



British Geological Survey

# Historical Seismological Observatories in the British Isles



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## FRONT COVER DESCRIPTIONS

<p><b>Montage published by the Daily Mirror after the death of John Milne on Thursday July 31, 1913.</b></p>	<p><b>J.J. Shaw at work in his observatory in West Bromwich in September 1923 after the great Kanto earthquake, Japan (photo from The Times)</b></p>
<p><b>Ben Nevis Summit Observatory, (photo courtesy of Royal Meteorological Society).</b></p>	<p><b>The Mainka (left) and modern BGS Willmore seismometers in the vault, Maison St Louis, Jersey, (BGS photo).</b></p>
<p><b>Seismogram of the 18th April 1906 magnitude 8.3 Ms San Francisco, California, earthquake recorded by Milne seismograph at the Coats Observatory, Paisley (now held in the National Seismological Archive).</b></p>	

**BRITISH GEOLOGICAL SURVEY**

**Global Seismology & Geomagnetism Group**

**TECHNICAL REPORT WL/99/13**

**HISTORICAL SEISMOLOGICAL  
OBSERVATORIES IN THE BRITISH ISLES  
(PRE-1970)**

**Version 3**

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# HISTORICAL SEISMOLOGICAL OBSERVATORIES IN THE BRITISH ISLES (PRE-1970)

## Abstract

The National Seismological Archive (NSA), maintained by the British Geological Survey (BGS) in Edinburgh, has undertaken to publish as much information as possible on historical seismological observatories in the UK. Examination of material curated in the NSA, enquiries to local libraries, museums and other public bodies, and searches of published journals, has revealed much new information. Updates have been made to many observatory entries, and newly found observatories described where possible. This version of the report is also presented on the Internet where updated information will be added as it becomes known.

## 1. Introduction

### 1.1 The National Seismological Archive

The National Seismological Archive (NSA) is maintained by the British Geological Survey (BGS) in Edinburgh. It is supported by a Customer Group of organisations under the chairmanship of the Department of the Environment, Transport and the Regions (DETR), (formerly the Department of the Environment (DoE)), with major financial input from the Natural Environment Research Council (NERC). The NSA is the United Kingdom national repository for seismological material. It contains a wide range of original seismograms, bulletins, reports, and reference material from all over the world dating from the late 1800s onwards, held in a variety of media.

The key objectives of the NSA are:

- to curate and catalogue existing material. This includes microfilming, and the generation of electronically searchable data;
- to maintain a watching brief on archives held by other organisations, with a view to seeking the transfer to the NSA of any considered at risk;
- to supply data and provide inspection facilities for scientists and researchers.

The NSA database will ultimately contain details of all holdings in the NSA and be available as an online, constantly updated resource for researchers - one of the key objectives of the NSA. Table 1 shows the constituent parts of the NSA database, with their assigned NSA identity codes.

### 1.2 The project

Since Neilson & Burton's (1988) paper on Historical Seismological Observatories in the British Isles, a considerable amount of new material has been acquired by the NSA. The present authors have made a search of some of this material, which has revealed much previously unknown detail on many of the known observatories. This has also led to the discovery of much new information about little known and previously unknown observatories and the seismologists of the time. Searches have been made in the archives of public libraries, museums, universities and other institutions, with the assistance of their staff. Questions raised about observatories have been researched, and, in most cases, answers discovered.

<b>Code</b>	<b>NSA Collection</b>
<b>ABU</b>	Aberdeen University Collection
<b>ATJD</b>	ATJ Dollar Collection
<b>CSEM</b>	Centre Sismologique Euro-Mediterranéen Collection
<b>ET</b>	E Tillotson Collection
<b>JW</b>	J Wartnaby Collection
<b>LAP</b>	Lapworth Museum Material
<b>MAQ</b>	Macroseismic Questionnaire Collection
<b>NPC</b>	Newspaper Collection - Cuttings
<b>NPH</b>	Newspaper Collection - Historical
<b>PLW</b>	PL Willmore Collection
<b>POL</b>	EW Pollard Material
<b>SEL</b>	Selfridges Material
<b>UKEF</b>	UK Event Folder Collection
<b>UKSG</b>	UK Historical Seismogram Collection
<b>UKSR</b>	UK Seismicity Reference Collection
<b>VDP</b>	FL Vanderplank Material
<b>WRP</b>	World Report and Publication Collection
<b>WSB</b>	World Seismological Bulletin Collection
<b>WWS</b>	WWSSN Microfilm Collection

**Table 1: Constituent parts of the NSA database**

Numerous well known seismological experiments have been carried out over the years, for example, those by Milne, Ewing, Mallet and Shaw. In general these are not discussed, being transitory in nature, although the results were significant. The exceptions are the long-lasting Comrie earthquake investigations and the ‘earth tremor’ experiment at Marsden that was repeated at various other UK and European locations.

### **1.3 Updates**

Since the publication of Version 2 of this Report, a considerable amount of new information has been found on existing observatories, and the existence has been revealed of several previously unknown observatories. This new information has been incorporated into Version 3 of the Report, and it is intended to continue this updating process as new information is revealed. The Internet will be used as a medium for these updates.

New information has been incorporated into the following observatory descriptions: ABD, ABU, BIN, BID, BIR, CAR, CDU, DOR, FAG, GUI, HAS, IOW, NEW, OXF, PLY, SCI, SEL, and SHI. The National Museums of Scotland have been included because of their holdings of seismographs, and the locations and, where possible, descriptions of three previously unknown observatories (BRI, KEN, and LSP) have been added. In addition, further information on Irish observatories has been incorporated with the collaboration of researchers there (see Section 2.5). References to major collections of seismological instruments have also been included.

## **2. Discussion**

### **2.1 Historical background**

Astronomical and meteorological observatories have been established since the 17th century and many contained seismological instruments. Unfortunately the readings

have not survived as seismology was a secondary interest until the latter half of the 19th century, when references to recorded earthquakes start to appear. The development of seismology has been described by Dewey & Byerly (1969) and Ben-Menahem (1995).

By the mid-19th century, several experimenters were using primitive seismoscopes, probably influenced by work in Italy (Ferrari 1992, 1997) on observations of seismicity and vulcanism, and by pendulum and other experiments by Kater (Kater 1818) and Mallet (summarised by Wartnaby 1972). Amongst these gentlemen was E.J. Lowe of Nottingham. A boost was given to UK instrumental seismology in the last decade of the 19th century by the return to England of John Milne, and his setting up by 1910 of a world-wide network of up to 50 observatories, most using similar instruments and reporting data to him. Several amateur seismologists were inspired by Milne, the most prominent being J.J. Shaw, E.W. Pollard and W.H. Bullock. In addition, several fundamental postulations and discoveries about the nature of the Earth had been made, for example the postulation by Wiechert of an Earth model (Ben-Menahem 1995), and instruments capable of use in seismometry had been developed (Ferrari 1997). This engendered an enthusiasm for the sciences, exemplified by the setting up of a seismograph in Antarctica in 1902.

Another boost to research on instrumental seismology was the San Francisco earthquake in 1906, after which Milne himself contributed advice. This event certainly stimulated the Jesuits, particularly in the USA, but an observatory was also set up in England and two in Ireland. In the case of the Cardiff observatory, additional impetus was given by the 1908 Messina event.

A significant but little-known group of seismological workers were the enthusiastic amateurs, who carried on their work generally with home-made instruments but who did not report to the major scientific institutions. Most of their work is therefore lost, except if a chance reference to them is found. Those references we have found have been pursued, sometimes with success, but it is becoming increasingly difficult to trace these workers, as collected papers disappear and older seismologists take their knowledge to the grave. There will certainly be many more of these amateurs than we will ever find. In addition, the nature of seismology has changed over the last 20 or 30 years and few long-period as opposed to broad-band instruments are used today, reflected in the closing down of stations such as Durham and Aberdeen. However, there are still several amateur observatories known to us.

The demise of several observatories, for example Guildford, Haslemere and Cardiff, can probably be attributed to the First World War. Major problems in running the Shide station on the Isle of Wight were noted (correspondence held in NSA) by Prof. H.H. Turner of Oxford who supervised that station for several years after Milne's death in 1913. Similar difficulties during the Second World War were the subject of correspondence (held in NSA) between A.T.J. Dollar and the operator of the Comrie Dunira station, where difficulties were experienced in obtaining the shellac and methylated spirit with which the fixing varnish for the smoked paper seismograms was made.

From the 1950s onwards, the development of short-period instruments led to a vast increase in earthquake observation and seismological research. One of the new instruments was the short-period electromagnetic sensor developed by Dr P.L. Willmore of Cambridge/ISC, who later formed the Seismology Unit at the Institute of

Geological Sciences (now BGS). Willmore's seismometer and Manual of Seismological Observatory Practice (Willmore 1960; Willmore 1979; Willmore & Connell 1963) became standards in the UK and in many other institutions and university departments world-wide. Their use marked the beginning of UK modern instrumental seismology (see below). The many arrays and networks for specific monitoring of earthquakes or nuclear blasts, or various types of experimental work cannot really be classified as 'seismological observatories', so will not be discussed in great detail here.

## **2.2 The Milne World-Wide Seismograph Network**

During his stay in Japan, John Milne became a pioneer of instrumental seismology, and developed his own seismograph. After his return to the UK in 1895, and with strong support from the British Association for the Advancement of Science and other seismologists, Milne quickly established a seismological observatory at his home on the Isle of Wight, and also encouraged the setting up of a network of seismograph stations throughout the UK. Many of these stations were run by enthusiastic amateurs; others by schools, local authorities, academic departments and learned societies. By about 1910, and with the stimulus provided by major earthquakes such as the 1906 San Francisco event, Milne was receiving data from a world-wide network of up to 50 'standard' stations, the majority using the Milne instrument or a variant. This network is shown in Figure 1, and predated the better known WWSSN network by 50 years.

## **2.3 The World-Wide Standard Seismograph Network (WWSSN)**

The WWSSN was a world-wide analogue network of standard stations which started operation around 1961. It was originally funded by the Advanced Research Projects Agency (ARPA) and administered by the Seismology Division of the U.S. Coast and Geodetic Survey (USC&GS). Subsequently, administration moved to the National Earthquake Information Center (NEIC) of the United States Geological Survey (USGS). The WWSSN model provided the basis for the spread of newer digital networks. Some WWSSN stations continue to record, but it is the data accumulated that remain an extremely useful resource, recorded globally to a documented standard (Powell & Fries 1964).

As a result of the WWSSN, instrumental coverage of the UK was enhanced in the 1960s with the establishment of a WWSSN station at Eskdalemuir Observatory which operated until 1995, and UKAEA array stations near Eskdalemuir and Rookhope.

The NSA has a large collection of original Eskdalemuir WWSSN seismograms and a comprehensive set of microfilm/fiche of the WWSSN station seismograms world-wide. A map of WWSSN stations, data from which are held in the NSA, is shown as Figure 2.

## **2.4 Modern UK instrumental coverage**

Older types of long-period seismometers are relatively insensitive to local disturbances, and became redundant as development took place firstly of sensitive instruments capable of recording vertical motion, then of high-frequency short-period seismometers and broader band instruments. For the purposes of this Report, the end of the historical instrumental period in the UK is taken to coincide with the

installation in the late 1960s of Lownet (Crampin et al. 1970; Browitt et al. 1985), a network around the lowlands of Scotland utilising the Willmore seismometer.

Since that date, a dense UK network has been built up, consisting chiefly of short-period digitally-recording instruments but with additional data being provided by low-gain and broad-band seismometers and microphones. The current BGS and DIAS network is shown in Figure 3 (Walker 1997).

## 2.5 Irish Observatories

Information originally presented by Neilson & Burton (1988) on Irish observatories has been supplemented here from BGS sources. In addition, T. Murphy, Emeritus Professor at the Dublin Institute for Advanced Studies, has kindly permitted some of the results of his research on Irish observatories to be quoted. This has enabled the Mungret and Rathfarnham Castle observatories to be described more fully. Further information on Irish observatories will be included as it becomes available in the electronic version of this report.

## 2.6 Collections of scientific instruments

Many ex-observatory seismographs are now held in scientific collections (Holbrook 1992) throughout the UK and Ireland. Foremost among these collections are those in the London Science Museum (home pages at <http://www.nmsc.ac.uk>) (McConnell 1986; Wartnaby 1957) and the National Museums of Scotland in Edinburgh (home pages at <http://www.nms.ac.uk>). Working seismographs have been exhibited at both locations, and full descriptions are given in the Appendix (see NMS and SCI). The Whipple Museum of the History of Science, Cambridge (home pages at <http://www.cam.ac.uk/CambUniv/RepMuseums/Whipple.html>) houses many records from, and instruments made by, the Cambridge Scientific Instrument Company, manufacturers of Ewing, Milne and Galitzin seismographs. A Ewing seismoscope and a 'model' of an 1887 Japanese earthquake are held. St Patrick's College, Maynooth, Co. Kildare, houses the remains of Father W. O'Leary's large seismograph from Rathfarnham Castle (see I\_RTH), together with a collection of Irish scientific instruments (Mollan & Upton 1994). The NSA holds the ex-Bidston Milne-Shaws, examples of modern Willmore instruments, and probably the only Jaggard shock recorder in existence. Milne-Shaw seismographs are held by the Universities of Aberdeen and Birmingham; the latter also houses the JJ Shaw papers in its Lapworth Museum.

Other major instrument collections exist, for example, those at the Oxford Museum of the History of Science and the Manchester Museum of Science and Industry, but no seismological exhibits are held.

