water eel was first identified on the coast of Sicily, and Dr. Schmidt has stated that the full-grown larvæ were not found by him east of the 500 fathom line, which is inconsistent with the view that they pass through the Straits of Gibraltar. It has been stated, also, that metamorphosed elvers are found at the mouth of the Nile in February, which is as early as, or earlier than, the time of their annual appearance on the west coast of Ireland, although the coast of Egypt is so much farther from the Atlantic breeding place.

On the other hand, Grassi and Calandruccio do not state that they obtained on the coast of Sicily the youngest and earliest stages of the Leptocephalus of the eel. The depth of the sea to the north of Sicily increases to more than 1000 fathoms and it is possible that this is a sufficient depth for eels to spawn in, but if they do spawn there the very young larvæ and the eggs should be captured there. This brings us to the question of the eggs, and Schmidt himself has not yet obtained them from the Atlantic or identified them with certainty. On the other hand, Dr. Raffaele, an extremely able Italian naturalist, studied and described at Naples in 1885–1887 a number of buoyant fish-eggs which, from the characters of the larvæ hatched from them, certainly belong to the eel family. The question is: Was one kind of these eggs the egg of the common eel? One kind had a single oil globule in the yolk, and the youngest of the eel larvæ seen by Dr. Schmidt show a single oil globule in the portion of yolk still unabsorbed. But the larva hatched from this egg, although certainly a Leptocephalus, has not been identified with the larva of the common eel. The question, therefore, whether the eel spawns and develops in the Mediterranean cannot yet be answered positively, though the above facts indicate the possibility, if not the probability, that it does so.

In conclusion, we may mention some remarkable facts concerning both the eel and the conger in the adult state. In the first place, there is a great difference between the sexes in size. The male eel seldom exceeds a length of 18 in., while the females may reach a length of 3 ft. or somewhat more. In the conger the difference is still greater. The present writer made a study of the conger for a considerable time at the Aquarium and Laboratory of the Marine Biological Association at Plymouth. The largest male conger recorded was not quite 2 ft. 6 in. in length, while females 6 ft. in length are common, and specimens up to 8 ft. 3 in. in length are on record. Secondly, although nothing has been seen of mature eels after their descent to the sea, observations of the present writer and one or two others on conger in the aquarium show that both sexes cease to feed when the reproductive organs begin to mature, and they live for three to six months without feeding, and finally die, the females without spawning, the males in a mature condition. When the females die the roes are enormously enlarged though the eggs are not quite mature. But a more extraordinary fact is that the bones have lost all their lime, and become soft as cheese, while the muscles are much reduced. The males before they die get into a much worse condition, the skin becomes ulcerated, the body emaciated, and the eyes so much diseased that the fish is quite blind. It is evident, therefore, that though the female conger is unable to spawn in the aquarium, this process taking place naturally at depths of more than 1000 fathoms, both sexes spawn only once and die a natural death when the reproductive function has been accomplished.

Dr. Schmidt concludes from his discoveries that the fresh-water eel, which lives the whole of its life after its metamorphosis in inland fresh waters, but is hatched and developed in the sea and returns to great depths of the ocean to breed, is to be regarded as properly a marine fish. On the other hand, there is good evidence that the earliest bony fishes were evolved in fresh water, and some of the more primitive forms, such as the carp family, are still confined to rivers and lakes; few of them live exclusively in salt water. Migration from river to sea or sea to river is not uncommon among these more primitive fishes, as, for example, in the salmon family. Here the migration is in the opposite direction from that of the eel; salmon leave the sea and ascend rivers in order to spawn, and go down to the sea to feed and grow. The Pacific salmon (*Oncorhynchus yschawitscha*) offers a case almost as wonderful as that of the eel. It ascends great rivers of N.W. America and N.E. Asia to distances from 1000 to more than 2000 miles from the coast, and, like the eel, spawns only once and then dies.

## Obituary.

### Rev. Prof. T. G. Bonney, F.R.S.

THOMAS GEORGE BONNEY, whose death on December 10 was referred to in NATURE of December 15, was born at Rugeley on July 27, 1833. His family is of Huguenot origin, and both his father and grandfather, the latter a fellow of Jesus College, Cambridge, were hard-working clergymen of wide and varied interests. After a distinguished career at Uppingham, Bonney entered at St. John's College, Cambridge, and in 1856 took a degree both in the Mathematical and the Classical Tripos.

Bonney was elected to a fellowship at St. John's in 1859 and returned to the College in 1861 as junior dean. A movement was then in progress to secure a wider recognition in the University for the study of natural science: this was joined by Bonney whole-heartedly, and one of the first results was an open exhibition in natural science offered by St. John's. In 1868 he was appointed tutor, and in 1869 lecturer in geology in the College. He had been interested in this subject from boyhood up, and his mathematical training had particularly fitted him for its pursuit. At this time Sedgwick occupied the chair of geology, but was prevented by failing health from exercising his functions as professor. The teaching of geology in the University devolved in consequence upon Bonney, who thus became the founder of the flourishing school which has given pre-eminence to Cambridge in this subject ever since. He was the first to introduce into English teaching the new petrology which had sprung from Sorby's application of the microscope to the study of rocks in thin slices, and his work has since been brilliantly developed by the labours, now continued for many years, of Dr. A. Harker.

