

The Penllergare Observatory

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This rather picturesque and historically important Victorian observatory was built by the wealthy John Dillwyn Llewelyn near to his mansion, some four miles north-west of Swansea, Wales. He had many scientific interests, in addition to astronomy, and was a notable pioneer of photography in Wales. Together with his eldest daughter, Thereza, (who married the grandson of the fifth Astronomer Royal, Nevil Maske-lyne), he took some early photographs of the Moon from this site. This paper describes the construction of the observatory, and some of those primarily involved with it. Despite its having undergone restoration work in 1982, the state of the observatory is again the cause for much concern.

The Penllergare Observatory (nowadays spelt Penllergaer) and its adjoining laboratory was built by John Dillwyn Llewelyn (J.D.L.), in 1851, on his large country estate some four miles north-west of Swansea, Wales. The historic photograph (Figure 1) showing the observatory in the grounds of his mansion was taken by J.D.L., soon after the building was completed, using the calotype photographic process. It is one of only two nineteenth century astronomical observatories in Wales, the other being at Hakin, Pembrokeshire.

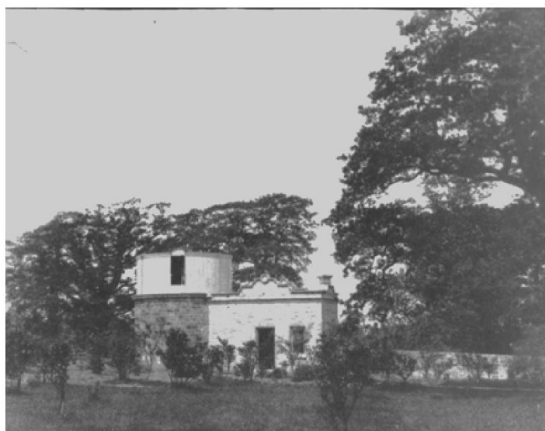


Figure 1

**The Penllergare Observatory
in 1852, soon after construction**

Photograph taken from slightly east of south.

Photograph supplied by, and reproduced courtesy of, Mr R. Morris.

The observatory is now situated in the grounds of the Neath/Port Talbot Borough Council Civic Centre, at grid reference SS 622991, just off junction 47 of the M4 motorway¹. The original Llewelyn family mansion on this site, dating from the early eighteenth century, eventually fell into decay and was demolished in the mid 1960s, but the observatory was superficially renovated by the Lliw Valley Borough Council, assisted by members of the Swansea Astronomical Society, in 1982, when

the Council built their new offices on the 14-acre site. A contemporary newspaper article described the restoration work done on the old observatory, with the assistance of youngsters on a Manpower Services Commission scheme².

John Dillwyn (1810-1882) was the son of Lewis Weston Dillwyn, who was the Member of Parliament for Swansea from 1834 to 1841 and owner/manager of the famous Swansea Cambrian Pottery. John inherited the Penllergare estate from his grandfather, Colonel John Llewelyn, in 1817,



Figure 2

**John Dillwyn Llewelyn
with photographic equipment, circa 1850**

Photograph supplied by, and reproduced courtesy of, Mr R. Morris.

when he was only seven years old, and lived there with his parents and brothers until he was 21 years old, when he came into his inheritance. His parents

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then moved to Sketty Hall on the western outskirts of Swansea. John Dillwyn became the local squire, taking on the additional surname Llewelyn, and was both a magistrate and High Sherriff of Glamorgan. Figure 2 portrays him with his bulky camera and darkroom tent, essential components for photographic work in the 1850s.

J.D.L.'s wife (Emma Thomasina Talbot) was sister to the very wealthy Mr C.R.M.Talbot, who owned land at Margam Abbey in Glamorgan and also at Penrice Castle in Gower. She was a cousin of William Henry Fox Talbot, the pioneer of photography, of Laycock Abbey, Wiltshire. The Llewelyns, together with their cousin Fox Talbot and another distant relative, the Reverend Calvert Richard Jones, developed from the 1840s the art of photography, and initiated improvements in early photographic techniques, around the Swansea area.

