

Throughout his career Mr. Borthwick exhibited mental attainments of no ordinary kind, combined with great energy, indefatigable industry, and judicious application of these powers. He had acquired great theoretical and practical knowledge. His numerous avocations constantly brought him into contact with men of high position in the several professions, as well as with distinguished persons of all classes, from whom he did not fail to acquire useful knowledge and experience; and, from his great resources and the ready use of his powers, his society and advice were much courted. In any disputed question, whether professional, or otherwise, he was always prepared, and as to past and current events, men and things, dates and epochs, and on subjects of almost every description, his knowledge rarely failed. He had high feelings of honour and integrity, and was much esteemed by his professional brethren. He was a warm and attached friend to many, who will greatly feel his loss; and he was a most affectionate, dutiful, and generous son and brother. The bereavement to his aged and respected mother and his surviving brother and sister is indeed very severe, and they will meet with the deep sympathy of every friend.

He was a regular attendant at the meetings of the Institution, frequently taking part in the discussions, and always displaying great anxiety for the welfare of the Society.

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MR. JAMES BREMNER was born on the 25th September 1784, at Keiss, parish of Wick, county of Caithness, and was the youngest of a family of nine children, six of whom died in infancy. His Father was a man of great physical strength, uncommon energy of character, and high moral principle, who exerted considerable influence in the district, till his death, which took place at an advanced age, after a prolonged service in the defence of his country. During the absence of the Father on foreign service, young James was with his mother at Keiss, and obtained such an education as her means afforded. He left school at about the age of fourteen, and then had a robust constitution, with a good deal of the rover and adventurer about him. Among the crags and rocks of the district, none were half so venturous; fear was not in his vocabulary; and on one occasion he was found paddling himself through Sinclair's Bay, sitting in the bottom of a large tub! This characteristic determination lasted him through life, and when in his prime, he is believed not to have known what the sensation of fear was. The temporary settlement of his Father at Fort George, took young Bremner there, at the age of fifteen. Here he became a favourite with Colonel Macdowal, who one day asked him whether he would like to join the army, or the navy; to which

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he replied, "None of the two;" but added, "that he would like to learn shipbuilding, and that his Father intended sending him to Leith for the purpose." Subsequently, at the recommendation of Colonel Macdowal, he was received as an apprentice, in 1798, in the yard of Messrs. Robert Steele and Sons, shipbuilders of Greenock, whose extensive establishment and business operations at that port, (then unrivalled in Scotland, in commercial importance, and as the resort of shipping) afforded good opportunities for instruction, both theoretical and practical, as well in the planning and building of large ships, as in the methods of drawing them up, and raising them out of the water, when requiring repair and alteration. To the operations of the last-mentioned process, and to various experiments afterwards tried by himself, Mr. Bremner attributed the early and ardent desire he long felt, of being enabled to discover, some effectual means of abating the labour, and facilitating the progress of building under water. In 1804, some improvements in the harbour of Greenock were commenced, and were watched with interest by Mr. Bremner. After remaining at Messrs. Steele's for about six years and a half, he made two voyages to North America, and had all but arranged for permanent settlement, with the view of commencing shipbuilding, at Pictou; but was dissuaded by his friends.

Public attention was now being directed to the herring fishing. Tempting promises were made by the British Fisheries Society to all who should settle in Pulteney-Town, then just becoming of importance; and Mr. Bremner, in his twenty-fifth year, resolved on commencing business in his native parish, where he eventually occupied the shipbuilding yard for nearly half a century, during which time he built fifty-six vessels, from a ship of 510 tons, to a small sloop of 45 tons. These were almost exclusively built for strangers, and were registered at distant ports; but at the same time he greatly improved the boats used for the herring fishery.

Besides carrying on shipbuilding operations, Mr. Bremner was, on numerous occasions, since 1807, employed in making surveys for, designing, and constructing harbours and piers on the northern and most dangerous coast of Scotland, for an extent exceeding six hundred miles. His first work of this kind is believed to have been in connection with the North, or what is now called the 'Old,' harbour of Pulteney-Town, which was designed by Mr. Telford, in 1803, and was contracted for by Mr. George Burn, in 1806. In the progress of this undertaking, Mr. Burn experienced extreme difficulty, in raising and laying the materials required to found the pier. He thereupon consulted Mr. Bremner, who prepared an adequately sized lighter, or barge, on which he erected a crane, capable of being worked simultaneously on both sides of the barge. Again, in 1807, when the breakwater had been extended, so that at the

