
The geology of Anglesey

By Edward Greenly

Memoirs Of The Geological Survey. England & Wales.

In Two Volumes, Volume 1

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Frontispiece (Plate 1): The folding of the Mona Complex. As viewed from the South Stack, Holyhead. Height seen = 445 feet.

Preface by the Director

The Island of Anglesey was geologically surveyed on the old series one-inch map in 1849 and the following years, mainly by Ramsay but in part by Selwyn and Warrington Smyth. The map was published in 1852 and was followed by a Memoir on the Geology of North Wales in 1866. The Memoir, except for a palaeontological Appendix by Salter, appeared under the authorship of Ramsay, and the preparation of a second edition, which was published in 1881, occupied much of his time towards the close of his tenure of office as Director General.

The author of the present Memoir, after spending six years in the geological surveying of a part of the Highlands of Scotland as a member of the staff of the Geological Survey, resigned his post in 1895. But the fascination of the crystalline schists with their infinitely complicated structures and metamorphism was strong upon him, and within a few weeks, actuated solely by a spirit of research, he commenced, single-handed, the detailed six-inch survey of Anglesey, of which the results are embodied in the following pages and upon the forthcoming one-inch geological map.

There were many reasons for his choice of this island for an investigation that proved to be the work of no small part of his life. It is a naturally defined tract that could be dealt with apart from adjacent ground. There was no doubt that much reconsideration was required of some of the earlier conclusions with regard to the crystalline schists. Little was known of some occurrences of Lower Palaeozoic rocks, which were likely on further investigation to furnish connecting links between the Welsh and Scottish types of development. That Old Red Sandstone existed in the Island had long ago been recorded, but its relations to the subdivisions of that formation as recognised elsewhere, remained to be ascertained. The Carboniferous rocks presented several almost unique characters, some of surpassing interest, all of which called for detailed examination; while lastly a study of the glacial deposits, which were not shown on the original map, promised to throw much light on the movements of the ice along the North Wales border and in St. George's Channel. That the examination of an area, presenting problems so numerous and so varied, should have occupied Mr. Greenly's energies for 24 years is no matter for surprise. The wonder is rather that one man should have been able to concentrate on so many subjects, and mete out to each the exhaustive attention which is evidenced in the following pages.

In May, 1908, Mr. Greenly wrote to Sir J. J. H. Teall, at that time Director of the Geological Survey, in the following words. 'The end of my work is now within moderate distance, and I therefore wish, and the act gives me great pleasure, to offer its results to the Geological Survey to which I am so much indebted for training and experience. The only condition I would ask is that the Geological Survey should publish a one-inch map of the Island, together with a descriptive Memoir which I would write to accompany that, as soon as might reasonably be done after the completion of the work'. This generous offer was accepted by Mr. J. A. Pease (Lord Gainford), at that time President of the Board of Education, subject to the map being certified to be satisfactory. Inspection was made at once with the result of showing that the six-inch

survey had been made with the utmost care and accuracy, and that the map offered by Mr. Greenly was up to the highest standard of Geological Survey work.

The MS. of the Memoir was completed in 1916, and a suggestion made by Mr. Pease in 1908 that the author should receive the thanks of the President of the Board of Education when the map and memoir were handed over, was adopted by Mr. Pease's successor. The following letter was addressed to Mr. Greenly by Mr. A. Henderson:

'I understand that during the 20 years that have elapsed since you were a member of the staff of the Geological Survey, you have devoted yourself to geological investigations in Anglesey, and that you have now completed a geological memoir to elucidate the map which you have already presented to the Survey.'

I am informed that the map is a work of great skill and precision, and that it will rank among the best productions of the Geological Survey. The memoir which you now offer is, I have no doubt, a lucid interpretation of the geology of the area, and worthy of the map. I wish to convey my personal thanks to you for giving the results of your long labours to the public through your old branch of the Service, and I congratulate you upon the successful completion of so admirable an example of well-directed effort'.

In the meantime however difficulties in preparing the map and printing a memoir had arisen in consequence of the war. Colour-printing of maps was temporarily in abeyance; there seemed also to be probability of delay in printing, at such a time and as an official publication, a long and detailed memoir that had little direct bearing on war requirements. Influenced by a desire to have perfect freedom as to the time and manner of producing his results, Mr. Greenly offered to bear the whole expense of producing the Memoir, and though the great increase over the estimated cost which resulted from the War rendered this impossible, he has nevertheless contributed a considerable part. Of the results of this generosity the volumes themselves bear evidence. The author has availed himself of his freedom from the official restrictions which were inevitable in a time of stress, not only fully to present his scientific conclusions, but to record the wealth of detailed observations on which those conclusions are based, and at the same time to do justice to the remarkable structures he describes by numerous drawings and photographic reproductions.

This briefly is the history of the Memoir on Anglesey. Ample proof will be found in its pages of the labour and thought which have been bestowed upon it, both as regards its editing and the exhaustive treatment of the geology. Nor has the author hesitated to call upon others who have been engaged in kindred subjects elsewhere, to give him their aid in dealing with the problems presented by this difficult area. The volumes are included among the Geological Survey Memoirs in the confidence that they will rank not only as the standard work on Anglesey, but as a work of reference in several branches of geological research, for many years to come.

A. Strahan. Director. Geological Survey Office, 28, Jermyn Street, London, S. W. 1. 2nd May, 1919.

Author's preface

In England and Wales there are about a dozen places at which we seem to catch a glimpse of the old floor that underlies all the Paleozoic and later formations. Of these glimpses, the most extensive and varied is that which is afforded us in Anglesey. Yet mists have long hung about this fascinating view. For many years indeed it was held, and that by those who, rightly, commanded most authority, to be but a mirage, a simulation of the sought-for by that which in reality was hiding it from our eyes. The enthusiasm kindled by such a problem did not fail to lead to keen and persistent investigation. Eventually, however, a stage was reached when it became evident that what was needed, not merely as a mode of research but as a reliable basis for future research, was a detailed re-survey upon the lines that had been found so successful in other regions. Hence the present map and memoir. But whatever the interest of the ancient crystalline schists and their associates, hereinafter called (see p. 39) 'The Mona Complex', they have been accorded no special treatment on the maps, every formation, 'Drift' as well as 'Solid', having been similarly mapped, in accordance with the practice of the Geological Survey. Information concerning the various maps that have been used will be found in Appendix 1.

In dealing with the Succession in, the Tectonics of, the General View of, and the Age of the Mona Complex (Chapters 6, 7, 8, 9), unrestricted expression has been given to the interpretations that are advocated; but in full realization of the hazardous nature of the subject, and with the expectation that they will be modified, perhaps extensively, by criticism and future research. Special attention is asked to the fact that the interpretations in question do not in any way affect the lines upon the maps, which were drawn without any reference to them, and in fact, before they had been adopted. The succession in Holy Isle was made out on the completion of the mapping of that isle in 1906, and its tectonic interpretation followed upon a suggestion thrown out by the late C. T. Clough in 1907; but the interpretations of the rest of the Complex were not arrived at until after the whole of Anglesey had been surveyed.

