

company's district in the South of England, he was always to be found superintending the arrangements in person. He was elected an Associate of the Institution on the 7th of December, 1858, and to the last he retained a strong interest in the success and development of the Institution. He had been member of various Lodges of Freemasons for over forty years, holding office in all. At the time of his decease, he was the oldest Past-Master of the Britannia. He died on the 1st of November, 1888, and was buried in the Brighton Cemetery on the 5th of that month. A large number of his old colleagues and employees attended the funeral, notwithstanding that nearly twenty years had elapsed since his retirement from active life.

GRAHAM HEWETT HILLS, Staff Commander, Royal Navy, was born on the 5th of July, 1826, at St. Lawrence's, near Ramsgate, his father, the late Captain John Hills, R.N., being then a lieutenant attached to H.M.S. "Ramilies," 74, stationed at Pegwell Bay. He received an education in mathematics and classics under a graduate of Cambridge, at Lancing, in Sussex, till April, 1842, when he embarked as a midshipman in one of Messrs. Soames's vessels then employed as a transport in the service of the Admiralty. This ship, during the first war with China, was sent to Hong Kong, where Mr. Hills contracted the illness which well nigh decimated the troops engaged in the expedition. But through the almost parental care of his captain, he was brought home alive. On his restoration, he embarked again in another transport of the same owners, engaged as a troopship for the service in the West Indies. Returning to England in December, 1844, he was soon after entered by the Admiralty as Master's Assistant, and joined H.M.S. "Victory," at Portsmouth, on February 20th, 1845; being thus settled in the navigating branch of the royal navy. On the 18th of March, 1845, he was transferred to H.M.S. "Vindictive," 50, carrying the flag of Vice-Admiral Sir F. W. Austen, and commanded by Captain Sir Michael Seymour, with an old shipmate of his father, Lieutenant Franklyn, as First Lieutenant. In this ship he served till the 16th of June, 1848. By his log-book he can be traced as employed occasionally on surveying service, and drawing and copying charts. Particularly, he was several times engaged in buoying the outer shoals at Halifax. On the 19th of

June, 1848, Mr. Hills was again appointed to the old "Victory," the flagship at Portsmouth, and on the 28th of June, he received his commission for the rank of Second Master. On the 19th of September following, he was removed into H.M. steam vessel "Dwarf," Lieutenant Sherard Osborne commanding. In company with another steamship, the "Dwarf" started the next day for Ireland, being destined to intercept the communications of the disaffected followers of Mr. Smith O'Brien, in the River Suir, and to encourage and support the loyal. In this service the vessel was frequently patrolling the river from Waterford to Carrick-on-Suir, often with much doubt where her old-fashioned and nearly worn-out machinery and frame would land her. Mr. Hills utilized his opportunities to make a survey of the river, and drew up sailing-instructions for it which were published by the Admiralty. The collapse of the armed movement of Mr. Smith O'Brien enabled the services of the "Dwarf" to be dispensed with in the Suir, and on the 19th of January, 1849, the "Dwarf" proceeded to Haulbowline, in Cork harbour, for a complete refit. In June, the vessel returned to the Suir, and made one trip up the river, and was at Queens-town again in August, assisting in the honours of the visit of the Queen and Prince Consort. On the 15th of November, 1849, Lieutenant Sherard Osborne retired on half-pay, and for the remainder of the commission, Mr. Hills was commander.

This insight into coast service in Ireland, led to Mr. Hills being commissioned on the 13th of April, 1850, on the Irish coast survey. Accordingly, on the 15th of that month, he joined H.M.S. "Sparrow," at Waterford, on surveying service under Captain Fraser, R.N.; under whom he took command of the ship whilst the survey was completed from Carnsore Point to Cork. Mr. Hills went to Portsmouth in February, 1851, and on the 11th, passed at the Naval College for the rank of Master, with full numbers on the college sheet. The work of Captain Fraser being brought to an end, the "Sparrow" was paid off at Cork, on the 24th of January, 1852, upon which occasion the ship's company presented Mr. Hills with a regulation sword. His next commission, January 28th, 1852, was to H.M.S. "Neptune," 80, guardship at Portsmouth, which he joined on the 5th of February. The monotony of harbour duty brought his regularly kept log-book to an end at the end of April. On the 11th of September, Mr. Hills was glad to be "lent" from the "Neptune" for second-master's duty in H.M.S. "Tyne," carrying troops to and from Ascension, and visiting Rio de Janeiro. A fortnight after returning to Woolwich, on the 3rd of February,

1853, he rejoined the "Neptune" at Portsmouth; and on the 25th of April, he was again lent to take charge of H.M.S. "Illustrious," appointed as a hospital ship on account of an outbreak of sickness in the crew of the "Agamemnon." On the 19th of July, 1853, Mr. Hills was sent in the "Rhadamanthus," under the orders of the master attendant of Portsmouth dockyard, to assist in fitting out and bringing round the "Cæsar," expected to be found launched at Pembroke dockyard. But the first attempts to launch that vessel failed, and it was not till the 9th of September that the "Cæsar" was navigated into Portsmouth harbour, and Mr. Hills rejoined the "Neptune."