## 3. The Results

Data are presented as the Appendix to this Report. Some work done originally by Neilson & Burton is necessarily repeated, but with the incorporation of the new information found. Table 2 lists the historical seismological observatories together with their coordinates and brief details of their known records, and their positions are plotted in Figure 4. Information found to date on each observatory is given in tabular form in the Appendix. An electronic version is presented on the BGS Web Pages at: [http://www.gsrn.nmh.ac.uk/~phoh/nsa\\_observatories.htm](http://www.gsrn.nmh.ac.uk/~phoh/nsa_observatories.htm), and will be updated as necessary

## 4. Conclusions and appeal for further information

As far as time and resources have permitted, the authors have carried out a search of material in the NSA, the archives of universities, local newspapers, museums, libraries, and those of several learned societies. This research has added new information on those observatories already known, and has also revealed details of previously unknown centres of research. The work is presented as an Appendix to this report, and in an updateable form on the Internet. By its nature this kind of research will never be complete. Further examination of the seismological collections of Tillotson, Willmore, and various others held in the BGS archive and elsewhere may well reveal further details, and it is hoped that this work can continue when funding permits. In the meantime, the authors would be pleased to receive further details, reminiscences, or suggestions for further lines of research from readers of this paper. The Internet will be used as a medium for the promulgation of any new information.

## 5. Acknowledgements

We would like to thank the many private individuals and staff in libraries, museums, university departments, and local authorities, who have helped us in many ways. Without their efforts, much of the information in this report would still be unknown. Professor Emeritus T. Murphy of DIAS, Dublin, kindly allowed the inclusion of data from his research on Irish observatories. Comments from G. Neilson and Dr P. Burton, both formerly of BGS, have clarified many points raised during this work. The continuing study of archival material is supported by a DETR-led Customer Group. This report is published with the permission of the Director of the British Geological Survey (NERC).

## 6. References

(those marked \* are not referenced, but are useful for background reading)

Ahmad, M.U., 1966. *A geophysical study of the Great Glen Fault*, unpublished PhD thesis, Dept of Geology, Birkbeck College, University of London.

Annual Reports 1954-1961. *Annual Reports, Dept of Geodesy and Geophysics*, University of Cambridge.

Anon, 1888. Report of the Committee appointed to inquire into the observations of earth tremors with the view of determining their connection (if any) with the issue of gas in mines, *Transactions of the North of England Institute of Mining Engineers*, **Volume XXXVIII**, 1887-88, pp 55-69.

Ballinger, J., 1908. *Guide to Cardiff City and Port*, Cardiff.

Ben-Menahem, A., (1995). A Concise History of Mainstream Seismology: Origins, Legacy and Perspectives, *Bull. Seism. Soc. Am.*, **Volume 85, No. 4**, pp 1202-1225.

Bernacchi, L.C. & Milne, J., 1908. Earthquakes and other earth movements recorded in the Antarctic regions, 1902-1903, in *National Antarctic Expedition 1901-1904. Physical Observations*. London, Royal Society, 1908, pp 37-96.



- British Association, 1841-44. *Report of the British Association for the Advancement of Science*, 1841, pp 46-50; 1842, pp 92-98; 1843, pp 120-127; 1844, pp 85-90.
- British Association, 1870-76. Reports of the Committee on Earthquakes in Scotland, *Report of the British Association for the Advancement of Science*, 1870, pp 48-49; 1871, pp 197-198; 1872, pp 240-241; 1873, pp 194-197; 1874, p 241; 1875, pp 4-65; 1876, p 74.
- British Association, 1884-1887. *Annual Reports, British Association for the Advancement of Science*,
- British Association, 1886, 1887. *Report of the Corresponding Societies, British Association for the Advancement of Science*,
- British Association, 1908, 1911, 1912, 1913, 1915, 1928, 1930, 1932, 1933, 1939, 1950-1964. *Report of the Seismological Committee, British Association for the Advancement of Science*.
- Browitt, C.W.A., Turbitt, T. and Morgan, S.N., 1985. Investigation of British earthquakes using the national monitoring network of the British Geological Survey, in *Earthquake Engineering in Britain*, Thomas Telford, London, pp 33-47.
- Burton\*, P.W. & G. Neilson, 1978. Historical Seismological Archives 1: The Milne Library, *Brit. Geol. Survey Glob. Seism. Unit*, **Report No. 100**.
- Burton, P.W., Musson, R.M.W., and Neilson, G., 1984. Studies of Historical British Earthquakes, *Brit. Geol. Survey Glob. Seism. Unit*, **Report No 237**.
- Charlier, Ch. & J.M. Van Gils, 1953. Liste des Stations Séismologiques Mondiales, Observatoire Royal de Belgique à Uccle, Belgique.
- Cox\*, R.C (ed), 1982. Robert Mallet 1810-1881, Centenary Seminar Papers. *Irish Engineering Publications for the Institution of Engineers of Ireland*, Dublin.
- Crampin, S., Jacob, A.W.B., Miller, A. and Neilson, G., 1970. The LOWNET Radio-linked Seismometer Network in Scotland, *Geophys. J.R. Astr. Soc.*, **Volume 21**, pp 207-216.
- Davison, C., 1899. *The Hereford Earthquake of December 17, 1896*, Cornish Bros., 37 New Street, Birmingham.
- Davison, C., 1900. On Some Minor British Earthquakes of the Years 1893-1899, *Geol. Mag.* **Volume 7**, pp 164-177.
- Davison\*, C., 1905. *A Study of Recent Earthquakes*, Walter Scott Publishing Co. Ltd., London & Newcastle-on-Tyne.
- Davison, C., 1924. *A History of British Earthquakes*, Cambridge University Press.
- Dewey, J. & Byerly, P., 1969. "The Early History of Seismometry (To 1900)", *Bull. Seism. Soc. Am.*, **Volume 59**, No. 1, pp.183-227.

- Dollar, A.T.J., 1950. A Catalogue of Scottish Earthquakes, 1916-1949, *Trans. Geol. Soc. Glasgow*, **Volume 21 part 2**, pp 283-361.
- Dollar, A.T.J., 1953. The 'Earthquake House' at Drumearn, Comrie, Perthshire, in 57<sup>th</sup> Report of the Committee on Seismological Investigations, *British Association Annual Report, 1953*.
- Ewing\*, A.W., 1940. *The man of room 40: the life of Sir Alfred Ewing*, Hutchinson, London
- Ewing, J.A., 1885. On the measurement of movements of the Earth, with reference to proposed earthquake observations on Ben Nevis, *Nature*, **Nov 19**, 1885, (Abstract of paper read to Section A of British Association at Aberdeen. The same abstract appears in Proceedings of BA Aberdeen 1885).
- Ewing, J.E., 1886. Earthquake-recorders for use in observatories, *Nature*, **Volume XXXIV**, May 1886-October 1886, pp 343-344.
- Ferrari, G., (ed), 1992. *Two hundred years of seismic instruments in Italy 1731-1940*, Istituto Nazionale di Geofisica, SGA Bologna.
- Ferrari, G., (ed), 1997. *Proceedings of the Workshop: Historical seismic instruments and documents: a heritage of great scientific and cultural value, May 16 to 18, 1994, Walferdange, Luxembourg*. Conseil de l'Europe, Cahiers du Centre Européen de Géodynamique et de Séismologie, **Volume 13**. ISBN No 2-87977-001-7.
- Forbes\*, J.D., 1844. On the Theory and Construction of a Seismometer, or Instrument for Measuring Earthquake Shocks, and other Concussions, *Trans. Roy. Soc. Edin.*, **Volume XV**, pp 219-228.
- Griffiths, E.H., 1908. The establishment of a seismograph in Cardiff, *Transactions of the Cardiff Naturalists' Society*, **Volume 41**, pp 54-58.
- Henderson, Revd. A., 1901. *The Coats Observatory, Its History and Equipment*, J. & R. Parlane, Paisley.
- Herbert-Gustar, L.K. & Nott, P.A., 1980. *John Milne, father of modern seismology*. Paul Norbury, Tenterden, Kent.
- Herbert-Gustar\*, L & Nott, P.A., 1983. Was seismology lucky to acquire John Milne? in *USGS Earthquake Information Bulletin*, **Volume 15, no.5**, pp 164-176.
- Ingram, R.E., and Timoney, J.R., 1954. Theory of an Inverted Pendulum with Trifilar Suspension, *Dublin Institute of Advanced Sciences, School of Cosmic Physics, Geophysical Bulletin No. 9*.
- Holbrook, M., 1992. *Science Preserved: a directory of scientific instruments in collections in the United Kingdom and Eire*, HMSO, London, for the Science Museum.
- Honeycombe, G., 1984. *Selfridges Seventy-Five Years. The Story of the Store 1909-1984*. Selfridges Limited.

Jacobs, L., 1964. Seismology at Eskdalemuir Observatory, *Met. Mag.*, **Volume 93**, pp 289-294.

Jacobs, L., 1969. The 200-years history of Kew Observatory. *Met Mag* **Volume 98**, pp 162-171.

Jeffreys\*, H., 1939. Seismological Tables, *Mon. Not. R. Astr. Soc.*, **Volume 99**, pp 397-408.

Kater\*, H., 1818. An account of experiments for determining the length of the pendulum vibrating seconds in the latitude of London, *Phil. Trans. Roy. Soc. Lond.*, **Part I**

Knott\*, C.G., 1908. *The physics of earthquake phenomena*, publisher unknown.

Lee, A.W., 1939. Seismology at Kew Observatory, *Meteorological Office, Geophysical Memoirs No. 78*, HMSO, London.

Lester, J., 1995a. A Black Country Scientist, *The Blackcountryman*, **Volume 28 No 2**, pp 51-56.

Lester, J., 1995b. A Black Country Scientist (Conclusion), *The Blackcountryman*, **Volume 28 No 3**, pp 59-63.

Lovell, J.H., 1999. A Catalogue of Archive Material associated with John Milne, F.R.S. *British Geological Survey, Global Seismology Series, Technical Report WL/99/14*.

Lowe, E.J., 1864. History of the Earthquake of 1863, October 6<sup>th</sup>. *Proceedings of the British Meteorological Society 1864 Jan*, pp 55-62.

Lowe, E.J., 1870. *The Natural Phenomena and Chronology of the Seasons*, Bell & Daldy, York Street, Covent Garden, London.

McConnell, A., 1986. *Geophysics and Geomagnetism, Catalogue of the Science Museum Collection*. London, HMSO. ISBN 0 11 290434 3

Merlin E. & O. Somville, 1910. *Liste des Observatoires Magnetiques et des Observatoires Seismologiques*, Observatoire Royal de Belgique, Brussels.

Milne\*, J., 1893. *Earthquakes and Other Earth Movements*, Kegan, Paul, Trench, Trubner & Co., London.

Milne\*, J., 1906. *On the Installation and Working of Milne's Horizontal Pendulum Seismograph*, R.W. Munro, London.

Mollan, R.C. & Upton, J., 1994. *The scientific apparatus of Nicholas Callan and other scientific instruments, Catalogues of historic scientific instruments in Irish collections No. 1*, St Patrick's College, Maynooth: Blackrock, Co. Dublin, Samton.

Mungret College Annuals, 1909-1911.

Murphy, T., *in press*. The seismology observatories of Mungret and Rathfarnham, Ireland, *Geophysical Bulletin Series, Dublin Institute for Advanced Studies, 1999*.

Musson, R.M.W., 1993a. Comrie: a historical Scottish earthquake swarm and its place in the history of seismology. *Terra Nova*, **Volume 5**, pp 477-480.

Musson, R.M.W., 1993b. Discovery of a curious seismological monument from 19th century Scotland. *Terra Nova*, **Volume 5**, p 513.

Musson\*, R.M.W., 1994. A Catalogue of British Earthquakes, *Brit. Geol. Survey, Seismology Series, Technical Report WL/94/04*.

Musson, R.M.W., 1995. Report on the Relicts of West Bromwich Observatory, *Brit. Geol. Survey, Technical Report WL/95/20*, Global Seismology Series.

Neilson, G. & P.W. Burton, 1988. A brief history of Seismological Observatories in the British Isles, 1896-1960 in Lee, W.H.K., Meyers, H. & Shimazaki, K., (eds.), *Historical Seismograms and Earthquakes of the World*, Academic Press Inc.

Neilson, G., 1981. Historical Seismological Archives 2: Report on a visit to the Aberdeen University Department of Natural Philosophy, *Brit. Geol. Survey Glob. Seism. Unit, Report No. 144*.

Norris, F.E., 1910-1915. *First to Sixth Annual Reports of the Seismograph Station at Woodbridge Hill, Guildford*, printed at the Observatory and by Curtis, Guildford.

Notes on Instruments in *Trans. Roy. Soc. Edin.*, **Volumes 34**, 1890; **42** 1902; **43** 1907; & **44 Parts 1 & 2**.

Nott\*, P.A., 1974. *Earthquake Milne and the Isle of Wight*, Vectis, IoW

Omond, R.T., 1902. Abstract of paper on a comparison of observations at the Observatory and at the Public School, Fort William, *Trans. Roy. Soc. Edin.*, **Volume 42**, p49.

Paton, J., 1983. *Ben Nevis Observatory 1883-1904*, Royal Meteorological Soc. James Glaisher House, Bracknell, Berkshire.

\*Pollard, E.W., 1943. Earthquakes for the practical amateur, *Proceedings of the Isle of Wight Natural History and Archaeological Society*, **Volume III, Part V**.

\*Pollard, E.W., 1943b. Recording Earthquakes, *Discovery Magazine*, October 1943, pp 307-309.

\*Pollard, E.W., 1951. Earth Movements and how recorded, *The South-Eastern Naturalist and Antiquary*, **Volume LVI**.

Powell, C.F., 1938. The Royal Society Expedition to Montserrat, B.W.I., Final Report. *Philosophical Transactions, Royal Society of London*, **Volume A 237**, pp 1-34.

Powell, T. and Fries, D., 1964. *Handbook: Worldwide Standard Seismograph Network*, [Revised August 1965]. US Coast and Geodetic Survey/University of Michigan - Institute of Science and Technology.

Robinson, P.R., 1982. Geomagnetic observatories in the British Isles, in *Vistas in Astronomy*, **Volume 26**, pp 347-367, Pergamon Press 1983.

Scott, R.F., 1905. *The voyage of the Discovery*, **Volume 1**. John Murray, London.