A chapter entitled 'Metamorphism in the Mona Complex', treating that subject as a connected whole, its various aspects are described and discussed in Chapters 4, 7, 8, and 10, ought properly to have followed upon Chapter 7. At the time it would have had to go to press, however, I had not succeeded in bringing the metamorphic into satisfactory correlation with the tectonic phenomena. The Supplement, and the genetic studies added in Chapter 41 (pp. 900–4 and especially 907–10) partly supply the lack; but I hope, ere long, to deal with the aetiology of this fascinating aspect of the Complex in a systematic manner.

The local detail of the more extensive formations has been relegated to special chapters, in which have also been placed the local fossil lists, with the registered numbers of fossils and microscopic slides. Their prime object has been to provide a guide to the more important exposures; but they also provide means of verifying generalised statements, thus relieving the general descriptions from a distracting multiplicity of place-names and reference-numbers.

The fossils have been determined by specialists: the graptolites by Miss Elles, Miss Elles has also kindly contributed a valuable essay on the Graptolite Sub-Faunas, the Ordovician trilobites by Mr. Lake, the Ordovician brachiopods by Dr. Matley, and the Ordovician phyllocarida by Dr. Peach. The Carboniferous Limestone fossils were named by the late Dr. Ivor Thomas (some having been previously examined by the late Dr. Vaughan), the Millstone Grit and Coal Measure fish by Mr. E. T. Newton, their mollusca by Dr. Wheelton Hind, and their plants by Dr. Kidston. Some miscellaneous forms, chiefly from glacial and later deposits, were named by Dr. Kitchin, Mr. Allen, and Dr. Ivor Thomas. The late Dr. G. J. Hinde examined all the sponge-spicules and other microscopic organisms. The fossils from the South Stack Series of the Mona Complex were determined by Dr. Peach and Dr. G. J. Hinde. Particulars of the Survey collection are given in Appendix. For more than half of these indispensable fossils we are indebted to the skilled and patient collecting of Messrs. Macconochie and Muir, who, sent to Anglesey for that purpose by the Geological Survey, pursued their aim through a succession of visits amounting in the aggregate to a year's work, and with enthusiasm never damped by long searches, often in cleaved and barren rocks.

For the Petrology I am responsible, except for assistance upon the following important subjects, as well as on some others mentioned in the text. Most of the slides and specimens of the spilitic volcanic rocks and of the serpentine-suite of the Mona Complex, as well as of the silicified rocks of Parys Mountain, were examined by Dr. Flett; the igneous boulders of the Skerries conglomerates by Sir J. J. H. Teall; and the Palaeozoic Intrusions, the Later Dykes, and the Red Measure sandstones by Dr. H. H. Thomas. More than half of the chemical analyses are the work of Mr. John Owen Hughes, but several other chemists have contributed, and others kindly permit us to quote unpublished analyses. Statistics of the Anglesey rocks and slides in the collection of the Geological Survey, and of these analyses, will be found in Appendix 2.

To all these specialists, and particularly to Miss Elles and Mr. John Owen Hughes, we desire to return the most cordial thanks.

The work of Miss Elles upon the zonal graptolites has made it possible to determine the effects of the Post-Silurian disturbances, not only upon the Lower Paleozoic rocks themselves, but also upon the Mona Complex, knowledge essential to the interpretation of the Complex. Mr. J. O. Hughes, during seven years, devoted all the time at his disposal to chemical analyses of the rocks of the Island, without which the petrological work would have been seriously defective. The results he has obtained represent an important contribution to petrological science in general, quite apart from their bearing on the geology of Anglesey.

I have also had the great advantage of going over much of the ground with Sir J. J. H. Teall, Sir Aubrey Strahan, Dr. Horne, and Dr. Flett. Dr. Horne, who was detailed in 1908 to inspect the maps, visited the Island again in 1911. And all these officers have been ready at all times with valued aid and advice, especial thanks being due to Sir Aubrey Strahan for his tact and patience throughout the period of difficulty caused by the recent war.

The public-spirited interest which has been taken in this work by the County Council of Anglesey, by the Senate of the University College of North Wales, and by the Agricultural Committee of that college, ought also to be remembered.

The grants generously made, in aid of the chemical analyses, by the British Association and the Senate of the University College are referred to on p. 28.

To the Elder Brethren of the Trinity House we are indebted for a unique opportunity to survey the remote islets of The Skerries at leisure. They not only gave me permission to live for several days in the Skerries Lighthouse, but, with great courtesy, despatched me there and brought me back in their own vessel, the Triton'.

To Mr. Thomas Prichard of Llwydiarth Esgob in Anglesey we are indebted for a series of kind actions, continued over a period of some 18 years, too varied and too numerous to specify, but among which may be mentioned his loan of the valuable plants from the Coal Measures.

To him, and, equally, to the generosity of Mr. E. Neil Baynes, we owe nearly all the information of an archaeological or historical nature that is given in Chapters 1, 32, 35, and 37. Mr. Baynes has now been working for several years on the archaeology of Anglesey. By the energy and public spirit of Lord Boston and Mr. Baynes, an Anglesey Archaeological and Natural History Society has been formed, which has already done excellent work. Its aim is not only research, but preservation of destructible objects of interest, and several of the great erratic boulders of the Island are now included in its watchers' list.

The late Dr. Callaway's interest in Anglesey problems never flagged, and I had often the privilege of discussing them with him, especially the origin of the Peninynydd mica-schists, on which his views have proved most enlightening. Mr. Barrow also contributed valuable suggestions, chiefly concerning the jaspers and the hornfels; while Prof. Bonney never begrudged the trouble of correspondence upon any question submitted to him. Certain chapters were kindly read by various friends, as follows by Dr. Horne and Dr. Callaway; 13, 14, 15, by Miss Elles; 13 by Prof. O. T. Jones; parts of 16, 28, by Dr. H. H. Thomas; 20, 23, 24, 25, 35, by Sir A. Strahan; 30, by Sir J. J. H. Teall, Sir A. Strahan, and Dr. Horne; and all those which contain fossil names by Dr. Kitchin. Mr. Edmund Dickson made five analyses of rocks, and the late J. Hort Player made many reproductions of the field-maps by his photographic contact-process. The rest of the photographic map-reproductions are by Mr. J. Wickens of Bangor. Microscopic slides were presented to the Survey by Dr. Matley and Mr. Barrow, and lent by Miss Blake, Dr. Callaway (who also lent fossils), Prof. Bonney and Miss Raisin, and the Sedgwick Museum at Cambridge. The plates are from photographs by Mr. J. Rhodes, Junr. (who was sent for that purpose by the Geological Survey), with the exception of Nos. (Plate 26)B, by Mr. Griffith J. Williams; (Plate 38), (Plate 43), by Mr. J. Trevor Owen; 56, by Mr. E. Neil Baynes; and 59, by Mr. H. E. Spencer; who have also presented photographs to the Survey Collection. Information concerning this collection, and the means of obtaining photographs therefrom, will be found in Appendix 2. We are indebted to the Council of the Geological Society for leave to reproduce (Figure 135), (Figure 135), (Figure 189), (Figure 190), (Figure 191), (Figure 194), (Figure 195), (Figure 260); to the Editor of the Geological Magazine for (Figure 169), (Figure 258), and (Figure 289); and to the Council of the Cambridge Philosophical Society for (Figure 305). The half-tone and line blocks are by the Thames Engraving Co., the folding-plates and collotypes by Malby and Huth respectively.