As the year 1854 opened, the probabilities of war with Russia were strong. In preparation for the despatch of a fleet to the Baltic, the Admiralty assigned the "Hecla" (s.v.) for special service to embark several scientific officers and specialists to ascertain particulars of the navigation and of the fitness of certain ports for the reception of the fleet. Mr. Hills was one of the officers ordered to join the "Hecla" on this duty, and he sailed from Sheerness, on the 14th of February. But on the 16th he was commissioned to H.M.S. "St. Vincent," and he was so borne whilst absent in the "Hecla." That ship proceeded to Hull, and embarked a number of Baltic and North Sea pilots for the common instruction of all concerned. The first attempt to use photography for warlike purposes was made by Captain E. A. Scott, R.N., in the examination now made of the coasts of Norway and Sweden; but the draughtsmen (chief of them Mr. Hills), were held to be more successful in carrying away likenesses of the coast, than the photographic apparatus, owing to the minute size of its representations. The process used was instantaneous. They reconnoitered the coast of Pomerania, crossed over to Copenhagen, embarked various Swedish and Danish pilots for information, and returned to the Downs on the 12th of March, where Captain Washington, R.N., of the Admiralty hydrographic department boarded the ship and guided them to the fleet under Sir Charles Napier. The "Hecla" proceeded to Portsmouth, where Mr. Hills was ordered to join the "James Watt," 91, fitting out for the Baltic at Devonport, which he did on the 25th of March. It became necessary to secure a handy anchorage for the fleet away from the enemy's towns or fortresses; this was found in Barosund, on the north side of the Gulf of Finland, nearly opposite Revel, and was surveyed, Mr. Hills being one of the officers employed. Shortly afterwards, Mr. Hills was employed on survey-

ing for the attack on Bomarsund, but having been promoted Master for his services at Barosund, he was ordered home at once. Mr. Hills was next commissioned as Master to H.M.S. "Geyser," which he joined on the 15th of December, under Captain Towers. In April, 1855, this vessel was sent as an advance ship to the Baltic, and on the 2nd of May, found Faro Sound frozen across; nevertheless, the fleet arriving, picked up several prizes, and on the 17th the "Geyser" was ordered to convoy them to England and reached Sheerness on the 30th. By the 20th of June, the "Geyser" had got back to Copenhagen, and soon after was with the fleet off Cronstadt, and took part in sundry contests with bodies of Russian troops employed to harass the fleet from the shore. In August he was engaged at the attack on and the destruction of the great fortress of Sweaborg. On the 11th of November, the fleets took their departure from the Gulf of Finland for England, leaving only frigates and cruisers to bring up the rear, and on the 18th, the "Geyser" had reached Faro Sound on the homeward voyage.

During the winter of 1855-6, a number of gunboats were built at Birkenhead for the Government. The "Geyser" was sent to the Mersey about the end of April, 1856, to superintend their fitting out, and to bring them to Portsmouth; but certain of them being found incomplete, Mr. Hills was left to superintend the completion of the "Blossom" and the "Gadfly." This delay led to his becoming, on the 6th of May, a candidate for the post of Assistant Marine Surveyor for the port of Liverpool. Shortly he had to rejoin the "Geyser," and at Portsmouth he learned that the Liverpool Dock Board had selected him for the post, and had applied to the Admiralty on the 28th of May for leave for him to accept the appointment. The leave was granted, and thus began his twenty-nine years' service under the board, now entitled the Mersey Docks and Harbour Board. At the commencement of his service, the superior authority was known as the Liverpool Dock Board, but upon taking over the control of the Birkenhead Docks by Act of Parliament in 1857, the title was extended to embrace both sides of the river.

On the 15th of November, 1866, Mr. Hills was promoted to Marine Surveyor, and became head of the department. The service extended from the Mersey Bridge at Warrington, to the whole of Liverpool Bay, and to the whole north coast of Wales, requiring in its chief an accurate knowledge of the shoals and channels always shifting, and a constant alertness to keep the sea-

marks in serviceable positions. It included the control of the lighting of the coasts and signal stations, and of the lightships in the bay; and constant readiness in all weathers, by night and by day, to proceed with steam-power, and often with gunpowder and dynamite, to the removal of wrecks and accidental obstructions occurring in the navigable channels; and the organization of a portion of the life-boat service.

