parts and in the lower parts. Such significant lines have been called lineaments (2), (3), "the character lines of the earth's physiognomy". These lineaments in the island under consideration are found to fall into a number of parallel series with, more or less, three directions - viz. - south-west - north-east; south-east - north-west; and north-south - the three directions of the fiords of the west coast of the mainland (4). This similarity of island and

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(2) P.227. (3) P.109. (4) P.157.

mainland suggests that the island and the mainland have had a similar history. Of the three directions the south-west - north-east trend is dominant. A long and, more or less, straight inland cliff can be recognised in the south-eastern part of the island, stretching from the River Ardilistry below the 400 feet contour to the Claggain river, and striking in a south-west - north-east direction. It marks the straight line of contact of two distinct rock-types; it is emphasised not only by the line of the Kintour river at its base but also by the fact that in the low ground between it and the shore there are numerous sills outcropping parallel to it, and showing themselves in conspicuous low scarps. Moreover, stretches of the adjacent shore have the same direction, being determined in places by these igneous intrusions. It is also significant that if the line of the cliff be continued to the north-east it passes along a similar cliff on the east side of the island of Jura. Another line in more or less the same direction is seen in the upper Sorn Valley. The east side of Loch Staoisha and the west side of Loch Finlaggan rise steeply and mark a fault that is continued to the south-west in the drainage line of the Sorn river. North of this there are long faults, almost north and south in direction, marking the upthrow of massive dolomites. At Loch Gruinart, and again, at the junction of the Oa with the main part of the island there are rectilinear low inland cliffs overlooking the raised beaches,

showing that in Pleistocene times the shoreline was determined by lineaments belonging to the same system as those which control it today.

The drainage lines lie in two main directions, south-west - north-east, and north-west - south-east, probably indicating the directions of the hidden rock fissures, the master-joints of the rock basement. This is most in evidence in the Rhinns. That these stream lines represent the position of joints is supported by the fact that the joints of the cliffs along the shores of the island fall into the same parallel series; and the further fact that numerous intrusive dykes, especially in the north-west and south-east, cut across the trend of the rocks in a north-west - south-east direction. These dykes give the north-west coast and the coast of the Oa a bold rugged appearance. It is worthy of note that the drainage on the west slopes of the quartzite hills in the main part of the island shows little evidence of having been determined by rock-joints. This is perhaps due to the fact that these streams flow over deep boulder-clay overlaid, in places, with sands and gravels deposited by streams, probably glacial. These superficial deposits obscure the architecture of the underlying rock basement.

An examination of these lineaments, tectonic in origin, and partly developed by erosion, suggests two points in particular. First, that the same series of lineaments in evidence on the major part of the island is repeated in the Oa

and Rhinns; second, that the series is that of the mainland also. Raised beaches are the only connection between the Oa and the Rhinns and the main eastern part of the island. There is here more than a suggestion that the island is built up of three once-separate blocks that were derived by the splitting up of the same land mass along a commom set of directions. The suggestion seems reasonable, and may be useful, that the fracturing which detached the western portion of an older Scotland and broke it up into fragments produced here a compact Archipelago of smaller islets which the later emergence, evidenced by the raised beaches, reunited into the modern Islay. This gives a meaning to its tripartite structure and introduces a method into its study.

A study of each of the blocks of which the island is thus composed should throw further light on the form of the land, and give a hint on its evolution. For this purpose a study of the hypsographic or morphometric curves[X] of each block and of the island as a whole is of interest and value (Figures 2,3,4 and 5)

The Rhinns may be taken as one block though there is

X To obtain these curves each contour on the 1" O.S. map of the island was traced on to a separate sheet of squared paper and the area bounded by each calculated by the method of counting the squares. Then the area above each level was expressed as a percentage of the area of the whole island. This process was repeated for each separate section - Rhinns, Oa and the main part of the island.

evidence in the distribution of raised beaches that its northern part has been formed from two separate blocks.

At a first glance at these curves it would seem that the blocks of land represented were more or less at the same stage of morphological development, for there is a general agreement in the form of the curves; but a closer examination reveals differences, pointing to independent evolution. Each curve shows the presence of a long, gently-sloping platform intermediate between lower slopes with a slight convexity in the lowest part, and concave and abrupt upper slopes. Each shows, moreover, definite breaks of slope separating the extremes from the long intermediate platform. Thus there is a degree of similarity. But there are important differences, most in evidence in the comparison of the Oa curve with the others - differences, for example, of general level and of slope of platform.

The form of the hypsographic curve of the Oa, with its high general level and very striking truncation indicates that in this land mass there is a great amount of undissected plateau. A break of slope occurs about the 200 feet level, but below this level there is only 18 per cent of the surface of the whole peninsula.

For the calculation of the curve the inland boundary of the Oa was somewhat arbitrarily drawn, and a certain amount of raised beach left to the Oa. There is no doubt 18 per cent of surface

below the 200 feet level is too high an estimate morphologically.

The low-lying coastal areas on the three seaward sides of the Oa are extremely narrow. It presents to the sea rugged cliffs on which marine erosion has been powerfully active, and form which beach terraces would be rapidly removed. Only 8 per cent of the surface lies above 400 feet while the plateau surface (that is, between the breaks of slope at 200 feet and 400 feet) occupies 74 per cent of the whole peninsula.

It is interesting to note that on this surface lies the arable land, and, further, that the break of slope at 400 feet marks the upward limit of farmland on the peninsula.

In the curve for the Rhinns, the intermediate platform lies between the 100 feet and the 300 feet breaks of slope. It occupies 54 per cent of the whole of the peninsula. Below 100 feet 34 per cent of the surface of the peninsula forms gentle slopes which, in virtue of aspect alone (mainly south-east) are valuable as crop-land.

The land above the 300 feet break of slope is small in amount, only 12 per cent of the whole surface. On this western low ridge of 17 miles in north and south extent the land of economic value does not rise above 300 feet, except in a very small part.

A comparison of these two curves (Oa and Rhinns) indicates that each block has reached a different stage in its evolution, the Oa exhibiting the earlier erosion stage. Field observation

bears this out. From its greatest altitudes the land surface of the Rhinns falls in gentle slopes. Its rivers flow in valleys whose transverse profiles are concave slopes of easy gradient; their longitudinal profiles are smooth save for breaks of slope at 50 feet and 100 feet. The drainage of the Rhinns, consequent on a much larger catchment area than that of the Oa has reached a more mature stage. The Oa, on the other hand, has deep valleys; the river profiles are truncated by waterfalls. This is strikingly in evidence on the west side of the Oa where no fewer than thirteen streams have waterfalls near the sea, at 50 feet or 100 feet or about 200 feet in altitude. In the south-west one stream falls over a 200 feet cliff into the sea. The largest streams - Ghil (Fig.5a) and Glenastle - 'hang' conspicuously above sea level. Viewed from above the 400 feet level at Coillabus, Glenastle, between Maol Buidhe (542') to the north, and Maol Mhor (500') to the south, exhibits the aspect of the dark forbidding glen, its steep sides, lochs, and waterfall indicating immaturity. The profile of the Ghil (Fig.5a) is that associated with streams whose equilibrium is disturbed by uplift or tilt. The Abhuinn Glas flows from the Oa ~~into~~ on the 25 feet beach, near Kintra - part of the lowland connection of the Oa and the main part of the island. A waterfall is travelling upstream through the raised beach.

The disparity in the form of the curves for these two sections of Islay does not indicate an absolutely corresponding

disparity in the degree of morphological evolution; for, in the north of the Rhinns there is a great extent of raised beach connecting low-lying land masses, especially around Loch Gorm (Plate 1). Moreover, part of the raised beaches between Lochindaal and Loch Gruinart is included in the Rhinns area as the line of separation between the Rhinns and the main part of the island was taken for the purpose of the measurements, arbitrarily, at the position of the shortest distance between the heads of these lochs. The total effect of these extensive low-lying areas (extensive in relation to the area of the Rhinns) is to flatten, at low levels, the hypsographic curve representing the Rhinns.

The two peninsulas, Oa and Rhinns, are connected as arms to a larger mass, the main eastern part of the island, 168 square miles in extent, and rising in the east to 1609 feet in Beinn Bheigeir. The curve of this part shows breaks of slope at 100 feet and at 400 feet. (It is to be noted that the altitude scale of curves in figures 4 and 5 is less than that of curves in figures 2 and 3. The larger altitude scale of the curves of the peninsulas permits of the lesser features being shown. If the curve of the Rhinns were plotted on the same altitude scale as the curve of figure 4 its minor features would be lost in the general flattening of the curve that would result). Below the 100 feet level lies 22 per cent of the whole surface, while the abrupt slopes above 400 feet include 32 per cent of the entire area of this major block. Between these two levels lies rather less than half of the whole

surface, viz. 46 per cent, forming a gradually rising slope. This is the region of economic value, the highest farmland just crossing the 400 feet contour. Much peat-covered raised beach lies below 100 feet.

This curve has the same general form as that of the Rhinns. It is, however, much steeper, possibly indicating that the evolution of the drainage throughout the mass has not advanced so far as that of the Rhinns. This block has ten times the area of the Oa, and three times the area of the Rhinns, but nearly 20 per cent of its surface lies above the greatest elevations of the Rhinns and the Oa. The large catchment area has enabled the westward flowing streams effectively to erode their valleys so that gentle slopes result. On the eastern side, however, the valleys are narrow, deep and steep-sided. These features, so obvious in the field, are brought out clearly in the profiles of the rivers (Fig. 5a). The Laggan river has a smooth profile, except for breaks of slope, due to the raised beaches, and the Sorn has a smooth profile above and below Loch Finlaggan. Of the two main eastward streams the Claggain is the less advanced in evolution. Its profile is very steep. The Proaig is less steep; its minor features, (breaks of slope) have moved upstream. It has evolved further than the Claggain probably because of its head waters draining two extensive steep-sided corries. Both the Claggain and the Proaig, however, show immaturity. This im-

maturity of eastward drainage has an effect in the steepening of the hypsographic curve of the main mass of the island, and precludes it from showing the maturity that the westward streams would suggest.