Scrase, F.J., 1969. Some Reminiscences of Kew Observatory in the Twenties, *Met. Mag.*, **Volume 98**, pp 180-186.

Shaw, J.H., 1992. *Catalogue of WWSSN Microfilm in the National Seismological Archive 1965-1990*, *Brit. Geol. Survey, Technical Report WL/92/22*, Global Seismology Series.

Shaw\*, J.J., undated. *Milne-Shaw Seismograph Handbook*, J.J. Shaw, West Bromwich.

Stonyhurst College Observatory, 1909. *Results of Meteorological and Magnetical Observations*, Philip, Son & Nephew Ltd., Liverpool.

Sumner, W. L., undated. *The Beeston Observatory*, 8pp, deposited in Nottinghamshire Local Studies Library.

Truscott, J.R., 1964. The Eskdalemuir Seismological Station, *Geophys. J.R. Astr. Soc.*, **Volume 9, 1**, pp 59-68.

Udias, A. & Stauder, W., 1991. Jesuit Geophysical Observatories. *EOS, Transactions, American Geophysical Union*, **Vol. 72, No. 16**, pp 185-192.

University College, Cork, 1912-1919. *University College, Cork, Official Gazette*.

Walford, E., 1911. The Cardiff seismograph, *Transactions of the Cardiff Naturalists' Society*, **Volume 44**, pp 19-20.

Walker, A.B., 1997. BGS Seismic Monitoring and Information Service: Eighth Annual Report, *Brit. Geol. Survey, Technical Report WL/97/16*, Global Seismology Series.

Walton Brown, M., 1887. An account of experiments in France upon the possible connection between movements of the Earth's crust and the issues of gases in mines, *Transactions of the North of England Institute of Mining Engineers*, **Volume XXXVI**, 1886-87, pp 43-45.

Wartnaby, J., 1957. *Seismology: A brief Historical Survey and a Catalogue of Exhibits in the Seismological Section of the Science Museum*. Geophysics Handbook **No. 1**, HMSO, London.

Wartnaby, J., 1972. *Seismological investigations in the nineteenth century, with special reference to the work of John Milne and Robert Mallett*, unpublished Ph.D. dissertation, University of London.

Willmore, P.L., 1960. The detection of earth movements, *in* Methods and techniques in geophysics (ed. Runcorn), London, Interscience, pp 230-276.

Willmore, P.L., (ed.) 1979. *Manual of Seismological Observatory Practice*, World Data Center A for Solid Earth Geophysics, U.S. Department of Commerce, **Report SE-20**.

Willmore, P.L. and Connell, D.V., 1963. A New Short-Period Seismometer for Field and Observatory Use, *Bull. Seism. Soc. Am.*, **Volume 53, 4**, pp 835-844.

Wood, H.O., 1921. A list of Seismologic Stations of the World, *Bulletin of the National Research Council, National Academy of Sciences, Washington D.C.*, **Vol 2 Part 7, Number 15**.



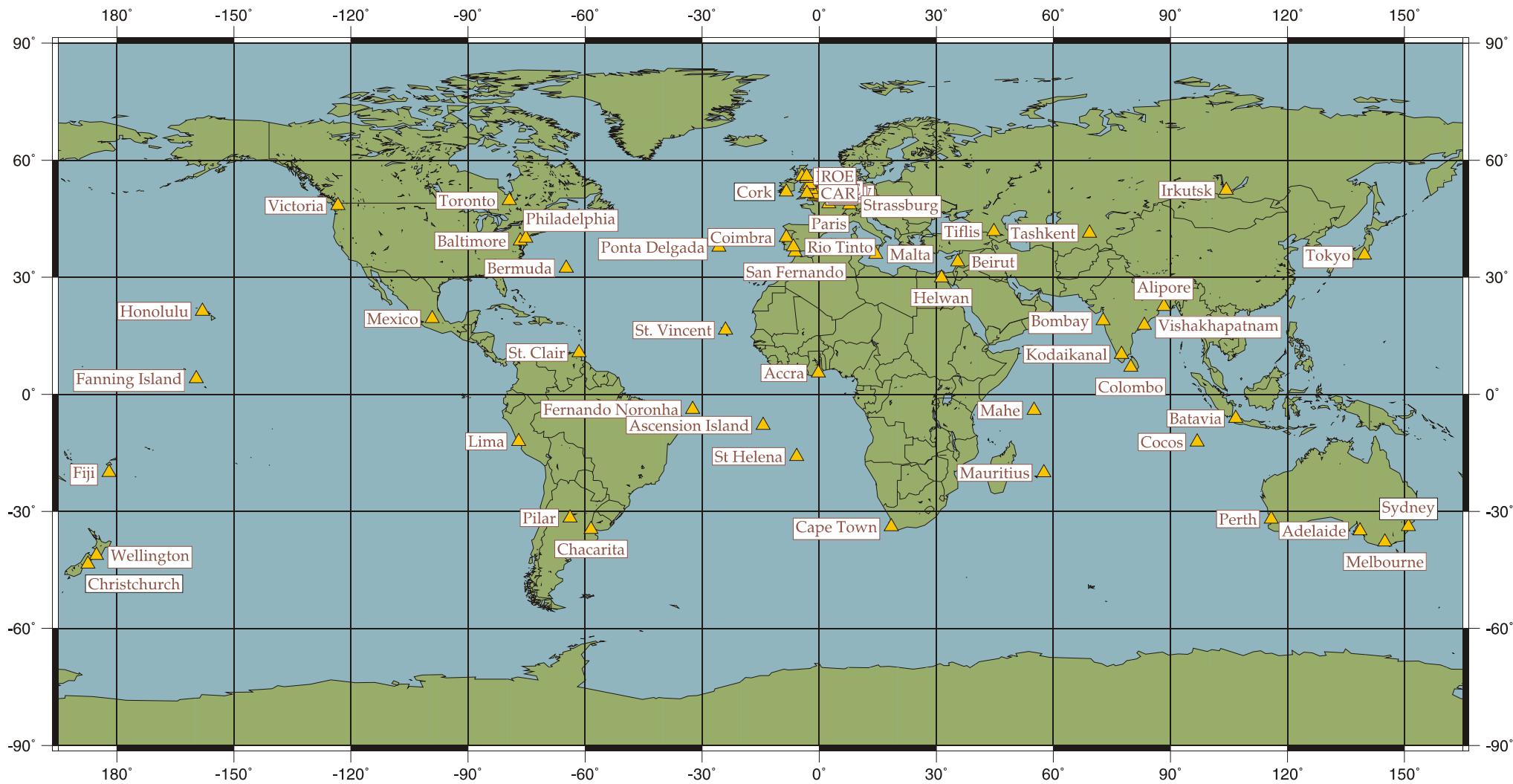
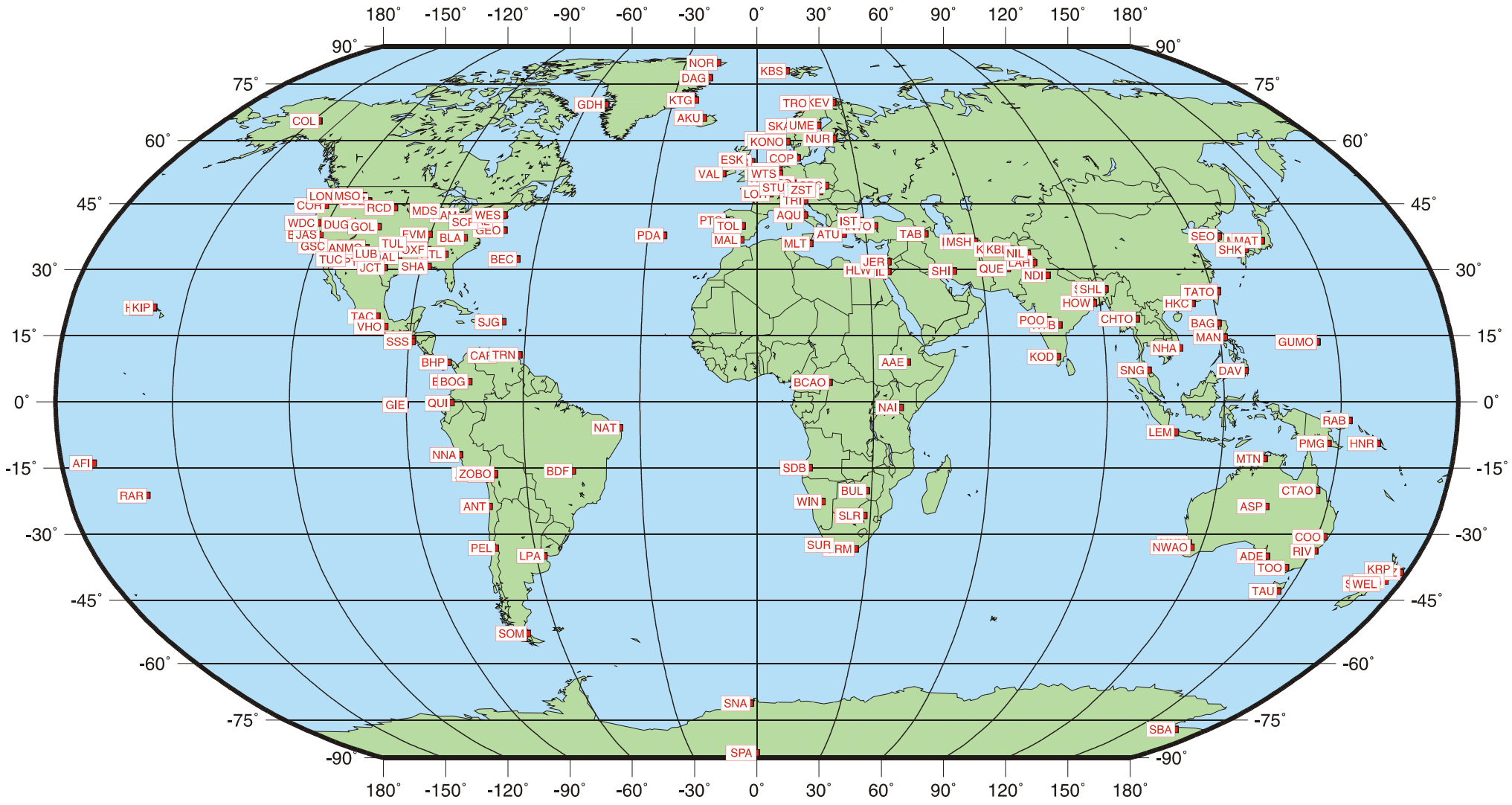
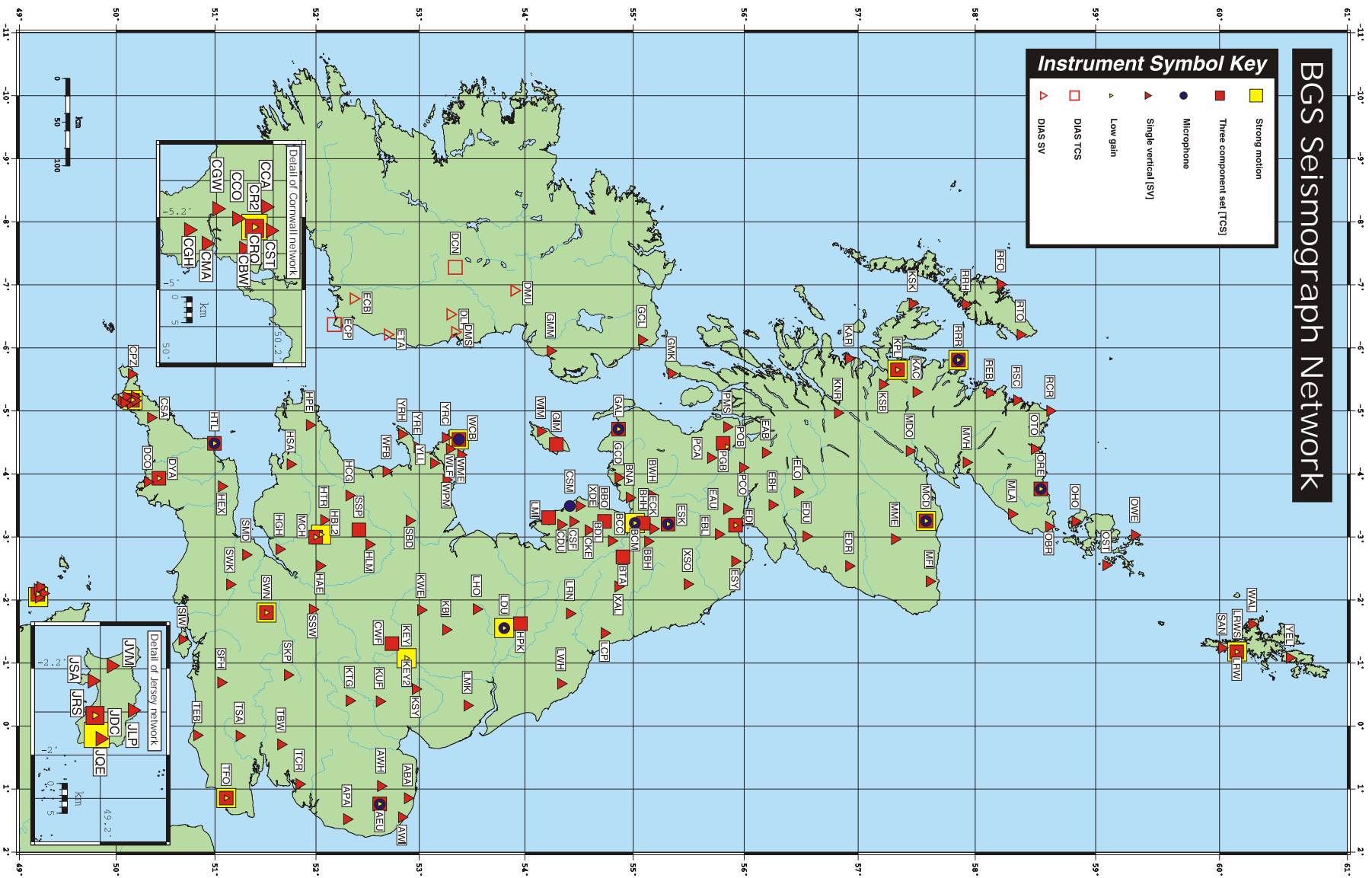


Figure 1. World wide network of stations reporting data to Milne at Shide, around 1910.