In 1867 Mr. Hills, with the whole of the naval officers of his grade, passed from the old fashioned title of Master, to the newly invented one of Navigating Lieutenant; some time before his name had been placed on the Naval Reserved List. On the 1st of August, 1869, he succeeded by seniority to the rank of Staff Commander with the courtesy title of Captain.

Early in his service at Liverpool, it was proposed to him to ask the leave of the "Dock Board" to give his assistance in selecting the landing-places for the Atlantic Cable. He objected to any attempt at "serving many masters," and declined to make the proposal. A matter in which he accepted employment, extra to his service with the Dock Board, was on the occasion of the construction of the Runcorn Bridge across the Mersey, by the London and North Western Railway. It was necessary in 1861, to have an exact record of the state of the bed of the river, before the construction of the bridge in reference to the widening of the water-way required by the Admiralty of about 100 feet at Runcorn, and the effect afterwards of that widening, and of the construction of the bridge upon the river-bed, some 5 miles along the river. Captain Hills was applied to by the parties interested, and made the record required; two or three copies of the chart being made in London from his instructions for deposit in the interested quarters.

A system of regular surveys of the Mersey had been set on foot by his predecessors in office, Captain Denham, R.N., and Lieutenant Lord, R.N. As a permanent basis for such surveys, Captain Hills, in 1860, made a complete survey, with a 100-foot chain, of both sides of the Mersey, from Warrington Bridge to the sea; he also levelled and fixed bench-marks on both banks of the river, and with the theodolite fixed by triangulation the position of all prominent objects near the Lancashire and Cheshire shores. This has been the basis for the periodical surveys and observation of the navigation of the river ever since. In 1861 Captain Hills made the first survey of the river-bed founded on that basis. A point which he very early took in hand was the form and construction of buoys. He found the variety, in form, in colours, and in

numbering confusing, though intended to distinguish the buoys as sea-marks. The first necessity was to fix on a form which would not be run under water and lost to sight, as many were when most needed in view, by the strength of the currents and the violence of the sea. Another necessity was, that a buoy when sighted by a navigator, should tell him at once that he was inside the channel (where he wished to be), or was outside of it and in peril. The system established by Captain Hills for Liverpool, founded on that introduced by the first Marine Surveyor of Liverpool, Admiral Denham, was ultimately adopted by the Corporation of Trinity House, when in 1882 a universal system was established for the kingdom.

The attention of Captain Hills was earnestly directed to that part of the Manchester Ship Canal, which proposed to continue the cut from its union with the Mersey above Runcorn down the tidal estuary by a deep low-water channel, as far down as a point near the middle of the river-bed, between the opposite towns of Frodsham and Garston. By his little book on the Hydrography of the Mersey, published in May 1858, it can be seen how early he began to study the causes of the formation of the water-channels of the river, and the changes in them, and that, like his predecessors in office, he then objected to any interference with their natural formation. He now strongly felt that such a low-water channel as was proposed to be formed in the estuary would certainly, in the course of years, entirely change the character of the inner estuary, and adversely affect and impede, by the deposits it would occasion, the navigation of the outer estuary. The result of the canalization, viz., the silting up of the whole estuary of the Dee, had already been matter of observation with him.

The year 1883 saw the scheme of Mr. Leader Williams introduced into Parliament, and after a protracted examination at thirty-nine sittings of the Committee, the House of Commons passed the measure; but in the House of Lords, the Committee, after ten sittings, decided, on the 10th of August, "that it is not expedient to proceed with this Bill in the present session of Parliament." Captain Hills was examined at great length before the House of Commons.

In 1884 the Parliamentary campaign was entered upon, with a much better knowledge on each side of the opposing views, and of the facts relied upon. The inquiry began in the House of Lords on the 12th of March. The opponents to the measure commenced their case on the 25th of April, opening with the case of the Mersey Docks and Harbour Board; after the Solicitor to the Board had given evi-

dence on legal matters, Captain Graham Hills was called, on the 26th of April, and was three days under examination. After forty sittings the Lords' Committee, by a narrow majority, passed the Bill, with some modifications of a monetary character. On the 7th of July the Bill came before the House of Commons' Committee, and on the 18th of July Captain Graham Hills was again the second witness called for the opposition by the Mersey Docks and Harbour Board, and was for three days under examination. He pointed out how the instances of an artificial channel in the Tees, the Tyne, and the Clyde, had no analogy with the case of the Mersey, and that each of these cases, nevertheless, showed that silting up and the reclamation of land followed. This, and the circumstances of the Dee and the Seine, which were analogous to those of the Mersey, proved that the proposed low-water channel in the bed of the river must lead to silting up, to the contraction of the anchorages in the river, and loss of the scouring power of the water. As a practical seaman, Captain Hills pointed out some of the difficulties which must occur in the navigation of the distance from Liverpool Bar to Manchester in a single tide. Powerful engineering evidence supported Captain Hills' scientific views, and on the 1st of August the Committee unanimously threw out the Bill.