The Coal-mine plans and boring-sections were kindly lent by Lord Boston, the late Hon. Lady Neave, the late Lady Reade, Mr. T. Prichard (on behalf of Sir G. Meyrick), and (through Mr. Bernard Smith) by the Menai Colliery Co., Ltd. Access to the Parys Mountain plans, together with frequently repeated other aid, was cordially given by Mr. T. Fanning-Evans, the Manager of those mines.

For aid on a number of different points we are indebted to the following persons: the late James Bennie, the late J. F. Blake, Prof. K. Busz, Mr. T. C. Cantrill, the late C. T. Clough, Prof. Grenville A. J. Cole, the late J. R. Dakyns, Prof. J. R.

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For local aid and information we are indebted to the following residents: Miss J. H. Adeane, the Town Clerk of Beaumaris, Mr. Barbagli of Bryn-fuches, Lord and Lady Boston, Sir R. W. Bulkeley, the late Admiral Burr, Mr. F. E. Cotton, Mr. T. Clegg, Mr. J. R. Davies, Mr. R. L. Edwards of Bodafon-isaf, Mr. R. Ellis of Llanfairynghornwy, Mr. S. J. Evans (Headmaster of Llangefni County School), Mr. W. Fanning, Mr. J. J. Ffoulkes of Bodrwyn, Col. W. A. Fox-Pitt, the Managers of the Holyhead and of the Porth-wen Silica Works, Mr. H. O. Hughes of Llangaffo, the late James Hughes of Llanerchymedd, Mr. J. Hughes of Parys Mountain Mines, Mr. W. Jones of Llanrhwydrys, Mr. L. D. Jones (Llew Tegid), Mr. W. E. Jones (Agent to the Marquis of Anglesey), Col. Lloyd of Tregaian, Mr. O. J. Lloyd of Llangefni, Capt. McKinstry, Sir G. Meyrick, Messrs. E. Morris and W. E. Williams, Mr. and Mrs. Humphrey Owen of Treddolphin, the late C. F. Priestley, Miss M. F. Rathbone, Mr. J. Rice Roberts, Lord Sheffield, Mr. Toiler, Major Lawrence Williams, the late Rev. Chancellor Williams of Llanrhyddlad, Dr. R. M. Williams, the District Superintendent of the London and North-Western Railway, the Secretary of the Holyhead Waterworks; also to the local naval and military officers, and to the county police, for their courtesy and co-operation during the recent war; and, for many years past, to land-owners, farmers, and many others all over the Island.

It is pleasing to reflect upon the magnitude of this body of aid, and upon the cordiality with which it has been given.

There is no one to whom so great a debt is due as to my wife. To mention that she has read both the proofs and the manuscripts of this book, as well as prepared the Index, is to mention but the last of a long series of services, too numerous and varied to be specified, or even to be recalled to memory. But this material aid has been as nothing when compared to the moral aid and support, that has never failed, no matter what the vicissitudes (neither few nor light) of the 24 years through which this work has been in progress. Had dedication been admissible, it should certainly have been to her.

I cannot close this long list of obligations without a tribute of gratitude to those officers of the Scottish Geological Survey (Drs. Horne and Peach) with whom I had the privilege to be thrown when first joining that staff. Also in particular, to the memory of our noble-minded colleague the lamented C. T. Clough, on account of the inspiring standard ever held up in his truly marvellous mapping, an embodiment at once of the highest scientific precision and of lofty devotion to an ideal.

Edward Greenly.

April, 1919.

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Figure 276 Section on the north side of Bodafon Moor, *s.l.*

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Figure 282 Isoclinal anticline, Lligwy Bay, *s.l.*

Figure 283 Isoclinal syncline, Lligwy Bay, *s.l.*

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Figure 330 Sand and gravel, Ty-gwyn, Llangefni

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Figure 336 The gravel of, Porth-dafarch, *s.l.*

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Figure 338 Sketch-map of the Sea-Floor

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Figure 342 Post-glacial coast erosion, Trwyn-bychan, *s.l.*

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Figure 344 Shaft and boring Sections, by *Mrs. Greenly*

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Figure 345 Index-chart to the 'Solid-geology' maps

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Plates

The scale is indicated by a hammer, stick, bag, or compass, or by a hin figure, and when there is no such object, the dimensions are 'stated'. hammer used is 12½ inches long, and the diameter of the compass is 1½. inc.

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Plate 2 Microphotographs of the Mona Complex. See App. 3

Plate 3 Ellipsoidal spilitic lava. Dunes of Newborough

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Plate 5 Microphotographs of the Mona Complex. See App. 3

Plate 6 Rose-Limestone with ellipsoidal structure. Dunes of Newborough

Plate 7 Autoclastic Mélange. Coast near Porth Cadwaladr, Bodorgan

Plate 8 Gwna Green-schist with quartz-augen. Menai Strait

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Plate 16 The North Stack and the sea-cliffs of the Holyhead Quartzite. Note — The feature determined by the North Stack fault runs on, from sea-cliff, up the mountain-side, below the sky-line.

Plate 17 The Namarch Fault. Porth Namarch

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Plate 25 The Hwch lower thrust-plane. Porth-yr-Hwch

Plate 26 The Skerries. From near Carmel Head

Plate 26b Careg-onen Cliffs. Mona Complex, Careg-onen Beds, Ordovician Shales, and Carboniferous Limestone [Note — The crags in the foreground are composed of the Careg-onen Beds, ex where to (1 3/4 to 2 1/8 inches from right hand edge of view) the sharp anticline of G Green-schist (Figure 194) (Figure 195) rises from under them.]