As a typical Victorian gentleman, J.D.L. had wide interests, which encompassed the subjects of botany, geology, physics and chemistry, and he made some of the earliest experiments concerned with the electrical propulsion of small boats on his estate lakes. He also assisted Professor Charles Wheatstone in 1844 with experimental under-sea telegraphy in Swansea Bay. He was a Fellow of the Royal Society (elected in 1837), a founder member of the Photographic Society of London (now the Royal Photographic Society), and a Fellow of the Linnaean Society (he was a pioneer in the cultivation of exotic orchids and tropical epiphytes in his heated greenhouses at Penllergare). He was elected a Fellow of the Royal Astronomical Society on 13 February 1852, following his proposal on 26 November 1851 by several Fellows, including the President, Admiral W H Smyth R.N., John Couch Adams and Richard Sheepshanks.

J.D.L. built an observatory of the rotunda (or 'drum') type, with a rotating, top-hat-shaped cupola some 19 feet³ in diameter, originally made of wood with a copper cladding (the smelting of copper ores made Swansea the 'copper capital' of the world in those days). The outer surface was coated with white lead paint to reflect sunlight and so keep the interior from becoming too hot. The cupola rotated on a metal rail, which encircled the top of the observatory wall, and had doors in the roof and on its side to permit the telescope to be pointed at any part of the sky. A large wheel, similar to that used to steer a ship, was fixed to the observatory wall and used to rotate the cupola.

The lower part of the circular observatory tower wall was built of dressed masonry and was about 32 inches thick. On the north and south sides, diametrically opposite each other, two holes, 6 inches square and about 18 inches apart, penetrate the base of the wall; their purpose is unclear. They might have been part of a ventilation system or a floor-supporting structure. The upper part of the

wall was reduced to a thickness of some 12 inches. Excavation of the decayed internal contents in 1981 revealed a substantial, cone-shaped, brick-built pillar of some 7½ ft maximum diameter and about 12 ft high with fragments of cast-iron reinforcements, some brass pulleys, etc.

At the top of the pillar was fixed a capstone, which had three, iron levelling screws to support the telescope mounting. It is thought that this massive, supporting pillar was designed to prevent vibrations from the railway line which ran nearby, or from the passing of horse-drawn carts on the road outside, affecting the long refractor telescope at high magnifications, and when photography was being undertaken. There was almost certainly a cast-iron telescope support fixed at the top of the pillar capstone, as such an object, about 5 feet in length, was lying broken in the overgrown shrubbery near the ruined building in the 1940s, but this has since disappeared⁴. The wooden observation platform would have been reached by steps from ground level inside the building, but this woodwork had completely disintegrated by the time the 1981 excavation started.

The outside wall of the observatory consists of solid, coursed stonework. The inner skin of the wall shows another of the observatory's unusual features: It is built from specially-designed, hollow, clay bricks which were interspersed with wooden blocks set in a regular pattern, and onto which were fixed 4- by ½-inch tongued and grooved wall cladding set on battens. This construction was probably intended to provide thermal insulation, and so promote temperature stability inside the observatory.



Figure 3

Penllergare Observatory in 2005

Photograph from the north-east by the author.

The photographic laboratory, attached to the east side of the observatory, is some 10 feet wide and 20 feet long, and has an interesting type of construction. It consists of two skins of hollow, glazed bricks of specially-designed, triangular shape. A nineteenth century German publication⁵ states that such bricks, or tiles, were made by Claytons of 21 Upper Park Place, Dorset Square, Lon-

don, and examples were displayed at the Great Exhibition in London in 1851. Their purpose seems to be to provide temperature stabilisation, and thus limit convection currents that might affect the clarity of viewing at the telescope, which was at a higher level. The building has a vaulted roof fitted with iron tie rods, and each side of the building is finished with an ornamental, Dutch-style gable of specially-moulded bricks. There is an entrance door and a window on the south side, and another window (formerly a door) on the north side. The single room has a fireplace and chimney at the east end, and there is evidence of a wooden floor, and of wooden steps that led up to the telescope room on the western side. The building unfortunately has again deteriorated since the renovations of 1982, and as it is judged to be unsafe the Council forbids entry to the interior. Figure 3 shows the observatory as it appears today.

Another interesting early calotype photograph of the observatory and laboratory during its construction, taken by J.D.L., is reproduced in the book *Penllergare: a Victorian Paradise*, by Richard Morris, a distant descendant of the family¹. In addition to containing a general description of the estate, it has a chapter devoted to the observatory.