In 1885 the indefatigable promoters of the canal came to Parliament a third time, but with almost a new scheme. The land course of the canal was much modified, and the canal between training-walls in the bed of the estuary, beginning a mile above Runcorn and going down some 9 miles, was abandoned. In lieu of it, accepting the suggestion of the engineers called by the former opponents, Mr. Eads, Mr. Lyster, Mr. Law, and Mr. Stephenson, the canal was proposed to be carried from Runcorn to Eastham, along the Cheshire shore of the Mersey, terminating with locks there in deep water, and entering at once a large anchorage called the Sloyne. Again on the 23rd and 24th of March Captain Hills was in the witness chair before the House of Lords' Committee, contending for the least possible infringement on the area of the estuary, and against establishing an unnatural channel along the Cheshire shore. On the 7th of May the Lords' Committee reported in favour of the Bill. On the 15th of June it appeared before the House of Commons' Committee. On the 6th and 7th of July Captain Hills was called to give evidence; but the dangers of the present scheme were admittedly far less and more remote than those of its predecessors, and on the 5th of August the Bill was read a third time, thus terminating one of the most remarkable scientific controversies dealt with by Parliament.

Before this great question had reached its solution, Captain Hills' health had shown signs of weakness, which he had been warned would imperil his life, if he continued night service afloat another winter. In fact, in the year 1883, in the month of January, the wreck of the "City of Brussels," in one of the channels in the bay, about 10 miles outside of the Rock Lighthouse, had brought upon him such exertions and exposure during forty-eight hours, in the pressing necessity to remove the wreck, that a state of collapse followed, which left a permanent physical weakness behind. Before the third hearing of the Manchester Canal Bill, the Mersey Dock Board had consented to his retirement from office with a pension, and with a retaining fee to secure his consultative services. In the quiet of his retirement at Beckenham, Kent, he lived a little over three years, and then succumbed suddenly whilst on a visit to Folkestone, on the 16th of August, 1888. He was elected an Associate of the Institution on the 6th of March, 1866.

* * The following deaths have occurred, or been made known, since the 3rd of September last, in addition to some of those included in the foregoing notices :—

Members.

BATEMAN, FREDERIC FOSTER; <i>born</i> 22 July, 1853; <i>died</i> February, 1889.	MURTON, FREDERIC; <i>died</i> 17 January 1889, <i>aged</i> 71.
BELL, WILSON; <i>died</i> 27 November, 1888, <i>aged</i> 49.	PARKES, WILLIAM; <i>died</i> 5 February, 1889, <i>aged</i> 66.
DIBBLEE, FREDERICK LEWIS; <i>died</i> 28 September, 1888, <i>aged</i> 50.	PHIPPS, GEORGE HENRY; <i>born</i> 27 March, 1807; <i>died</i> 11 December, 1888.
HAMAND, ARTHUR SAMUEL; <i>died</i> September, 1888, <i>aged</i> 51.	PURDON, WELLINGTON; <i>died</i> 14 February, 1889, <i>aged</i> 73.
LASTARRIA, VICTORINO AURELIO; <i>born</i> 22 November, 1843; <i>died</i> 27 July, 1888.	SALTER, FRANK, B.Sc., Wl. Sc.; <i>born</i> 19 October, 1848; <i>died</i> 31 December, 1888.
LESLIE, FREDERICK; <i>died</i> 20 February, 1889, <i>aged</i> 61.	SCHMIDT, BERNHARD; <i>died</i> 6 February, 1889, <i>aged</i> 60.
MILLER, DANIEL; <i>born</i> January 1826; <i>died</i> 28 September, 1888.	STEPHENS, FREDERICK COOK; <i>born</i> 21 September, 1829; <i>died</i> 3 January, 1889.
MUIR, JAMES; <i>born</i> 31 May, 1817; <i>died</i> 4 January, 1889.	

Associate Members.

BATTEN, WILLIAM; <i>died</i> 18 July, 1888, <i>aged</i> 65.	PHILLIPS, ALFRED; <i>died</i> 8 February, 1889, <i>aged</i> 44.
BOOTHBY, ALEXANDER CUNNINGHAM; <i>born</i> 26 February, 1857; <i>died</i> 17 December, 1888.	ROBERTS, PETER; <i>born</i> 3 April, 1846; <i>died</i> 25 February, 1888.
CROWLEY, JONATHAN SPARROW; <i>died</i> 13 September, 1888, <i>aged</i> 62.	TYNDALL, GEORGE REAVELEY; <i>born</i> 17 October, 1856; <i>died</i> 17 November, 1888.