Plate 27 Boulder from the Mona Complex in Arenig conglomerate. Tywyn Trewan

Plate 28 Microphotographs of rocks later than the Mona Complex. See App. 3

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Plate 30 Paleozoic dolerite dyke on the Menai shore

Plate 31 The Carmel Head thrust-plane at Carmel Head - Frontispiece to Vol 2

Plate 32 Brecciation at the Carmel Head thrust-plane. Gwaen-ydog

Plate 33 Silicification obliterating cleavage. Parys Mountain

Plate 34 Cleavage and bedding, Old Red series. Porth-y-môr

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Plate 36 Limestone conglomerate. Borth-wen, Benllech

Plate 37 Carboniferous coral-beds. Penrhyn, Traeth-bychan

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Plate 39 Large sandstone pipe near Castell-mawr

Plate 40 Bedded cherts resting upon Carboniferous Limestone. Castell-mawr

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Plate 42 Late olivine-dolerite Dyke. Henborth, Holy Isle

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Plate 45 Boulder of hornblende-picrite. Mynydd-mwyn-mawr, Llanerchymedd

Plate 46 Boulder of Galloway granite. Porth-yr-ysgaw, Llaneilian

Plate 47 Transported block of Carboniferous Limestone. Lleiniog

Plate 48 Boulder of Penmynydd mica-schist, with tree growing in crack. Trefarthen

Plate 49 Desert scenery. Dunes of Newborough

Plate 50 The Menaian Platform and the Bodafon monadnock. From Mynydd-mwyn-mawr

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Plate 52 The Menai Strait at the submerged watershed. From the top of the column

Plate 53 The Middle Reach of the Menai Strait. From the top of the column

Plate 54 The Western Reach of the Menai Strait. From above Port Dinorwic

Plate 55 Typical scenery of the Mona Complex. Amlwch Port Moor

Plate 56 Rock table of Carboniferous Limestone. Near Marian-glas

Plate 57 Llangwyfan Church Islet at half-tide

Plate 58 The same. From the headland

Plate 59 Blocks moved by the Sea. Holyhead Breakwater

Plate 60 The West Pit and the summit. Parys Mountain

Folding plates at end of book

The horizontal base-line of the sections indicates sea-level, and the vertical scale is the same as the horizontal in all except 16.

Plate

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Folding Plate 2 Section parallel to the coast at Rhoscolyn.

Folding Plate 3 Section through Holy Isle from the North Stack to Cymyran Bay.

Folding Plate 4 Section through the Western Region of the Mona Complex..

Folding Plate 5 Section through the Northern Region of the Mona Complex.

Folding Plate 6 Section through the Middle Region of the Mona Complex, from Trefor to Glan-traeth.

Folding Plate 7 Generalized Section through the Aethwy Region of the Mona Complex,

Folding Plate 8 Section through Mynydd Llwydiarth.

Folding Plate 9 Section through Mynydd-y-garn.

Folding Plate 10 Section from Carmel Head to near Rhos-y-Cryman

Folding Plate 11 Section across the Principal Ordovician Area from Llanol to Prys-Owen.

Folding Plate 12 Section through the Principal Carboniferous Area from the Vale of Lligwy to the mouth of the Pentraeth River.

Folding Plate 13 The North-West corner of Anglesey. Reproduction of manuscript six-inch map.

Folding Plate 14 The Skerries. Reproduction of manuscript six-inch map.

Folding Plate 15 Llanddwyn Island. Reproduction of manuscript six-inch map.

Folding Plate 16 Sketch-section across Anglesey from Torllwyn to Moel-y-don.

Folding Plate 17 Sketch-section across Anglesey from Amlwch to Garth Ferry.

Corrigenda

Page 35: After Line 13 — Insert '1907. Greenly, E. " Sandstone Pipes in Carboniferous Limestone, Anglesey." *Geol. Mag.* p. 238'.

Page 201: Line 26 — For 'p. 201 ' read 'p. 244'.

Page 202: Line 3 from bottom — For 'Fig. 37' read 'Fig. 38'.

Page 205: Note — For 'Appendix 9 ' read 'Chapter 41, pp. 909–402

Page 207: Line 31 — For 'Fig. 36' read 'Fig. 37'.

Page 207: Line 3 from bottom — For 'Fig. 38' read 'Fig. 39'.

Page 230: Line 23 — For '17' read '18'.

Page 242: Note — For 'Appendix 9' read 'Chapter 41, pp. 907–8'.

Page 303: Line 30 — For 'Bryn-llywd ' read 'Bryn-llwyd'.

Page 311: Line 13 — For 'Dynas Cynfor' read 'Dinas Cynfor'.

Page 329: Line 'Drudwy ' read 'Ddrydwy'.

Page 347: Line 12 — For 'Porth Tywyn-mawr ' read 'Porth Twyn-mawr'. They are two distinct places.

Page 362: Line 4 above Fig. 168 — For '[E6091](#) [SH 583 745] ' read '[E6090](#) [SH 588 752]'.

Page 409 Line 29 — For '(1911) ' read '(1912)'.

Page 498: Bottom — For 'Appendix 9' read 'Chapter 41, pp. 892–3'.

Page 515: Line 30 — For 'evidently older ' read 'apparently older'.

Page 520: Line 12 from bottom — For 'spherulitic ' read 'spheroidal'.

Page 557: Line 24 — For Appendix 9' read 'Chapter 41, pp. 900–1'.

Page 739: line 4 — For 'Trwyn-yr-eryr ' read 'Trwyn-cerig-yr-eryr'.

Note — In the text (see p. 3), Welsh place-names are spelt as on the one-inch map, of which this book is an explanation; but inconsistencies as to hyphens, capitals, &c., in compound names have crept in, owing mainly to the different usages on the six-inch and one-inch-maps. In the Index, care has been taken to follow the usage of the new geological one-inch map.

Abolition of Appendix 9

The matter that was intended to have been placed in this has been transferred to Chapter 41. Consequently, on pp. 205, 242, 498, 557, (as indicated in the Corrigenda-list) for Appendix 9' read Chapter 41, pp. 909–10, 907–8, 892–3, 900–1' respectively. See *also* the Table of Addenda, p. xl.

Six-Inch Map names not quoted as such

It is stated at the top of p. 3 that the place names used in this book will be those found on the published One-inch Geological Map, except in a small number of cases, which are indicated in the text. In 23 other cases, however, I have inadvertently made use of names taken from the six-inch maps without indicating that they are such. By means of the following table they can be translated into equivalents that will be found on the one-inch map.

Page 78: Analysis I — For 'Capel Soar' read 'Soar'.

Page 281: Line 14 from bottom — For 'Bryn-palma ' read 'Three-eighths of a mile west-south-west of Llynon Hall'.

Page 281: Line 14 from bottom. For 'Pen-yr-argae' read 'Three-eighths of a mile north-east of Tan-yr-allt'.

Page 326: Line 4 — For 'north end of Ty-croes lane' read '277-foot level'.

Page 371: Lines 16–17 — For 'about Bryn-tirion' read 'east of the 178-foot level'.

Page 406: Lines 19–20 from bottom — 'For Gorlan-goch' read 'Bonw lane'.

Page 407: Line 9 from bottom — For '275 yards north-west of Gorlan-goch ' read '660 yards south-east by east from Bonw'.

Page 416: Line 14 — For Gorlan-goch ' read ' Bonw lane'.

Page 434: Line 11 from bottom — For at Tan-y-gwreiddyn... east-north-east' read '270 yards south of Llanddona Church, the other at a farm 200 yards to the west-south-west'.

Page 434: Line 5 from bottom — For '233 yards... Ty'n-y-pistill ' read '700 yards south-west by south from Llanddona Church'.

Page 456: Lines 13–14 — For 'Tyddyn-bach' read 'The farm north-east of Glan-y-gors'.

