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Geological Notes on Skomer Island

by F. T. Howard and E. W. Small

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1. Previous Literature.

Whilst the northern shore of St Bride's Bay has long been made familiar to geologists by the classic researches of Dr. Hicks upon the strata in the neighbourhood of St. Davids, the Southern margin has not hitherto attracted so much attention, and comparatively few brethren of the hammer appear to have visited the outlying island of Skomer. De la Beche mentions the presence of a 'quartzose and striped cornean,' of 'bedded greenstone' near the landing stage, and ' massive compact greenstone ' in the north of the island. Murchison gives a section which it is difficult to understand, and indicates the presence of upper Cambrian rocks, and many flows and dykes of igneous origin. Rutley gives a microscopic description of some Skomer rocks which had been collected by Ramsay, and placed in the Jermyn street Museum, especially of a very curious banded and spherulitic felsite, and Teall includes a short description of Skomer basalts and porphyrites in his encyclopaedic " British Petrography."

None of these authorities; however, give exact localities, and we have, therefore, thought that the results of a hasty survey, made during two short visits to the island (in 1893 and 1895), might be worth recording.

2. General character and arrangements of the Sedimentary and Igneous Rocks.

After some search we succeeded in finding a simple base line in a well-marked ridge of conglomerate, running from the west side of the Wick in an east by north direction, terminating a little to the north of Welsh way. Along the north of the Wick a well marked dip-slope has been formed. This conglomerate consists of large pebbles of white felsite, as well as some of granite and greenstone, set in a siliceous matrix. Beneath it are finer conglomerates, sandstones rich in felspar, and red shales; while above it finer beds occur to the south, along a valley between the conglomerate ridge and the mass of basalt which forms the southern promontory of the island. The junction between the basalt and sedimentary beds, as seen in the cliff near High Cliff, appears to be a conformable one, but in the Wick the basalt is brought up by a fault very sharply in a perpendicular wall (which forms the cliff at the south of the Wick), so as to rest against the truncated edges of the sedimentary rocks.

The sedimentary beds are followed to the north-east by a basalt, which unmistakably passes beneath them; farther to the west they are in contact with a highly siliceous banded and spherulitic felsite weathering white, and shewing spherules up to several inches in diameter. (This is the felsite described by Rutley, and is, probably, the striped quartzose cornean of De la

Beche.) The rock seems to have only small spherules in the upper part, and to get coarser on the east side of the Basin and finer, with more perfect flow-structure, on the west face of Tom's House.

It is difficult to clearly make out the relations of this rock with the surrounding ones, as the ground, inland, is mostly covered with bracken and coarse grass. In the cove, west of Tom's House, a basalt is seen on a dip slope, which appears to pass (quite regularly beneath the felsite. Following the coast round to the NW., all the rocks are found to be of basaltic type, up to a point a quarter-of-a-mile to the N N W. of Bull Hole. Here we meet with felsite again, occupying the northernmost portion of the island, including the outlying Garland stone The basic rock begins again where the wall, running due north from the farm reaches the cliff, and can be traced along the cliff to North Castle, and thence along the western shores of North Haven and South Haven to the Junction with the sedimentary beds near Welsh Way.

All the rocks inland are basic in character. Whether they are all of one series, or whether there are several sills, cutting through older flows, it is difficult to say. A curious series of ridges, running across the island in a mole or less east and west direction, would seem to suggest the outcrop of dykes or sills, and the junction of felsites with basalts would be most easily explained in this way. Beginning at the north of the island, the first of these ridges is formed by the outcrop of felsite. To the south of this there are five fairly distinct ridges of basaltic character, viz., one from the Table Rock, by Bull Hole, to the end of the wall running north from the farm; another very marked one from the Spit to Waybench; a third from the Pigstone Rock, through the north yard of the farm, to North Castle (very prominent eastwards from the farm); another from Skomer Head, by the flagstaff, south of the farm, to North Haven; with a smaller one, appearing only as low ' humps ' in the fields, a little to the south. Farther to the south again are the short ridge of spherulitic felsite, the well-marked conglomerate ridge already referred to, extending from the point west of the Wick to Welshman's Way, and the basalt ridge running from the south of the Wick to High Cliff.