J.D.L. was a graduate of Oriel College, Oxford, and had an extensive knowledge of chemistry. He was one of the pioneering amateurs in the application of photography to astronomy, and it was his enthusiasm for improving photographic techniques that led to the building of the photographic laboratory adjoining the observatory. It was only in March 1840 that Dr J.W.Draper of New York had produced the first photographic image of the Moon on a Daguerreotype plate using a 20-minute exposure⁶, and over the next 20 years several notable pioneers began to apply photography in astronomy⁷.

In Britain, Warren de la Rue⁸ first photographed the Moon in 1852 using Daguerreotype plates, exposed using a 13-inch reflector telescope, and achieved good success after 1857 when he acquired a motor drive to control the telescope during the long exposures required⁹. Henry Scott Archer published details of the wet collodion photographic process in 1851, which made faster exposures possible onto glass plates, and it was this technique that J.D.L. adopted in the early 1850s. With the assistance of his eldest daughter Thereza, J.D.L. produced an image of the Moon (referred to below) using this collodion process. However in 1856, following the example of his more-famous relative W.H.Fox Talbot, who in 1841 had patented the calotype process in which negatives are first produced from which true positive prints could be made, J.D.L. developed the oxymel photographic process¹⁰. This process stabilised the photographic image on dry plates, utilising a solution derived from a mixture of honey and vinegar. It was consid-

erably more light sensitive than the daguerreotype process and made 'instantaneous' photography in daylight possible¹¹. Oxymel dry plates would have been considerably easier to use in a camera attached to a telescope than dripping wet ones, and once prepared they could be used up to a week later, in contrast to wet plates that had to be used soon after they had been prepared.

These early photographic techniques often involved the use of some rather more hazardous chemicals such as mercury, bromine, iodine, chlorine and other volatile substances, and it was their use which probably exacerbated the asthmatic condition which seriously affected J.D.L.'s health as he grew older. He retired from his mansion at Penllergare to Cornwall Gardens in London in 1871, leaving his son John T.D.Llewelyn in occupation, and later moved to Atherton Grange in Wimbledon, where he died in 1882.

It is known that in 1846 J.D.L. purchased a 4¾-inch Dollond refractor telescope (presumably George Dolland), but the size of the observatory suggests that it probably housed a longer refractor having an aperture of 6 to 8 inches. The details and whereabouts of these telescopes is now unknown, although it is on record that the object glass of the main telescope was of fine quality, and cost over £100. J.D.L.'s son, John T.D.Llewelyn recounted that the objective was procured by J.D.L. after he had made a long coach journey to Gloucester and then a train journey on to London¹².

It is almost certain that J.D.L. constructed the observatory mainly for his astronomically-minded daughter, Thereza, as a 16th birthday present. In an unpublished letter to her father, Thereza refers to her grandparents, Lewis and Mary Dillwyn, and her younger sisters, Emma and Elinor, being present on the occasion of the laying of the observatory foundation stone on 7 July 1851.

'I laid the foundation stone of the observatory today, July 7th. When Grandpa and Grandmama were here on Saturday we told them about it and they were so very kind as to come over here today to see the first stone laid; so we went in procession to the place; they had got some stone already and after I had laid the first stone Emma laid the second and Elinor the third, which she was very much delighted to do'.¹³

These foundation stones may have been at the base of the central pillar, and have not been identified during the renovation work.

Thereza, following in her father's footsteps, was very interested in astronomy, as well as many other sciences. The photograph of Thereza (Figure 4), taken in the early 1850s, was staged outdoors to represent an indoor scene (because of the requirement for maximum light) and the edge of the background screens can just be seen. The photo portrays her interest in astronomy, books, and the globe of



Figure 4

Thereza Llewellyn with small telescope

Photograph supplied by, and reproduced courtesy of, Mr R. Morris.

the world. She was a particularly capable botanist, but also was very familiar with the night sky and is said to have noticed Donati's comet in August 1858 (whilst on her honeymoon in Europe) before the Italian astronomer had announced its discovery. Her diary records on another occasion:

'This westerly wind has brought clouds along with it, otherwise I should have been looking at Jupiter or the Moon'.¹⁴

She was always eager to show visiting guests the splendours of the night sky through the observatory telescope, and she enthusiastically assisted her father with experiments in astrophotography, producing early pictures of the Moon around 1855. A copy of the collodion photograph of the Moon they took in the mid-1850s is in the possession of the Swansea Astronomical Society (Figure 5). If the original still exists, its location is unknown; finding it would obviously be of great historical interest.