The curve for the whole island shows 24 per cent below the break of slope at 100 feet, 24 per cent above that at 400 feet, with a sloping intermediate region of 52 per cent of the island surface. It has the general form of the curves for the Rhinns and the main part in the east. It is a slightly flatter curve than the curves for the eastern block for it embodies the curve of the Rhinns and the curve of the Oa. The effect of the Oa, due to its immaturity, even though its area is only one-fourteenth of that of the whole island, is to introduce into the curve of the island a slight elevation, into the lower half of the curve;, while the effect of the Rhinns, which is almost one-quarter of the whole island surface, is to introduce a flattening of the curve. The curve for the whole island suggests that the cycle of erosion imposed upon the old surface before it was disrupted into island blocks each destined to independent morphological development by the disruption, had so modified the old surface that it advanced far in its evolutionary progress, perhaps to a very mature or even senile stage. It is precluded from doing more than suggesting such an advanced development because it embodies three curves, the curves of the three distinctive parts of the island. From each of these it differs. Thus each of

the blocks represented by these three curves presents an individuality due to difference in original extent, elevation, and possibly tilt, and to independent evolution.

Nevertheless, the profile elements which the island, as a whole, exhibits, are those that are characteristic of the whole of Scotland - sweeping curves at higher levels, indicating an early mature or even senile general character, and smooth curves at lower levels, indicating a fairly advanced stage of a new evolution, following on a disturbance of the equilibrium of the streams, the degree of advancement being determined by the size of the block on which the new cycle has operated as well as by the other factors. These lower curves are truncated by minor breaks of slope due to the causes that brought about the development of the raised beaches. Separating the lower from the higher curves there is a long sloping shelf or terrace marked off from both by breaks of slope. This feature of the curve expresses the plateau nature of the country, and its general slope indicates earlier more or less complete peneplanation. The smoother lower valleys pass inland into gorges, notching rather than dissecting the upper platform.

It is interesting to relate the nature of the island blocks under study to that of Scotland as a whole. If we adopt a view very generally accepted we shall consider that Scotland, when it had attained the condition of a peneplane

must have had a profile something like that shown in figure 6, with a long slope on the west extending perhaps to somewhere about the present bounds of the continental shelf. This western slope was, possibly, even gentler and longer than the eastern one which must have been adjusted to a lesser rainfall than that of the west. The contrast in the rainfall would be even greater then than it is today when the land is so much narrower.

Applying Dutton's theory of isostasy (5) which regards the continents as floating on a substratum of viscous-solid rock, this ancient peneplane may be represented as in figure 6A. Below the highest part of the peneplane, the watershed, there is compensation in that the 'sial' displaces a greater amount of 'sima' beneath. The whole land mass is in a state of isostatic equilibrium (6). If this were the state of the old peneplane in early Tertiary times when disturbances occurred in the western region, evidenced by the outpouring of lavas, then it is believed that the strain imposed on the western limb resulted in extensive fracturing. Subsidence of parts of the sial between parallel fractures (Fig. 6B) (the fate of those submerged blocks may be neglected as it does not seriously affect the argument) would leave isolated blocks. The elevation and tilt of the individual blocks, including the largest or mainland block, immediately on dismemberment, would be that required for equilibrium of the whole original mass whose rigidity distributed the load due to strain in individual sections.

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(5) P.194. (6) P.175.

The separated members would become independent floating bodies not in a state of equilibrium. Each would tend to adjust itself in the plastic material. The adjustment would involve tilt with or without elevation or depression due to increased or decreased relative buoyancy. From such a block (or blocks) as that in position X (Fig. 6b) near the western side of the mainland the modern island of Islay would be formed, for it lies well within the edge of the continental shelf. It occupies the position characteristic of the loftier Inner Hebrides and would correspond say to Western Aberdeenshire on the Eastern flank of the original peneplane. The Outer Hebrides, the Long Island, for example, would rather represent the blocks of position analogous to Y in Fig. 6, and would correspond in position to Buchan in the east.

The westward flowing streams, flowing from a watershed close to the eastern margin of the block, though now reduced in volume owing to a lesser catchment area, would be rejuvenated in virtue of their fall over the fractured edge of the land block (or blocks). The rate of evolution would depend on the size of the block. In figure 6c this new evolution is represented on one block. It is to be noted that an erosion curve of an early stage of the evolution corresponds in form to the hypsographic curve of the Oa Peninsula, and to the profile of the largest stream of the Oa (Fig.5A), suggesting the immaturity of drainage of that land mass. On the eastern edge of the block, short, swift streams, supplied by a small catchment area would work out

a very slow cycle of erosion.

In the great eastern limb of the old peneplane, shorn of its western counterpart, there would be a shift to the east of the centre of gravity, and as it slowly adjusted itself in the plastic substratum there would be a new centre of buoyancy of the displaced magma. The high viscosity of this sustaining material would cause it to yield but slowly to the overlying land mass in process of adjustment. This adjustment would necessarily involve a rise and tilting of the whole land mass. Both the long eastward flowing streams and the short westward ones from the now elevated watershed would be rejuvenated - the inauguration of a new cycle of erosion.

Of this new cycle which has reached different stages on the island fragments and on the mainland there is ample evidence in both regions. The main results at the position of Islay of this dismemberment of the ancient Scottish peneplane were the formation of a western archipelago, and the inauguration of a new drainage evolution. Subsequently, the forces that brought about the formation of raised beaches united three (at least) island fragments to form the island of Islay.

It would seem, therefore, that at least three cycles of erosion have brought about the topographical features of the island. First there was the long continued cycle that formed the ancient peneplane of Scotland (It is to be noted that in a peak section from the mainland watershed across the islands of the west there is a gradual decline (7) in the altitude of the

(7) P. 113

peaks westwards, suggesting the old peneplane surface (Figures 7, 8 and 9). In each detached land mass the high peaks are on the east of the mass and the downward slope is to the west. The section in figure 8 shows Islay lower on the east side: this is due to the line of the section passing from the Oa along the lower south-eastern part of the main mass of that island.

A new cycle of erosion in consequence of rejuvenation by fracturing of the ancient peneplane would work out, on the island fragments, new slopes, while a third cycle associated with the formation of raised beaches would give such minor topographical features as breaks of slope in the lowest parts of the island.

An examination of the eastern limb of Scotland brings out the fact that the same three cycles have been operative there. Geologically, Islay belongs to the central Highlands of Scotland. This gives it a higher potentiality of development than that of the other large islands of the west, for its geological composition is the more diverse. It has an economic advantage over Lewis which, built up of greisses, has soils of a rather infertile nature; over Skye and Mull where massive lavas and other igneous rocks give superimposed relief, and, on account of poor drainage, little improvement to the soils. Variety of rocks, some calcareous, confers on the island of Islay a fertility that has made the island of greater agricultural importance than any of the others on the west. It has been styled "The Queen of the Hebrides".

Topographically east coast, and geologically (and climatically)

west coast, it has edaphic characters that, resulting from its evolutionary history, are, at once, the basal or fundamental condition of its human geography and the key to its degree of economics development.

3. EDAPHIC CHARACTERS.

The diversity of the solid rocks of which the island is composed gives a corresponding diversity of loose surface materials which form the raw materials from which soils are elaborated. In this connection it may be remarked that the parent rocks are regarded by the Russian Pedologists (8,9,10) as playing only a secondary part among the soil-forming agents. This may be true in a broad classification referring to extensive areas where a large climatic type gives a basis for soil-classification, but, within a restricted area, such as the island of Islay, where climatic conditions are sensibly the same throughout, differences in soil are recognisable as due to differences in the parent rock, the disintegration of which gives the first essential in soil production. There are soils in the island of a highly siliceous character, and soils that are calcareous - characteristics that are the result of the weathering of quartzite and limestone respectively. The weathered material of the parent rock, whether sedentary or transported by water or by ice, would always carry a certain plant cover which would itself pass through successive stages and play no small part in

the formation of soil.[x] Its chief contribution would perhaps be decayed organic matter on which a vast micro-flora and micro-fauna would operate, the intensity and character of their activity being dependent on the physical nature and conditions of the material in which they lived. The aeration of the material, the relative quantity of moisture it contained, and its content of nutritive salts would determine largely the power of the organisms in their work as soil-forming agents. In the island of Islay the upper horizons of the soil-profile undoubtedly contain a great amount of moisture due to topography in parts but due chiefly to the humid atmosphere of the island in consequence of a vast ocean to its west from which the moist air travels. Morainic material accumulated on the flat lands to the east of Laggan Bay and to the east of Loch Gruinart gives such an irregular topography that water accumulates in excess. Other smaller areas in the island exhibit the same excess of moisture. Too much moisture in the soil, to some extent due to slow evaporation into a humid atmosphere, means poor aeration and therefore little oxidation of humus. The activity of the micro-organisms is checked and humus accumulates. Peat is formed. Soluble products are leached out of the surface

x A study of the weathering of the materials of the "bings" of debris or spoil heaps so numerous on our coal-fields and the succession of floras that colonise them would throw some light on this subject.

layers. Iron separates out as ferrous iron. Of this there is much evidence in the island. Iron and manganese are revealed on chemical analysis in soil specimens[x] taken where water has percolated down through the surface layers and in sheep drains on the hill sides. Peaty soil on a leached subsoil is not, however, so widespread on the island as it used to be, for the controlling factor of moisture has been modified by drainage. This work has been extensively carried out on the island with the result that forbidding land has yielded to man's purposes. This transition is noticeable especially on the 50 feet beach which seems to have carried much peat in the past. The reduction of the amount of moisture in the soil and consequent improvement in aeration, together with means of counteracting the acid nature of such soils, have allowed those immature soils to develop.

The other soils of the island are varied - sandy soils, sandy loams, calcareous soils, siliceous soils, granular soils, and boulder 'clay'. Their distribution is set out on the map of Islay (Fig.10). Much is sedentary; (see map) and in places alluvium has been laid down by running water, drift by the ice, sands and gravels by glacial streams, and sands and muds by the sea. On all of these soil-forming agents have been active with the result that soils of a considerable degree of fertility have been formed therefrom. They constitute the medium of a changing

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x Specimens richest in iron and manganese were taken by the author in the Oa, southwards of Port Ellen Lighthouse.

natural vegetation and of man's crops which replace it.