**Figure 2. WWSSN stations, data from which are held in the NSA.**



**Figure 3. British Geological Survey (BGS) and Dublin Institute of Advanced Studies (DIAS) seismograph stations in use, December 1998.**

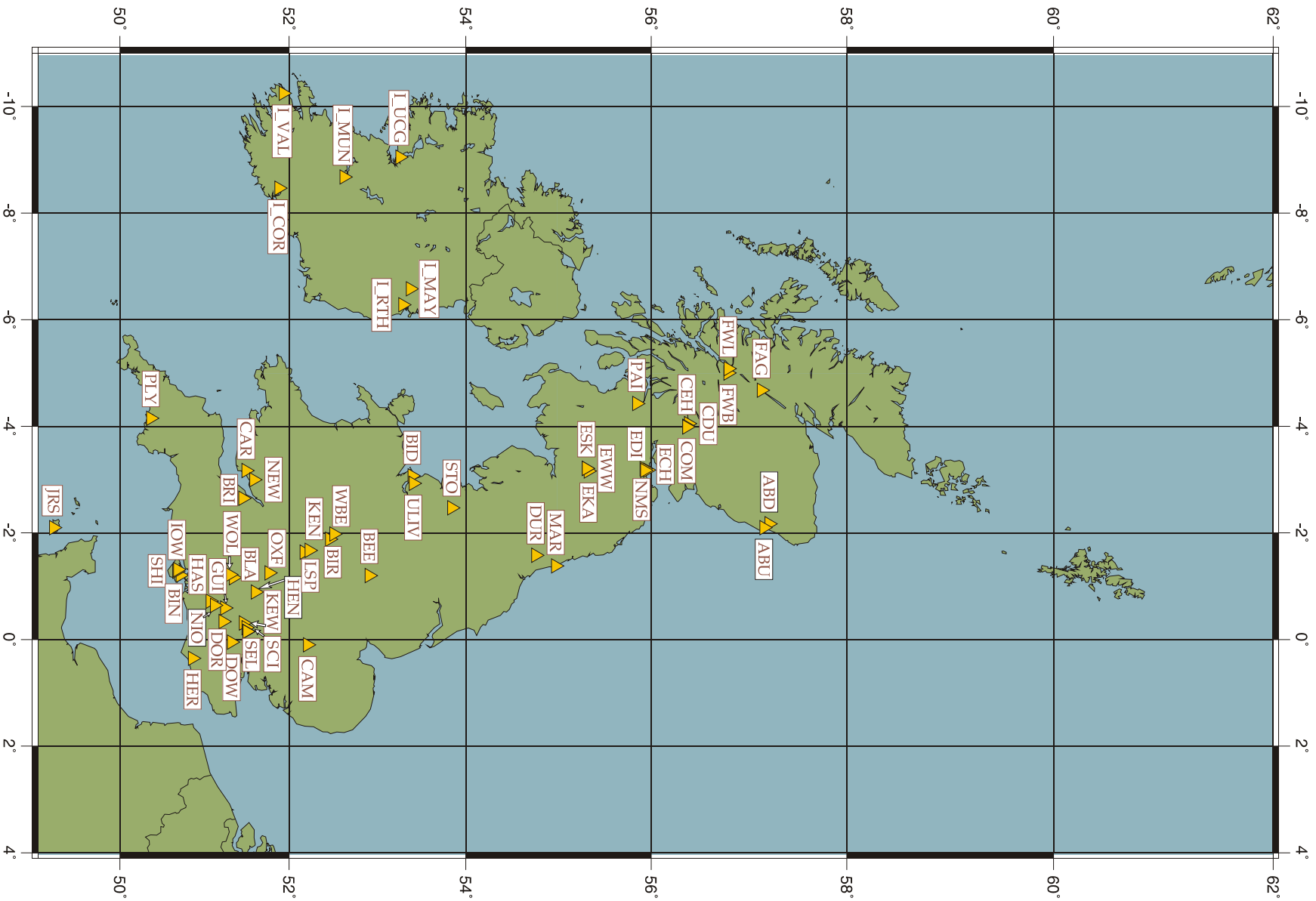


Figure 4. Historical seismicological observatories, pre-1970.

**Table 2: Observatory Details Summary**

BGS CODE	NAME	LAT	LON	OVERALL SPAN OF OBSERVATIONS		KNOWN DETAILS OF SEISMOGRAMS (S:) AND BULLETINS (B:)
<b>ABD</b>	Parkhill House Observatory	57.217	-2.167	1914	1932	S: Presumed lost except for one illustrated below B: Presumed lost
<b>ABU</b>	Aberdeen University Observatory	57.167	-2.100	1936	1967	S: 1936-1967, not Jan 1946 - Mar 1947, held in NSA. Microfilmed. B: 1939, 1941-1966, held in NSA.
<b>ANG?</b>	Anglesey?					S: B:
<b>BAT?</b>	Bath?					S: B:
<b>BEE</b>	Beeston Tower, Nottingham	52.920	-1.204	1850	1866?	S: None known to exist B:
<b>BID</b>	Bidston Observatory, Liverpool	53.401	-3.072	1898	1957	S: 1938-1956 held in NSA. Microfilmed. B: 1901-1919, 1925-1940 held in NSA.
<b>BIN</b>	Binstead, Isle of Wight	50.730	-1.180	c.1900	1947	S: One known to survive (held in NSA) B: Handwritten bulletins 1940-1959 held in Carisbrooke Castle Museum, copies in NSA
<b>BIR</b>	Birmingham Observatory	52.466	-1.883	1900?	1920?	S: Two seismograms from 1903 published in Davison (1924) B:
<b>BLA</b>	Blacknest, Reading	51.364	-1.187	1961	present	S: B:
<b>BRI</b>	Bristol	51.479	-2.639	1931	?1939	S: None found so far, although recordings were made from early 1931. B: None found so far. Macroseismic survey made of 2.8ML Bristol event of 17 March, 1934 held in NSA.
<b>CAM</b>	Cambridge Observatory	52.215	0.096	1956	1960?	S: None known B: One bulletin, for 1958, held in NSA
<b>CAR</b>	Cardiff Observatory	51.501	-3.170	1910	?	S: Some published in Transactions of the Cardiff Naturalists' Society B: None known
<b>CDU</b>	Dunira House, Comrie	56.389	-4.045	1938	1950?	S: Whereabouts unknown but some readings survive in Dollar's papers in NSA B: None known
<b>CEH</b>	Earthquake House, Comrie	56.372	-3.999	1874	present	S: B:
<b>CHE?</b>	Cheltenham?					S: B: Bulletins for Cheltenham (1926-1931) are recorded in NSA as held by IPG/CSEM

**Table 2: Observatory Details Summary**

BGS CODE	NAME	LAT	LON	OVERALL SPAN OF OBSERVATIONS and KNOWN DETAILS OF SEISMOGRAMS (S:) AND BULLETINS (B:)			
<b>COM</b>	Comrie	56.370	-3.990	1840	1876?	S:	
						B:	
<b>DIS</b>	Discovery, Antarctica	-77.842	166.745	1901	1904	S:	not known at present, although some published in Bernacchi & Milne (1908)
						B:	not known at present
<b>DOR</b>	Dorking Observatory, Surrey	51.230	-0.340	1948	1960?	S:	None known to survive from this observatory
						B:	Handwritten bulletins 1940-1959 held in Carisbrooke Castle Museum, copies in NSA. The last record is for March 29, 1959.
<b>DOW</b>	Down House, Kent	51.330	0.050	1947	1949?	S:	None found
						B:	None found
<b>DUR</b>	Durham University Observatory	54.767	-1.583	1930	1976	S:	1930-1939, 1945-1976 held in NSA. Microfilmed.
						B:	1930-1938, 1946-1975 held in NSA.
<b>ECH</b>	Calton Hill Observatory, Edinburgh	55.960	-3.180	1894	1895	S:	None known
						B:	
<b>EDI</b>	Royal Observatory, Edinburgh	55.925	-3.184	1896	present	S:	Seismograms destroyed, except for Milne 1902-1908 held in NSA. Microfilm copies are held in the NSA for 1896-1962
						B:	1922-1962 bulletins held in NSA
<b>EKA</b>	Eskdalemuir Arriv	55.331	-3.159	1962	present	S:	
						B:	Some material held in NSA
<b>ESK</b>	Eskdalemuir Observatory	55.312	-3.206	1908	present	S:	Gaitzin 1910-1920, Milne-Shaw 1916-1918 held in the NSA
						B:	1913-1916, 1920-1925, 1965-1967 (WWSSN?) and 1969-1972 original notebooks are held in the NSA
<b>EWW</b>	Eskdalemuir Observatory WWSSN	55.312	-3.206	1964	1995	S:	Original seismograms are kept at Esk (1965-1992?). Microfilmed by NEIC and held in NSA.
						B:	1965-1967 (WWSSN) held in NSA
<b>FAG</b>	Fort Augustus Abbey	57.140	-4.680	1950		S:	None ever recorded
						B:	None published
<b>FWB</b>	Ben Nevis Summit Observatory	56.796	-5.002	1883	1904	S:	No record of any
						B:	No record of any; none were published with the meteorological observations.
<b>FWL</b>	Fort William Low Level Observatory	56.800	-5.083	1893	1904	S:	no record of their fate
						B:	no record of any
<b>GUI</b>	Woodbridge Hill Observatory, Guildford	51.250	-0.590	1910	1915?	S:	None found
						B:	1910-1915 held in NSA
<b>HAS</b>	Frensham Hall Observatory, Haslemere	51.080	-0.717	1909?	1916?	S:	None found
						B:	None found but readings reported in the Slide Circulars



**Table 2: Observatory Details Summary**

BGS CODE	NAME	LAT	LON	OVERALL SPAN OF OBSERVATIONS and KNOWN DETAILS OF SEISMOGRAMS (S:) AND BULLETINS (B:)		
<b>HEN</b>	Turville Vicarage, Henley-on-Thames	51.610	-0.890	1933?	1946?	S: None known to exist B: None known to exist
<b>HER</b>	Herstmonceux Castle, Sussex	50.870	0.350	1960	1960	S: Almost all destroyed B:
<b>I_COR</b>	University College, Cork, Ireland	51.883	-8.467	1911	1919	S: None known B: Readings reported to Shide and published in the Shide Circulars until December 1917, Annual Bulletins published by the University 1943-1949
<b>I_MAY</b>	St Patrick's College, Maynooth, Ireland	53.383	-6.583			S: B:
<b>I_MUN</b>	Munret College, S.J., Limerick, Ireland	52.633	-8.683	1907?	1915	S: Some published in new papers, no originals found B: None published
<b>I_RTH</b>	Rathfarnham Castle, S.J., Dublin, Ireland	53.300	-6.283	1916	1964	S: At Dublin Institute for Advanced Studies B: 1950-1960 held in NSA
<b>I_UCG</b>	University College, Galway, Ireland	53.266	-9.050	1960?	?	S: B:
<b>I_VAL</b>	Valentia Observatory WWSSN, Ireland	51.933	-10.250	1962	present	S: Record duplicates 1965-1990 held in NSA on film and fiche B:
<b>INV</b>	Gorthleck, Loch Ness			1962	1964	S: B:
<b>IOW</b>	Newport Observatory, Isle of Wight	50.683	-1.283	c. 1915		S: None known to exist B: Published with the Shide Circulars
<b>JRS</b>	Maison St. Louis Observatory, S.J., Jersey	49.192	-2.099	1935	present	S: 1936-1985, (missing 1942-45, 1968, 1972-74, 1980 Jan-Aug) held in NSA. Microfilmed. B: 1946-1965 held in NSA
<b>KEN</b>	Kenilworth	52.350	-1.583	?1936		S: Not known B: Not known
<b>KEW</b>	Kew Observatory, London	51.468	-0.313	1898	1969	S: Mine 1904-1925, Galitzin/Wood-Anderson 1925-1965 seismograms held in NSA 1909-1905 Microfilm held in NSA B: 1899-1912, 1914, 1963-64, 1968-69 + Bound 1927-1962 (Span) held in NSA Observations Yearbook 1928-1969 held in NSA contains Kew Bulletin
<b>LSP</b>	Leamington Spa	52.283	-1.533	?1936	?	S: B:
<b>MAR</b>	Marsden Colliery, Sunderland	54.980	-1.380	1886?	1887?	S: Some published in Transactions B:

**Table 2: Observatory Details Summary**

BGS CODE	NAME	LAT	Lon	OVERALL SPAN OF OBSERVATIONS		and KNOWN DETAILS OF SEISMOGRAMS (S:) AND BULLETINS (B:)	
<b>MEN</b>	Menai Bridge					S:	
						B:	
<b>MILNE</b>	Milne Collection					S:	Seismograms mixed held w ith the Milne material
						B:	
<b>NEW</b>	New port, Gwent	51.590	-3.000	1906?	?	S:	
						B:	
<b>NIO</b>	National Institute of Oceanography, Wormley	51.130	-0.640	1957?	?	S:	
						B:	
<b>NMS</b>	National Museums of Scotland	55.950	-3.190			S:	A collection is held in the Museum of original seismograms recorded by the Milne-Shaw and the Selfridges instrument.
						B:	No bulletins were issued
<b>OXF</b>	Oxford University Observatory	51.767	-1.250	1918	1947	S:	Only three known to survive; two held in NSA, one (of the Sept 1, 1923 magnitude 8.3 Kanto earthquake in Japan) in the Isle of Wight County Record Office
						B:	Published as International Seismological Summary
<b>PAI</b>	Coats Observatory, Paisley	55.846	-4.431	1898	1918	S:	Milne (small rolls) 1900-1919, Milne tw in boom 1914-1919 and Milne 1931-1935 at BGS Edinburgh
						B:	Seismographic Register 1902-1909 held in NSA
<b>PLY</b>	Plymouth Observatory	50.370	-4.150	1923?	?	S:	None found although Dr Fisher is noted in press cuttings as having recorded earthquakes
						B:	None found
<b>SCI</b>	Science Museum, London	51.500	-0.180	1935	present	S:	Various seismograms held, detailed by McConnell (1986)
						B:	None
<b>SEL</b>	Selfridges Store, London	51.510	-0.150	1932	1947	S:	One Selfridge seismogram held in NSA, others have been published in old magazine and newspaper articles. A few seismograms recorded during the instrument's display in Edinburgh are held by the National Museums of Scotland
						B:	None located
<b>SHI</b>	Shide Observatory, Isle of Wight	50.686	-1.286	1895	1918?	S:	Some held on the Island (Lovell 1999)
						B:	Published as the Shide Circulars by British Association.
<b>STO</b>	Stonyhurst College Observatory, S.J., Blackburn	53.844	-2.470	1908	1947	S:	Never found despite extensive searches
						B:	1909-1917, 1920-1924, 1927-1929 and 1933 held in NSA.
<b>ULIV</b>	University of Liverpool Observatory	53.417	-2.933	1932	1950?	S:	Several from 1933 archived at University
						B:	Some handw ritten bulletin material in NSA
<b>WBE</b>	West Bromwich Observatory	52.517	-1.983	1908	1948?	S:	About 40 mixed records from 1908 to 1926 (not sequential) are held in the Lapworth Museum and will be microfilmed for NSA
						B:	Earthquake notebooks (September 1908 to January 1909) and Station Bulletins (February 1909 to June 1911) are held in the Lapworth Museum
<b>WOL</b>	Wolverton, Hampshire	51.310	-1.220	1909?	present	S:	
						B:	Data reported to Blacknest





## APPENDIX: Historical Observatory Details

<b>NAME</b> Parkhill House Observatory	<b>LOCATION</b> Parkhill House, Dyce, Aberdeen, Scotland, UK	<b>BGS IDENTITY CODE</b> <b>ABD</b>
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<b>ORGANISATION</b> Dr J.E.Crombie	<b>FIRST YEAR (seismology)</b> 1914	<b>LATITUDE</b> 57.217	<b>LONGITUDE</b> -2.167	<b>INTERNATIONAL STATION CODE</b> 
	<b>FINAL YEAR (seismology)</b> 1932	<b>HEIGHT (approx in metres)</b> 53.3		

<b>INSTRUMENT ONE</b> Mainka NS & EW	<b>FIRST YEAR Inst 1</b> 1914	<b>FINAL YEAR Inst 1</b> 1932	<b>OTHER INSTRUMENTS</b> Agamennone (1914?-1932)
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<b>INSTRUMENT TWO</b> Milne-Shaw Horizontal	<b>FIRST YEAR Inst 2</b> 1918	<b>FINAL YEAR Inst 2</b> 1932	
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**SEISMOGRAMS**  
Presumed lost except for one illustrated below

**BULLETINS**  
Presumed lost

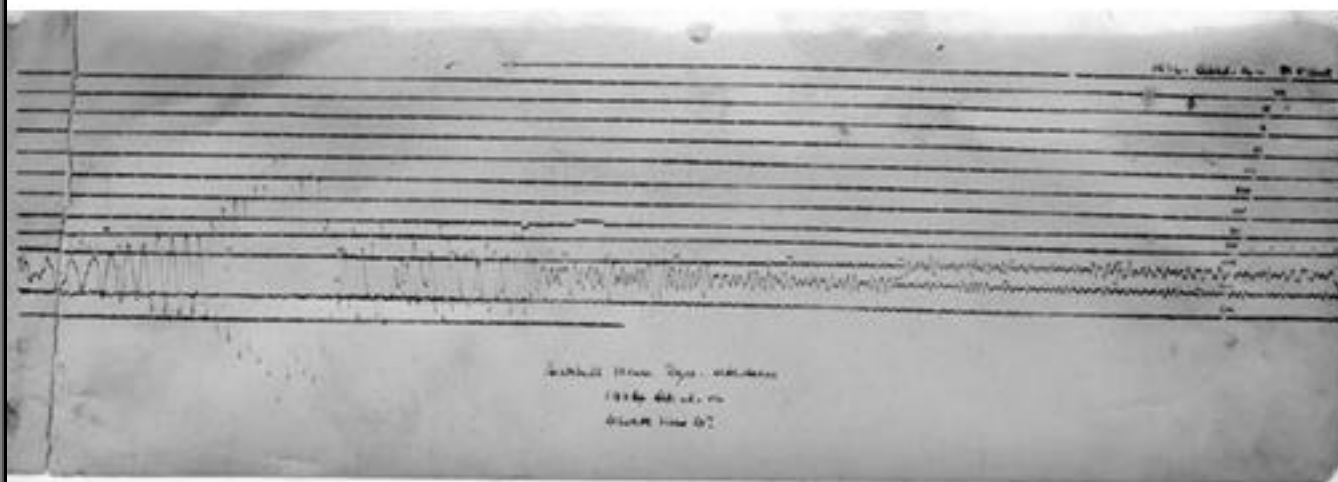
**OTHER MATERIAL**  
Presumed lost, although the seismographs were sent elsewhere. However, some biographical material on Crombie is held with the Aberdeen University seismological collection in the NSA.

**OBSERVATORY OVERVIEW**

The first seismological observatory to be established in the Aberdeen area was founded by Dr James E. Crombie at his home, Parkhill House, Dyce. The house itself dated from 1732, and was part of a large estate. Crombie was a graduate of Aberdeen University and became a partner in the family's woollen manufacturing business and a prominent local citizen. Throughout his life he gave generously to the University, local hospitals, and other worthy causes. He was awarded an honorary LL.D. by the University in 1907 in recognition of his services. In 1927 he donated two Milne-Shaw seismographs to the Oxford Observatory (see OXF) and financed their installation in the 'Crombie Basement'. On his death he bequeathed a large sum to the British Association for the support of seismological research.

Recording started at Dyce in 1914 using two Mainka horizontal seismographs and an Agamennone instrument. The Mainkas had a free period of 10 seconds, a static magnification of 150, and a mass of around 440 kg, and received time signals broadcast from the Eiffel Tower. In 1918 a Milne-Shaw seismograph was added.

All these instruments ran until Crombie's death in August 1932, when the Agamennone and one of the Mainkas were donated to the Science Museum in London. Another Mainka was put at the disposal of the BA Seismological Committee by Crombie's executors with the intention that it should be sent to Jersey Observatory (see JRS), but this did not happen. The Milne-Shaw was donated to Aberdeen University in the same year, and eventually became the E-W component of the Aberdeen University station which operated continuously from December 1936 to June 1967. Parkhill House was demolished in the 1960s.



Seismogram, of a large event near the Philippines on April 14, 1924, thought to be the only one surviving from Crombie's observatory (held in NSA)

**REFERENCES**

Neilson, G., 1981. Historical Seismological Archives 2: Report on a visit to the Aberdeen University Department of Natural Philosophy, Brit. Geol. Survey Glob. Seism. Unit. Report No 144.  
Neilson, G. & P.W. Burton., 1988. A brief history of Seismological Observatories in the British Isles, 1896-1960 in Lee, W.H.K., Meyers, H. & Shimazaki, K., (eds.), Historical Seismograms and Earthquakes of the World, Academic Press Inc.



## APPENDIX: Historical Observatory Details

<b>NAME</b> Aberdeen University Observatory	<b>LOCATION</b> Kings College, Dept of Natural Philosophy, Aberdeen University, Scotland, UK	<b>BGS IDENTITY CODE</b> <b>ABU</b>
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<b>ORGANISATION</b> Department of Natural Philosophy, Aberdeen University	<b>FIRST YEAR (seismology)</b> 1936	<b>LATITUDE</b> 57.167	<b>LONGITUDE</b> -2.100	<b>INTERNATIONAL STATION CODE</b> <b>ABE</b>
	<b>FINAL YEAR (seismology)</b> 1967	<b>HEIGHT (approx in metres)</b> 12		

<b>INSTRUMENT ONE</b> Milne-Shaw EW	<b>FIRST YEAR Inst 1</b> 1936	<b>FINAL YEAR Inst 1</b> 1967	<b>OTHER INSTRUMENTS</b> Tiltmeter (1968-1983)
<b>INSTRUMENT TWO</b> Milne-Shaw NS	<b>FIRST YEAR Inst 2</b> 1938	<b>FINAL YEAR Inst 2</b> 1967	

**SEISMOGRAMS**  
1936-1967, not Jan 1946 - Mar 1947, held in NSA. Microfilmed.

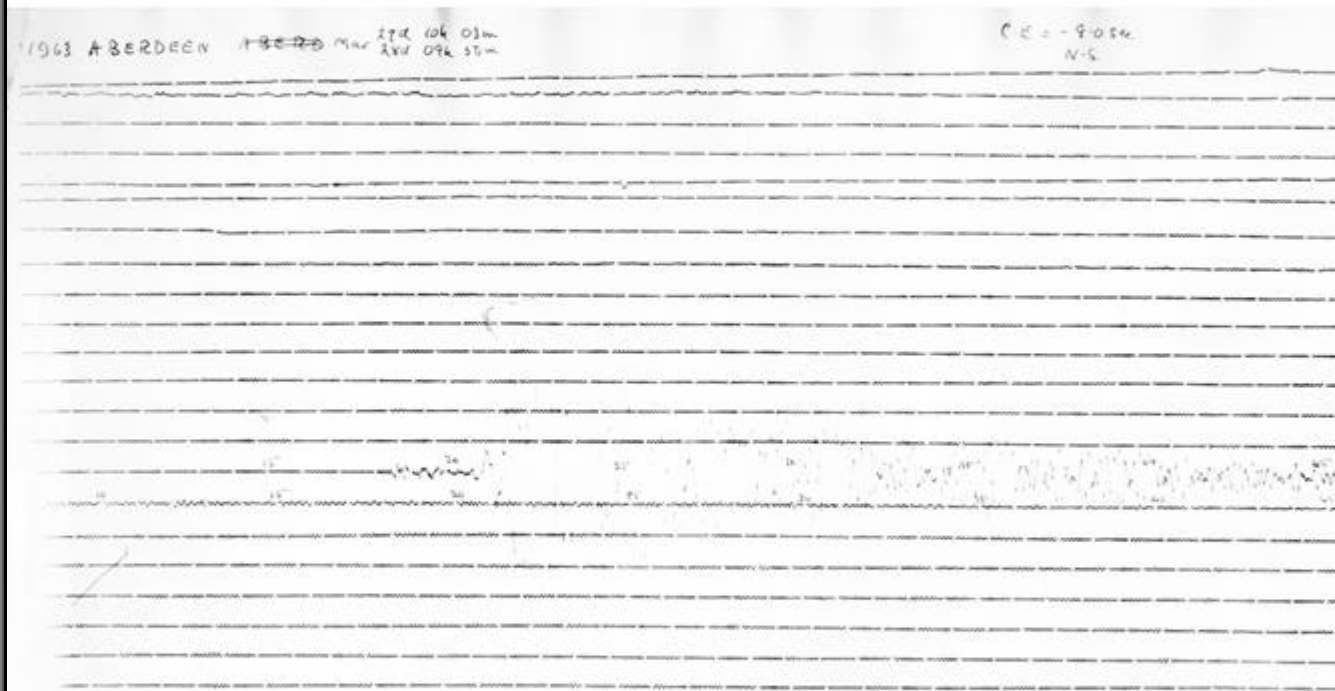
**BULLETINS**  
1939, 1941-1966, held in NSA.

**OTHER MATERIAL**  
Other material includes station bulletins, reprints of papers, reports, journals, lantern slides, tiltmeter records and some biographical material on Crombie, all held in the NSA

**OBSERVATORY OVERVIEW**

The Dyce Milne-Shaw , which was donated to Aberdeen University after the death of Dr Crombie, was set up for testing in the basement of King' s College, Aberdeen in 1932, and eventually became the E-W component of the Aberdeen station which operated continuously from December 1936 to June 1967. A Milne-Shaw N-S component was added in 1938. The Milne-Shaw instruments ceased recording in 1966, and are still stored in the Natural Philosophy building (Neilson 1981).

In 1997, all extant seismological material (excluding the two remaining Milne-Shaw seismographs, the Tiltmeter, and various photographic slides, volcanological and meteorological papers) were transferred to the NSA from Aberdeen University, for storage on their behalf. Final incorporation of this material into the NSA catalogue has now been completed.



Aberdeen seismogram from N-S Milne-Shaw component for an event in the Indian Ocean, March 28 1963 (held in NSA).

**REFERENCES**

Neilson, G., 1981. Historical Seismological Archives 2: Report on a visit to the Aberdeen University Department of Natural Philosophy, Brit. Geol. Survey Glob. Seism. Unit. Report No 144.  
 Neilson, G. & P.W. Burton., 1988. A brief history of Seismological Observatories in the British Isles, 1896-1960 in Lee, W.H.K., Meyers, H. & Shimazaki, K., (eds), Historical Seismograms and Earthquakes of the World, Academic Press Inc.

