

production of falls of snow in the higher northern latitudes, and, therefore, an increased snow-fall in one portion of these latitudes must be compensated by diminished snow-fall in another portion.

I have omitted to notice the effects which might be produced when the snow-caps thus formed were set in motion. Moving masses of ice or snow might considerably alter the general phenomena of glaciation. If we take the most southerly portion of our hemisphere in which permanent glaciation is possible, the snow-cap would form most readily if the irruption of northern ice commenced about the same period when the conditions for local glaciation were becoming favourable. These latter conditions would, I apprehend, be most favourable when the earth was in aphelion at midsummer; but the Polar Pack would not attain its full dimensions until some time after the mid-winter aphelion, and in its slow southward motion it might not begin to overrun the northern portion of the Temperate Zone until a still later period. The invasion of Polar ice might nearly coincide with the commencement of the local glaciation produced by very different causes, and a Glacial period would result.

13, BELVIDERE PLACE, DUBLIN,
MAY 7TH, 1887.

W. H. S. MONCK.

O B I T U A R Y .

EDWARD TOWNLEY HARDMAN, F.C.S., F.R.G.S.I., ETC.

BORN 6TH APRIL, 1845; DIED 30TH APRIL, 1887.

GEOLGICAL science has suffered a serious loss in the early death, from typhoid fever, of Mr. Hardman, of the Irish branch of the Geological Survey of the United Kingdom.

Descended from an old and respected Drogheda family, Mr. Hardman received his early education at that town. Having by his ability won a Government Exhibition and entered the Royal College of Science, Dublin, in 1867, he obtained a diploma in mining, etc., as well as numerous prizes, and in 1870, he was appointed to the staff of the Geological Survey of Ireland. In 1871 he was elected a Fellow of the Geological Society of Ireland, and in 1874 of the Chemical Society of London.

He examined, and prepared a Memoir upon, the Geology of the Coal-fields of Kilkenny and Tyrone, and prepared a list of papers on the Geology of the North of Ireland. Mr. Hardman was also an active and earnest antiquary, and communicated several papers to the Royal Irish Academy.

In 1883 he was selected by the Colonial Office to examine and report upon the geology and mineral resources of the Kimberley district of the colony of West Australia. Here he was attached to a local surveying expedition, under the direction of the Hon. J. Forrest, C.M.G., Crown Surveyor General to the Colony, and set out for the North-East Territory. Having a camera, he was enabled to photograph numerous points of interest, and also to make sketches of characteristic geological sections. The most important practical

result of his investigations was the discovery of an extensive gold-field in the vicinity of the Napier Range in the Kimberley district, where by actual experiments he was able to attest the presence of auriferous deposits at various points.

There is no doubt that Mr. Hardman's work was performed in such an efficient and satisfactory manner that he would have been at once appointed as geologist to the Colony, but for the difficulties raised by the Legislative Council on the subject of expenditure. His engagement having terminated, he returned home in October, 1885, bearing however the assurance that he would certainly be appointed if the post was created.

Last year he was called upon to assist in the arrangement of the rocks, fossils, and minerals sent by West Australia for the Colonial and Indian Exhibition in London.

He had returned to his duties on the Irish Survey, and in March last he inspected a district in the Wicklow Mountains and adjacent country, with the view to compiling a second Survey Memoir thereon; his constitution no doubt suffered owing to the inclemency of the weather and frequent exposure to snowstorms and rain amongst the hills, so that when attacked by fever he was too reduced in health to withstand its effects, and he passed away after only a few days' illness, leaving a widow and two young children quite unprovided to face the struggle for existence deprived of a father's protection and support.

It is all the more sad to think that had he lived the long-desired post of geologist to West Australia would have been offered to Mr. Hardman, the financial difficulties in the way of his appointment having been removed just before he died.

A considerable reward had been offered by the Government for the discovery of gold in the colony, and Mr. Hardman was at the time of his death a claimant for the prize. It is earnestly to be hoped that the Legislative Council will be pleased to award at least a part of such premium to the widow of the man who discovered the Kimberley Gold-field.