lowest ebb of ordinary tides, there was a depth of 5 feet of water, Mr. Bremner undertook the submarine building and foundation of the breakwater heads, which he completed to Mr. Telford's entire satisfaction. These works were finished in 1811, at an expense of £16,400, but the harbour soon became filled with sand, and when, after the conclusion of the continental war, and the consequent lowering of freights, larger vessels were employed, they could only be partially loaded in the harbour, and finished in the bay, by means of boats. This was attended with expense, and risk to lives and property, and led to the erection of the South harbour, in deeper water. The survey for this was made by Mr. Joseph Mitchell, M. Inst. C.E., in 1823, and the contract for the quay, and part of the south pier, was let to Mr. Bremner. In 1825, and again in 1826, he was instructed to extend the pier. In the latter year, he also entered into a contract for building the north pier; building and embanking the jetty; making an opening from the south to the north harbour, and closing in the old entrance; and for completing the harbour. As there were only about twenty-four weeks in the year fit for carrying on such works, Mr. Bremner had all his materials at hand, and during the season of 1827, had men at work night and day; the work was making rapid progress, and would have been closed in by the 20th of September, when, on the 10th of that month, a violent storm arose, which swept away about 100 feet of the pier, down to the level of low water. To prevent the breach from spreading, chain cables were passed round the open end, laid upon the pitching of the roadway, and were securely fastened inwards. This was accomplished in two tides, but in that time the damage which had been done amounted to £5,000. Of these works he presented an account to the Institution.<sup>1</sup>

In 1818, Mr. Bremner designed and superintended the construction of Keiss harbour, situated on the north side of Sinclair's Bay, 4 miles from the south-east entrance to the Pentland Firth. At this work, one individual only, the foreman, amongst all the operatives employed, had been bred to the business of a mason. It was used in an unfinished state from 1821 to 1833, being protected during that period by a rough causeway, and was completed in 1834. During the progress of the works, huge stones from 10 to 40 tons weight had to be moved a distance of two miles. For this purpose, two old fishing boats, 16 tons burthen each, were made tight and impervious to water, and across them two ship's yards, fished with hard wood, were placed. Chains of sufficient strength were passed underneath the stones, with the assistance of long levers to lift them slightly. During fine weather the boats were grounded at low water, on each side of the stone intended to be removed, and the

<sup>1</sup> *Vide Minutes of Proc. Inst. C.E.*, vol. iii., p. 115.

chains were passed over the yards and secured, and on the flow of the tide, the boats buoyed up and floated off the materials. Subsequently, being desirous of removing some heavy stones for the repair of Banff harbour, from a part of the coast where boats could not approach, casks were used with great effect.<sup>1</sup> Lewises were inserted in the blocks of stone, chains were passed round the casks and made fast at low water, so that on the rise of the tide, the stones were lifted, and could be towed to any spot that was desired. These casks have also been used at Banff and Macduff to assist laden vessels out of harbour. Four of them gave a lift of 44 tons, and on one occasion a vessel of 100 tons burthen, had a deficiency of 15 inches in her draught of water met by these means.

In the summer of 1835, Mr. Bremner was induced to undertake the reconstruction of Sarclet harbour, which is situated in a most exposed position, about six miles south-west of the Bay of Wick. The breakwater, which for its whole length had been built parallel to the run of the sea, and perpendicular, was twice laid in ruins, and on the last occasion was allowed to remain so for some considerable time. But the local situation was so good, that in 1834, Mr. Gibb, of Aberdeen, accompanied by Mr. Mitchell, of Inverness, inspected the harbour, and Mr. Telford being consulted, plans were drawn for its reconstruction. At this work travelling jib cranes were used; they were fixed at such a height as to be above the reach of the sea in winter storms, and the jibs being 120 feet in length, the whole work was commanded by them. The materials for the sea-walls, were quarried at the Bay of Wick, and were conveyed thence by the means previously used at Keiss. The whole of the breakwater was laid and completed in the summer of 1836.

In the latter year he, with other contractors, gave tenders for executing a harbour at Lossiemouth, the plan of which was found impracticable. The Directors then called upon Mr. Bremner to furnish plans, and to tender for the execution of the work. Both of these being accepted, the late Mr. Gibb, of Aberdeen, was mutually chosen referee, to see that the work was finished according to the adopted plans and specification. At this place Mr. Bremner caulked and shored the sea-walls on the inside, put gates on the entrance, 70 feet or 80 feet wide, pumped out the water by steam power, and thus laid the entire area dry, and maintained it so for a period of four months, during which time the excavations, which were in rock, were carried on. He had at that work, also, an ingenious system of cranes, commanding a range of 120 feet, by which he lifted the stones for the sea-wall from the quarry, and deposited them in their places in the wall. These cranes were made with travelling carriages, and the long jibs were swung by

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<sup>1</sup> *Vide Minutes of Proc. Inst. C.E., vol. iii., p. 122.*

chains. Each crane was proved to be capable of removing a weight of 6 tons to a distance of 240 feet, in little more than 30 seconds. They answered the purpose of abridging labour admirably. After completing Lossiemouth harbour, he built the harbour of Pitullie, near Fraserburgh, and one on the Caithness coast, of which Mr. Joseph Mitchell, M. Inst. C.E., was the Engineer, for whom he had previously built the harbours of Keiss, Sarclet, Cairnish, and Callicott.