## APPENDIX: Historical Observatory Details

<b>NAME</b> Anglesey?	<b>LOCATION</b> Unknown	<b>BGS IDENTITY CODE</b> <b>ANG?</b>
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<b>ORGANISATION</b> Unknown	<b>FIRST YEAR (seismology)</b>	<b>LATITUDE</b>	<b>LONGITUDE</b>	<b>INTERNATIONAL STATION CODE</b>
	<b>FINAL YEAR (seismology)</b>	<b>HEIGHT (approx in metres)</b>		

<b>INSTRUMENT ONE</b>	<b>FIRST YEAR Inst 1</b>	<b>FINAL YEAR Inst 1</b>	<b>OTHER INSTRUMENTS</b>
<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>	

**SEISMOGRAMS**

**BULLETINS**

**OTHER MATERIAL**

**OBSERVATORY OVERVIEW**

Anglesey has been queried (G. Neilson, formerly of BGS, personal communication, 1997) as a station location. However, nothing has been found on an Anglesey station, and the name is probably a misnomer for a tidal gauge station operated in the Menai Straits by either Bidston or Bangor University

**ANG?**

*REFERENCES*

## APPENDIX: Historical Observatory Details

<b>NAME</b> Bath?	<b>LOCATION</b> Not found	<b>BGS IDENTITY CODE</b> <b>BAT?</b>
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<b>ORGANISATION</b> Unknown	<b>FIRST YEAR (seismology)</b>	<b>LATITUDE</b>	<b>LONGITUDE</b>	<b>INTERNATIONAL STATION CODE</b>
	<b>FINAL YEAR (seismology)</b>	<b>HEIGHT (approx in metres)</b>		

<b>INSTRUMENT ONE</b>	<b>FIRST YEAR Inst 1</b>	<b>FINAL YEAR Inst 1</b>	<b>OTHER INSTRUMENTS</b>
<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>	

**SEISMOGRAMS**

**BULLETINS**

**OTHER MATERIAL**

**OBSERVATORY OVERVIEW**

The location Bath UK has been queried as a possible seismological observatory (G. Neilson, personal communication 1997). Holdings by EMSC of bulletins for Bath have been investigated. This station is probably confused with Bath, USA (Merlin & Somville 1910). Bath UK probably refers to the meteorological observatory of Henry Lawson, a wealthy friend of E.J. Lowe of Beeston, and an inventor of meteorological apparatus. Several other stations called Bath were opened in 1978 in the USA.

**BAT?**

**REFERENCES**

Merlin E. & O. Somville 1910. Liste des Observatoires Magnetiques et des Observatoires Seismologiques, Observatoire Royal de Belgique, Brussels.

## APPENDIX: Historical Observatory Details

NAME	LOCATION	BGS IDENTITY CODE
Beeston Tower, Nottingham	Beeston, Notts. (two other observatories operated in same area- Highfield House (52.937N -1.196E, c50m), and Broadgate House)	BEE

ORGANISATION	FIRST YEAR (seismology)	LATITUDE	LONGITUDE	INTERNATIONAL STATION CODE
E.J. Lowe	1850	52.920	-1.204	
	FINAL YEAR (seismology)	HEIGHT (approx in metres)		
	1866?	27		

INSTRUMENT ONE	FIRST YEAR Inst 1	FINAL YEAR Inst 1	OTHER INSTRUMENTS
Pendulum seismograph	1850	1866?	

INSTRUMENT TWO	FIRST YEAR Inst 2	FINAL YEAR Inst 2	OTHER INSTRUMENTS

**SEISMOGRAMS**

None known to exist

**BULLETINS**

**OTHER MATERIAL**

Nothing known to survive

**OBSERVATORY OVERVIEW**

Three observatories existed at one time around Beeston, Notts. They were built and operated by the wealthy Joseph Lowe and his more famous son Edward Joseph Lowe (1825-1890), a founder member of the Meteorological Society. E.J. Lowe published extensively on many branches of science, and was elected FRS in 1867.

In 1797 Highfield House was built by J. Lowe as the family home and meteorological observatory. It is now occupied by the Vice-Chancellor of Nottingham University. Broadgate House, also now occupied by the University, was acquired too, and equipped for astronomical observation.

The octagonal brick-built tower, known as the Beeston or Rylands Tower (and other local epithets), was constructed probably in the late 1840s on flat land near the River Trent, and used for meteorological measurements, but its height suggests that its main function was to house a long pendulum, the installation of which in 1850 was described by E.J. Lowe (1864) in the one major scientific reference to seismology at these observatories. In it Lowe describes his macroseismic survey of the Hereford earthquake of 6 Oct 1863 in considerable detail, and incidentally describes his own instrument. This was housed in the observatory tower, and consisted of a 30 foot wooden rod freely suspended in a tube 6 inches in diameter extending from top to base of the tower. At the bottom of this rod was a brass weight, made in 1850 under Lowe's directions, with a steel index which ploughed a furrow in a dish of chalk. This pendulum is similar to many instruments of the time, particularly those in use in Italy. Lowe recorded several local earthquakes with this instrument, and reported them to Nature and The Times. He also made and published an earthquake catalogue (Lowe 1870). Sumner, (undated) has provided a summary of the Lowes' work in Nottingham. On the death of J. Lowe in 1865, E.J. Lowe inherited the estate, and continued his work. The instruments were moved from the Beeston Tower to Highfield House in June 1866 (Proc. Brit. Met. Soc. 1866), although it is not clear whether this included the pendulum, and the tower eventually fell into disuse. It remained for many years a store-room and conversation piece, before being demolished in the 1960s. Bedrock in the area consists of post-glacial river terrace deposits overlying Keuper Marl, neither deposit being conducive to clear recording of seismic waves.

E.J. Lowe sold his estate in Nottingham in 1882 and moved to Shirenewton Hall, near Chepstow. There, realising that his time was short (he died in 1890), he offered to the British Association an acre of land, his instruments, books and services, with the intention of establishing a permanent observatory, although no reference to seismology was made. He established contact with 'scientific men' of Bristol who approved his site, and investigated sources of funding. However, local support and finance were ultimately lacking, and in 1887 the BA Committee, established in 1884 to collaborate with Lowe, did not request its reappointment (BAAS 1887). (BAAS 1884 p35, 1885 p64, 1886 p139, 1887 p39 refer to these events).



E.J. Lowe, (photo courtesy of the Library, Royal Astronomical Society), and his Beeston Tower Observatory.

**REFERENCES**

BAAS 1884-1887.

Lowe, E.J., 1864. History of the Earthquake of 1863, October 6th. Proceedings of the British Meteorological Society 1864 Jan, pp 55-62.

Lowe, E.J., 1870. The Natural Phenomena and Chronology of the Seasons, Bell & Daldy, York Street, Covent Garden, London.

Proc. Brit. Met. Soc. 1866

Sumner, W. L., undated. The Beeston Observatory, 8pp, deposited in Nottinghamshire Local Studies Library.



## APPENDIX: Historical Observatory Details

<b>NAME</b> Bidston Observatory, Liverpool	<b>LOCATION</b> Birkenhead, Liverpool	<b>BGS IDENTITY CODE</b> <b>BID</b>
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<b>ORGANISATION</b> Various, including Liverpool Corporation, Docks Board	<b>FIRST YEAR (seismology)</b> 1898	<b>LATITUDE</b> 53.401	<b>LONGITUDE</b> -3.072	<b>INTERNATIONAL STATION CODE</b> <b>BID</b>
	<b>FINAL YEAR (seismology)</b> 1957	<b>HEIGHT (approx in metres)</b> 60		

<b>INSTRUMENT ONE</b> Milne-Shaw (No. 1) NS	<b>FIRST YEAR Inst 1</b> 1914	<b>FINAL YEAR Inst 1</b> 1924	<b>OTHER INSTRUMENTS</b> Darw in bifilar pendulum (1898?-?) Milne (1901?-?) Improved Milne-Shaw (1934-1957) Horizontal
<b>INSTRUMENT TWO</b> Improved Milne-Shaw (No. 32) Horizontal	<b>FIRST YEAR Inst 2</b> 1924	<b>FINAL YEAR Inst 2</b> 1957	

**SEISMOGRAMS**  
1938-1956 held in NSA. Microfilmed.

**BULLETINS**  
1901-1919, 1925-1940 held in NSA.

**OTHER MATERIAL**  
Some correspondence and the dismantled Milne-Shaw s are held in the NSA.

**OBSERVATORY OVERVIEW**

Originally founded in 1845 at Waterloo Dock and moved in 1867 to its final site, this observatory had a variety of owners. The first seismographic instrument in operation at Bidston was a Darw in bifilar pendulum, the readings from which were first published in the British Association Report for 1898. By the year 1901 a Milne instrument had also been installed. A vault was specially constructed in the observatory to house the instruments. The vault contained two piers on which the seismographs rested, one made of brick and the other a large, cement-filled drainpipe. A Milne-Shaw seismograph was installed in 1914 (no. 1) and an improved version of the same instrument replaced it in 1924 (no. 32). The static magnification of these instruments was 150. A second component was added in 1934. The station ceased recording in 1957 after the International Geophysical Year. There is some confusion between Bidston and the Milne-Shaw operated by the Geology Dept., Liverpool University, located some distance away, as the Liverpool University readings were sometimes included with those from Bidston.

After dismantling, the Milne-Shaw s were moved to BGS Edinburgh, and are now held in the NSA.

APPENDIX: Historical Observatory Details

BID

No.	Date.	P.W. Commences		S.W. Commences		Max.		End.		Max. Amplitude mm	Duration " migs	Remarks.
		H	M	H	M	H	M	H	M			
1	1485 Jan 9	17	49.8	17	52.9	18	0.9	18	10.3	0.9	- 20.5	Milne-Shaw always light oscillating. Machine replaced by a new one. MS Possible 'quake' - 27" 2.30 onwards.
2	18	12	18.7	12	24.8	12	57.8	13	42.6	3.5	1 23.9	
3	26	19	26.42	19	30.48	19	46.18	20	9.48	0.7	- 45.6	A photograph taken by Mr. Shaw.
4	28	4	17.48	4	27.45	4	59.22	5	50.27	4.4	2 26.84	
5	30	18	11. -	18	7.5	?		?		?		2.5
6	Feb 1	5	46.13	5	56.0	6	17.35	6	8.0	2.1		Complete 'Quake'
7	" 1											
8	2	13	40.24	13	51.23	14	22.5	14	14.0	2.5		
9	2	20	5.38	20	9.18	20	40.3	20	20.8	4.2		
10	2											22 hrs.
11	9											15 "
12	13					15	15.7			0.8		
13	16	18	8.20?			18	45.0	18	24.0	0.8		
14	20	1	14.30	1	23.30	1	23.5	1	41.8	4.6		
15	24	0	12.16	0	16.28	0	23.2	0	24.0	5.0		Light spot oscillating a ground
16	Mar 1	2	27.3	2	35.11	2	29.2	2	26.5	5.0		Capadocian 'Quake'
17	1	13	8.52	13	13.38	13	24.2	15	15.8	1.0		s.o.
18	6	14	6.56	14	24.30	Uncertain		Uncertain				
19	15											about 17 hrs.
20	16	15	4.2	15	13.10	15	25.9	15	18.8	4.8		
21	17	0	12.25	0	21.30	0	24.0	0	30.0	1.9		Recrudescence <del>Apparent</del>
22	20	13	15.7	Uncertain		13	20.8					
23	22	9	1.27	9	14.58	10	6.7	9	30.0	3.3		
24						15	18.4					
25	29	21	24.31	21	38.52	21	54.1			0.6		
26	April 1					18	54.9			0.4		April 7 <sup>th</sup> - Magnitude changed to 2.30.
27	5											22.50-28 23.50-25
28	7	18	30.24	18	?	19	14.2	18	54.0	1.8		
29	11	10	56.12	11	6.54	11	22.8	11	21.5	2.5		
30	16	20	9.28	20	16.24	20	43.1	20	28.9	19.0		
31	19											
32	19	P or S		16	8.34	about 16.45		?		0.2		

Page from Bidston handw ritten bulletin noting photo taken by J.J. Shaw on Jan 28 1925 (held in NSA).

REFERENCES

Neilson, G. & P.W. Burton., 1988. A brief history of Seismological Observatories in the British Isles, 1896-1960 in Lee, W.H.K., Meyers, H. & Shimazaki, K., (eds.), Historical Seismograms and Earthquakes of the World, Academic Press Inc.

## APPENDIX: Historical Observatory Details

<b>NAME</b>	<b>LOCATION</b>	<b>BGS IDENTITY CODE</b>
Binstead, Isle of Wight	The Quarry, Binstead, Isle of Wight	<b>BIN</b>

<b>ORGANISATION</b>	<b>FIRST YEAR (seismology)</b>	<b>LATITUDE</b>	<b>LONGITUDE</b>	<b>INTERNATIONAL STATION CODE</b>
	c.1900	50.730	-1.180	
	<b>FINAL YEAR (seismology)</b>	<b>HEIGHT (approx in metres)</b>		
	1947	15		

<b>INSTRUMENT ONE</b>	<b>FIRST YEAR Inst 1</b>	<b>FINAL YEAR Inst 1</b>	<b>OTHER INSTRUMENTS</b>
Home-built Milne type pendulum, initially undamped	c.1900	c. 1923	
<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>	
Home-built Milne type pendulum	c. 1939	1947	

**SEISMOGRAMS**  
 One known to survive (held in NSA)

**BULLETINS**  
 Handwritten bulletins 1940-1959 held in Carisbrooke Castle Museum, copies in NSA

**OTHER MATERIAL**  
 Pollard's collection of papers, newspaper cuttings, etc. is held in Carisbrooke Castle Museum; additional material in the Isle of Wight County Record Office. Pollard's autobiographical and seismological notes have recently been acquired by NSA

**OBSERVATORY OVERVIEW**

Evelyn William Pollard qualified as a pharmacist in 1898, and in 1912 succeeded to the pharmacy business founded by his father in Ryde, Isle of Wight. He was one of several private individuals to come under the influence of John Milne on the Island (see SHI), and, according to Milne, built and ran his own instrument which was probably a variation of Milne's own horizontal pendulum. Pollard says only that this instrument was an experiment, and did not report data to Milne, although he refers to meetings with Milne and knew many of Milne's associates on the Island. Nothing else is known of his early seismological activities, and Pollard himself does not elaborate. Later, though, when he had the space to house an instrument, he described his boom at Binstead as recording best east-west vibrations, especially those originating in the Andes region. He was also interested in botany, especially in alpine and rock gardening, and photography.