A glance at the map of the island will shew that the small eastern portion, called the Neck, is joined to the main part by a narrow isthmus This is formed of sedimentary beds, which can be examined at low tide in the South Haven, where, on the east side, the following section can be seen.

Basalt, with much epidote in veins, calcite, and a red zeolite in amygdaloids.
Light grey well-bedded sandy shale.
Hard red quartzite, interbedded with sandy shales.
Light grey sandy shale.
Basalt, at least 8 feet seen.

The beds are so much crushed and faulted that it is impossible to make out a clear succession. On the west, these beds are faulted against the basalt.

Sedimentary rocks of the same character are found at the Rye Rocks, and in the cliff on the east side of North Haven. At an inlet, about 200 yards E.S.E. of

the Rye Rocks, they pass under a basalt which, apparently, forms all the remaining portion of the Neck.

3 . Influence of the Geological structure on the Geography.

The two marked inlets of North and South Haven have, evidently, been formed by the more rapid erosion of the sedimentary beds. The fault on the west side of the Haven has thrown back the outcrop of these beds for about 200 yards. The Wick has clearly been eaten out along a line of fault between the basalt and the sedimentary beds. The ridges running east and west across the island have already been referred to. The farm house has been built behind one of the most marked of these, in the middle of the island.

The water supply is good. There is a strong spring at the base of the conglomerate, forming a small stream, which runs down to the Wick, east of Tom's House. Another, near the base of the felsite, has washed out a course immediately west of Toms House. A brook, starting near the base of the sedimentary rocks, runs down to South Haven, near the junction with the basalt. There are also small streams near the Pigstone Rock, Bull Hole, and west of North Castle. The larger streams, in the middle of the island, probably rise out of the surface soil only.

4. Relation of the Rocks to the other Islands and the Mainland.

(a) GRASSHOLM This is a small island, about seven miles to the west of Wooltack Park, which, from its position, apparently represents an exposed portion of a ridge between Pembrokeshire and the South-west of Ireland. No sedimentary rocks were found, the island being formed .entirely of a black dolerite, in which felspar and a reddish mineral, probably due to alteration, can be seen. This dolerite is of a type not actually found on Skomer.

(b) MIDLAND. This small island, between Skomer and the mainland, consists of a mass of basalt, very similar in character to that on the east side of Skomer.

(c) WOOLTACK PARK Along the south side of this promontory some grits and shales occur; which closely resemble those of Skomer, and have the same general dip. The basalt, which is found along the north side from Wooltack Point to Martin's Haven, rises from beneath them. Fossils are recorded from these beds in the memoirs of the Paleontographical Society (Davidson, Silurian Brachiopoda), but we have not yet succeeded in finding any, either here or on Skomer, and it is possible that those recorded, Pentamerus oblongus, P. globosus, Orthis elegantula, really came from a point a quarter of a mile farther to the east. Hitherto, the beds have been regarded as of Ordovician age, chiefly on the evidence afforded by the rocks in Musclewick Bay, where Asaphus, Trinucleus &c.; occur, in black cleaved slate. These Llandeilo beds are faulted against the Old Red Sandstone on the north, and the junction, with igneous rocks on the south, seems also to be a faulted one. If faults could be presumed absent, Landovery beds should occur about Wooltack Park, so that we are inclined to regard these sedimentary strata, and the corresponding beds on the island of Skomer, as of Upper Ordovician or Lower Silurian age.

5. Evidences of Ice Action.

Having already found, in almost every valley on the mainland opposite to Skomer, distinct evidence of the action of icebergs or an ice sheet which came down the St. George's Channel, we expected to find proofs of glacial action on the island.

We found no glacial stria on the rocks, but saw a large number of raised blocks, some of which appear to have come from the St. Davids district. The largest block is a felsite, just south of the brook running down by the Pigstone. It measures, roughly, 16 feet by 13 feet by 2 feet. Smaller felsite boulders are very numerous especially on the basalt knoll north of Bull Hole, and in the valley just to the south. Some of the felsites may be local, others, probably, come from St. Davids, or possibly from North Wales. Small boulders of Brimaston granite are found in the little brook running into the Wick and in an old wall just north of Bull Hole. On the north side of the island some boulders of diorite, like that of the Precelley Hills, in North Pembrokeshire, occur, and near North Castle a few blocks of grit are found. Flints of various sizes—usually rounded—are scattered about the fields, as well as boulders of oolitic limestone. The latter, probably were brought by man.