Besides these works Mr. Bremner built the harbour of Ham. He designed and superintended the construction of the harbour of Castlehill, the entrance of which he secured by boom gates, capable of being shipped, or unshipped at pleasure. He also secured the harbour of Sandside, constructing similar boom gates at the entrance. He jointly superintended the harbour of Ocumster, in Caithness. He surveyed, and prepared working plans, with detailed estimates, for the harbours of Scrabster, in the bay of Thurso, and the Kirk ebb of Thurso, and for the improvement of the river; also of the harbours of Acherfell, of Portsoy (Banffshire), and of Hopeman (Morayshire); and through Mr. Telford, for the harbours betwixt Cape Wrath and Bighouse (Sutherland), viz., Rispond, Talmine, Kirkcoury, Armadale, and Portskerry. He likewise surveyed, and after their completion, preserved, the harbours of Banff and Helmsdale, in Sutherlandshire. He proposed to connect the island of Tongue with the mainland, by an earthen mound, whereby a steam-boat might ply with safety and facility, and he designed four passage-boat piers, for the ferries of Loch Erribol and Tongue.

Mr. Bremner, from long experience, had arrived at the conclusion, that the surveys for intended harbours should be made, when the liability of the intended buildings to the ravages of winter storms could be observed, and the power required to be provided for defence, could be ascertained. The currents and tides, and their influence on the bottom, particularly when near an estuary, or the mouth of a river, should be carefully noted, and the liability of the formation of banks, or bars, as at Shields, Aberdeen, Ayr, Lossiemouth, &c., with the view of ascertaining how the latter might be remedied. His objections to diving-bell operations were, that they could only be carried on for a short period of the year, that they were liable to serious interruptions from the weather, and that, on such occasions, the work was left exposed. The hearting of the works was frequently washed out, during storms, and the face work was not supported by timber. The expense of the staging and barges was also a serious item; and, moreover, a diving-bell was barely sufficient for building a single stone at a time, so that there was no power of connecting them properly together. At Plymouth and Dunleary they were only

used for forming the ends of the breakwaters, the rest of the stones being thrown promiscuously together—a mode of construction which might be suitable for an open roadstead, though not for a quay wall, where shipping had to lie abreast. He always considered it a bad practice to protect the feet of walls, by throwing down large stones for a width of from 20 feet to 30 feet, as it prevented the approach of vessels. He devised a method of constructing harbours, breakwaters, and other buildings, in deep water—for cleansing harbours, and for raising sunken vessels and other property, of which he has given a minute account, in a treatise published in 1845.<sup>1</sup>

His system consists in building in what he terms ‘flotations,’ or caissons, framed with transverse beams, during the winter months, but instead of caulking them from without, as is the ordinary practice, he recommends their being caulked from within. These caissons are then to be taken out for deposit, and when over the site of the intended work, the caisson and its appendages are to be disengaged, and according to the nature of the foundation, whether hard, or soft, the inside bottom planking was proposed to be in part, or altogether removed, leaving only the transverse bars, which it is presumed would bind the wall together.

But Mr. Bremner’s greatest talent was evinced in the raising and recovering of wrecked vessels, in the wide circuit betwixt Aberdeenshire and the Isle of Skye; comprehending the islands of Orkney, Shetland, and Lewis, and the critical navigation of the Pentland Firth. On these occasions his kindness to the crew and officers was very marked, and he has been known to keep them for months in his own house. He raised not less than two hundred and thirty-six vessels, many of them sunk in a depth of 12 fathoms. His first anxiety was to ascertain the size of the vessel, the position in which she lay, or was sunk,—the nature of the bottom,—whether rock, shingle, or sand; and the description of the ship’s cargo, if loaded. He always kept ready six sets of portable machinery, each capable of being conveyed in double carts. The first operation was to bind the ship together, by double, or triple chain purchases, and to endeavour to force the stern of the ship inward and her bows to the sea. The cargo was then discharged early in the following spring, placed on rafts and drawn beyond the reach of breakers. In this way, in 1825, he extricated the cargo of the ship ‘Orion,’ of Pillau, wrecked at Watersound, on the east side of Orkney. The cargo consisted

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<sup>1</sup> Vide “Treatise on the Planning and Constructing of Harbours in Deep Water, applicable to the deepening and clearing of rivers for navigation; on Submarine Pile-driving; the Preservation of Ships stranded; and raising of those sunk at sea; on principles of lately-patented inventions.” By James Bremner. Tract, 8vo., Plates. Wick, 1845.

of timber, which together with the whole wreck of the ill-fated ship, he carried off by a single raft. On this raft he constructed paddles, wrought by manual labour, with five sheer poles, on which he rigged the courses and topsails of the 'Orion.' In this state he traversed upwards of one hundred miles, through the dangerous navigation of the Pentland Firth, at the rate of three miles and a half per hour, and reached his ship-building establishment at Pulteney-Town in safety.