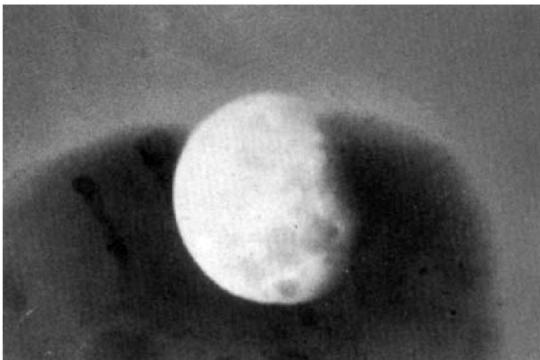


Figure 5

**Collodion photograph of the Moon
taken by John Dillwyn Llewellyn in the 1850s**

Photograph supplied by, and reproduced courtesy of, Mr R. Morris.

Later, Thereza wrote in her diaries:

'In 1857 N [then her fiancée, later her husband] sent me the photo of the Moon taken with Mr de la Rue's telescope - Dec. 27th. About this time, if not earlier, my father and I made like photos at Penllergare - without clockwork motion.'¹⁵

Many years later she recalled:

'About 1855 my father made a photo of the Moon, and as moonlight requires much longer exposure it was my business to keep the telescope moving steadily as there was no clockwork action. That photograph was one of the first ever made of the Moon. In 1869 a photograph now historical and described as being taken 'at a time when the art of photography was in its infancy' was made by Sir David Gill, and is now at the Royal Astronomical Society in London.'¹⁶

Thereza eventually married Professor Nevil Story Maskelyne (1823-1911), a notable chemist and mineralogist, and the grandson of the famous Astronomer Royal, Nevil Maskelyne. He later became Keeper of Minerals at the British Museum as well as occupying the Chair of Mineralogy at Oxford University. Initially J.D.L. invited Maskelyne down from Oxford because of his interest in early photographic techniques and the chemistry of photographic processing, and he afterwards became a frequent visitor. The romance of Maskelyne with Thereza Llewellyn, initiated by their mutual interest in science, particularly astronomy and photography, blossomed in and around the observatory at Penllergare¹⁷. They married in 1858, and thenceforth Thereza had to tear herself away from the family paradise in Wales to set up home in London.

Despite the best efforts of several interested persons, it has not been possible to trace more completely the work that J.D.L. contributed to astronomy, other than the early collodion image of the Moon, and it is somewhat doubtful if original records of his work in astrophotography still exist¹⁸. However, further information on their early work in astrophotography and their equipment may emerge if the journals of Thereza Dillwyn Llewellyn, which are in private family archives, are eventually made available to researchers.

J.D.L.'s son, Sir John T.D.Llewellyn, succeeded his father and he also had scientific interests. He was President of the Swansea Scientific Society and instrumental in encouraging that Society to purchase a telescope for erection at the Royal Institution of South Wales, which later became Swansea Museum. A newspaper article¹² records him hosting the visit of the Committee of the Swansea Scientific Society to the Penllergare observatory on the previous Wednesday evening to see the telescope, during which they made observations of the Moon, Mars, and Jupiter with its four prominent moons.

From the late 1920s the Penllergare estate declined. It was once owned by the Bible College of

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Unfortunately, despite widespread enquiries, it has not been possible to trace the original telescope with its German Equatorial mounting or J.D.L.'s 4¾-inch Dollond telescope, which it is believed were sold at auction when the contents of Penllergare Mansion were disposed of in 1936.

It had been hoped, following the restoration work in 1982, that the old observatory and its adjacent laboratory would be used as an exhibition centre for J.D.L.'s photographic and astrophotographic work. However lack of funds, and the death of some of the enthusiasts in the Swansea Astronomical Society who had worked hard on the project, has allowed the building once again to fall into disrepair. The building, the second oldest astronomical observatory in Wales, is obviously of national historic importance as a scientific site and therefore it is hoped that a more complete and lasting restoration of the observatory may be made at some future time.

Acknowledgements

The late Mr Gerry Lacey, Secretary of the Swansea Astronomical Society at the time, worked untiringly to discover as much as he possibly could about the Penllergare observatory and encouraged its renovation in 1981-1982. Together with other members of the Astronomical Society, and the Lliw Valley Borough Council, he rescued this historically important building from long-standing neglect and what might have been total loss. Many of his papers are kept by the Swansea Astronomical Society and have been an important resource for this article.