In 1923 Mr Pollard moved from Ryde to Binstead. He constructed in his garden there, in 1938, an underground concrete bunker, initially as an air raid shelter but later housing a seismograph which he built in the early war years after many experiments. The bunker survives, and is an impressive structure with a vault approximately eight ft. square now housing water pumps for the present owner's pool. It was built on the site of a large Bembridge Limestone quarry. This distinctive, white, freshwater limestone of Oligocene age was formerly extensively quarried around Binstead and used in many of the major buildings on the Island, for example, Yarmouth Castle, Carisbrooke Church and Castle, as well as being exported to the mainland for use chiefly in ecclesiastical buildings.

Pollard obtained his first successful recording, of an earthquake in Mexico, on May 19 1940. Given the competent bedrock, it is unfortunate that so little of his work survives as he is likely to have obtained cleaner records than either Milne or Bullock, whose seismographs were sited on deposits less conducive to clear recording (weathered Upper Chalk and poorly consolidated Lower Tertiary deposits respectively). However, he does remark, in a letter to Dr Dollar in 1944, that 'the Island rocks all the winter from November till April', and states (Pollard 1943b) that microseisms are a 'confounded nuisance'. Accompanying this letter was the only seismogram known to survive (this is used as an illustration for DOR), although others were used in his publications.

E.W. Pollard retired from the Island in May/June 1947, after having constructed a seismograph, a duplicate of his own, and installing it at his own expense in a local school where it worked for a year or so. He moved to a house formerly owned by his sister in Dorking, Surrey, and continued his seismological activities (see DOR) until about a year before his death there in 1961. He was buried at Ryde.



E.W. Pollard's seismograph bunker at Binstead (photo courtesy of Mr. & Mrs. S. Harris).

**REFERENCES**

- \*Pollard, E.W., 1943a. Earthquakes for the practical amateur, Proceedings of the Isle of Wight Natural History and Archaeological Society, Vol III, Part V.
- \*Pollard, E.W., 1943b. Recording Earthquakes, Discovery Magazine, October 1943, pp 307-309.
- \*Pollard, E.W., 1951. Earth Movements and how recorded, The South-Eastern Naturalist and Antiquary, Vol. LVI.
- \*Pollard, E.W., undated autobiographical notes held in NSA

## APPENDIX: Historical Observatory Details

<b>NAME</b>	<b>LOCATION</b>	<b>BGS IDENTITY CODE</b>
Birmingham Observatory	(in 1910) 16 Manor Road, Edgbaston, Birmingham	BIR

<b>ORGANISATION</b>	<b>FIRST YEAR (seismology)</b>	<b>LATITUDE</b>	<b>LONGITUDE</b>	<b>INTERNATIONAL STATION CODE</b>
Dr. Charles Davison	1900?	52.466	-1.883	
	<b>FINAL YEAR (seismology)</b>	<b>HEIGHT (approx in metres)</b>		
	1920?			

<b>INSTRUMENT ONE</b>	<b>FIRST YEAR Inst 1</b>	<b>FINAL YEAR Inst 1</b>	<b>OTHER INSTRUMENTS</b>
Omori Horiz. Pendulum. Erected in N-S plane i.e. E-W component	?1903		Ew ing-Duplex pendulum
<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>	
Ew ing 3-component			

**SEISMOGRAMS**

Two seismograms from 1903 published in Davison (1924)

**BULLETINS**

**OTHER MATERIAL**

Nothing known to survive

**OBSERVATORY OVERVIEW**

Dr Charles Davison was a mathematics master, initially in Stirlingshire then for over thirty years at the King Edward's School in Birmingham. He operated for many years an Omori horizontal pendulum instrument (Merlin & Somville 1910) at his home in the Edgbaston area. It is difficult to date the installation of this Omori, as Davison mentions no recording of his own of the 1896 Hereford earthquake (Davison 1899) and his earliest references to his own seismograms are for events in 1903 (Davison 1924). No reference of his to his other instruments has been found. He retired to Cambridge in 1920. There is no reference to further instrumental seismology by him, in any case his interests were primarily in macroseismic work which he carried on between the late 1800s and about 1926 using newspaper advertisements and questionnaires. He died in 1940. Dr. RMW Musson (personal communication, 1998) has examined Davison's will in which Davison bequeathed all his goods to his wife, and states that all the papers were destroyed.

The very few details of Davison's observatory and illustrations of his seismograms come from his published works. Davison's instrument was set up in the NS plane, i.e. as an EW component, and recorded many UK earthquakes (Davison 1924), for example those in Derby (24 March 1903); Carnarvon, (19 June 1903); Swansea (27 June 1906); and Doncaster (1905), although there is no evidence for any seismic records after 1908. However, in 1912 the observatory coordinates were given as 52.466N 1.883W. This is quite near the West Bromwich observatory of JJ Shaw, although the two never seem to have collaborated. Shaw's interest, though, was primarily in instrumental seismology. In addition, Davison makes the only reference so far found of seismic records from the Fort William observatory (Davison 1924, see also FWL).

After Davison's retirement to Cambridge, he retained an interest in seismology, and encouraged Dollar when, in 1934, the latter set up his British Earthquake Enquiry. Dollar's idea was to complete the work started by Davison, and generate a British earthquake catalogue from 1916, the year in which Davison had ceased his operations. The two corresponded on macroseismic methods, and Davison advised Dollar to use a typewriter in order to speed up production threefold (correspondence in Dollar's papers held in NSA).





Dr Charles Davison (photo c. 1906 courtesy of the Governors of the Schools of King Edward the Sixth in Birmingham).

**REFERENCES**

- Davison, C., 1899. The Hereford Earthquake of December 17, 1896, Cornish Bros., 37 New Street, Birmingham.
- Davison, C., 1924. A History of British Earthquakes, CUP.
- Dollar, A.T.J., papers held in National Seismological Archive, BGS, Edinburgh.
- Merlin E. & O. Somville, 1910. Liste des Observatoires Magnetiques et des Observatoires Seismologiques, Observatoire Royal de Belgique, Brussels

## APPENDIX: Historical Observatory Details

<b>NAME</b> Blacknest, Reading	<b>LOCATION</b> Blacknest, nr Reading	<b>BGS IDENTITY CODE</b> <b>BLA</b>
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<b>ORGANISATION</b> UK Atomic Energy Authority/MOD/AWE	<b>FIRST YEAR (seismology)</b> 1961	<b>LATITUDE</b> 51.364	<b>LONGITUDE</b> -1.187	<b>INTERNATIONAL STATION CODE</b> <b>BLA</b>
	<b>FINAL YEAR (seismology)</b> present	<b>HEIGHT (approx in metres)</b> 107		

<b>INSTRUMENT ONE</b>	<b>FIRST YEAR Inst 1</b>	<b>FINAL YEAR Inst 1</b>	<b>OTHER INSTRUMENTS</b>
<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>	

**SEISMOGRAMS**

**BULLETINS**

**OTHER MATERIAL**

**OBSERVATORY OVERVIEW**

A definitive history of Blacknest and the stations reporting data to it is the subject of investigations within Blacknest. The results are awaited and will be included in the Internet version of this Report.

**BLA**

*REFERENCES*



## APPENDIX: Historical Observatory Details

NAME	LOCATION	BGS IDENTITY CODE
Bristol	Springfort House, Stoke Bishop, Bristol	BRI

ORGANISATION	FIRST YEAR (seismology)	LATITUDE	LONGITUDE	INTERNATIONAL STATION CODE
Dr F.L Vanderplank	1931	51.479	-2.639	
	FINAL YEAR (seismology)	HEIGHT (approx in metres)		
	?1939	71		

INSTRUMENT ONE	FIRST YEAR Inst 1	FINAL YEAR Inst 1	OTHER INSTRUMENTS
Home built, N-S Milne-Shaw type, another added early 1933	1931	?1939	Constructed in April 1936: N-S modified Galitzin Vertical unspecified Wiechert
INSTRUMENT TWO	FIRST YEAR Inst 2	FINAL YEAR Inst 2	
N-S Shaw -Milne N-S Galitzin short period Vertical experimental unspecified	1933	?1939	

**SEISMOGRAMS**  
None found so far, although recordings were made from early 1931.

**BULLETINS**  
None found so far. Macroseismic survey made of 2.8ML Bristol event of 17 March, 1934 held in NSA.

**OTHER MATERIAL**  
Dr Vanderplank's papers are held by the family, have been examined by his sons, and press cuttings and photographs copied to the NSA. Other press cuttings and correspondence are held among the Dollar papers by the NSA.

**OBSERVATORY OVERVIEW**

The observatory of Frederic Vanderplank in Bristol was one of several operated by private individuals, and was revealed as a result of Dr ATJ Dollar's appeal for information on British earthquakes. In 1934, Dollar set up his Earthquake Enquiry, and appealed by letter to museums, local authorities, and scientific institutions throughout the land for information on local earthquakes. He intended to take up where Dr Charles Davison had left off, and complete an earthquake catalogue from 1916-on.

Dr Frederic L Vanderplank F.R.H.S. (1914-1993) was an entomologist and biologist, working at Bristol Zoo and for the Tanganyika (now Tanzania) Research Department, Human Sleeping Sickness Research Station, amongst other locations in Africa. His 1948 PhD from Bristol was entitled 'Experiments in crossing various species of tsetse-flies (Glossina Diptera)'. From 1939-40 he was Officer-in-Charge of the Research Station, and was absent from Bristol on other occasions. He probably became one of Dollar's British Earthquake Enquiry Observers; correspondence between the two exists, but no list of these observers has ever been found. Dollar was first made aware of Dr Vanderplank's work through the Meteorological Society to whom data were reported by Vanderplank (meteorology was another of his many interests).

Dr Vanderplank headed his notepaper 'Seismological Station', and writes that seismology was a hobby. He was addressed by Dollar as 'Seismologist to the British Empire Naturalist's Association' in 1936, but appears not to have published seismological articles in that Journal. However, he described his instruments in great detail in a letter to Dollar, stating that they were underground, about 50 feet from his house and set up on a one-ton reinforced concrete pier directly on Carboniferous Limestone. One seismograph had a 350lb pendulum. Recording drums were driven by synchronous mains motors, minute- and 10-second timing marks were made on the paper and the G.M.T. checked daily by radio. A fire alarm was also rigged to his instruments. This setup (see above) would have been the envy of many professional observatories, and says much about Vanderplank's enthusiasm. Some local schoolboys are also recorded as having built a seismograph under Vanderplank's tutelage.

Press cuttings exist describing Vanderplank's recording of two events in Bristol - the 2.8ML Bristol earthquake of 17 March, 1934, and the March 1936 Avon Gorge landslide. He performed a macroseismic survey for the earthquake, receiving over 150 replies to his newspaper appeal for information, and stated that the earthquake damaged his instruments. He also obtained good records of the landslide which occurred on the Somerset side of the Avon Gorge, only a mile or so from his home, and suggested that this rock fall and another in the Mendips were caused by a small local tremor. Dollar appears not to have made macroseismic surveys of these events, and the seismograms have not been found.

Urged on by Miss Bellamy of Oxford Observatory, Vanderplank offered his seismographs to Bristol University in 1938, prior to his departure for Tanganyika, but the University had neither the personnel nor the facilities to maintain them in continuous operation. There had been some rather terse correspondence between Dollar and Dr CF Powell about the performance of Powell's Jaggard Recorder at Comrie (see observatory CDU, also FAG & KEW), and this may explain the University's reluctance. Miss Bellamy also suggested to Dollar that they could



Dr F.L. Vanderplank in the 1950s with his eldest son (photo courtesy of Messrs. J. and A. Vanderplank).

**REFERENCES**

Dollar, A.T.J., papers held in National Seismological Archive, BGS, Edinburgh.  
Vanderplank, F.L., seismological papers held in National Seismological Archive, BGS, Edinburgh

## APPENDIX: Historical Observatory Details

NAME	LOCATION	BGS IDENTITY CODE
Cambridge Observatory	Crombie Seismological Laboratory, University of Cambridge	CAM

ORGANISATION	FIRST YEAR (seismology)	LATITUDE	LONGITUDE	INTERNATIONAL STATION CODE
Royal Society/BAAS/University of Cambridge	1956	52.215	0.096	
	FINAL YEAR (seismology)	HEIGHT (approx in metres)		
	1960?	20		

INSTRUMENT ONE	FIRST YEAR Inst 1	FINAL YEAR Inst 1	OTHER INSTRUMENTS
Benioff 3 component SP	1958	1960?	
INSTRUMENT TWO	FIRST YEAR Inst 2	FINAL YEAR Inst 2	
2 LP horizontals, Hill/Adams design	1956		

**SEISMOGRAMS**

None known

**BULLETINS**

One bulletin, for 1958, held in NSA

**OTHER MATERIAL**

None found

**OBSERVATORY OVERVIEW**

The setting up of a seismological observatory by Cambridge University in 1956 coincided with the moving of the Geophysics and Geodesy Department from the town centre to Madingley Rise, outside the city but nearer to the Pendulum House. A two-component long period electromagnetic instrument was installed in the basement, but trouble was experienced with the suspension system and the unconsolidated gravel bedrock made the site noisy. Accordingly, with a grant from the British Association Crombie Bequest, an instrumental vault and a surface lab for recording were built in 1957. It was proposed to operate continuously, with a full time observer, the Hill/Adams electromagnetic instrument and a vertical and two horizontal short period Benioff seismometers, and to issue bulletins from 1958 (Annual Reports of Dept of Geodesy and Geophysics, University of Cambridge). Bulletins were issued between January 1958 and January 1959, after which date no further references to the Crombie Lab appear in the Annual Reports.