The following is a list of the papers of which Mr. Hardman is the author:—

1. On the Analysis of Trachyte Porphyry from Tardree Quarry near Antrim. Roy. Geol. Soc. Ireland, May 10, 1871.
2. On the Analysis of a Limestone compared with that of the same rock where it is in close proximity to a Doleritic Dyke. R.G.S.I., June 14, 1871.
3. On the Occurrence of Gypsum in Keuper Marls near Coagh, Co. Tyrone. R.G.S.I., June 12, 1872.
4. On the Recent state of Coal Mining in the County of Tyrone. Roy. Dub. Soc., Nov. 18, 1872.
5. List of Geological Papers on North of Ireland. Mems. G. Sur. I., 1872.
6. On the Occurrence of Silicious Nodular Brown Hæmatite (Gothite) in the Carboniferous Limestone beds near Cookstown, Co. Tyrone. R.G.S.I., May 14, 1873.
7. On Analysis of White Chalk from the Co. Tyrone; with Notes on the occurrence of Lime therein. R.G.S.I., June 11, 1873.
8. Notes on a Small Raised Beach at Tramore Bay, Co. Waterford, showing traces of severe oscillatory movements during the recent period. R.G.S.I., Dec. 10, 1873.

9. On the Substitution of Zinc for Magnesium in Minerals. *Roy. Irish Acad.* vol. i. 1870, p. 533; *GEOL. MAG.*, May, 1874.
10. Further Researches on the supposed Substitution of Zinc for Magnesium in Minerals. *R.I.A.*, vol. iii. p. 146.
11. On Bones discovered in a Cave of Dunmore, Co. Kilkenny. *Proc. R.I.A.*, 1870-1879, p. 354.
12. On Two new Deposits of Human and other Bones discovered in the Cave of Dunmore, Co. Kilkenny. *P.R.I.A.*, February 22, 1875.
13. On the Age and Mode of Formation of Lough Neagh, Ireland; with Notes on the Physical Geography and Geology of the surrounding country. *R.G.S.I.*, January 13, 1875.
14. On the Origin of Anthracite, with suggestions as to the possible Correlation in time and manner of Production of the Anthracite of Southern Ireland, Wales, Devonshire, and France. *R.G.S.I.*, 1875.
15. On the Sub-Glacial Theory of Gravels. *GEOL. MAG.*, April, 1875.
16. Analysis of Coals and Ironstones from the Dungannon Coal-fields, Co. Tyrone. *R.I. Acad.*, February 28, 1876.
17. A Contribution to the History of Dolomite (with plates). *R.I. Acad.* (xli. and xlii.) vol. ii. p. 705.
18. The Dolomites of the Carboniferous Limestones of Ireland. *R.I.A.*, May 8, 1876.
19. Fossiliferous Pliocene Clays. *GEOL. MAG.* Dec. II. Vol. III. p. 556, 1876.
20. On a Triple System of Post-Miocene Faults in the Basaltic Region around Lough Neagh. *R.G.S.I.*, April 11, 1877.
21. Memoir on Tyrone Coal-field. *Mems. G.S.I.*, 1877.
22. Chemical Notes in Connection with Prof. Hull's paper on the Nature and Origin of the Beds of Chert in the Upper Carboniferous Limestone of Ireland. *R.G.S.I.*, May 9, 1877.
23. On the Barytes Mines near Bantry. *R.G.S.I.*, January 21, 1878.
24. On Hullite: a hitherto undescribed mineral: a hydrous Silicate of peculiar composition from Carnmoney Hill, Co. Antrim, with analysis. *R.I. Acad.*, June 24, 1878.
25. Preliminary Report on Soundings in Lough Gill, Co. Sligo. *R.I.A.*, vol. iii. p. 473.
26. Memoir on the Kilkenny Coal-field. *Mems. G.S.I.*, 1881.
27. First Report to Government on the Geology of the Kimberley District, West Australia. 1884.
28. Second Report to Government on the Geology of the Kimberley District, West Australia. 1885.
29. Notes on a Collection of Flint Implements and other Weapons, etc., from Tropical Western Australia. *R.I.A.* (in course of publication). Read 22 February, 1886.
30. Catalogue of the Geological Survey (Ireland) Library (for private official use). 1886.
31. Notes on some Habits and Customs of the Natives of Kimberley, West Australia. *R.I.A.* (in course of publication). Read 10 January, 1887.
32. Memoir on the Geology of the Country in Sheets 148-49 *Geol. Surv. Ireland.* *Mems. G.S.I.* (in the press). 1887.
33. Note on Professor Hull's paper with reference to Dr. Hinde's paper on Beds of Sponge Remains; Greensand. *Royal Society, Lond.*, April 28, 1887.

A. B. W.

It is with deep and sincere regret that we record the death, on the 5th June, of our friend and fellow-worker in geology, ARTHUR CHAMPERNOWNE, Esq., M.A., F.G.S., of Dartington Hall, Totnes, S. Devon, aged 48 years. We hope to publish a notice of his life and work in our next Number.—EDIT. *GEOL. MAG.*