In the Rhinns peninsula the Lewisian Greisses in the south give a granular material which forms soil of a spongy character. Basic material is contributed by the intrusive rocks that are frequent in this region. Northwards, the rocks are Torridonian grits and slates overlaid by sandy loams containing between 30 and 40 per cent of clay.[x] The gritty and clayey nature of this deposit is undoubtedly due to the underlying rock material. Calcareous flaggy bands at Sanaig render the deposits there less exclusively siliceous. Eastwards of this pre-Cambrian region the metamorphic rocks that make up the major portion of the island are represented mostly by quartzites which weather to form a covering of a highly siliceous nature - a property strikingly reflected in the vegetation. The soil cover is thin high up on the hillsides. The steep slopes near the summits are largely devoid of soil. The quartzites constitute the highest relief of the island. To the west and to the south, of the upland mass they form, lie broad areas of mica-schist, chlorite-schist, phyllites and slates which, on account of the presence of many calcareous bands of sandy dolomitic material (especially near Port Ellen) yield a superficial deposit that is slightly

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X Specimens of soils were taken from different localities throughout the island and subjected to physical examination. When figures are quoted they are based on the author's analysis.

calcareous. In the south-east part of the island numerous igneous sills, of epidiorite, forming crags occurring in more or less parallel arrangement, contribute basis material to the soils. The contrast is marked by a sharp line of demarcation in vegetation from the 'acid' uplands to the 'basic' sills that lie to the south.

The most important rock, economically, of all this greater body of the island is the Islay limestone. It occurs largely in the basin of the River Sorn between Bridgend and Port Askaig. Small outcrops are found in the region to the south, and also in the eastern part of the Oa. It contributes calcareous material to the soils; the best agricultural land coincides with it. North of the River Sorn, sandy shales and flags, dolomitic bands and massive dolomites, and conglomerate with grains of limestone and a dolomitic matrix(11) give a calcareous deposit only utilised in the lower slopes, for much of this area is elevated above 500 feet.

Glaciation has played a part in contributing surface material. Boulder clay, varied in colour, but mostly red, mantles the western slopes of the quartzite upland regions east of Loch Gruinart and east of Laggan Bay. It is exposed in the valleys of the streams that flow on the south and south-east sides of the quartzite hills in the eastern or major portion of the island; on the west side of the Oa; and also in western parts of the Rhinns where it is not so greatly developed. North of

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(11) P. 42.

Port Ellen tracts of sand and gravel, probably deposited by interglacial streams, overlie the boulder clay.

Unlike the blue till of the Midland Valley of Scotland the red clay of Islay is not a stiff cold clay. It has a certain tenacity when moist. When dry it has a gritty texture, and when it is washed in a gentle stream of water through several vessels the first washing does not give colloidal solutions but consists of an extremely fine suspension. Very minute particles of silica, in part coloured red, are revealed under the microscope. The red colour is probably due to the former existence of Triassic sandstones (11). The joint-planes of the quartzite show a red staining, especially in the Oa, and a red sandstone breccia occurs in the south-east of the Oa. Much of Islay must have been covered with this red sandstone. The boulders of the clay are derivable from the rocks of the island with the exception of porphyrite which probably came from Jura, and of andesite probably from the mainland (11).

The alluvial deposits of the island are, for the most part, of a light sandy nature with a very small percentage of clay (about 10 per cent). The raised beaches carry a very light material, gritty and porous in texture which has developed into good, dry agricultural soils, except where drainage conditions have been such as to favour the formation of peat, for example on the 100 feet beach, north of Port Ellen, and east of

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(11) P. 56. (11) P. 71.

Loch Gruinart. The sands of the dune regions are not without importance in relation to agriculture. Specimens of the sands of fixed dunes, taken from different areas in the island are found to be composed of much fragmental shell material. (See Table of Lime Content of Dune Sands, Page ~~58~~ 46)

Though the distribution of agricultural land and the character of the agriculture are very closely related to edaphic conditions, climate remains the dominant control even in this western and comparatively low island.

4. CLIMATIC CONDITIONS.

The climate is essentially an oceanic one, its mildness and its high relative humidity being elements of paramount importance where agriculture is concerned.

The distribution of temperature is very roughly shown in figure 11. The direction and position of the isotherms shown is based on the average temperature readings of a few stations only - five in all. These average monthly temperatures are exhibited in the graphs of figure 12. That the graphs all lie in a narrow band indicates that conditions are more or less uniform over so small an island. The winter isotherm over the land is 41°F., and the summer isotherms of 56°F. and 57°F. fall just north and south of the island respectively, suggesting an isotherm of 56.5°F. passing over the southern part of the Rhinns, the head of Lochindaal, and curving to the south-east.

Four months, June to September, have mean temperatures of

54° and above, while the coldest months are the first three months of the year, February being the coldest. It is even colder in March than it is in December. August is rather warmer than July and September has practically the same temperature as June. Thus there is a lag of summer and of winter - characteristics of the Western Scottish climate but more marked in the insular oceanic climate. When the graph of annual march of temperature for the island is compared with those of stations on the west coast (12) of the mainland two facts emerge - the peak of the island graph is reached nearly a month later, and the sharp rise in the graph from winter to spring of the island occurs about a month after that of the mainland graph.

An idea of the movement of air over the island is obtained when the wind-carry in each direction (8 points of the compass in the case of Rhinns, Lochindaal and McArthur's Head Lighthousees, and 16 for Rhuvaal)x is worked out and expressed as a polygon of velocities, the arrows flying with the wind and being proportional in length to the product of velocity and duration of flight (Fig. 13 A.B.C.D.)

From each polygon of air trajectories a resultant is obtained. It is different in all four cases. This difference may be partly due to the 'personal equation' as judgment by the

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x The data for this study of winds was kindly furnished from the logs of the lighthouses by Dr. Goldie, Superintendent of the Scottish Meteorological Office, Edinburgh.

(Over)

Foot-Note (Contd)

The figures were constructed as follows. The accepted value of wind velocity for the proper Beaufort number of wind force was noted for each point of the compass, and these numbers were added up so as to give one-sixth of the total travel of air in the course of the year in each observed direction - one-sixth, since the observations were only made once in 6 hours. These values of travel were then plotted in a polygon of velocities from which a resultant travel was read. It is considered that this resultant travel is a more useful concept than 'prevailing wind'. The scale for reading the polygon is constructed to give total travel on the assumption that a reasonably accurate idea of this distance may be reached by multiplying the figures by six, i.e. that 6-hourly readings give an adequate approximation to the relative frequency and duration of winds. The auxiliary scale on which mean daily travel can be read is 365 times as large as this.

While topographic effects show themselves in this resultant just as in the 'prevailing winds' it is realised that for a complete discussion individual winds must be considered. This is regarded as unnecessary in a geographical essay.

(End of Footnote)

lighthouse keeper of wind force will not be readily uniform among men who have perhaps had experience at stormy exposed stations or, on the contrary, at very sheltered ones. The wind force observations are not instrumental. On the other hand, the fact that all four observations in the 24 hours at any one station would not be made by the same observer would tend to reduce the amount of error made perhaps by one or other of the observers. At any rate, the wind direction would be accurately gauged, and, on the average there would not be a very great discrepancy in the estimation of force.

A comparison is made of the exposed station (The Rhinns lighthouse - exposed to the winds of the Atlantic) with the sheltered station McArthur's Head, at the south entrance to the Sound of Islay, standing high on the cliff face, and sheltered from the westerly winds by the high relief immediately behind. At the former, west winds and north-west winds give an almost equal carry, but, at the latter, the north-west wind preponderates. It is significant that when the observer at Rhinns recorded (in 1926) a west wind the observer at McArthur's Head almost invariably recorded at the same hour a north-west wind. The west winds following the low-lying country of the Sorn and Laggan Valleys seem to be diverted so as to come from the north-west, the steep-sided Sound of Islay acting as a funnel, and South-west winds at the Rhinns usually coincided in time with a South wind at McArthur's Head. The

average velocity of the wind (in 1926) at Rhinns was 16 miles per hour; 14 at McArthur's Head; 12 at Lochindaal; and 25[x] at Rhuvaal.

From each polygon of velocities the resultant wind-carry is obtained. At Rhinns it is 10° south of west and at Lochindaal it is south-west.

At Rhuvaal it is 31° west of south, and at McArthur's Head 30° ~~south~~ NORTH. of west. These are shown on the sketch map in figure 13E.

It would appear that the winds from the west following the low relief of the centre of the main part of Islay, and reaching the fiord of the Sound of Islay, where they are confronted by the high relief (over 2,500') of the south of Jura diverge in two directions, facilitated in their movement by the direction of each half of the fiord. (Fig.13F) It provides a striking illustration of the effect of topography on wind direction.

Winds of gale force, and stronger (number 8 and above in the Beaufort Scale) are frequent in the island, 18 being the mean annual number. (Figs. 14 a,b,c,d. and Fig. 19) They are least in May, June, and July, but increase from August onwards. (The prevalence of high winds in the Autumn when crops are ripening is a serious drawback to the farmer).

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x This relatively high velocity may be due to 'the personal equation' or perhaps to diminished pressure along the north coast of Jura.

At the Rhinns and Rhuvaal, exposed stations, 20 and 19 storms on the average for the year are experienced, and these have an average duration of 28 hours and 25 hours respectively. The sheltered stations, Lochindaal and McArthur's Head have fewer storms, and of shorter duration, 16 per year at the former with an average duration each of 23 hours, 15 at the latter, lasting for 18 hours on the average. It is a peculiar fact that the September storms at Rhinns and Lochindaal have a much longer duration than those at Rhuvaal and McArthur's Head, while July storms at the latter places last longer than those at the former pair of stations. The direction of the winds must have something to do with this.

The rainfall of the island is distributed very evenly, throughout the year: the ratio of winter rain (Oct. to March) to summer rain (April to Sept.) being 5:4. The annual average fall is 48 inches, a small fall for a maritime climate. The topography of the island, however, is not such as to induce a heavy rainfall. Moreover, the island seems to miss much of the cyclonic rain. At the extreme south point of the Rhinns the mean is 38" while at McArthur's Head it is 64" (Fig. 16) There is no suggestion of a rain-shadow area. The wettest month is December while the month of least rain is June (Fig.17). The wettest period is from October to January. The average number of rain days is only 204 in the year, which is the average for Great Britain as a whole, while 225 or more is

usual in the west of Scotland. At the Rhinns point the lowest number for the month is 10 in June, and the highest 19 in December, the average per month being 17.

The humid state of the sea-borne air of the island is reflected in the frequency with which fogs occur in the island. (Figs. 15a,b,c,d. and 18). The yearly average of occurrence of fog is 18, with an average duration of 8 hours. The highest average is in June usually accompanying anticyclonic conditions. The average number of fogs for Great Britain is 20 so the island compares favourably but it is to be remembered that fogs on and around an island are of greater significance than on the mainland, for they intensify the greatest drawback - its isolation. The exposed station, Rhinns, has 29 on the average for the year with a duration of 9 hours. At Lochindaal the December fogs hang long over the loch. At McArthur's Head only 9 occur in the year on the average and last for 6 hours only. The funnel form of the Sound here must cause a movement of air which prevents the formation of much fog. Rhuvaal shows a similar decrease in comparison with Rhinns - 11 fogs of 8 hours duration. The fogs are worst on the west side of the island.