Page 456: Bottom — For 'Cefn-du-mawr' read 'Cefn-du'.

Page 506: Line 11 from bottom — For Porth-y-nant ' read north nook of Porth y Bribys'.

Page 507: Fig 248 — To Bathing House' add at end of long plantation'.

Page 533: Line 2 from bottom — For by Pen-yr-allt ' read 180 yards south of Glasgoed'.

Page 542: Line 2 from bottom — To Llanfairynghornwy Post Office ' add by the "S" of " Smithy." '

Page 545: Line 8 from bottom — To Llanfairynghornwy Post Office' add by the " S " of " Smithy." '

Page 550: Line 20 from bottom — For Casten ' read 'the cottage south of the " S " of " Smithy." ' '

71 562: Middle — For 'at Pen-y-nant' read 'east of the "r" of "Part's."

Page 588: Table — For 'of Pen-y-braich ' read south of Penrhyn'.

Page 731: Line 16 — For 'Penrhyn' read 'Porth Penrhyu-mawr'.

Page 756: Line 21 from bottom — For 'north of Tyddyn-hir ' read 'south of Glan-morfa'.

Page 767: Line 14 from bottom — For 'Pen-yr-allt reefs' read 'reefs west of Bodlasan-groes'.

Addenda

The additional studies which have been placed in Chapter 41 really belong (as explained on p. 887) to preceding chapters. It is requested that they be read as parts of those chapters. The places at which they should be interpolated can be found from the following table. See also (with regard to four of them) the note on p. 933, concerning the Abolition of Appendix 9.

Chapter/Page/Interpolate addition on

Chapter 4 p.41 Another Analysis of the Holyhead Quartzite.

Chapter 4 p.46 The Green-mica-schists.

Chapter 6 p.159–60 The Gwna-Skerries Junction.

Chapter 6 p.161 The Fydlyn-Gwna Junction.

Chapter 6 p.163 The Relations of the Basic and Acid Gneisses.

Chapter 6 p.167 The Age of the Gneisses.

Chapter 7 p.201 The Age of the North Stack and Namarch Faults.

Chapter p.7 205 Folding and Metamorphism.

Chapter 8 p.214 The Thrust-planes at Porth-yr-hwch.

Chapter 8 p.223 The Penmynydd Zone.

Chapter 8 p. 233 Vulcanism in the Mona Complex.

Chapter 8 p.241 Reconciliation of the Metamorphic with the Tectonic Succession.

Chapter 9 p.253 The Age of the Mona Complex.

Chapter 10 p.291 The Thrust-planes at Porth-yr-hwch.

Chapter 10 p.336 The Bodafon Moor Flags.

Chapter 10 p.367–8 The Plâs Newydd Boring.

Chapter 10 p.384 Soldier's Point beds to the west of the Namarch Fault.

Chapter 10 p.386 The Penmynydd Zone.

Chapter 12 p.397–9 The Age of the Careg-onen Beds.

Chapter 16 p.498, 516 Later Vulcanism.

Chapter 16 p.510, 516 The Age of the Palaeozoic Intrusions.

Chapter 25 p.670 Red Measure Erosion.

Chapter 28 p.689 Later Vulcanism.

Interpolation on pp. 615–16. After the paged proofs of Chapter 41 had been passed, papers were read before the Geological Society (Jan. 8, 1919) by Prof. Kendall and Dr. Gilligan, in which they suggested that certain irregularities of bedding in the Coal Measures of England might be due to contemporaneous earthquakes. Their views should, accordingly, be combined with those of Prof. Hobbs and the Comte de Ballore.

Note to p. 799. For the history of Cemlyn pebble-ridge, as well as for several other matters of local history, we are indebted to my friend Mr. Ellis of Llanfairynghornwy.

Note to pp. 264–7. The colour-band on the one-inch map represents the passage-beds, where the basic band itself may be barely visible, as at the spot illustrated by (Figure 112), where also the curved line indicates the base of the zone of passage.



(Plate 1) The Folding of the Mona Complex, as viewed from the South Stack, Holyhead. Height seen: 445 feet. Frontispiece to Vol 1..



(Plate 38) Sandstone-pipe in Carboniferous Limestone. Foreshore, Trwyn-dwlban.



(Plate 43) Glacial stria deflected into mouth of pipe. Foreshore, Trwyn-dwlban.

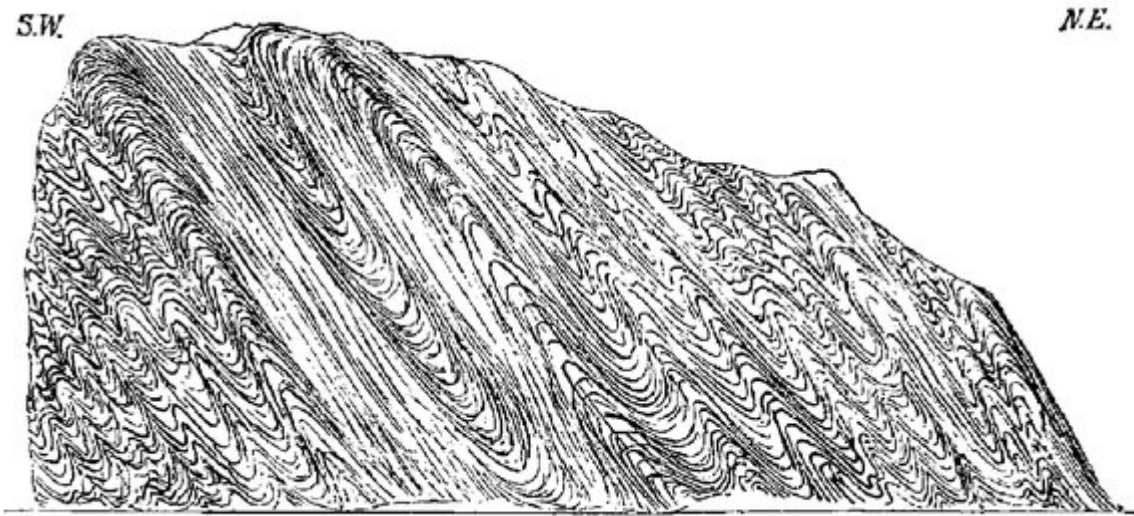


FIG. 135.—ISOCLINAL FOLDING IN AMLWCH BEDS.

(Figure 135) Isoclinal folding in Amlwch Beds. Behind rectory, Llanfairynghornwy. [Matley.]

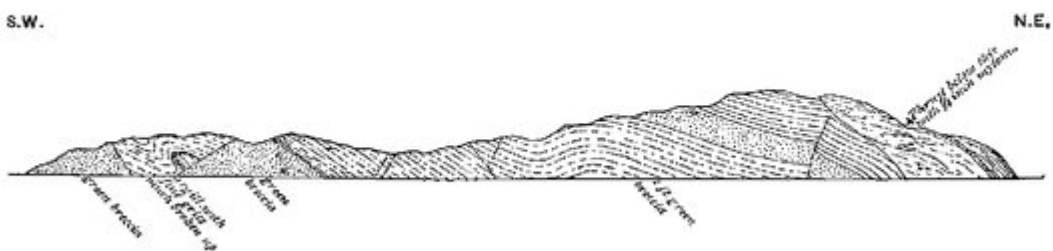


FIG. 189.—THIRD BOSS ON BARON HILL DRIVE.