6. Microscopic characters of the rocks

We have examined a large number of thin slices of the various rocks occurring on the island and t e neighbouring parts of the mainland. The following are some of the chief varieties.

(a.) SEDIMENTARY ROCKS. The grits found on the island and on the mainland all shew the same general character, consisting of clear quartz grains with the angles rounded off, a felspar weathered beyond recognition, and, rarely, some mica. A granite pebble from the conglomerate ridge is, undoubtedly, from the same mass as the Brimaston granite of the St. David's area; there are also pebbles of felsite, some showing good flow structure, and of basalt.

(b.) FELSITES. The felsite of the Garland stone, in the extreme north of the island, shews phenocrysts of felspar, in a brownish felsitic ground mass, exhibiting extremely good flow structure. Some of the felspar crystals shew the Carlsbad twin with straight extinction, others are singly twinned, giving oblique extinction with crossed nicols, and a few shew multiple twinning. Most shew some alteration, and some are largely kaolinized. Fairly clear quartz occurs, somewhat corroded. There are several dark, irregular, patches of stained material sometimes encasing felspar crystals, and crossing the lines of flow in places, more or less, at right angles, are certain lines which seem to be decomposed felsitic matter in the form of minute crystals of quartz and felspar. The felsite of the cliff opposite the Garland stone shews fewer phenocrysts, and no definite flow structure.

A slide, cut from the base of the spherulitic felsite on the south of the island at Tom's House, shews no porphyritic minerals. The greater part is light brown with darker portions, the remnants of small spherulites which were once

numerous, some being still fairly well marked. Certain bands are clear, and contain small quartz crystals. The rock shews, macroscopically, exceedingly good flow structure, which is not so evident under the microscope. A section, cut from the more coarsely spherulitic part of the rock to the east of Tom's House, shews five well-marked whitish spherules (of about 5 inch diameter), in a greenish granular ground. The spherules are much cracked. They show dusty brown material in concentric bands towards the edges, but become more transparent in the central portions, except where patches of opaque material occur. Under crossed nicols a well-marked fibrous radiating structure is apparent, but the crystallisation is somewhat confused, and the spherules do not show a clearly defined black cross. In two places the slide shews patches of crystalline character, which appear to be basaltic inclusions.

This rock is, doubtless, as Rutley maintained, a devitrified obsidian, or glassy acid lava, and he remarks upon the close resemblance in minute structure between this Skomer lava and the Tertiary lavas of the Yellowstone district in the United States. It is, probably, near akin in character, and possibly also in age, to the felsites of North Wales.

(C) BASALTS AND PORPHYRITES. The rock seen at the Table, on the NW. coast of the island, is a porphyritic basalt, with large felspar crystals, shewing very distinct crystal outlines, some olivine, a little augite, and numerous opaque granules of magnetite, or ilmenite. That found at the north side of Bull Hole is a basalt, or porphyrite, shewing phenocrysts of felspar, with good crystal faces, and well developed cleavage. The alteration has obscured the twinning. The small lath-shaped felspars shew a distinct flow structure, and are seen to bend round the larger crystals There is some dark ilmenite and also some serpentinous pseudomorphs.

The Skomer Head Rock is a basalt—ophitic in parts—with lath shaped felspar crystals, much augite, some of which is quite fresh, and shews bright colours with crossed nicols, magnetite or ilmenite, and greenish decomposition products.

The basalt of the Pigstone Rock shews good phenocrysts of felspar in a fine-grained dusty ground-mass. The augite is small, and mostly altered.