Fogs are of threefold significance in relation to the economic activity of the island. Their prevalence in June means a very serious restriction of sunshine where growing crops are concerned, especially for a sun-crop like turnip;

they give a damp atmosphere, encouraging the growth of plant diseases; and they render dangerous or prohibit communication with the island by boat.

Another factor of maritime climate is the absence of keen frost. This is most marked on the island, and it has the drawback that the soils do not come under the disintegrating power of frost. In addition, the sheep-farmer finds it more difficult to maintain his flocks in good health since harmful organisms survive in the absence of frost.

5. NATURAL VEGETATION.

These ecological factors - topographic, edaphic and climatic - discussed above, are reflected in the general character of the vegetation. It is their combined effect that determines the type of association that the vegetation most commonly presents. In the island of Islay moor is widespread (Plate 5). Of a calluna and bracken-heath nature where the soils are light and permeable and the drainage good, it exhibits bog associations where the drainage is deficient and the soils extremely acid. Sphagnum - moss bogs with their associated plants are encountered both on the low and on the high ground and peat (13) is both extensive and deep in the lower parts of the island. Peat occupies over 15,000 acres, representing 10·5 per cent of the whole island. It is most in evidence on the Laggan Bay shore regions and to

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(13) P. 282 and 283.

the east of Loch Gruinart. A wide peat area, a depression occupied by Loch Gorm, stretches from the head of Lochindaal westwards to Saligo Bay. North of Loch Gorm the surface of the Rhinns peninsula carries much peat. In such places as the flat land fringing Laggan Bay and at Bonahaven where a new road was recently made, stumps of trees are seen in the peat fully 10 feet below the surface. The same indication of a former woodland cover in the island obtains at Loch Gorm. In the connection it may be noted that in 1595 it was recorded that "This ile is plenteous of woodis, quhairin are mony deer, raes and wild foullis"(14).

The woodland of today is partly planted and partly natural. There are about 3,580 acres of wood (2·4 per cent of the whole island) of which 37 per cent is planted and 63 per cent natural woodland or scrub. There are small patches of scrub in the north of the island but it is mainly confined to the south-eastern parts. Here the basic intrusive sills of epidiorite that ~~be~~ LIE in parallel lines and form peculiarly serrated ridges are mostly clothed with a dense scrub with hazel, birch and willow as dominants and rowan, oak, hawthorn, and sloe as associates. The scrub has a dense undergrowth of bushes of ~~F~~ Gorse, dog-rose and bramble. Honeysuckle, ivy, lichens and mosses are abundant on the trees. As a ground vegetation the area carries bracken, male-fern, fox-glove,

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(14) P. 428.

royal fern, and bell heather. In addition there are marshy patches of sphagnum bog at the base of the slopes. So close is the ground vegetation and so marshy in places that through time degeneration of this scrub-land is likely to go on apace, and the area become one of a peaty nature with old tree stumps at its base. Herein lies a hint for interpreting the presence of tree-stumps in the peat of today. The degeneration of the scrub-land has begun and it is not difficult to visualise its future state. It would seem to repeat a process that must have taken place on the island long ago when the former forest cover vanished, leaving only traces of its existence in the peat that replaced it.

It is a very noticeable feature of this region that the scrub stops short at the foot of the quartzite hills that lie to the north (Plates 6 and 7). The acid soils of this region forbid such tree-growth. Many of the peaks of the quartzite hills are bare of vegetation and look snowclad in the sunlight (Plate 8).

Yet another association is that of the saltings (15) at the head of Lochindaal and of Loch Gruinart (Plates 9 and 10). These lochs are being rapidly silted up and salt-plants (halophytes) are helping in the reclamation of these areas. Good grazing ground is thus formed especially where embankments

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(15) P.21.

have been constructed to keep back the high tides. The turf of the saltings is close and matted and composed of a very rich flora in which (Glaux maritima, Armeria, Juncus Gerardi (Loisel), Carex extensa (Good), Glyceria, Triglochin, Spergularia, Plantago maritima, Cochlearia officinalis, Aster-Tripolium are dominant. Patches of brackish water, numerous in the seaward margin of the saltings are fringed with masses of Scirpus maritimus. Further back the saltings pass into good pasture with bird's foot trefoil and white clover mixed with the sea plants.

Another vegetation type is that of the dunes which are very extensive (Fig. 10) occupying an area of some 3½ square miles or 2,240 acres, 1·5 per cent of the whole island. Mobile next the sea the dunes further back have passed to the grey or fixed stage, a transition (15) that has been very extensively achieved in the Islay dunes. This is the more remarkable in view of the fact that the island is subject to strong winds. It is perhaps to be explained by the fact that the great moisture of the island, coupled with low evaporation, causes the water-table of the dunes to lie, at no time, far from the surface, thus maintaining a rich flora of flowering plants and such mosses as Hypnum, Hylacomium triquetrum, and Tortula ruralis. The sands are in places blown high on the shoulders of the hills, especially at Kilnaughton and Kilchoman Bays. (Plates 11, 12 and 13). At Lossit Bay the sand reaches

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(15) P. 17.

the 200 feet contour. As a rule the mobile dunes present a steep edge to the sea and are capped with clumps of ammophila. The fixed dunes show a certain alignment, very noticeable at Killinallan where the bare lee sides of dunes not completely fixed all face the north-east, the dunes being in parallel lines obliquely set to the shore. The wind is the factor in this arrangement. Some old fixed dunes give evidence of denudation and re-formation by wind. Probably burrowing by rabbits has reopened them and exposed them to the force of the westerly winds. At the north end of the Laggan shore the old dunes are in various stages of de-formation and re-formation, and meanders of the River Laggan are cutting the dunes back.

In addition to their value as sheep pasture the dunes provide shelly sand that is applied to arable land on account of its limey content. In table (1) the distribution of the dunes is set out in column one, and the limy content of the sand in each region is expressed as a percentage of the weight. The average lime content (calcium carbonate) is 43 per cent, the sands of Saligo Bay facing the Atlantic Ocean giving the highest yield. In addition to these large dune areas there are many small bays of sand around the shores but not all of them have a high limy content. For example the sands at Port Ellen gave only 4·5 per cent of limy material. Here the sands form, when wet, a very heavy medium, so much so that some of the strand plants, especially Glyceria maritima, exhibit

vegetative characters far from normal. The micas of the rocks form which these sands are derived seem to weather out as a whitish clay.

At Killinallan, on the east side of Loch Gruinart, a marshy hollow behind the dunes is overlooked by the old sea cliff (plate 14) above which there are the 50 and 100 feet beaches mostly covered with peat.

TABLE 1.

DUNES.

Distribution		Lime content expressed as %age of weight +
Loch		
Gruinart (West)	) - Ardnave.	44.5
do. (East)	) - Killinallan.	39.1
Lochindaal (E.)	- Laggan Bay.	41.5
Rhinns (West)	- Sanaig.	43.78
do.	- Saligo.	48.7
do.	- Kilchoman	35.15
do.	- Lossit.	53
South Coast	- Kilnaughton.	35.6
		Average 43

NOTE: Sands (white) form the shore at Port Ellen showed only 4.5% of lime content.

+ Analysis by the Author.

TABLE 2.

TYPES OF VEGETATION.

Type.		Percentage of whole island.	Utilisation.
Moorland		67	Largely used as 'outrun'
Peat		10.5	Fuel, also for drying malt in distilleries.
Dunes		1.5	Sheep pastures, where 'fixed'.
Woodland		2·4	
- Scrub	1.6		-
- Planted	0.8		
Saltings		0.1	Cattle-grazing.

6. AGRICULTURE.

(a) Introduction; and historical.

An analysis of the foregoing conditions that obtain on the island shows that while many of the factors are favourable to agriculture, there is a preponderance of conditions that are decidedly inimical. For example, the advantages of topographic factors of low relief, of gentle slopes with good drainage and aspects to south and south-east are more than offset by the disadvantages of high relief, steep slopes and westerly aspect evidenced in a large part of the island. In edaphic conditions, too, this preponderance of unfavourable conditions

shows itself, for while there are smaller areas of good soils (e.g. calcareous soils, sandy loams and the light soils of the raised beaches) there are much larger areas of highly siliceous soils, of spongy soils, and of cold heavy soils. Again, in climatic conditions the hindering factors are the more potent. For example, the frequency of storms and fogs, the high humidity of the atmosphere, the absence of frost in winter, and the lateness of the Spring, are more than an offset to the advantages of mildness and the warmth of Autumn. Yet, in spite of the many disadvantages, agriculture and its associated industries have been developed to a wonderful extent. This has been achieved by the industry of the islander in utilising to the utmost those phases of the environment that were favourable and in controlling and subduing those that were within his power.

The need for this was early recognised. Land was enclosed, roads made and bridges built. (It is difficult to determine the relationship in time of the commencement of these island improvements to that of the mainland). Many parts of the moor were reclaimed. The water was let off in open and wedge drains, the moss removed, the surface delved and levelled and overspread with shell sand usually at the rate of eight tons per acre (17). On the basis of the lime content of the sands this would seem to be a lavish application, about 5 times the amount of calcium carbonate that would have sufficed if the estimate of Demolon(16)

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(16) Pp. 185-187.

that arable land loses 1,000kg. of CaO per hectare in one year be accurate. Of course, it is to be remembered that in addition to supplying the needs of crops much calcium carbonate would be needed to neutralise the acidity of the peaty soils.

Seaweed and shelly sand were used as manure as far back as the 18th century and probably much earlier for the growing of potatoes. In the Statistical Account of Scotland (1794) it is recorded of the parish of Kilarrow and Kilmeny that "where shell sand and lime are easily obtained and the lands drained the yield is improved. Large tracts of moor now yield good crops". Much reclaimed land lies at the head of Loch Gruinart where the streams were diverted into new channels, drains formed and embankments raised, thus acquiring for agricultural purposes the good shelly soil of the raised beach. In many parts of the island agriculture has only been possible by such work.