(Figure 189) Third boss on Baron Hill Drive. Scale: one inch = 50 feet.



(Figure 190) Fourth boss on Baron Hill Drive. Scale: one inch = 50 feet.

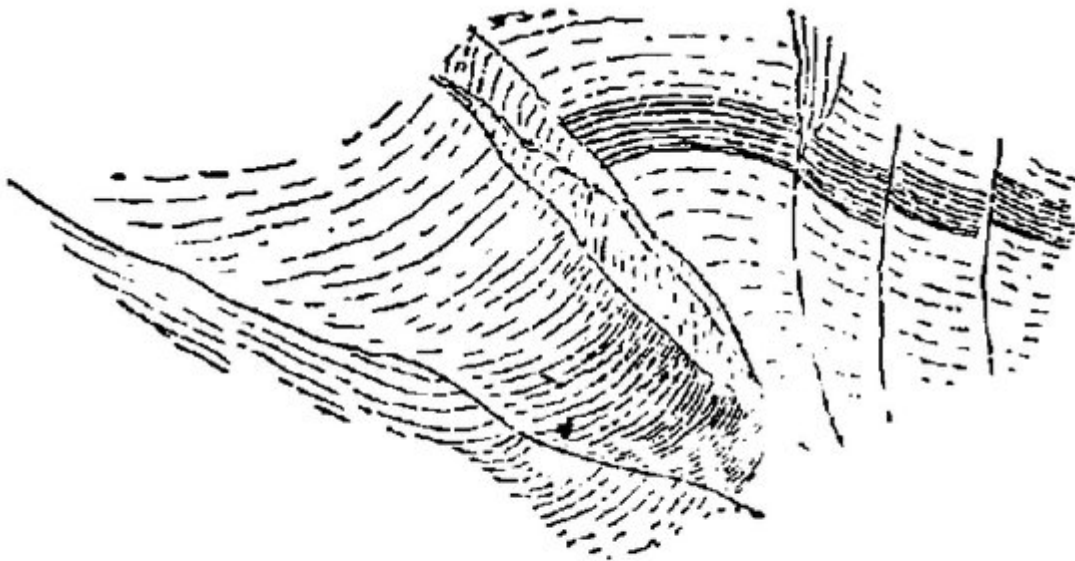
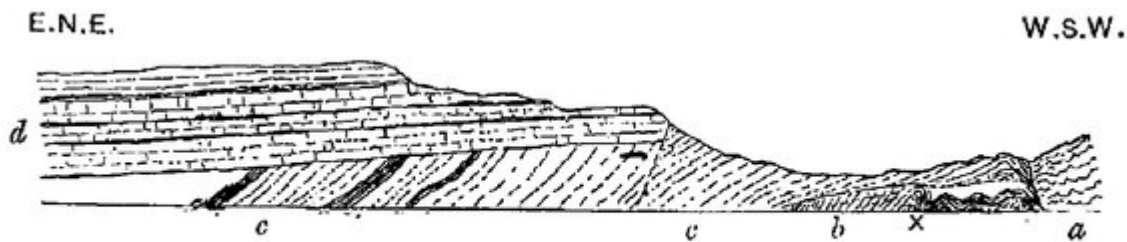


FIG. 191.
FACE OF CLIFF.

(Figure 191) Face of cliff. Two and three-quarter inches below the thrust shown under x in (Figure 189) Natural size.



(Figure 194) Section along the cliffs at Careg-onen. Scale: one inch = 440 feet. Gwna Green-schist (a); Careg-onen Beds (b); Ordovician Shales (c); Carboniferous Limestone (d).

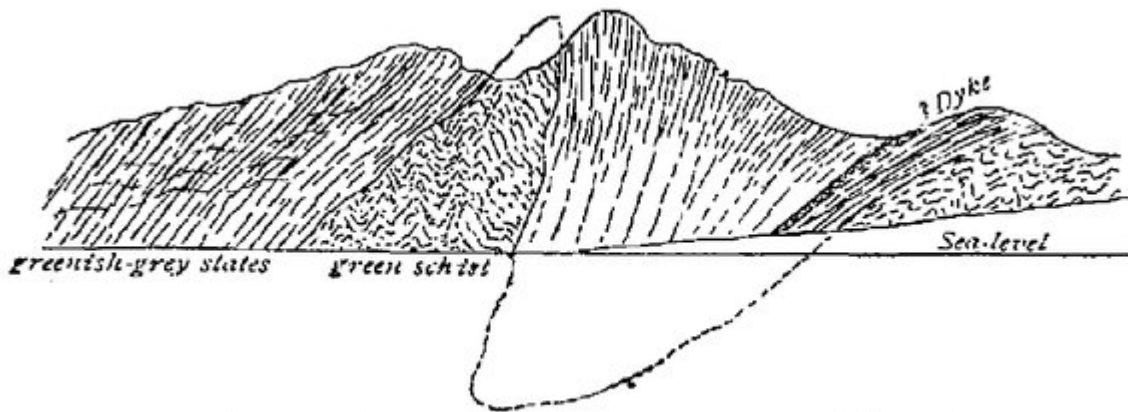


FIG. 195.—THE ANTICLINE AT X IN FIG. 194.

(Figure 195) The anticline at x in (Figure 194) [Section along the cliffs at Careg-onen]

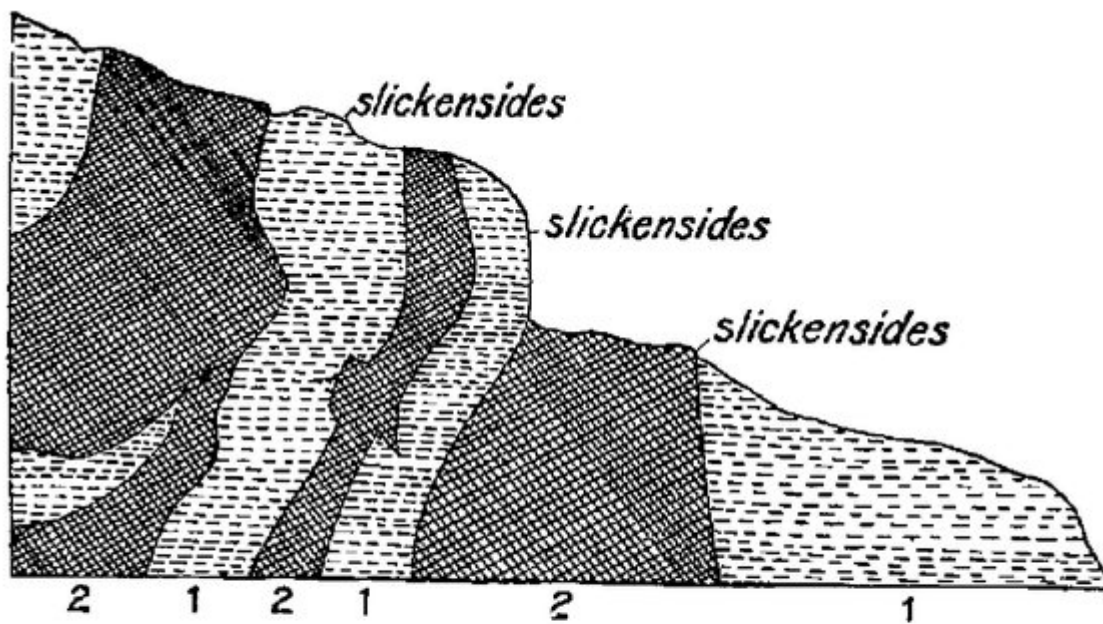


FIG. 260—SECTION IN THE COMPOSITE DYKE WEST OF LLANFECHELL. (Matley.)