The slides cut from specimens obtained from the west side of Tom's House, the cave at the bottom of the Wick, the west side of South Haven, and from North Castle, all show porphyritic felspars, often with good crystal outlines, granules of augite, and much ilmenite and magnetite, sometimes shewing crystalline form. These rocks may all be termed porphyritic basalts. The rock from the Neck opposite Midland is a porphyrite, shewing fine laths of plagioclase, felspar, and much black granular material, probably ilmenite, with no phenocrysts. Another porphyrite occurs on the mainland, by the keeper's lodge, just outside Wooltack Park; it shews small lath-shaped felspar crystals, rather decomposed, in a greenish brown matrix, and has circular holes filled with secondary quartz, etc., round which the felspars seem to bend. The basaltic rock of Wooltack Point shews good porphyritic crystals of felspar, in a ground of finer felspar microliths, granules and rough cubes of Magnetite, and small augite crystals. The rock just inside the gate of Wooltack Park appears

to be the same, but the phenocrysts .of felspar are more numerous, and there is more of a greenish .decomposition product.

GRASS HOLM. The whole island is composed of a volcanic rock of distinctly basic character.

The lath shaped felspars are small, sometimes arranged in skeleton crystals, but do not exhibit nuxion structure.

There are, in addition, crystals of augite and larger crystals of olivine most of which arc altered—some into a curious mineral Iddingsite.

A small portion of a rock of lighter character was cut, and probably belongs to a volcanic ash.

Veins of secondary quartz and epidote cross the rock in every direction.

The presence of olivine in abundance distinguishes the Grassholm from the Skomer type of basalt.

EXPLANATION OF PLATE.

Fig 1 Felsite. Garland Stone, showing a good flow structure X 6
Fig 2 Felsite Base of cliff west side of Tom's House, showing sperulitic and flow structure X 40
Fig 3 Felsite, East side of Tom's House, showing good spherulitic structure X 6
Fig 4 Basalt Table Rock, showing felspar phenocryst and lath-shaped felspars, indicating flow structure X 40
Fig 5 Basalt Midland Island, showing felspar phenocrysts x 40
Fig 6 Basalt Bull Hole, showing good flow structure X 40

Further Notes on the Geology of Skomer Island

by F. T. Howard and E. W. Small

Trans. Cardiff Naturalists Society 29 pp61-63 (1896-7)

Read at the Biological and Geological Section.

Since the reading of our short paper, entitled " Geological Notes 4 on Skomer Island," on December 15th, 1896 (Transactions, Vol. 28., part I.), we have had an opportunity of again visiting the island, and have photographed several of the more important sections described in our former paper as well as some others which we had not seen previously.

We were especially desirous of being able, if possible, to obtain decisive evidence as to whether the basaltic rocks, of which the island is so largely composed, are (as De la Beche held) of an intrusive character, or whether they were poured out as contemporaneous flows during the period (probably Bala) when the sedimentary grits and conglomerates were formed (as indicated in Murchison's Section). The junctions between the basalt and sedimentary beds, as seen near High Cliff and to the south of South Haven, appeared to be conformable ones, such as would be expected in a series of interbedded flows, but the curious series of ridges running across the island, and the association of felsites with basalts seemed to us to be more suggestive of intrusive sills. An examination of a very interesting section on the west of the island in Pigstone Bay, which we had not previously seen, appears to give satisfactory evidence of the contemporaneous character of both acidic and basic lavas, as will be seen by a reference to the figures. The upper part of the cliff forming the south side of Pigstone Bay, consists of a massive basalt; beneath this comes a band of what appears from a little distance to be a thinly bedded sedimentary rock, but an examination of hand specimens and of thin slices under the microscope shows it to be a felsite; beneath this felsite is another massive basalt resting conformably upon sedimentary beds consisting of hard quartz-grits and reddish shales, with a conglomerate (containing rolled basalt-fragments and spherulites of felsite) at the base. This conglomerate rests upon an uneven floor of basalt, from the disintegration of which it seems to be in part derived. Low down in the cliff, towards the north of the bay, another bed of grit appears to crop out below this basalt, but this part of the cliff is inaccessible from the land, and we had no opportunity of visiting it by boat. We hope, however, to be able to examine the whole section more completely on a future occasion, and to measure the thickness of the different beds. (The rough measurements of the upper part of the section which we made were unfortunately lost.) These bands of sedimentary strata appear to be striking across the island in an easterly direction, but there are no out-crops inland, and we did not succeed in finding them exposed in the cliffs on the north-east in the neighbourhood of North Castle. Probably, however, the blocks of quartz-grit found here on the surface, which we had previously supposed to be ice-borne boulders, belong to this series. Another exposure of quartz grits, which we had not seen on our former visit, occurs at the extreme south of the island, and forms the narrow portion of land connecting (at low water) the Mewstone with the main island. It is evident

that here, as in the case of the Wick, North Haven, South Haven, and .Pigstone Bay, the geographical features have been determined by the more rapid erosion of the sedimentary beds.