Yet, though much of this improvement of land was done in the 18th century, the non-observance of rotation of crops and lack of adequate drainage led to unproductivity, so much so that at the beginning of the 19th century cultivation was in a backward state. An item in the Stent Book (1803) reveals this. "The meeting considering that the island is in a backward state of cultivation have resolved as an improvement that each occupier of 4d. land[x] in tillage over the whole island, shall sow in the

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x Groat land, the groat being a nominal rent to the chief.

ensuing Spring 2 pecks of Peas and Beans, and for enabling them to have proper seed they now request that Shawfield will take the trouble of sending a Cargo of Peas and Beans to the Island in proper time, that the Tenants may be abundantly Supplyed - The Clerk to the Meeting is Directed to Intimate to the whole Tenants these resolutions that they may prepare their ground accordingly". It was further recommended that no grain or potatoes be exported until it was clearly ascertained that there would be a sufficiency for the inhabitants. Thereafter much attention seems to have been paid to fencing, draining and general improvement. In 1845 it was put on record that "agricultural improvements have proceeded with astonishing rapidity: the land has been enclosed and drained, a great many roads made and bridges built and a new system of husbandry adopted. It now produces good crops of barley, oats, peas, flax, some wheat and excellent crops of potatoes" (18). By this time, however, emigration of the people set in, and the tendency thereafter was for small crofts to be absorbed in larger farms and for much tilled land to go back to a state of nature.

(b) DISTRIBUTION AT PRESENT:

The present distribution of agricultural land shows relief control and, in addition, the control of edaphic conditions. The distribution is shown in figure 20 in relation to altitude and in figure 10 the agricultural land is superimposed on the

edaphic conditions.

Taken in conjunction these maps illustrate the dominant factors in determining the distribution of arable land. The largest areas lie in the valleys of the River Sorn and the River Laggan. The Sorn basin has the larger proportion although it is not so large as the basin of the Laggan. In the former the Islay limestone is widespread, and although covered in places with drift it outcrops on the surface frequently and washings from these outcrops enrich neighbouring lower-lying fields. Moreover, where the limestone is not far below the surface a limy solution can rise by capillarity into the overlying deposits. Again, it may be remarked, that the boulder clay has boulders and clay of limestone in it, and the slopes on the north-east of this basin (the Sorn basin) are of conglomerate, rich in limy matrix. This contribution of lime is reflected in the richness of the pasture lands and in the yield of crops. The valley is broad and more or less flat, and on its northern side the slopes are gentle and have a south-eastern aspect. Tracts of alluvial land in the upper parts of the river are cultivated. To the north-east of Loch Finlaggan which feeds the Sorn, there is a slightly more elevated tract of land enriched by the limestone, and containing some acres of alluvium. It coincides with the limestone and contains much rich pasture and arable land. The highest arable land in the basin of the Sorn, is at Lossit, fully 400 feet above sea level.

The Laggan basin is much larger than the Sorn basin but much of it lies on the slopes of the quartzite uplands which do not permit of agriculture on account of acidity of soils, steepness of slopes and altitude. Far up the valley, at Cattadale and Barr the northern slopes form good land: it is a limestone region. Below Cattadale a tract of alluvium of a light sandy nature containing less than 10 per cent of clay is cultivated. Further down the valley there are tracts of alluvium, mostly cultivated; below Laggan Bridge the river winds across the raised beach and below Bridge House through a wide alluvial plain, mostly cultivated to reach the sea at the north end of the dunes. Along the lower course of its tributary, the Duich, alluvial land is cultivated. On the seaward side of this strip of land lies the 25 feet beach covered with blown sand. Draining a large area on which there are numerous sheep drains, the Laggan river carries away the surface water quickly and is thus liable to rapid rise and fall.

Between these two valleys and to the south-east of the watershed of Beinn Bharradail arable land is almost continuous to Laggan Point. It is partly on limestone and partly on the gritty soils of the pre-Cambrian rocks. About one-third of it lies on raised beaches. The 25 feet beach appears at Laggan Farm; at Gartbreck, extending about a mile to the south; and again a little to the north-east of Bowmore. In all three cases it carries light sandy soils and is cultivated. The 50 feet and 100 feet beaches are also cultivated, with the

exception of a large area of the 50 feet beach north of the mouth of the River Laggan which is peat covered.

To the west of the mouth of the Sorn River, lies an area of raised beaches, the 25 feet and the 50 feet beaches, each of which yields some arable land. A large area of good farming land lies to the south of Loch Gruinart. Stretching from Gruinart Farm round the south end of the loch to Bun-an-uillt on the east side there is the 25 feet beach. To the south of Loch Gruinart this beach, one and a half miles broad, from east to west, extends southwards for more than a mile and sends tongues over to Lochindaal. By drainage it has been made an area of excellent agricultural land. It is known as the Gruinart Flats. The cultivated land extends northwards on the east side to half a mile north of Craigens. At Bun-an-uillt which stands on this beach there is a small area of arable land lying on both the 25 feet and the 50 feet beaches. Raised beaches extend for some five miles from this point in a north-west direction, but only two small areas are cultivated, viz. at Killinallan (50 ft. beach) and at Gartantaoid (100 ft. beach). At Killinallan there are sand dunes, some three miles in extent along the shore and one mile wide at the widest part (i.e. at Killinallan Point), on the 25 feet beach behind which a cliff rises to the higher beach. These dunes form good sheep pastures. The 100 feet beach ~~which~~ stretches from Bun-an-uillt to about one mile north of Gartantaoid. It is almost entirely

covered with peat, morainic material having prevented adequate drainage to the sea.

On the west of Loch Gruinart the 50 feet beach is cultivated the arable land rising to the 100 feet contour. In the north, at Ardnave, both the 50 and the 100 feet beaches yield farmland. This peninsula, however, is largely covered with blown sand as high as the 100 feet contour.

Southwards at Sanaigmore both the 25 feet and the 50 feet beaches, the former with much blown sand, add to the pastures and cultivated land of this farm. On the gentle slopes on either side of the River Leoig, flowing southwards into Loch Gorm, there are long tracts of agricultural land where there are mainly sandy loams, having about 30 per cent of clay. At Sinaull, in the extreme west, this combination of cultivated raised beach and pasture areas of the fixed dunes also obtains. The 50 feet and 100 feet beaches, forming a large V are cultivated, the closed end of the V having the dunes of Saligo Bay.

South of Coul and to the east of Machir the 50 feet and 100 feet beaches form arable land which abuts seawards on the fixed dunes of Machir and Kilchoman. At Rockside an alluvial tract forms excellent farm land.

South-east of the peaty depression occupied by Loch Form, the agricultural land occupies ground of gritty soils; areas won from the moss; and the 50 feet beach in part at Tynacoille. The rest of the Rhinns peninsula carries arable land on its east

and west margins, the central area being largely upland moor on the spongy soils of the gneiss.

Along the eastern shores for a distance of some twelve miles the farm land rises from the raised beaches (25 feet at and in the neighbourhood of Bruichladdich, and 50 feet in places southwards to Port Wemyss and Portnahaven) up the slopes to a height of 250 feet. These braes have a south-easterly aspect and are protected from the westerly winds by the rolling uplands.

The western side of the Rhinns has a less favoured aspect, being much subjected to storms. However, some good pasture land lies on the gently sloping land above the steep cliffs that face the Atlantic. To the north of Kilchiaran the farm land rises high (over 200 feet) on the slopes of the slaty rocks (Plate 15). In the extreme south of the Rhinns much land has been won, for agriculture, from the moss. The 50 feet beach is here cultivated (plate 17), its soil being peaty.[x]

In the Oa peninsula the arable land rises at Coillabus to over 400 feet (plate 16) with soils of sandy loam overlying limestone. Here the slopes give good drainage and dry soils. The pastures are rich: cattle are sent up here to be fattened. Limestone crops out here and is quarried and burned for lime. It is to be noted that the best arable land of the Oa corresponds with the Islay limestone (Plate 18). Boulder clay clothes the

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x When a sample of this soil was strongly ignited in a crucible it lost 50% of its weight when dry.

slopes in the west and in the south-east of the peninsula. Some good land lies on the west and north of Loch Kinnabus. Here also there is limestone. The arable land in the west lies mainly on the southward facing slopes of the Abhainn Ghil valley, rising to the 300 feet level. The long ridge of quartzite stretching from Beinn Mhor (658') to Beinn Biorach (499') in the east of the peninsula is moor country, its braes on the north-east being at one time good croft land. The lower slopes to the south-east of the ridge have three farms on the mica-schist soils and drift that flank the quartzites. At the north end of the Oa the farmland occupies the 25 and the 100 feet beaches inland from Kilnaughton bay (where fixed dunes occur) to the north of Cornabus farm.

Along the Laggan Bay shores the raised beaches are only partly cultivated. Much of the 25 feet beach is masked with blown-sand. To the west and east of Glenmachrie the 50 feet beach partly forms arable land, and to the north of Leorins the 100 feet beach is cultivated in part. Part of the alluvial terrace of the Duich provides an area of arable land. For the most part the 50 feet and the 100 feet beaches of this long stretch of low-lying land fringing Laggan Bay are either lake-dotted swamps or peat areas. In the south the peat area is about one mile from east to west and two miles from north to south; in the north of the region the east and west extent

of the peat is about two miles. The drainage from the quartzite hills that lie to the east collects on this flat coastal region whose morainic material gives an irregular topography, rendering most of it useless for agriculture. Patches of land ('lots' or allotments) are, however, wone from the moss (plate 19). The 25 feet and the 50 feet beaches that stretch from Port Ellen to the north-west form good crofts tilled by the villagers. Another area of good farmland stretches from Port Ellen to Ardbeg. The soils here are partly calcareous. It includes the 50 feet beach to the north of Laphroaigl From this area a tongue of arable land passes up to the quartzite hills in the red-boulder clay filled valley of the Kilbride river.

On the south-east coast small farming areas are situated on the alluvium at Port Mor and at Aros Bay, and partly on raised beach at Trudernish.

In this survey it emerges that the distribution of the agricultural land of the island is a coastal and valley one. The valleys of the Sorn and the Laggan carry a good proportion of the farmland of the island. The distribution is seen at a glance in figures 10 and 20, both in relation to the valleys and to the coast. The agricultural exploitation of the soil types is about equally effective on the calcareous soils, sandy loams, and light sandy soils of the raised beaches.

TABLE 3.

SOIL TYPES.