As a tutor Bonney realised the ideal. Among those



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who had the good fortune to be his pupils in the early 'seventies were Sir J. J. H. Teall, Sir Aubrey Strahan, and Profs. Sollas, Marr, and Watts. All regarded him not merely as a tutor whose duty was to exercise strict discipline, but as a personal friend deeply interested in their welfare. He invited confidence, and there were few subjects he was unwilling to discuss. In country walks where he had but one companion even religion was not "taboo," and the most heretical views were listened to and considered with kindly tolerance. At his hospitable table, conversation over the wine did much to broaden our youthful outlook upon life; and on the numerous occasions when we gathered together at an evening reception in his rooms, we were introduced to some of the leading investigators of the day, and learnt that these princes of our science after all were human.

When quite a young man Bonney was captivated by a love of mountains and mountain climbing—he was at one time president of the Alpine Club—and this led him to take a particular interest in their features and structure, as well as in the phenomena of their attendant glaciers. To these subjects he returned again and again in his published writings. His intimate acquaintance with living glaciers proved of great assistance in his treatment of the manifold problems presented by the Great Ice Age, and his knowledge of the Alps served him equally well when he turned his attention to the surviving remnants of the great mountain chains of the past. Thus after a study of the folded complex which is all that remains in Devonshire of the ancient Armorican mountains he concludes "with perfect justice that this great series of folds scarcely yields in importance to the existing chain of the Alps and the gneiss of the Eddystone finds its parallel in the gneiss cores of those mountains."[1]

Bonney was among the first to recognise the truth of Nicol's views on the age of the so-called "newer" gneiss of the north-west Highlands of Scotland, but notwithstanding his familiarity with the great overthrusts which distinguished the Caledonian chain, he was never able fully to accept the evidence for the existence of those horizontal movements which, even on a grander scale, have affected the Alps. This has led to the rather unfair remark that Bonney was inclined to be sceptical of discoveries which he had not made himself.

Of the many important contributions which Bonney made to our knowledge of the stratified rocks, we may cite as of especial importance, first, his explanation of the Bunter beds of the Midlands, which he regarded as fluviatile deposits derived in large part from the Torridon beds of Scotland, and next, his account of the Pre-Cambrian rocks of Charnwood Forest. Prof. Watts, who afterwards studied this area in detail, was deeply impressed with the accuracy and completeness of Bonney's observations, and once remarked that Bonney had left but little for his successors to discover.

The relation of igneous to sedimentary rocks was a question in which Bonney took great interest at a time when extreme views on metamorphism were in fashion, and he impressed upon his pupils the fallacy of the Huttonian view which imagined the igneous rocks to turn into the sedimentary and the sedimentary back again into the igneous in a recurring cycle.

Though a great traveller and remarkably active in the field, Bonney was equally at home with the microscope: his petrological studies are numerous and important, and his name will always be associated with such rocks as serpentine, picrite, luxullianite, eclogite, lherzolite, and the matrix of the diamond. Palæontology he left severely alone; his only incursion into this field was when he investigated the structure of *Eozoon Canadense* and rightly concluded that it was no fossil but merely a kind of rock.

Besides his contributions to the literature of scientific societies, which number some hundreds, Bonney published several books on geological subjects, of which the more important are "The Story of our Planet" (1893), "Charles Lyell and Modern Geology" (1895), "Ice Work" (1896), and "Volcanoes" (1898). He was president of the Geological Society in 1884–6; Boyle lecturer, 1890–92; Rede lecturer, Cambridge, 1892; vice-president of the Royal Society, 1899; president of the British Association, 1910–11.

A scientific career was not enough to exhaust the energies of this many-sided man: he was also a clergyman and frequently officiated in the ministrations of the Church; he was Whitehall preacher 1876–1878, and on several occasions was chosen to deliver the sermon in connexion with annual meetings of the British Association. A selection of his sermons is published in four volumes.

On his retirement from active life Bonney made his home in Cambridge, but did not resign himself to idleness; he still found a pleasure in teaching and acted as a volunteer demonstrator in the petrological department of the Geological School, performing his duties as faithfully and regularly as in a paid post, and this he continued to do until incapacitated by a lingering illness which terminated by euthanasia on December 10, 1923. A memorial service was held in St. John's College and attended by a large concourse of mourners, among whom were many well-known dignitaries and many of his former students.

If, reflecting on this life so manifold in its interests, so industrious in their fulfilment, we venture to ask what is the outstanding feature it most deeply impresses on us: the answer will undoubtedly be its human qualities. When in 1895 a crowd of his former students met in University College, London, to present him with a portrait of himself, this was the feeling that prevailed among them, and found expression in the words of one of those present, who spoke of "the tutor we feared, the master we reverence, and the friend whom we love and respect."

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WE regret to announce the following deaths:

Prof. C. K. Clarke, since 1907 professor of psychiatry and dean of the medical faculty from 1907 until 1920 in the University, Toronto, aged sixty-nine.

Prof. G. H. Quincke, For. Mem. R.S., from 1875 until 1907 professor of physics in the University of Heidelberg, aged eighty-nine.

M. J. M. E. Stephan, correspondant of the Paris Academy of Sciences and honorary director of the Observatory of Marseilles, on December 31, aged eighty-six.

[1] Suess, "The Face of the Earth," vol. ii. p. 89. (English translation of "Das Antlitz der Erde.")



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