When a ship was in ballast, his plan was to remove the ballast forward to the bows, and by a purchase aft to get the bows directed to the sea. When the weather moderated, the ballast was discharged, the ceilings were caulked, and bulk-heads were put in, if near to a place of safety. If the hull was damaged, and the sea-beach was flat, he raised her by means of dumb craft and bilge-weighs, and shored her in such a way that the ship could not slip, or fall out of the cradle, either on being hauled up, or launched.

The ship 'Uncertain,' of Sunderland, laden with coals, was only 6 months old, when she struck on a sunk rock, at Broad Bay, near the Butt of Lewis, and lay there in 11 fathoms water, exposed to all the force of the Atlantic Ocean for upwards of two years. Three persons had endeavoured to recover her, but failed. Mr. Bremner effected the object by using five vessels, with twelve floating casks. Four balks of timber, each 60 feet in length, were laid across each pair of vessels; chains were then attached to these balks and to the casks, and at low water they were made fast to the ship to be raised. On the rise of the tide the casks and the vessels each bore a proportion of the weight, and notwithstanding the exposed situation, the ship was carried to the shore in safety. She was then dried, and a bullock's hide being nailed over the leak, she was navigated to Stornoway, where she was thoroughly repaired.

Numerous instances could be mentioned of ships of 500 to 700 tons burthen sunk and fixed in quicksands, being recovered by means of platforms. In 1828, the brig 'St. Nicholas,' of St. Petersburg, was stranded during low-water and ebb tides, in Sinclair's Bay, and sunk 7 feet deep in quicksand. There was a quantity of Russian iron in her hold, under some deals. On the flow of the tide, the buoyancy of the timber, with the violence of the sea, occasioned a separation at the ship's floor-heads, and the whole of the vessel and cargo became engulfed in the sand. Mr. Bremner then planned a long triangular machine of solid balks of timber, with a caisson in the centre, and having strongly hinged scrapers attached to the bottom, to act upon the wreck. Then by means of large iron swivel hooks, attached to long poles, and worked from a stage, the pieces of iron were succes-

sively fished up and raised, and thus 57 out of 60 tons were recovered.

He was employed with one of his sons in assisting to secure, and ultimately in taking the 'Great Britain' off the strand, at Dundrum Bay, in August 1847, after that vessel had been unfortunately run ashore during her first voyage.

For the last twelve years of his life, Mr. Bremner acted as agent at Wick for the Aberdeen, Leith, and Clyde Shipping Company, and in conducting the business of that agency he was frequently placed in positions of danger, from which he narrowly escaped with his life.

Mr. Bremner married early, and his marriage was a happy one in every respect. He had a numerous family, and the sons were all brought up as Engineers. One of them, David, who was Engineer for the Clyde Trustees, a young man of great promise and attainments, and of high moral principle, died four years back, and his Memoir is published in the Minutes of the Institution.<sup>1</sup>

Considering his education and his general career, Mr. Bremner must be regarded as a very extraordinary man. He had a natural perception for marine work, and no Engineer was more successful in constructing piers to withstand the heavy storms of the northern coast. He had a wild and struggling life, but died leaving considerable property for an inhabitant of so northern a locality as Wick.

During the whole of his ship and harbour building career, he was the same impulsive, impetuous, dashing individual. Nothing daunted him. No physical exertion was too much for his herculean frame. He has been known to stand, dripping wet, for two tides in succession, for hours up to the knees in water, without being even hoarse afterwards; and as for frolic and public spirit, his equal was not to be found in broad Scotland.

Mr. Bremner was elected a Corresponding Member of the Institution on the 12th of February, 1833. He received a Telford Medal, in 1844, for his Papers 'On Pulteney-Town Harbour,' 'Sarclet Harbour,' 'A new Piling Engine,' and 'An Apparatus for Floating large Stones for Harbour Works.' He was a contributor to the Great Exhibition of 1851, and received honourable mention "for his models of various apparatus for working in situations exposed to the sea, and of that used to assist in getting off the 'Great Britain' steam-ship," included in Class 7, of which Mr. I. K. Brunel, V.P., was the Reporter.

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<sup>1</sup> *Vide* Minutes of Proc. Inst. C.E., vol. xii., p. 148.