Type	Distribution	Agricultural Exploitation.	%age of Agri. land on each.	Improvements.
Calcareous	Sorn & Laggan Basins. Small part of Oa.	Largely Arable.	21	Fencing, diverting of streams, construction of drains, and embankments. Use of seaweed and shelly sand as manure. Use of lime from limestone burnt in kilns. Rotation of crops.
Sandy Loams	From Bowmore to Loch Gruinart. Rhinns - north of a line from Kilchoman to Bruichladdich.	Pastoral and Arable.	22	
Light Sandy Soils of the Raised Beaches	From mouth of R. Laggan to Bridgend. From head of Loch Gruinart to head of Lochindaal. Patches around Rhinns. Laggan Bay. Kilnaughton Bay Etc.	Arable and Pastoral.	20	
Slightly calcareous: (Much drift overlying)	Oa. Between SE. coast and line from Port Ellen to Ardtalla. Laggan Basin. Sorn Basin and northwards.	Largely pastoral.	19	
Granular (acid and basic)	Rhinns, south of a line from Kilchoman to Bruichladdich.	Largely pastoral.	11	
Alluvium	Basins of Sorn & Laggan. Strips N. and S. of Loch Gorm in the Rhinns.	Arable and Pastoral.	7	
Highly Siliceous	West of a line from Kilnaughton Bay to Port Askaig and east of a line from Port Ellen to Ardtalla.	None.	-	

(See Table (3)). The spongy soils of the southern half of the Rhinns carry only 11 per cent of the agricultural land of the island, and the alluvial terraces only 7 per cent. Liability to flooding, especially in the Laggan Valley, is a deterrent factor in the utilisation of the alluvial tracts.

Much improvement of the land has been made by draining, and rotation of crops has improved the yield here as elsewhere. Oats is usually grown to break in the ground, then a root crop in the following year. Oats and rye-grass follow. The rye-grass is sown with the oats and grows in the following season. Two or more crops of this may be cut, depending on the rate of fall in yield, and then the land maybe allowed to remain as permanent pasture.

TABLE 4 RAISED BEACHES.

Beach	District	Distribution: Sub-District	Cover, including vegetation where non-arable	Utilisation
25'	A. Loch Gruinart	Head of Gruinart to Head of Lochindaal	Moor in parts	Agricultural land. x
		East side - Killinallan	Blown sand: Fixed dunes.	Permanent Pasture (Sheep)
	B. Lochindaal	East side - Laggan Bay	Blown sand: Fixed dunes	" " (")
		" " - " Farm	-	Agricultural Land
		" " - Gartbreck	-	" "
		" " - N.E.of Bowmore	-	" "
		West side - N.and S.of Bruichladdich	-	" "
	C. Rhinns (West)	Sanaigmore	Blown sand: Fixed dunes	Permanent Pasture (Sheep)
		Saligo Bay	" " " "	" " (")
		Kilchoman	" " " "	" " (")
	D. South Coast	Kilnaughton	" " " " (in part)	Per.Past.(Sheep)& Agri.land
		Near Port Ellen	-	Agricultural land
50'	A. Loch Gruinart	West side - Kilnave	-	Agricultural land
		" " - Ardnave	Blown sand: Fixed dunes	Permanent Pasture (Sheep)
		East " - Killinallan	Moor and Peat	Patches of Agricultural land
	B. Lochindaal	Head of Lochindaal	Peat mostly	" " " "
		East side - Laggan R.to N.of Bowmore	-	Agricultural Land
		" " -Laggan Bay	Peat	Patches of Agri. land
		West side	-	Agricultural land
	C. Rhinns (West)	Sanaigmore	-	" "
		Smaull	-	" "
		Around Loch Gorm	Peat mostly	Patches of Agri. land
		Coul to Machir	-	Agricultural land
		Kilchoman	Blown sand: Fixed dunes	Permanent Pasture (Sheep)
		Portnahaven	Peat (Partly)	Agri. land (partly)
	D. South Coast	Near Port Ellen	-	Agricultural land
100'	A. Loch Gruinart	West side - Ardnave	-	Agricultural land
		East " -	Peat	-
	B. Lochindaal	East side - North of Leorin	-	Agricultural land
		" " - South of Bridgend	-	" "
	C. Rhinns (West)	Smaull	-	" "
		Coul to Machir	-	" "
	D. South Coast	Kilnaughton	-	" "

x Agricultural land includes arable land, pasture, and rotation grasses and clover.

Note on Table (4) - The Utilisation of Raised Beaches.

It has been noted above, (page 57) that the distribution of agricultural in the island is a coastal and valley one. On the coastal margin the raised beaches are utilised. Their distribution is set out in Table (4), and the nature of the cover indicated, including vegetation, where the land is non-arable. The lowest beach (25') has a cover of blown sand, on the solid, and the dunes have become largely fixed. Soils have developed and carry a close turf that affords permanent sheep pasture. In places, the soils of the beach, sandy and gravelly and porous in texture, have developed so far as to permit of crop-growing. Moor and peat, (the former drier) occupy parts of the beach.

The 50 feet beach yields agricultural land, much of it won from the peaty moor, and much of it on light well-developed soils, especially in the Rhinns. Dune pastures occur on this beach also.

The 100 feet beach is utilised, for the most part, as good agricultural land, partly on soils developed from 'drift'. Here again, 'moss' has had to be removed, in places, and the soils drained and enriched.

C. Statistical.

The parish of Kilchoman, in the west, has a larger proportion of agricultural land in relation to its area than obtains in the

other parishes. Twenty-five per cent of this parish is agricultural land, 58 per cent 'mountin and heath land' used for grazing, I.E. 'outrun', leaving 17 per cent unused or waste-land, composed mainly of peat-bog, mobile dune, bare rock, village sites, etc. These figures have remained constant since 1912. In the wind-swept western side of the parish pastoral pursuits occupy the attention of the farmers and crofters rather more than on the east side where sheltered concitions, aspect, and drainage favour the development of arable agricultural activity. Of the agricultural land 52.4 per cent was permanent pasture and 47.6 per cent arable in 1912. By 1926 the percentage of permanent grass had fallen to 49.3 per cent and arable land had risen to 50.7 per cent. The principal crops of the parish are oats, potatoes, turnips and swedes. The percentage of arable land under these and other crops is shown in the statistical agricultural table at the end of this section, and gives a comparison between the pre-war year 1912 and the year 1926. Of the arable land the percentage devoted to rotation grasses and clover has risen by about 8 per cent in 15 years - a significant increase probably due to better methods of utilisation of the land.

In the southern parish of Kildalton, the percentage of the total area in use as agricultural land has remained steady for 15 years at 15 per cent; and drainage operations have resulted in an increase in the utilisation of more mountain and heath

land, of fully 10 per cent. Over 60 per cent of permanent pasture, and slightly under 40 per cent of arable land made up the agricultural land in 1912. The percentage of the latter has decreased and that of the former increased equally. Rotation grasses and clover occupy 45 per cent of the arable land. The same crops are grown as in Kilchoman parish, and as in that western parish there has been a slight decrease in the number of animals reared - a decrease in horses, in cattle, in sheep, and in pigs.

In the parish of Kilarrow and Kilmeny about 6 per cent of its arable land has beenturned into grass since 1912. Although this parish contains the best farmland it has only 17.5 per cent of its total area as such, 70 per cent being mountain and heath-land. This leaves 12.4 per cent as unused or waste-land. Much of this parish is very high and inaccessible, especially in the north. About half of the arable land is under rotation grasses. Leguminous plants for fodder are grown in addition to the other crops. Fewer animals have been reared in recent years.

Grouping all these parishes together, it is found that for the island as a whole the mountain and heath land used for grazing is slightly increased, the percentage of the whole as agricultural land has remained steady at 18.5 per cent, the arable land is a little decreased in amount and the permanent grass increased. Over the island there has been a decline in stock-raising since 1912. Horses have decreased in number by 20 per cent, cattle

10 per cent; sheep 20 per cent; pigs 39 per cent.

Table (5) AGRICULTURAL STATISTICS.

TABLE 5. AGRICULTURAL STATISTICS.

		Parish of Kilchoman		Parish of Kildalton		Parish of Kilarrow and Kilmeny		Whole Island	
		1912	1926	1912	1926	1912	1926	1912	1926
Mountain and heath-land used for grazing - as percentage of total area		58	58	56.6	67.6	67.6	70	61.7	66.2
Agricultural land as percentage of total area		25	25	14.5	15	17.3	17.5	18.5	18.6
Waste-land as percentage of total area		17	17	28.9	17.4	15	12.4	19.7	15.1
Percentage of agricultural land under permanent grass		52.4	49.3	61.2	68.4	60.2	65.8	57.8	60.9
Percentage of agricultural land under arable conditions		47.6	50.7	38.8	31.6	39.8	34.2	42.2	39.1
Percentage of Arable Land under Various Crops	Wheat	-	-	-	-	-	-	-	-
	Barley and Bere	-	-	-	-	0.33	-	0.33	-
	Oats	32.4	28.6	36.2	34.6	32.2	35.2	33.2	32.2
	Rye	0.18	0.31	0.30	0.35	0.07	-	0.17	0.11
	Potatoes	5.2	3.9	5.1	5.5	4.5	4.2	4.9	4.3
	Turnips and Swedes	10.3	8.2	11.8	10.8	10.8	11.3	10.3	9.8
	Other crops, including Cabbages, mangolds, rape	0.43	0.47	0.33	0.45	0.47	0.93	0.42	0.63
	Bare Fallow	0.76	0.25	2.15	3.04	0.02	0.75	0.78	1.0
Percentage of arable land under Rotation grasses and clover		50.6	58.1	43.9	45.23	51.0	47.5	49.4	51.6
Number of horses per 1000 acres of total area		13.0	10.0	6.0	5.0	7	6	8	7
Number of cattle per 1000 acres of total area		96	83	49	44	52	48	62	56
Number of cattle per 1000acres of agricultural land		378	327	338	296	301	278	337	301
Number of Sheep per 1000 acres of total area		460	369	437	334	462	389	454	367
Number of Pigs per 1000 acres of agricultural land		39	25	31	20	35	18	36	21

Table (5)

NOTE:

The arrangement of the Returns of the Scottish Board of Agriculture, in respect of the county of Argyll, is rather misleading. Columns of statistics, under the heading, 'Islay' do not refer to the island of Islay but to a division of the county which, designated 'Islay' includes also Jura, Colonsay, and other smaller islands. (Report of the Boundary Commission, 1917. Cd.8759). Consequently the author of this paper was obliged to apply to the Scottish Board of Agriculture for Statistics relative to the island of Islay. There were kindly furnished, detailed in parishes, by the Superintendent of Statistics and Intelligence, and form the basis on which the percentages shown in table 5 were calculated.

(d) FLAX-GROWING AND SPINNING.

