



Alfred Harker

From a photograph by Elliott & Fry.

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ORIGINAL ARTICLES.

I.—EMINENT LIVING GEOLOGISTS.

ALFRED HARKER, M.A., LL.D. (McGill), F.R.S., President of the Geological Society of London 1916–17, Fellow of St. John's College, and Lecturer in Petrology in the University of Cambridge.

(WITH A PORTRAIT, PLATE XVIII.)

DR. ALFRED HARKER was born at Hull, in Yorkshire, on February 19, 1859; his name may thus be appropriately added, as an "eminent geologist", to the county which claims amongst its sons the name of Sedgwick, the Woodwardian Professor of Geology in the University of Cambridge (1818–73), the first who taught modern geology; and famous as having had such historians as William Smith (the "Father of English Geology") and his nephew, Professor John Phillips; also as the birthplace of Sorby, Williamson, Strickland, Hudleston, and many others.

He had, as a boy, a taste for chemistry and natural history, and made his first acquaintance with geology in his holiday wanderings along the Yorkshire coast, with John Phillips' writings as his guide.

It was as a student of mathematics that Harker went up to Cambridge, and was entered at St. John's College in 1878. But he soon found, in the genial Professor McKenny Hughes,¹ one who was ever ready to welcome any "freshman" with geological leanings, and Harker became one of the first members of the Sedgwick Club, founded about that time by Watts and others of his contemporaries.

After graduating in the Mathematical Tripos as 8th Wrangler, in January, 1882, Harker came back to geology by way of physics and mineralogy, and was at once offered a teaching post on the geological staff. As demonstrator and afterwards lecturer, he has been responsible for the teaching of petrology at Cambridge for more than thirty years; but for a long time the almost total want of accommodation and equipment in the old Woodwardian Museum made it impossible to carry out this work in a satisfactory manner.

Alfred Harker was elected a Fellow of St. John's in 1885. In those days this College, owing doubtless in part to Professor Bonney's influence, was notably strong in Geology. Of the last nine Presidents of the Geological Society five have been Johnians.

As a field-geologist his earliest original work was done in North

¹ Written on May 10. Our dear friend Professor Hughes passed away on June 9; see Obituary Notice, p. 334.—ED. GEOL. MAG.

Wales, first on the cleavage structure of the slates, and then on the Ordovician igneous rocks. The results of the latter work were in part embodied in the Sedgwick Prize Essay for 1888.

From 1889 to 1893, excepting a visit to America, Harker's vacations were spent mostly with his friend and fellow-Johnian, J. E. Marr, in the Lake District. Their aim was principally to decipher the geological structure and sequence of that district in the light of what had been learnt in other disturbed areas. This problem is perhaps not to be finally solved without a complete re-survey of the ground; but some conclusions were reached, and memoirs on the Shap granite and its metamorphism and on the Carrock Fell intrusions were also among the results of those pleasant years.

In 1895, by the good offices of Sir Archibald Geikie, Harker became attached to the Geological Survey of Scotland, and was engaged for ten years in the investigation of part of Skye and of the Small Isles to the south. The summer half of the year was spent in mapping and the winter half in the study of material gathered in the field. The results of this work are contained in the official maps and memoirs, including a special memoir on *The Tertiary Igneous Rocks of Skye*.

In 1905 he quitted the Geological Survey for other engagements. The geological department at Cambridge was now housed in the new Sedgwick Museum, and teaching duties, together with the charge of the petrological section of the Museum, had become more engrossing. Dr. Harker found time, however, for frequent visits to the Highlands and other parts of Britain with occasional excursions abroad. He had made it part of his programme as a teacher of students to bring together, as far as possible, complete representative collections of rock-specimens in the Museum at Cambridge, which now possesses large series from many British areas, as well as from Norway, Canada, and other countries. The collection of rock-slices also has grown until it now numbers more than 12,000.

Dr. Harker had written in 1895, chiefly to meet the needs of his own students, a Textbook of Petrography, and this has been revised from time to time in subsequent editions. In 1909 appeared *The Natural History of Igneous Rocks*, which aimed especially at interesting geologists in the genetic aspect of petrology.

In February, 1907, on the occasion of his presenting the Murchison Medal to Mr. Alfred Harker, F.R.S., Sir Archibald Geikie, then President of the Geological Society, said: "The Murchison Medal has been assigned to you as a testimony of the Council's appreciation of the importance of your contributions to Petrographical and Structural Geology.