It is a pleasure to acknowledge the willing assistance I have received from Dr S.J.Wainwright, F.R.A.S., who collected and made available to me the most important papers relating to the observatory.

The continuing interest of Jenny Ayers, Michael Norman, and others of the Penllergare Trust is also gratefully recognised.

The antique photographs in Figures 1, 2, 4 and 5 were supplied by, and are reproduced with the kind permission of, Mr Richard Morris.

Permission to print portions of the drawings made in June 1980 by the Planning Department of the then West Glamorgan County Council, which are now the copyright of the City and County of Swansea, is also gratefully acknowledged.

Thanks are also due to the archivists of the University of Wales in Swansea, West Glamorgan Archives at County Hall, and the Swansea Museum, for their assistance in attempting to find more information on the astronomical activities of John Dillwyn Llewelyn.

Notes and References

- 1 The history of the site, and information about its Victorian environment, can be found in the main reference to the Penllergare estate: *Penllergare; a Victorian Paradise*. Morris, Richard. Llandeilo: The Friends of Penllergare, 1999. This can be obtained from: The Friends of Penllergare, Coed Glantawe, Esgairdawe, Llandeilo, SA19 7RT, U.K.
- 2 Jones, P. Youngsters Restore Observatory. Article in *Western Mail*. Friday 26 September 1981. Page number unknown.
- 3 All measurements in this paper are in imperial units, the units in use at the time when the observatory was built and used.
- 4 Correspondence of G.P. Lacey with G.R. Redman, dated 22 September 1982. Archives of the Swansea Astronomical Society. Penllergare box file/envelope 7(a).
- 5 Archives of the Swansea Astronomical Society. Penllergare box file/envelope 5(b).
- 6 Article on Photography, Celestial. In: *Encyclopaedia Britannica. Micropaedia VII*. Chicago: Encyclopaedia Britannica Inc., 1976. 968.
- 7 Lankford, John. The Impact of Photography on Astronomy. Chapter 2 in: *Astrophysics and 20th Century Astronomy to 1950*, 4A. Ed. Gingerich, Owen. Cambridge: Cambridge University Press, 1984. 16-39.
- 8 Warren de la Rue, one-time President of the Royal Astronomical Society, was a family friend of the Llewelyn family, and a notable British amateur astronomer and pioneer astrophotographer. He photographed the 1860 total solar eclipse in Spain, thereby showing that the prominences seen at totality are emissions from the Sun, rather than from the Moon (see Hingley, P.D. The First Photographic Eclipse? *Astronomy and Geophysics*. 2001. 42(1). 1.18-1.22). His photographs of the Sun and Moon, including stereoscopic images of sunspots and surrounding faculae, received sensational acclaim at the 1862 International Exhibition in London.
- 9 Clerke, Agnes. *A Popular History of Astronomy During the Nineteenth Century*. London: A & C Black, 4th edition 1902. 152-154.
- 10 www.welshwales.co.uk/images.htm accessed on 21 November 2005.
- 11 Morris, Richard. The Oxymel Process. *The Photohistorian*. 100. Spring, 1993. Page numbers unknown.
- 12 An evening at Penllergare astronomical observatory. *The Cambrian*. 15 June 1888. Page number unknown.
- 13 Unpublished letter from Thereza Dillwyn Llewelyn to her father John Dillwyn Llewelyn, who was attending a British Association for the Advancement of Science meeting in Ipswich. Quoted in Morris, Richard [Reference 1]. 32.
- 14 Quoted in a leaflet entitled *Penllergare Equatorial Observatory*, which was published by Lliw Valley Borough Council in 1986. A copy is held in the Archives of the Swansea Astronomical Society, Penllergare box file/envelope 1(a).
- 15 Archives of the Swansea Astronomical Society, Penllergare box file/envelope 1(a).
- 16 Morris, Richard [Reference 1 above]. 32.
- 17 Morton, Vanda. *Oxford rebels: the life and friends of Nevil Story Maskelyne, 1823-1911, pioneer Oxford scientist, photographer and politician*. Gloucester: Alan Sutton, 1987. 130-135.
- 18 Some of the J.D.L. papers are, however, still in the possession of his family, and some are held in archives of the Royal Institution of South Wales and the Swansea Scientific Society, held by the West Glamorgan Archive Service, County Hall, Swansea.