Two crops grown in former days in the island brought a good income to the farmers. This is mentioned in the Old Statistical Account of Scotland, 1794 - "The rearing of barley and flax is much practised by the common tenantry who by these make up the greater part of their rent; yarn is one of the principal exports. Each parish imported hogsheads of flax seed; Kilchoman parish using about 80 of these, Kildalton 28 and Kilarrow and Kilmeny 120.

The cultivation of flax and the manufacturing of yarn constituted one of the chief occupations of the island. No less than £10,000 (18) worth of yarn was exported in one year. The cost of spinning at the mills seems to have been higher than that obtaining in other parts of Scotland. This caused complaint in the Local Parliament in 1777 which resolved "that this abuse may be corrected and the complaint removed", it being recorded "that the fees charged at the different fflax mills of Isla are much higher than in other parts of Scotland because the weight of dressed fflax delivered from the mill is less than what is given in other places". (18) This industry, however, died out in the first half of the 19th century, with the development of the textile industries of Glasgow. While the spinning industry declined and vanished the growing of flax for export might have gone on, but the disturbance of local spinning, the difficulties of transport and the tide of emigration that

set in during this period would all militate against the maintenance of the production of raw material intended primarily for local industry.

(e) BARLEY GROWING AND DISTILLING.

The other crop of commercial value - barley - found a ready market. It was purchased by the distillers. There were 14 distilleries in the island in 1840 (17). Illegal distilling was rife. In 1801 the 'Local Parliament' resolved "collectively and individually to use their utmost exertions for preventing any of the grain of the island being used by illegal distillers and for that purpose pledge themselves to inform against any person or persons that they may know or hear to be concerned in this illegal and distructive Traffick"(19). Barley was grown in each of the parishes, as much as 4,000 quarters being produced in the western parish of Kilchoman. Barley is no longer grown in the island yet there are nine distilleries. The farmer regards the barley straw as of little use to him; the distiller prefers the better dried barley of East Scotland, the Black Sea regions, and Canada, and Australia. Perhaps the chief explanation of the disappearance of the crop in the island lies in the fact that the distiller found it more convenient to import a cargo of barley than to purchase his requirements of barley in small quantities. The latter method involved him in book-keeping and other transactions that were expensive. In this connection it is to be noted, however, that barley growing

declined in Scotland generally. The use of barley meal in baking went out of vogue.

In the past few years the distilling industry has shown signs of declining. The duty-free warehouses carry a very large stock since the best customer, America, has been lost. However, in relation to the value of the output the distilleries do not form a very great asset to the island in the matter of employment. Almost 20 men can run a fair-sized distillery. Forty weeks are spent in distilling and the remaining weeks, in summer, are used in cleaning, painting of buildings, repairing, and in the cutting of peat, each distillery having large peat mosses near at hand. The peat is used in the drying of the malt and the reek of the peat-fire passing up through the perforated floor on which the malt is spread to dry gives a flavour to the spirit distilled therefrom.

For the distilling industry, yeast is imported; and in addition to the spirit distilled there is now the export of 'draff', the grain-residue after fermentation. It is dried and exported for the making of cattle-cake. Formerly it was sold to local farmers and proved to be of value for dairy-cattle, giving an increased yield in milk. In some cases it is not exported but exchanged for peat.

(f) CATTLE AND SHEEP REARING: (Plate 20)

The rearing of cattle is perhaps the oldest industry in

the island. For this the island is peculiarly suited in its possession of good pasture-land. As far back as 1626 this was observed - "It is fertile in cornes and producéth much good grasse very fit for pasture and very many cattle are breed in it".(20). And it is recorded elsewhere that in 1680 more than 1,000 cattle were sold out of the island. The rearing and exporting of black cattle formed an important industry in the 18th century. About 800 cattle were sold out of the parish Kilchoman per year and from the whole island some 3,000. The animals were usually ferried across the Sound of Islay to Jura, on their way to markets in Stirlingshire and elsewhere.

Good arable land seems to have been used for pasturing the animals. In 1794 complaint was made that the gentlemen farmers laid out their fine arable ground in feeding black cattle. This seems to have obtained for a long time, for, half a century later, it was recorded (17) that while much draining, ditching, and fencing had been done much more could be done to render moss and marsh available for feeding stock. Sheep rearing was not a profitable industry at this time.

For many centuries the cattle-rearing industry had been carried on profitably but some 40 years ago a change showed itself. The west highland cattle were gradually replaced on the island by Ayrshire cattle, good dairying cattle, but this new industry of dairy-farming does not seem to have thrived so well as expected. Probably the supply and cost of labour (As an example of increase of cost of labour, the case of the

ploughman may be cited. About 30 years ago £16 a year sufficed. Today 34/- to 38/- a week is a common figure. And the working hours are much reduced. This increased cost affects dairy-farming in that the winter-feeding of cattle depends on crop-growing) as well as cost of transport from the island militated against its development. Stock-raising is again engaging the attention of the farmer.

Sheep rearing has declined also. As already noted there has been a decrease of 20 per cent in the number of sheep reared since 1912. (68,508 sheep in 1912 - 55,256 in 1926). Lambs and wool are exported. Perhaps the greatest drawback in this industry is the mildness of the insular winter. A fair amount of good sharp frost would do much to maintain the health of the flock. The decline in stock-raising in the island is attributed to the fact that the land is now unable to carry the number of animals it was wont to do before depopulation occurred. There is too much moss among the grass, a result of lack of attention to drainage.

(g) AGRICULTURAL HOLDINGS.

The arable land of 28,000 acres is divided into 435 holdings, the average size being 64½ acres. Of these 27 per cent or 117 are small (one to five acres) and 22 per cent between 5 and 15 acres. The distribution of the small holdings, shows a certain disparity among the parishes. The western parish has by far the largest number of holdings from 1 to 5 acres. 40 per cent of

the total holdings of this parish are small and these represent 68 per cent of the small holdings of the island. Many of the villagers have small crofts near their village. In the days when saturation of population obtained in the Rhinns the crofters supplemented their scanty living by tapping the resources of the sea. During the period of emigration small crofts were swallowed up in larger farms, and when the sea"failed" to give a good yield of food some of the larger farms were again divided up into small holdings but not quite so small as those held by crofter-fishermen.

The biggest number of large holdings is in the parish of Kilarrow and Kilmeny where the average size of holdings is 68 acres, 14 acres larger than the average holding of Kildalton parish, and 40 acres larger than in Kilchoman. (Table 6 - Agricultural Holdings, 1927).

TABLE 6. AGRICULTURAL HOLDINGS - 1927.

Size of Holdings, in acres.	Parish of Kilchoman		Parish of Kildalton		Parish of Kilarrow and Kilmeny		Whole Island	
	Number of Holdings	Percentage of Parish Total	Number of Holdings	Percentage of Parish Total	Number of Holdings	Percentage of Parish Total	Number of Holdings	Percentage of Parish Total
1 to 5	80	39.6	21	21.4	16	11.8	117	26.8
5 " 15	42	20.7	23	23.4	30	22.2	95	21.8
15 " 30	30	14.8	15	15.3	15	11.1	60	13.7
30 " 50	16	7.9	10	10.2	14	10.3	40	9.1
50 " 100	14	6.9	9	.9.1	27	20.0	50	11.4
100 " 150	2	0.99	7	7.1	8	5.9	17	3.9
150 " 300	12	5.9	7	7.1	17	12.5	36	8.2
above 300	6	2.97	6	6.1	8	5.9	20	4.5
Total	202	-	98	-	135	-	435	-
Average size of Holding	46¼	-	72¼	-	86½	-	64½	-
Total Acreage	9358¾	-	7081	-	11.662	-	28,101¾	-

Note:- The above acreages are for arable land only and do not include rough grazings.

The farm houses on the larger holdings are well built and usually slated. Most are two-storeys in height. The distribution of the farmhouses and croft-houses is shown in figure 24, along with the roads. In the parish of Kilchoman most are reached by good roads, except those on the west where the roads are hilly and rough. In Kildalton parish proximity to good roads is a feature of the distribution, except in the peninsula of Oa, some of the roads there being little more than rough pebble-strewn paths over the moor. Even where the surface is good there are some very difficult gradients. The houses between Bowmore and Port Askaig are reached by a road of excellent surface and easy gradient. Many of the farmhouses stand on gently-rising ground overlooking the road. All over the island the orientation of the house is to some extent determined by the advantage of getting the strong westerly winds on a gable or on the back of the house, so that houses have an end to the road or the back to the road or to the sea in places.

The distribution of farms in 1750 is shown in plate 21, the photograph of an old map of the island.

(h) ROADS, BRIDGES ETC$ (Fig 21).

Agricultural activity in the island, in early times, was rendered difficult by the absence of good roads. Both in the Old and in the New Statistical Accounts of Scotland mention is made of the need of improvement of roads, especially with reference to their use by farmers. "Manure was carried in creels on

horseback owing to absence of good roads in the parish". So urgent was the need for improvement and maintenance of roads that an Act of the Balliary required "that the Inhabitants of Islay shall yearly in Summer perform two days Service for repairing and helping the roads wt. in the samen (within the same?) And that at such places as shall be appointed by the Magra^{t} and six of the Gentlemen of the Parish wherein the S^{d} roads or highways are to be repaired. Each possessor of a Leorheas$_{x}$ land sending a man and horse if needfull when required Oy^{r}wise (otherwise?) the Contraveeners to forfeit Sixteen Shillings Scots for each man pr day to be payd to ane other that supplys his place and that to be uplifted brevi manu". (19)

In consequence of this act the Local Parliament called on the farmers each year to give their services on specified sections of the roads, it being decreed "that the absents shall be ffynd in ffive pound ster".

In 1730 for example, "the Surveyors and Overseers of Islay appoint that the roads be wrought on this year on the last thursday, fryday, and Saturday of the Moneth as follows:-

> 'The people of Kildalton to work on the roads where they left off last year.
>
> 'The people of Duich, Laggan Island, Corrary, Talent, Mulindra and Curiloch with Avinbussa, and Torra from the water of Duich to the water of Kilarow, Gartloist and Grobolls to be with them inspected by Jas. Robertson and Robert Campbell to work three days except the last day that the half of these people goe/

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x Probably 'enclosed' land.

to Duich with Robert Campbell to help the water course there".(19)

That this work would be duly carried out it was decreed that the "Overseers would meet here on 2d Tuesday of Novr. next to make proper reports of what work had been Doun and what people have been abst".(19)

It can well be understood that this yearly effort did not make for roads of any permanent value. Bridges too, were a constant source of trouble. Repeatedly in the Stent Book items of assessment for the repair and construction of bridges appear. Quays also were to be repaired by the same kind of enforced labour.