"You had already distinguished yourself by your studies in cleavage, by the zeal and success with which you had thrown yourself into the pursuit of petrographical research along those modern paths in which this department of our science has been so transformed and enlarged, and lastly by the skill which you had shown in the field investigation of the ancient igneous rocks of North Wales and of part of the Lake District.

“With this reputation already established and yearly growing, you were induced, at my request, to enter the Geological Survey. Although the circumstances under which you joined that service formed a new departure in its usages, I have always felt that on no part of my long connection with the Survey could I look back with more satisfaction than on the arrangements which enabled us to secure your services.

“You speedily acquired the skill of a practised surveyor, and among the hills of Skye and Rum you had an opportunity of mapping some of the most complicated and deeply interesting pieces of volcanic geology in this country. Having had from time to time opportunities of visiting you on the ground, I can bear witness both to the bodily vigour and endurance and to the geological enthusiasm and insight with which you climbed crags and peaks on which no geologist had set foot before you. The maps and memoirs which you have produced of these portions of the Inner Hebrides will always remain as a monument of your prowess as a field geologist and petrographer.”

Another of his fellow-workers writes: “What specially struck me about Harker was his thoroughness. Having started on a piece of work he devoted his whole energy to its completion. All else was subordinated to its execution, and one might almost literally say that no stone was left unturned which would cast any light upon it.”

“He is one of those who believe that for the right understanding of a science it is necessary to know something of the history of its growth, and with this in view he has accumulated in his library a valuable series of works which bear upon the early history of the science of geology and the more recent branch of petrography.

“Harker’s time has been largely occupied by teaching and research, but he has nevertheless contrived to devote much of it to the enrichment of the petrographical collections in the Sedgwick Museum, and to their arrangement. He has travelled much to obtain specimens for this purpose. Of special interest are two magnificent collections which he has brought together to illustrate genetic connexion of igneous rocks, the one of those of Western Scotland, the other of the group rendered classic by the researches of Brögger in the Christiania region.

“Though Harker’s fame rests largely on his petrographical work he is also a physical geologist of a very high order, as might be expected from one who prefaced his geological career by a mathematical training. We may make special mention of the very important contribution which he made to the physics of glacial erosion in his paper on Ice Erosion in the Cuillin Hills (Skye), which appeared in the Transactions of the Royal Society of Edinburgh, 1901 (T.R.S.E., vol. xl, pt. ii).”

In addition to his service to science, as a Lecturer in Petrology in the University, Dr. Harker has published most of the results of his investigations, whether in the field, the laboratory, or with the microscope, in a permanent form, for the use of geologists generally; and the Editor is happy to record that, of his numerous publications, fifty are preserved in the pages of the *GEOLOGICAL MAGAZINE*.

Dr. Harker received the Wollaston Donation Fund, 1896; the Murchison Medal, 1907. He was President of Section C, British Association, at Portsmouth, 1911. He has also kept up connexion with his native county, and was President of the Yorkshire Naturalists' Union, 1911, and President of the Yorkshire Geological Society, 1912-13. The McGill University (Montreal) conferred on Dr. Harker the honorary degree of LL.D. in 1913. He is at this time President of the Geological Society of London, 1916-17, till February, 1918.

LIST OF DR. A. HARKER'S PRINCIPAL GEOLOGICAL WRITINGS.