Width shown = about 16 feet.
1 = Felsite. 2 = Dolerite.

(Figure 260) Section in the composite dyke West of Llanpechell. (Matley.) Width shown = about 16 feet. 1 = Felsite. 2 = Dolerite.

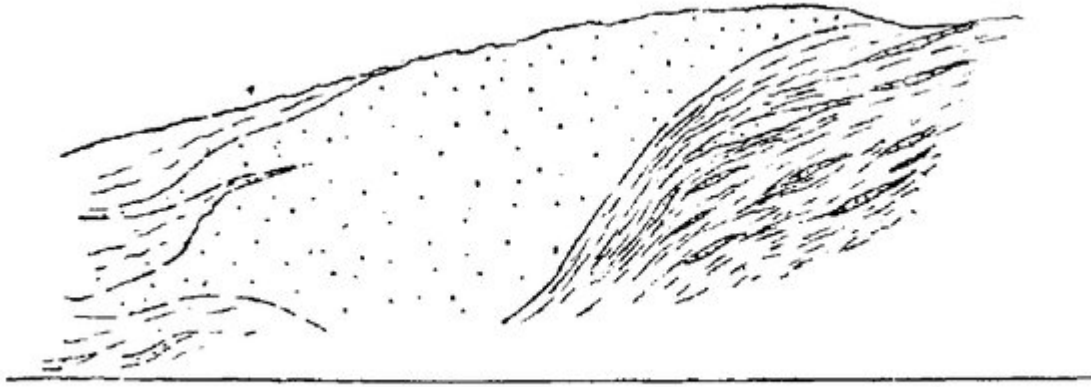


FIG. 169.—LENTICULAR QUARTZITE.

(Figure 169) Lenticular quartzite. Three and a half feet long. In Gwna Mélange, Llansadwrn.



FIG. 258.—DOLERITE ON COAST WEST OF CAREG-ONEN.

(Figure 258) Dolerite on coast west of Careg-onen.

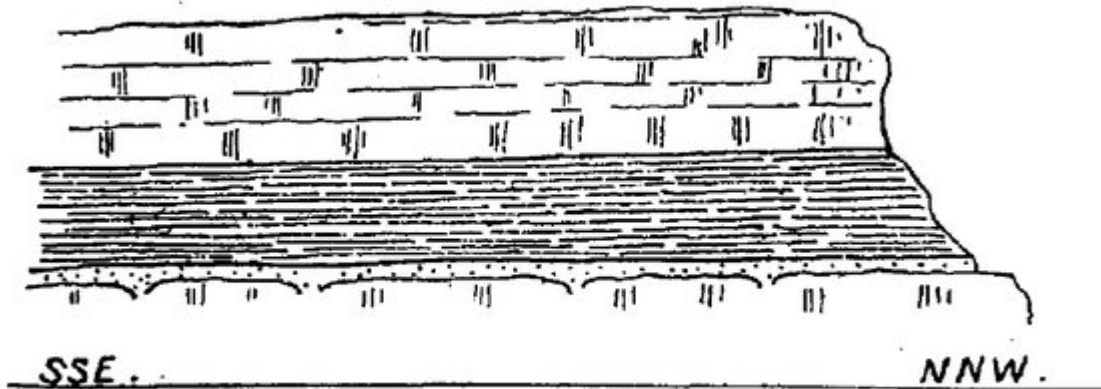


FIG. 289.—THE SUCCESSION AT TRWYN-DWLBAN.

(Figure 289) The succession at Trwyn-dwlban. (piped limestone, pipe-sandstone, shale, upper limestone.)

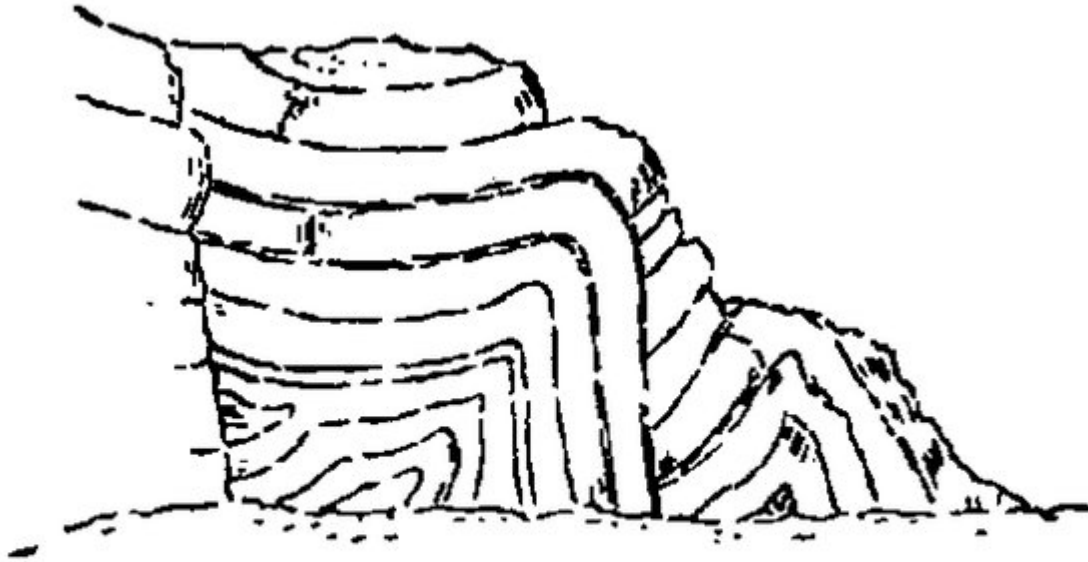


FIG. 305.

FOLDING AT THE BERW FAULT,
CEINT.

(Figure 305) Folding at the Berw Fault, Ceint. (after Henslow.)