In modern times when the roads are under the control of the County Council, some good roads are found in the island, more especially the road leading from Bridgend to Port Askaig and those from Bowmore and Bridgend to Port Ellen. The first of these runs through the best agricultural land of the island, consequently it is a 'fenced' road, and carries much traffic. The lower of the two roads between Bowmore and Port Ellen lies in a straight line and is remarkably flat. It is stated that it was laid down originally as the track of a light railway. The project, however, was abandoned as the amount of traffic would not warrant the expenditure. Before it was made, about 40 years ago, carts used to follow the Strand along Laggan Bay, reaching it by road to Kintra over the neck of land joining

the Oa to the main part of the island. This was the rather arduous way of reaching Bowmore from Port Ellen in the south. Both roads running north from Port Ellen are largely unfenced, passing over much moor. The road on the east side of the Rhinns is a comparatively good road. Other roads, notably between Kilchiaran and Portnahaven; between Kilchiaran and Port Charlotte; the Oa Road; and the Glen Road from Avenvogie to Ballygrant are hill roads with difficult gradients in parts. These, however, have little traffic.

Since the island abounds in intrusive igneous rocks - dykes of dolerite and basalt - material is abundant for road-making. In the limestone districts limestone is much used and beds well. There was, however, a tendency in places to use quartzite pebbles. This gave a dangerous surface. A good road leads eastwards from Port Ellen to Ardbeg beyond which, to Claggain Bay, it is narrow and passes through scrub-land where much moisture destroys its surface. The dykes along the roads are mostly dry dykes with the topmost stones placed on end and held together with cement. Many of the farm-roads are extremely rough and most destructive in these days when motor traffic is increasing on the island.

The surface of the roads is now repaired with granite chips and tar both of which are brought to the island by small steam-boats - "puffers".

The arrangement of the roads is determined by the need of tapping, from the capital - Bowmore - the productive farm land, and villages, and of reaching the ports of the island. They

may be regarded as radiating from Bowmore, - to the outlet, Port Askaig on the Sound of Islay, to Port Ellen in the South - both ports of call for steamers; through the Guinart Flats and thence to the old fish-curing station - Tayvullin in the north of the Rhinns (the station is now in ruins) and southwards in the Rhinns, along the east coast to the villages of Bruichladdich, Port Charlotte, (each with a distillery) to Port Wemyss and Portnahaven - old fishing ports.

Other roads in the island tap more remote farms and distilleries, e.g. from Port Askaig a road (dangerous for motor traffic) runs north to Bonahaven, where there is a large distillery. A road from Port Ellen passes along the south-east coast to the villages of Laphroaig, Lagavulin and Ardbeg, each having a distillery. Beyond Ardbeg the road taps farms at Kintour.

From the road on the east coast of the Rhinns, two roads go over the Rhinns to the west, one from the head of Lochindaal to Kilchoman, once a populous centre, and another from Port Charlotte to Kilchiaran which is joined by a road that passes through pastureland and moor to Portnahaven, tapping a number of crofts. Farms in the Laggan Valley are reached by a road from Avenvogie to Ballygrant where this glen road joins the Bridgend - Port Askaig Road.

(i) <u>CHANGES. (Figure 22)</u>

All over the island there is evidence of change, even since the last 6" survey was made in 1897-98. Some farms have disap-

peared, other have been divided into crofts, new farmhouses have been built, old ruins (marked on the 6" map) have been used up in building dykes and houses, farmland has been allowed to grow wild, becoming very coarse land with heather and bracken or, where water has accumulated, marsh land of a boggy nature. Some areas still show where the old furrows were. A typical example of such changes may be taken in the Oa peninsula and in the adjoining south part of the main block of the island (Fig.22). In four parts of the Oa, in particular, - viz, the valleys of (1) Abhuinn Ghil and (2) Glenastle, (3) the north west and (4) the Braes[x] of the east side, south of Port Ellen Lighthouse, great changes have occurred. In the first of these the ruins[x] shown on the 6" map have mostly disappeared, having been used up in building; two new farmhouses have been built, and the old croft-land that had become 'wild' has been ploughed up again. In Glenastle, a deep and narrow glen, Glenglach is now in ruins, while in the north-west of the Oa Glasdale and Frachdale have shared a similar fate. On the Eastern braes the old croft-land is covered mostly with heather and bracken. Further east, Balaclava, Torradale and Ballynaughton More are in ruins. A new farm house has been built at Lagavulin. Further east a small plantation has been planted.

Changes such as these are observed in most parts of the island.

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x Ruins of former croft - some 22 in number in the Ghil Glen and 15 or so in GlenAstle.

7. POPULATION.

The island community, being essentially an agricultural one, the population is distributed in the same way as the agricultural land - a coastal and valley distribution. Coastal in the Rhinns and in the south of the Island, but a good percentage of the people live in the broad valley between Bowmore and Bridgend on the west and Port Askaig on the north-west (Fig.21 - showing distribution of villages, farmhouses, crofts). This region has suffered depopulation. Glens that used to have clachans from which about 1,000 men could be mustered would scarcely yield 20 today. Such places as Mulindry and Kynagarry were busy agricultural communities. Indeed all over the island, from Tayvullin in the north of the Rhinns to the Oa in the south, there are indications of depopulation. Crofts in ruins, furrows in areas now covered with moor-plants, churches and schools now too big for the needs of the people speak of the decline that has occurred. (Plate 22). Many small crofts have entirely disappeared. In the Oa peninsula, for example, the population today is about one-tenth of what it was in the middle of the 19th century. While this reduction of numbers has been advantageous in raising the standard of living, the land shows the effect of less attention to drainage. The small crofter drained his land. The farmer in a large way neglects much of this under the stress of economic circumstances. One result is that land becoming water-logged and sour is apt to harbour organisms that cause disease in animals,

especially in sheep.

The population was at its maximum in 1831 in the parishes of (1) Kilchoman and (2) Kilarrow and Kilmeny. Since then the former has decreased by 60.6 per cent of its maximum; the latter by 68.4 per cent. (figures 23 and 24). Kildalton reached its maximum in 1841, losing 51.3 per cent since that date. Emigration was most active in the parish of Kilarrow and Kilmeny, rather less so in Kilchoman, and delayed for some years in Kildalton. Nearly 16,000 people were sustained by the island about a century ago; today less than 6,000, but the standard of life has risen. It is questionable if the larger population could be maintained today for the food resources, so successfully exploited in these earlier days, are no longer available. The inshore fisherman may still eke out a scanty living, but the deep sea fisherman can no longer obtain a sufficient reward for his labours in competition with the trawlers than can reach the fishing grounds so quickly. The dual exploitation of land and sea resources is severed. The islander has no longer the advantage of "the double larder of land and sea" (21).

That reduces the capacity of an island as the habitat of a large and growing population: it hastens the advent of the day when the island can no longer sustain its people.

8. CONCLUSION.

The island of Islay, the island of highest economic potentiality in all the Hebridean group, has, nevertheless, afforded to

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x (21) P.450

its inhabitants an environment whose geographic factors have imposed difficulties. Its people have had to battle with adverse conditions, especially of climate, and of vegetation - a function of climate. That is the essential difference between this island and the east coast region of the mainland which it resembles topographically and from the western counterpart of which it has been evolved.

In addition, restriction of area and isolation have enhanced the difficulties that beset development. Isolation, no doubt, develops self-reliance and initiative up to a point, beyond which it has a retarding effect and limits the scope of development. Even the problem of bringing from the mainland such a necessity as timber is an economic one of some difficulty.

Isolation, still a factor in the geography of the island and a great drawback in its commercial activity, was most pronounced in earlier days when communication with the mainland was achieved, on one day of the week only. The packet plying to Tarbert (i.e. West Loch Tarbert) was maintained by assessment, as well as by freight charges, so that its maintenance was a constant source of anxiety to the islanders. Items in the Stent Book indicate how important this problem was to the island. Again and again, the Local Parliament had to take the matter up, and to impose an assessment for the maintenance of the packet. A return journey was made once every week when the weather favoured. In the latter half of the 18th century the problem was evidently an acute one. In the year 1824 a steamboat was

substituted, and the assessment was dropped. Even today when a daily service is maintained there are difficulties for monopoly seems to have made charges too high, and storm and fog often isolate the island.

That there are difficulties of transport was evidenced in the Debate in the House of Commons on Transport in the Western Highlands and Islands on 18th May (1928). (22). It emerged, for example, that the freight for a ton of groceries from Glasgow to Islay was 45/- as compared with the freight from Glasgow to Oban - 27/6; that the cost of conveying a bullock from Islay to Glasgow was 22/6, while a bullock could be taken from Belfast to Glasgow for 14/6. Such relatively high charges (the trade is too small to permit of it being competitively shared) tend to depress the economic standard and lead to a decline in the population the island is capable of carrying under the standards of comfort demanded today.

Moreover, there would be little gain in embarking "on an ameliorative economic process .... if the advantage of improvements in their stock-breeding, crops and fisheries is going to be swallowed up by an inadequate service (Transport) .... at far too high a cost". (22)

On the other hand it seems to the present writer that it must in all fairness be admitted that importation to the island of such commodities as meet the demand for a higher and more

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(22) Col. 1445.

comfortable standard of living is not offset by exportation from the island to such an extent as to make for lower freight charges.

Undoubtedly it is the geographical factor of isolation that has been, and is, the paramount factor in relation to economic development of an island. It makes more acute the difficulties that the island environment imposes, of itself, on its dwellers. In the case of Islay it has necessarily involved a close adaptation in the utilisation of such limited resources as the island offered; in the reclamation of land; in the exploitation of the resources of sea as well as of land. The difficulties encountered were the necessary stimulus to a virile native growth, the building up of a sturdy resourceful people whose isolation had one peculiar advantage in that it tended to develop a local spirit, to maintain traditions, and to preserve the continuity of social organisation. Such qualities engendered in the island home have made the Islaymen excellent colonists - a success due also, in great measure, to their 'island' tendency to settle together. This segregation as a small community in an extensive area is a repetition of the isolation of their old island home. It enables them to foster the traditional spirit.

The development of these qualities in a people is the final test of the power of environment in exacting of a people minutely close adaptation. The measure of the response of the island dweller to the geographical factors is the measure of his success

in the economic development of his island home.

Further, it may be remarked that it is the peculiar geographical characteristics of islands that have made islands and their peoples so significant in the history of the world.

University of Glasgow.

With the Clerk of Senate's Compliments.

To be added to Graduation List for

19 June, 1929.