We spent some time in again searching for fossils in the grits and shales, but without any success. We examined the so-called " Encrinite Grit," referred to by Murchison as occurring on the mainland at the south side of Wooltack Park, and collected a number of imperfectly preserved fossils (including a species of Tentaculites) which seem to indicate that the beds here are of Bala age. As the beds closely resemble those of Skomer, and have the same general dip, we are inclined to regard the sedimentary beds and associated igneous rocks of the island as belonging to this

The only other fresh observations which we have to record are:— (l) the occurrence to the west of the Wick, beneath the felsite conglomerate that forms the ridge running from the Wick to the north of Welsh Way, of a very coarse breccia resting upon and obviously derived from the banded and spherulitic felsite that is so well seen at Tom's House:

(2) The occurrence of bands of ash in the basaltic cliffs, between the north point of the island and North Castle. Both these observations afford additional evidence of the contemporaneous' character of both the baslc and acidic lavas.

A Note on some Skomer Photographs

by Evan W Small

Trans. Cardiff Naturalists Society 30 pp 58-68 (1896-7)

(Read at the Biological and Geological Section)

During a short visit to Skomer Island, in company with Mr. F. T. Howard and (for part of the time) Mr R Drane, in August last (1897) I was able to secure rather better photographs of some of the more striking features of the coast line than those obtained during the previous visits which have been already shewn to the section

The first series I have now to exhibit well illustrate the geological features which have led to the formation of that curious long inlet of the sea upon the south side of the island, known as The Wick; they would probably have been more interesting to many members of the section had they been taken at an earlier period of the year, when the basalt cliff that forms the southern boundary of this creek is almost hidden by the numerous sea birds which make this spot their temporary residence A reference to the sketch map of the island (published in the 28th volume of the Transactions) will shew that The Wick runs into the land in an easterly direction to a distance of about a quarter of a mile, with a width of about 150 yards at the seaward end narrowing down to about 20 at its eastern extremity, and that it is bounded by sedimentary strata along the northern, and by basaltic rocks on its southern margin. All the photographs (one of which is here reproduced) show clearly the steep dip slope of the sedimentary beds which were consists of felsitic conglomerates, sandstones and shales, dipping at an angle of from 20 to 30 degrees to the S.S E, and in two or three photographs the faulted junction of these beds with the basalt is well seen.

It is this fault which has determined the position and character of the inlet, the sea having eaten its way along the line of weakness due to the contact of the hard, compact basalt, and the more easily eroded sedimentary rocks. Doubtless the first step in the formation of the creek was the production of a small cave, scooped out in the softer rocks along the fault line. Such a cave is now to be seen at the base of the cliff, at the extreme eastern end of the inlet. As the cavernous hollow first formed was gradually enlarged by the action of the waves, the waters were aided in their destructive work by miniature landslips down the steep slopes of the tilted sandy strata, that continually brought partially shattered rocks within reach of the billows. Byeand-bye the roof of the original cavern fell in, and the waves continued to dash up a narrow open creek, that was ever being widened by their successful attacks upon the more vulnerable rocks of the north side, which, traversed by numerous cracks and joints into which the sea washes, still continually slip and founder away. The waves have found it much more difficult to erode the hard, compact basalt that forms the land to the south, and thus it results that we have on the one side of The Wick a great sloping shelf of rock (down which it is possible to walk), from which almost every storm carries off great cubical slabs, whilst on

the other side stands a mighty perpendicular cliff, whose base is ever marked by a long line of white foam.