1884. "Graphical Methods in Field Geology": *GEOL. MAG.*, pp. 154-62.
1885. "The Oolites of the Cave District": *Naturalist*, pp. 229-32.
 "The Cause of Slaty Cleavage": *GEOL. MAG.*, pp. 15-17.
 "On the Successive Stages of Slaty Cleavage": *ibid.*, pp. 266-8.
1886. "Report on Slaty Cleavage and Allied Rock Structures": *Rep. Brit. Assoc. for 1885*, pp. 813-52.
1887. "On some Anglesey Dykes," I and II: *GEOL. MAG.*, pp. 409-16, 546-52.
1888. "Notes on the Geology of Mynydd Mawr and the Nantlle Valley": *ibid.*, pp. 221-6.
 "On some Anglesey Dykes," III: *ibid.*, pp. 267-72.
 "Additional Note on the Blue Hornblende of Mynydd Mawr": *ibid.*, pp. 455-6.
 "On the Eruptive Rocks of the Neighbourhood of Sarn, Caernarvonshire": *Q.J.G.S.*, vol. xlv, pp. 442-61.
1889. "Notes on the Physics of Metamorphism": *GEOL. MAG.*, pp. 15-20.
 "Local Thickening of Dykes and Beds by Folding": *ibid.*, pp. 69-70.
 "Eyes of Pyrites and other Minerals in Slate": *ibid.*, pp. 396-7.
The Bala Volcanic Series of Caernarvonshire (Sedgwick Prize Essay for 1888), 8vo, Cambridge.
 "Petrological Notes on Boulders from the Boulder-Clays of East Yorkshire": *Proc. Yorks. Geol. Soc.*, vol. xi, pp. 300-7.
1890. "Petrological Notes on Some of the Larger Boulders on the Beach South of Flamborough Head": *ibid.*, pp. 409-23.
1891. "The Ancient Lavas of the English Lake District": *Naturalist*, pp. 145-7.
 "Notes on a Collection of Rocks from the Tonga Islands": *GEOL. MAG.*, pp. 250-8.
 (With J. E. Marr.) "The Shap Granite and the Associated Igneous and Metamorphic Rocks": *Q.J.G.S.*, vol. xlvii, pp. 266-327.
 "Petrological Notes on Rocks from the Cross Fell Inlier": *ibid.*, pp. 512-25.
 "Thermo-metamorphism in Igneous Rocks": *Bul. Geol. Soc. Amer.*, vol. iii, pp. 16-22.
1892. "Physical Geology in the Basin of the Colorado": *Natural Science*, vol. i, pp. 205-10.
 "The Lamprophyres of the North of England": *GEOL. MAG.*, pp. 199-206.
 "Porphyritic Quartz in Basic Igneous Rocks": *ibid.*, pp. 485-8.
1893. "Norwegian Boulders in Holderness": *Naturalist*, pp. 1-4.
 "The Use of the Protractor in Field Geology": *Sci. Proc. Roy. Dubl. Soc. (n.s.)*, vol. viii, pp. 12-20.
 (With J. E. Marr.) "Supplementary Notes on the Metamorphic Rocks around the Shap Granite": *Q.J.G.S.*, vol. xlix, pp. 359-71.
 "On the Migration of Material during Thermal Metamorphism": *Journ. Geol.*, vol. i, pp. 574-8.
 "Extinction Angles in Cleavage - Flakes": *Min. Mag.*, vol. x, pp. 239-40.
 "Berthelot's Principle applied to Magmatic Concentration": *GEOL. MAG.*, pp. 546-7.

1894. "Carrook Fell: a Study in the Variation of Igneous Rocks," I: Q.J.G.S., vol. 1, pp. 311-36.
 "The Evolution of Igneous Rocks": *Science Progress*, vol. i, pp. 152-5.
 "Ancient Volcanic Rocks": *ibid.*, vol. ii, pp. 48-63.
 "Cordierite in the Lake District": *GEOL. MAG.*, pp. 169-70.
 "On some Variolitic Rocks on Carrook Fell": *ibid.*, pp. 551-3.
1895. "Carrook Fell: a Study in the Variation of Igneous Rocks," II and III: Q.J.G.S., vol. ii, pp. 125-47.
Petrology for Students: an Introduction to the Study of Rocks under the Microscope, 8vo, Cambridge. (Revised editions in 1897, 1902, and 1908, and French translation in 1902.)
1896. "On certain Granophyres, modified by the Incorporation of Gabbro Fragments, in Strath (Skye)": Q.J.G.S., vol. lii, pp. 320-8.
 "The Natural History of Igneous Rocks. I. Their Geographical and Chronological Distribution": *Science Progress* (N.S.), vol. i, pp. 12-33.
1898. "The Natural History of Igneous Rocks. II. Their Forms and Habits": *ibid.*, vol. ii, pp. 203-18.
1899. "Glaciated Valleys in the Cuillins, Skye": *GEOL. MAG.*, pp. 196-9.
 "On the Average Composition of British Igneous Rocks": *ibid.*, pp. 220-2.
 "Notes on Subaërial Erosion in the Isle of Skye": *ibid.*, pp. 485-91.
 (With C. T. Clough.) "On a Coarsely Spherulitic ('Variolitic') Basalt in Skye": *Trans. Edin. Geol. Soc.*, vol. ii, pp. 381-9.
1900. "Magnetic Disturbances in the Isle of Skye": *Proc. Camb. Phil. Soc.*, vol. x, pp. 268-78.
 "Igneous Rock-Series and Mixed Igneous Rocks": *Journ. Geol.*, vol. viii, pp. 389-99.
1901. "On a Question Relative to Extinction-Angles in Rock-Slices": *Min. Mag.*, vol. xiii, pp. 66-8.
 "Ice-Erosion in the Cuillin Hills, Skye": *Trans. Roy. Soc. Edin.*, vol. xl, pp. 221-52.
 "The Sequence of the Tertiary Igneous Rocks of Skye": *GEOL. MAG.*, pp. 506-9.
1903. "The Overthrust Torridonian Rocks of the Isle of Rum, and the Associated Gneisses": Q.J.G.S., vol. lix, pp. 189-215.
1904. (With C. T. Clough.) *The Geology of West Central Skye, with Soay* (Mem. Geol. Surv. Scot.).
 (With notes by C. T. Clough.) *The Tertiary Igneous Rocks of Skye* (Mem. Geol. Surv. U.K.).
1905. "The Tertiary Crust-Movements of the Inner Hebrides": *Trans. Edin. Geol. Soc.*, vol. viii, pp. 344-50.
1906. "The Geological Structure of the Sgùrr of Eig": Q.J.G.S., vol. lxii, pp. 40-67.
 "Cordierite in the Metamorphosed Skiddaw Slates": *Naturalist*, pp. 121-3.
 "A Cordierite-bearing Lava from the Lake District": *GEOL. MAG.*, pp. 176-7.
1907. "Notes on the Rocks of the *Beagle* Collection," I: *ibid.*, pp. 100-6.
 "Igneous Rock-magmas as Solutions": *Science Progress*, vol. ii, pp. 239-54.
1908. (With contributions by G. Barrow.) *The Geology of the Small Isles of Inverness-shire* (Mem. Geol. Surv. Scot.).
1909. *The Natural History of Igneous Rocks*, 8vo, London.
1910. *Tables for Calculation of Rock Analyses*, Cambridge.
1912. Presidential Address to Section C (Geology): *Rep. Brit. Assoc. for 1911*, pp. 370-81.
 "Petrology in Yorkshire" (Presidential Address to the Yorkshire Naturalists' Union): *Naturalist*, pp. 37-44, 69-73.