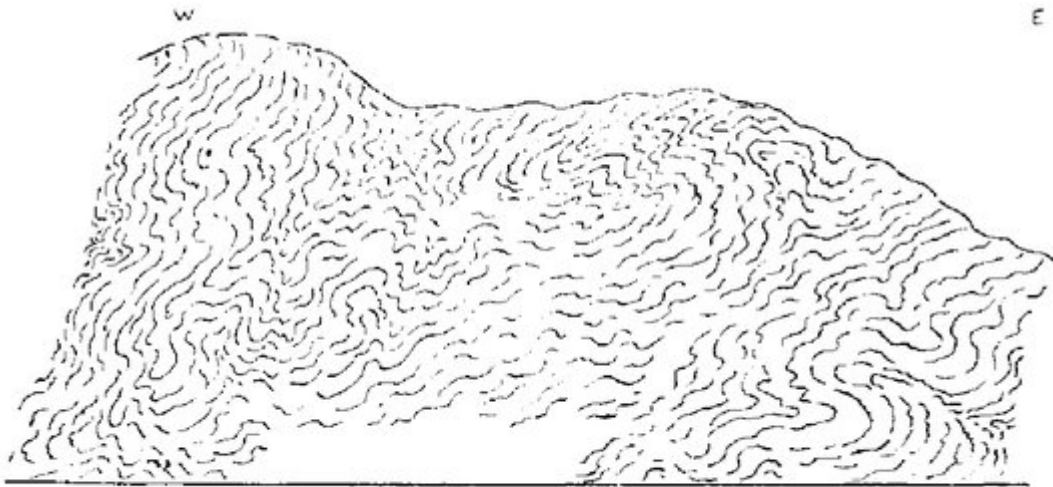


FIG. 59.—POLYCLINAL MINOR FOLDING.

(Figure 59) Polyclinal minor folding. 250 yards west of Ty'n-y-mynydd-east, south of dry pool. Height three feet.

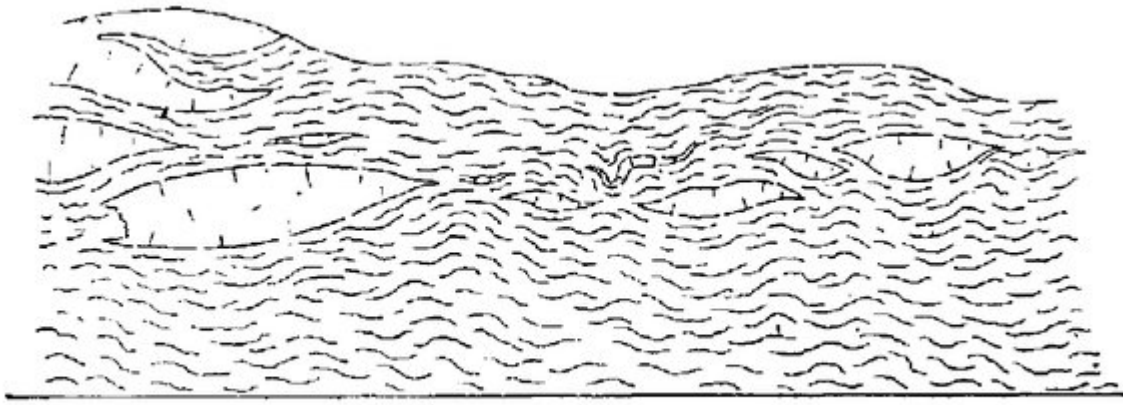


FIG. 78.—LIMESTONES IN GWNA GREEN-SCHIST.

(Figure 78) Limestones in Gwna Green-Schist. Baron Hill drive, at 'M' of 'Meurig'. Height about 15 feet.



FIG. 118.—SECTION ALONG PORTH NAMARCH.

(Figure 118) section along Porth Namarch. Height of cliff: 50–60 feet. HQ = Holyhead Quartzite. BC = boulder-clay. SSS = South Stack Series. BT = Breakwater Thrust-plane. Nf = Namarch Fault.



FIG. 165.

BASE OF LIMESTONE.

(Figure 165) Base of limestone. South-west of Pen-y-parc, at Bath House, Menai Strait. Height: about 10 feet.



FIG. 253.

THRUST IN DYKE AT PANT-HOWEL.

(Figure 253) Thrust in dyke at Pant-howel. Height about 20 feet.

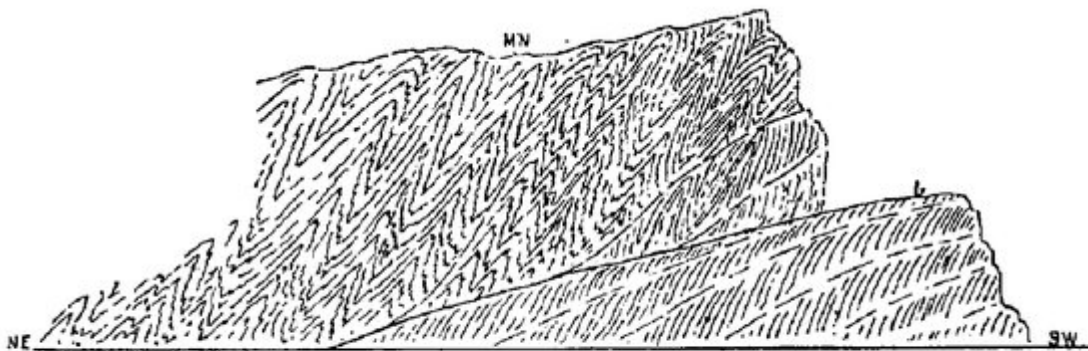


FIG. 270.—THE CARMEL HEAD THRUST-PLANE AT CARMEL HEAD.

MN = Amlwch Beds. b = Cleaved Ordovician Shale.

(Figure 270) The Carmel Head Thrust-plane at Carmel Head. MN = Amlwch Beds. b = Cleaved Ordovician Shale.



Fig. 275.—SECTION FROM THE NORTH END OF BODAFON MOOR, THROUGH THE OLD RED SERIES, TO THE SMITHY.

Scale: eight inches = one mile.

M = Bodafon Moor Schists } Mona
 MQ = Bodafon Quartzite } Complex.
 b = Ordovician.

Symbols used in Figs. 275, 276, 277, 278.
 c = Old Red Sandstone Series.
 c' = " " Corristones.
 c = Lligwy Sandstone (Carboniferous).

d₁' = D₁ Subzone of Carboniferous Limestone.
 d₂' = D₂ " " " "
 BT = Bodafon Thrust plane. " "

(Figure 276) Section from the north end of Bodafon Moor, through the Old Red Series, to the Smithy. Scale: eight inches = one mile. Symbols used M = Bodafon Moor Schists, Mona Complex, Mq = Bodafon Quartzite, Mona Complex. b = Ordovician. c = Old Red Sandstone Series. c = cornstones d = Lligwy Sandstone d2■ = D1 Subzone of Carboniferous Limestone. d2■ D2 Subzone of Carboniferous Limestone. BT = Bodafon Thrust-plane.



FIG. 112.

PASSAGE BEDS.

(Figure 112) Passage Beds. South-west of Millbank Gardens; north of 't' of 'Stryd'. With infolds of South Stack Series.