The next group of photographs illustrates in a somewhat different way the same general feature that is so strikingly seen in The Wick. They represent the rocks on both sides of the channel that (except at low tide) separates the Mewstone from the main island Here we have a series of sedimentary grits about 40 feet thick, sandwiched in between two igneous masses. The grit beds dip somewhat steeply to the S.S E, and it will be seen that they are continually falling away. The process of erosion has here reached a further stage, which a reference to the map suggests may one day be effected in the case of The Wick the sea has worked its way along the strike of the sedimentary strata so as to cut off the Mewstone felsite, and convert it into a separate islet, though curiously enough, there still remains a thin band of felsite capping the rapidly crumbling dip slopes of the opposite cliff.

The Rock Types of Skomer

by Professor 0. T. Jones, M.A., D.Sc., F.R.G.S.

Appendix (THE ISLAND OF SKOMER John Buxton and R.M. Lockley; 1950)

Apart from some bands of sedimentary rocks the igneous rocks of the island are almost wholly of volcanic origin, and many of them are of unusual constitution. They range in chemical composition from acid rocks with a high percentage of silica (nearly 80) to basic rocks with a relatively low percentage of silica (about 54). Their most important characteristic is the relatively high percentage of alkalis and the predominance of soda over potash, and correlated with this is a low percentage of lime. It is upon these characters that the unusual mineral composition of the rocks depend and to some degree their textural features.

The rocks of intermediate and basic composition are built up of a large number of separate outflows usually not exceeding l0 feet. These flows appear to have extended over a considerable area and were obviously very fluid lavas.

The acid rocks are more variable in thickness; individual flows were thicker and tended to thin away rapidly. Their behaviour undoubtedly indicates a more sticky or viscous lava. Another consequence of their viscous nature is the manner in which certain flows are strongly banded and streaked; many of the banded layers are strongly contorted.

Among the more basic lavas there is evidence that they were poured out subaerially and that fairly long intervals separated one flow from another. Under these conditions the top of a flow was strongly weathered to a red clay or bole before the next flow was laid out over it. It is believed that these lavas were poured from long fissures after the manner of fissure eruptions. Since the flows appear to thin out somewhat to the east, as on the Neck and Middleholm, it is believed that their source lay somewhere to the west of Skomer.

At the time of their formation the basic flows must have been laid down almost horizontally, but since that period the area has been affected by severe earth movements the effects of which are well displayed in the Skomer volcanic series and the overlying Silurian rocks of the mainland. It is probable that the major effects of movement were post-Carboniferous, but there is evidence that less severe movements occurred at earlier periods

The Skomer rocks are now tilted in a south-south-easterly direction at 20° to 25° and are traversed by some fairly large faults. The largest of these cuts off the tongue of land between the Havens from the main part of the island and the next in importance traverses the island obliquely from south-east to north-west, i.e. from South Haven to Bull Hole.

The sedimentary rocks are composed of breccias and conglomerates derived from the underlying rocks, also white and greenish quartzites and bands of red or green clays.

AGE OF THE ROCKS

Since the volcanic rocks of the Skomer series are of different types from those found elsewhere in Britain, it is difficult to correlate them with those in other volcanic regions the ages of which are known. Unfortunately also, the sediments associated with them are barren of fossils.

On the mainland volcanic and sedimentary rocks of the Skomer series can be seen in association on the north side with Llandeilo rocks and on the south side Upper Llandovery rocks.

The junction between the Llandeilo and Skomer rocks can be seen in the corner of Musselwick Bay near Marloes; it is, however, a powerful fault. Its direction of throw is unknown but consideration of the structures in the area makes it probable that the older rocks have been thrust northward over newer rocks in which case the Skomer series is older than the Llandeilo. On the south side examination of the relations between the Upper Llandovery rocks, as seen in Jeffrey's Haven and Anvil Bay, indicates the probability that the Skomer rocks are overlain unconformably by the Upper Llandovery and it is fairly certain that not only are they not of Upper Llandovery age, but are probably considerably older. The only other areas in which volcanic rocks occur which bear a resemblance to those of Skomer are at Llangynog localities the volcanic rocks are found in association with sedimentary rocks which have yielded fossils of Lower Arenig age. The rocks of the Treffgarne volcanic series present many points of resemblance to those of Skomer but do not show such a variety of types. The Skomer series are therefore believed to be of Lower Arenig age but are unique among the volcanic rocks of the British Isles.

