

Elements of Quaternions. By Sir W. Hamilton. 2nd edition. Edited by C. J. Joly. Vol. ii. Pp. liv+502. (London: Longmans and Co., 1901.) Price 21s. net.

THIS being the second volume of the reprint of a book that has become classical, and is known, by reputation at least, to all mathematicians, it is unnecessary to review it at much length. A comparison, however, seems to be called for between the work of the master and that published by his great disciple, Prof. Tait, since the first edition of the "Elements" made its appearance. The methods of treatment adopted differ radically. Prof. Tait's book is "essentially a working one," and for the most part contains only those formulæ that are necessary to a student when he commences the study of quaternions, and will afterwards be his working formulæ for general use. Sir W. Hamilton's book, on the other hand, aims at completeness. It gives fifty-three transformations for the vector of torsion of a curve in space, and treats the whole of the theory of curves and surfaces with the same elaboration! This wealth of methods and formulæ, which will only confuse the student who wishes to learn quaternions merely in order to apply it in his investigations in physics, &c., makes the book indispensable to the student who studies the subject for its own sake, or who wishes to deepen or consolidate the knowledge of it that he already possesses. Hamilton passes over statics and rigid dynamics quickly, but he treats dynamics and Fresnel's wave surface with his usual fulness.

About a quarter of this volume is occupied by notes by Prof. Joly. Among these are some on the invariants of linear vector functions, on the tri-linear function, and on the kinematical treatment of curves and surfaces. There is a long note on the operator ∇ , a symbol which Hamilton does not use in the "Elements." These notes are very valuable, both because they bring the work up to date, and because they are very suggestive of fields for original investigation. We regret that mention is not made of the properties of the quaternion that is the sum of the vector and scalar potentials in the case of irrotational fluid motion, &c., and that several useful words, such as "curl," "convergence," "vector potential" are little used. No mention is made of the notation (f, g, h) for a vector.

A difficulty under which quaternions at present suffers is that, on the one hand, a worker in a branch of applied mathematics does not care to publish papers in quaternion notation for fear that few will understand him; and, on the other hand, that the lack of such papers discourages the study of quaternions. The notation just referred to seems likely to afford a convenient bridge between Cartesian and quaternions. An investigation of the electromagnetic wave surface by Prof. Tait is quoted in a footnote. It might have been added that the surface was first found by Heaviside. The omission is no doubt due to Heaviside's use of vector algebra, but it is perhaps allowable to consider the latter to be quaternions written in a modified (but not improved) notation. H. C. P.

Our Country's Shells and How to Know Them: a Guide to the British Mollusca. By W. J. Gordon. Illustrated by A. Lambert. Pp. vii + 152. Thirty-three coloured plates. (London: Simpkin, Marshall, Hamilton, Kent and Co., Ltd.) Price 6s.

COLLECTORS of British shells will find this volume very useful for reference. The plates include coloured pictures of all our mollusca having shells, drawn life size in most cases, and also representatives of each genus without shells. Analytical tables are given to facilitate identification, and there are chapters on the habits and structures of the mollusca. If the collection of shells induces students to study the characteristics of the living animals, the book will be a means of education in natural history as well as a convenient reference manual.

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LETTERS TO THE EDITOR.

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Our Mountain Seclusion.

IN these days of continuous railway expansion it is only natural and desirable that our mountain solitudes should be made accessible to the general public. But obviously this praiseworthy object should not be attained by the destruction of the very seclusion which it is proposed to reach. A line of railway, with its cuttings, tunnels, embankments, stations, smoke and noise, will carry us much more swiftly and conveniently into a remote glen than the older and quieter modes of locomotion, but we then find that the charm of loneliness which used to give the glen its special fascination has disappeared. Where this transformation is absolutely necessary for the general benefit of the public we must submit to it, though with a sigh. But where the necessity or even the advantage may be disputed, surely the beauty or grandeur or solitude of untouched and unspoiled nature ought to be allowed to have a potent influence in the decision of such matters.

I have just heard of an assault at present being waged against the sanctities of Snowdon, and though it may be impracticable to ward off or mitigate that assault, and possibly too late, even if originally practicable, the attention of all lovers of scenery and of all geologists may well be drawn to it. A bill which has been introduced into Parliament for the construction of the Portmadoc, Beddgelert and South Snowdon Electric Railway, or Tramway, has passed the House of Lords and the Examiners in the House of Commons. If the line is ultimately sanctioned it will greatly lessen the quiet beauty of one of the loveliest and most secluded scenes in Britain—the easily accessible valley on the south side of Snowdon. I understand that, as the result of pressure, the Company has given way with reference to a proposed embankment in the Pass of Aberglaslyn, and will content itself with a brief disappearance in a tunnel. But geologists will learn with vexation that one important part of the scheme consists in the embanking of that picturesque mountain tarn, Llyn Llydaw, for the purpose of obtaining water-power. I need not refer to the special interest and importance of this lake-basin in questions of glacial and physiographical geology. Though it has long been studied, it has not yet yielded up all that it has to tell in these departments of science. But the transformation proposed to be effected by the company will silence it for ever by destroying the evidence which it can now afford.

Can nothing be yet done to save this geological sanctuary from the vandalism of the modern company promoter?

June 22.

ARTH. GEIKIE.

The National Antarctic Expedition.

THERE is one allusion in the article on the above subject last week which calls for a few words from me. I refer to the first introduction of the word "civilian." Through the kindness of a friend I have recently had the opportunity of seeing a copy of the agenda. The agenda correspond with the minutes, and the word "civilian" is used in both. I had myself forwarded the motion concerning the scientific leadership to the secretary to be put on the agenda, and the word "civilian" certainly had no place in my communication.

At the meeting I moved, and Prof. Herdman seconded, the motion in the terms of my original communication, and neither of us noticed the change on the agenda paper.

We must therefore plead guilty to some carelessness and inattention; but the argument in my letter to the Fellows of the Royal Society is not seriously affected. An important change, exceeding the instructions drawn up for the guidance of the Executive Committee, is not, on any reasonable view, properly introduced by a single word which appears in the agenda and is not noticed or used by the mover and seconder of the motion. So important a question of principle obviously demanded very special discussion.

June 22.

EDWARD B. POULTON.