1912. "Lamprophyre Dykes in Long Sleddale": *ibid.*, pp. 266-7.
1914. "Fractional Crystallization the Prime Factor in the Differentiation of Rock-magnas": *Congr. Géol. Int. Comp.-Rend.*, xii, pp. 205-8.
- "The Sgùrr of Eigg: some Comments on Mr. Bailey's Paper": *GEOL. MAG.*, pp. 306-8.
- "Some Remarks on Geology in Relation to the Exact Sciences, with an Excursus on Geological Time" (Presidential Address to the Yorkshire Geological Society): *Proc. Yorks. Geol. Soc.*, vol. xix, pp. 1-13.
1916. "Differentiation in Intercrustal Magma-Basins": *Journ. Geol.*, vol. xxiv, pp. 554-8.
1917. Presidential Address to the Geological Society of London, delivered February 16 (see Reports and Proceedings, *GEOL. MAG.*, pp. 191-2, April, 1917).

II.—CRETACEOUS MOLLUSCA FROM NEW ZEALAND.

By C. T. TRECHMANN, M.Sc., F.G.S.

PLATES XIX AND XX.¹

INTRODUCTION.

OWING to incomplete palæontological knowledge, the true age and correlation of the various divisions of the great Mesozoic series of New Zealand, which, together with the Maitai Series, forms such an important element in the structure of the country, has long remained a matter of uncertainty. In consequence the idea has to some extent taken hold among New Zealand geologists that the Mesozoic faunas, owing to supposed conditions of isolation, show archaic features. It was explained that certain Permian forms occurred in the Trias and that Trias forms may have persisted into Jurassic times, and to a still greater extent that a Cretaceous fauna lived on in this portion of the earth into the Tertiary period.

On going further into these questions I find no support for the theory, and in the case of the Cretaceous, a comparison of the fauna of the Senonian with corresponding faunas of Australia and especially of South America shows that the isolated survival theory is untenable. The arguments adduced in its favour apply equally well to the Cretaceous of South America and other parts of the Indo-Pacific region as they do to New Zealand.

It must be remembered that the present isolation of New Zealand as a land mass is a phenomenon of late geological time. In the Permo-Carboniferous period there was as much or more land in the Southern Hemisphere as there now is in the Northern. The Cretaceous and Tertiary faunas of New Zealand point to a much closer connexion with South America than obtains at the present day. The number of species of recent Mollusca common to the coasts of New Zealand and Tierra del Fuego is now very slight.

In a paper recently published in this Magazine² I showed that the Maitai Series contains a fauna which agrees, so far as it goes, exactly with that of the marine Permo-Carboniferous of New South Wales

¹ Plate XXI will appear with the second part in the August Number.

² "The Age of the Maitai Series of New Zealand": *GEOL. MAG.*, N.S., Dec. VI, Vol. IV, pp. 53-64, Feb. 1917.