PETROLOGY AND OCCURRENCE

Arranged in order from acid to basic, the Skomer series includes soda rhyol ites, soda trachytes, keratophyres, skomerites, marloesites, m ugearites, olivine basalts and olivine dolerites. All but the last-named are probably extrusive rocks, but the intrusive character of even the olivine dolerites cannot be proved with certainty.

Except for the olivine-bearing rocks the high proportion of soda felspars (albite or albite-oligoclase) usually characteristic of acid rocks, in association with minerals commonly found in basic rocks results in the peculiar mineral associations which distinguish some of the rocks of the Skomer series.

Soda Rhyolites. These are cream-coloured rocks which are well developed in the North Cliff, Tom's House and the Basin. In these latter localities they include layers composed of those remarkable nodules called spherulites which may occur in strings or layers or clustered together in bunches or

nests. These rocks are, in places, well-banded as the result of flow and the banding is not infrequently contorted. Their sections indicate that some of them were obsidians and have subsequently developed the beautiful structure of curving cracks called perlitic structure.

The Soda Trachytes are distinguished by containing large phenocrysts of albite in association with phenocrysts of such minerals as hypersthene and olivine. The ground mass consists of minute needle-shaped crystals of albite which shows the conspicuous flow-banding usually noted in trachytes. One band traverses the island from Pigstone Bay to North Castle and the type occurs also in the North Cliff.

The Keratophyres are somewhat darker speckled rocks which are developed sporadically among the above.

The Skomerites are fine-grained greyish rocks with a tinge of green. Several bands of this type cross the island from side to side. Their distinctive mineralogical feature is the occurrence of albite-oligoclase felspar in association with a large proportion of augite and some olivine. The ground mass is usually fine-grained containing both felspar and augite.

The Marloesites are a development of skomerites and are distinguished by the remarkable way in which large phenocrysts of albite, augite and olivine are clumped together in a fined-grained matrix. The type was chosen from Marloes Beacon; the rock also composes the larger part of Grassholm. On Skomer this type occurs among the skomerites but cannot be separately mapped.

The Mugearites. This rock type was first recognised by Harker in Skye but was identified many years later on Skomer by Thomas. It forms a band nearly 300 yards wide which crosses the centre of the island from near Skomer Head to North Haven. The base of the band passes south of the house and the flagstaff is on the lowest rocks of the band.

The mugearites are dark grey rocks weathering to a paler colour and often stained red at the surface. In their mineral composition they are not very different from the preceding rocks but the relative proportions of the minerals are different.

The Olivine Basalts. These are very dark and obviously crystalline rocks. The basic minerals augite and olivine are relatively abundant and the felspars are the basic felspars andesine to labradorite usually found in association with those minerals. Iron ores are much more prevalent than in any of the other types. They occur mainly in three bands the widest one at the north end, a narrower band south of the centre and another south of the Wick. A very narrow outcrop can be distinguished amongst the mugearites south of the house and the flagstaff. Small outcrops occur also on the Neck.

The Olivine Dolerites are sparsely developed near the Table on the west coast at the corner of South Haven and in Matthews Wick. Some of these exhibit the ophitic structure characteristic of these rocks.

The Sedimentary Rocks. The greatest development of these rocks is between the Wick and Welsh Way and in their upper part are associated with conspicuous bands of red clay which are well seen in the Wick. The band is faulted northwards into the tongue of land between North Haven and South Haven and is continued into the north end of the Neck. Thin bands of sediments occur near the centre and at the north end of the island.

Red clays are also found in association with some of the igneous rocks and their occurrence suggests that the tops of some of the flows were deeply weathered before the eruption of the overlying flow. They indicate clearly that the flows were erupted on to a land area. On the other hand, the red clays associated with the quartzites were deposited in water; they were probably washed off the surfaces of the weathered flows into nearby bodies of water in which the quartzites and associated rocks were laid down.

The above account is based on that given by H. H. Thomas (1911) in The Skomer Volcanic Series. Quart. Journ. Geol. Soc., LXVII, p. 175.