After this short period of operation, the staff concerned moved elsewhere, and the Department concentrated chiefly on marine geophysics and theoretical seismology. The seismographs fell into disuse, and ultimately the recording apparatus was thrown out to allow the installation of an electronics lab in the Crombie in the mid-1960s. The vault was filled in in about 1990. The fate of the seismographs is uncertain; they may be still stored in a loft together with other apparatus.

Cambridge is the home of the Whipple Museum of the History of Science, Free School Lane, Cambridge CB2 3RH, (home pages at <http://www.cam.ac.uk/CambUniv/RepMuseums/Whipple.html>). Amongst other scientific items this museum houses the catalogues and other artefacts including a Ewing seismoscope from the Cambridge Scientific Instrument Co., manufacturers of Ewing, some Milne and, later, Galitzin, seismographs.



**REFERENCES**

Annual Reports of Dept of Geodesy and Geophysics, University of Cambridge, 1954-1961.

## APPENDIX: Historical Observatory Details

NAME	LOCATION	BGS IDENTITY CODE
Cardiff Observatory	Pen-y-Lan Hill, Cardiff	CAR

ORGANISATION	FIRST YEAR (seismology)	LATITUDE	LONGITUDE	INTERNATIONAL STATION CODE
Cardiff Corporation	1910	51.501	-3.170	
	FINAL YEAR (seismology)	HEIGHT (approx in metres)		
	?	62		

INSTRUMENT ONE	FIRST YEAR Inst 1	FINAL YEAR Inst 1	OTHER INSTRUMENTS
Milne horizontal boom, E component	1910?	not know n	

INSTRUMENT TWO	FIRST YEAR Inst 2	FINAL YEAR Inst 2	OTHER INSTRUMENTS

**SEISMOGRAMS**  
 Some published in Transactions of the Cardiff Naturalists' Society

**BULLETINS**  
 None know n

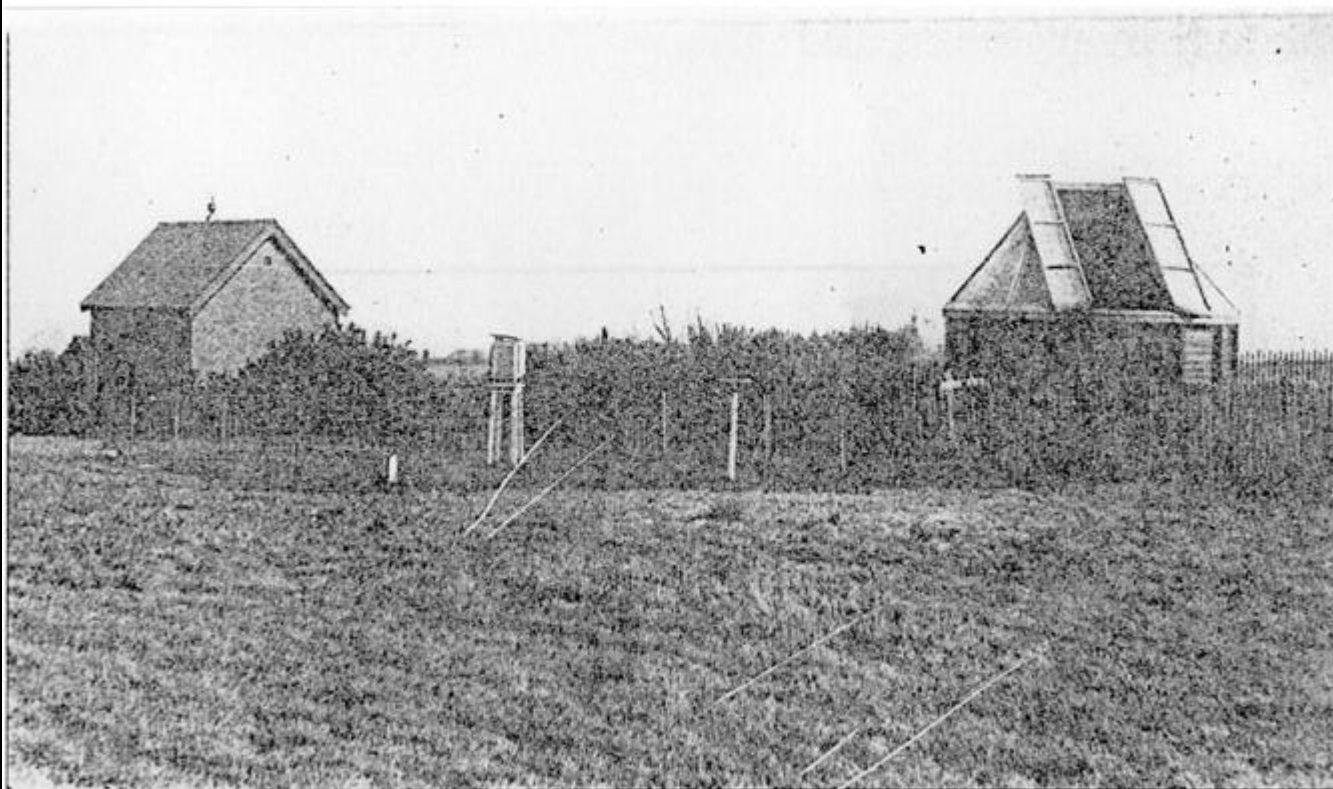
**OTHER MATERIAL**  
 None know n

**OBSERVATORY OVERVIEW**

On 20 December 1909 a Milne horizontal boom seismograph was presented to Cardiff Corporation by the Cardiff Naturalists' Society which had been engaged in discussing the setting up of a seismological observatory in the city for the previous two years, possibly influenced by the 1906 San Francisco earthquake. Impetus was definitely provided by news of the devastating Strait of Messina earthquake in Italy (28 December 1908), but, surprisingly, no mention has been found of the 1906 Swansea earthquake. The seismograph was installed, on a concrete pier built on Silurian and Old Red Sandstone formations, in a purpose-built brick building in the city observatory at Pen-y-Lan that was opened in 1906 to house a telescope gifted to the city in 1896 (Ballinger 1908). Milne acted as advisor throughout, and a duplicate of the illustration used here appears in his photograph album, now held in the Science Museum, London. Money was raised for the installation by public subscription and a small grant from the Corporation. These events are described in considerable detail by Griffiths (1908) and Walford (1911).

Reference to the Cardiff as a station in the 'Milne network' first appears in the BAAS Seismological Committee Report on the State of Science for 1911, when it was stated that 'BA type instrument in working order at Cardiff' and also in the 17th Report, 1912, reference is made to shielding of the Cardiff instrument as problems were experienced with air tremors. No record of this station reporting data to the Committee has been found, although good seismograms are presented in the Walford (1911) paper. A comment in a letter (held in NSA) from Miss E. Bellamy of Oxford Observatory to Dollar in 1938 concerning an earthquake in Belgium states that "...Cardiff have not recorded for years - I'm sorry to say", suggesting perhaps that the instrument at least still existed, nor has any mention of a Cardiff recording of the 1931 North Sea earthquake been found, suggesting that the observatory's demise was before that date; it was possibly during WW1, although the instrument is listed by Wood (1921). Additional evidence for an early date for cessation of recording is that in 1938, Dr Vanderplank's Bristol (see BRI) instruments were offered for sale, and Dollar was keen to see them in Cardiff. He appeared not to realise that Cardiff University had never had a seismograph, and must have assumed that any reference he found for a Cardiff instrument referred to the University until this error was corrected by Miss Bellamy.

Ultimately the observatory was decommissioned and the instruments dispersed but no dates for these events have been found. The buildings were demolished in the early 1980s, but the fate of the seismograph and its records is at present unknown.



Cardiff Observatory, Pen-y-Lan, c. 1910 with seismograph house to left (photo courtesy of Cardiff Naturalists' Society).

**REFERENCES**

- Ballinger, J., 1908. Guide to Cardiff City and Port, Cardiff.
- British Association 1911, 1912. Seismological Committee Report on the State of Science, British Association for the Advancement of Science.
- Griffiths, E.H., 1908, The establishment of a seismograph in Cardiff, Transactions of the Cardiff Naturalists' Society, v 41, pp 54-58.
- Walford, E., 1911. The Cardiff seismograph, Transactions of the Cardiff Naturalists' Society, v 44, pp 19-20.
- Wood, H.O., 1921. A list of Seismologic Stations of the World, Bulletin of the National Research Council, National Academy of Sciences, Washington D.C., Vol 2 Part 7, Number 15.



## APPENDIX: Historical Observatory Details

<b>NAME</b>	<b>LOCATION</b>	<b>BGS IDENTITY CODE</b>
Dunira House, Comrie	Dunira House, near Comrie, Perthshire	CDU

<b>ORGANISATION</b>	<b>FIRST YEAR (seismology)</b>	<b>LATITUDE</b>	<b>LONGITUDE</b>	<b>INTERNATIONAL STATION CODE</b>
B.A. Seismological Committee	1938	56.389	-4.045	
	<b>FINAL YEAR (seismology)</b>	<b>HEIGHT (approx in metres)</b>		
	1950?	80		

<b>INSTRUMENT ONE</b>	<b>FIRST YEAR Inst 1</b>	<b>FINAL YEAR Inst 1</b>	<b>OTHER INSTRUMENTS</b>
Jagggar shock recorder	1938	1950?	

<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>	

**SEISMOGRAMS**  
Whereabouts unknown but some readings survive in Dollar's papers in NSA

**BULLETINS**  
None known

**OTHER MATERIAL**  
Numerous negatives and photos taken by Dollar held in NSA

**OBSERVATORY OVERVIEW**

Dunira House, near Comrie, Perthshire, was the seat of W.G. Macbeth, Esq. With Mr Macbeth's encouragement and Dr Dollar's organisation, a Jagggar Shock Recorder built in Bristol under the supervision of Dr C.F. Powell (later awarded the Nobel Prize for Physics) was installed against the north wall of the Summer or Croquet House on September 14th, 1938 (BAAS Dundee 1939 and Dollar papers in NSA). This recorder was bolted through the wall into the dolerite dyke against which the house was built. It was owned by the B.A. and operated by the Geology Department of Glasgow University. Photographs exist taken by Dollar in 1938. Recordings were made on cardboard discs, which were changed daily by Mr White, who had been making meteorological observations for some time and who was one of Mr Macbeth's gardening staff. Mr White was succeeded in 1944 by Mr Clark, who ran the instrument until its removal.

The Jagggar instrument functioned throughout the war despite difficulties in obtaining the cardboard discs and the shellac and methylated spirits with which the fixing varnish was made. Maintenance costs of £5.00 were voted annually by the BA Seismological Committee. Many local disturbances were recorded, but only those discs containing records were fixed and preserved. Their whereabouts is not known although some readings are preserved in Dollar's papers held in the NSA. Dunira House itself burnt down in December 1947, with only an annexe remaining habitable. The Summer House, however, was unaffected, but after the estate changed hands the Jagggar recorder was moved to Fort Augustus Abbey in 1950.

The Jagggar shock recorder was developed in about 1928 by T.A. Jagggar, an American volcanologist, and was used extensively by him and others in the USGS for volcano monitoring in the Pacific and West Indies. It was later improved, and was the subject of a 1936 BA experiment at an unspecified location, probably in preparation for its use in Montserrat by the Royal Society expedition to investigate the seismicity there, or prior to its installation at Dunira (see KEW).



The Summer or Croquet House, Dunira, Comrie (photo taken in 1938 by A.T.J. Dollar, in NSA).

**REFERENCES**

British Association 1939. Report of the Seismological Committee, British Association for the Advancement of Science.  
Dollar, A.T.J., papers held in National Seismological Archive, BGS, Edinburgh.



## APPENDIX: Historical Observatory Details

<b>NAME</b> Earthquake House, Comrie	<b>LOCATION</b> Grounds of Drumearn house, Comrie, Perthshire, Scotland, UK	<b>BGS IDENTITY CODE</b> <span style="font-size: 1.5em; color: red; font-weight: bold;">CEH</span>
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<b>ORGANISATION</b> B.A.A.S. Earthquake Committee	<b>FIRST YEAR (seismology)</b> 1874	<b>LATITUDE</b> 56.372	<b>LONGITUDE</b> -3.999	<b>INTERNATIONAL STATION CODE</b> 
	<b>FINAL YEAR (seismology)</b> present	<b>HEIGHT (approx in metres)</b> 61		

<b>INSTRUMENT ONE</b>	<b>FIRST YEAR Inst 1</b>	<b>FINAL YEAR Inst 1</b>	<b>OTHER INSTRUMENTS</b>
Mallet seismoscope (vertical cylinders)	1874		

<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>

**SEISMOGRAMS**

**BULLETINS**

**OTHER MATERIAL**

**OBSERVATORY OVERVIEW**

Earthquakes have been detected in the Comrie area probably since 1608, but certainly since 1788 (Musson 1993a, see also COM). Information on events at this time was sent to the Royal Society of Edinburgh by two local ministers, and efforts were made to record these earthquakes with a variety of instruments and macroseismic methods. However, these attempts were thought to be crude and ineffective, so, following a particularly long-lived and strongly-felt outburst of seismicity in 1839, a British Association Committee for the Investigation of Scottish and Irish Earthquakes was set up (BA 1841-1844). Several instruments, mainly of the Forbes inverted pendulum type were installed at numerous locations in Comrie (in the church and Comrie House) and throughout the area (at Crieff, St. Fillans, Garrichrew and Invergeldie). Seismicity diminished after 1846, but, after renewed activity in 1869, the Committee commenced a new series of experiments (BA 1870-1876). The Forbes type pendulums were thought too insensitive, so newer equipment was installed in the specially constructed Earthquake House which was erected in 1874 on what was probably the last of many experimental sites used by the B.A. Committee. Despite being later upgraded, the Mallet seismoscope here recorded no earthquakes, and Earthquake House ultimately fell into disuse as the seismicity diminished and local interest waned around the turn of the century.

Following Earthquake House's inclusion in the Secretary of State for Scotland's List of Buildings of Special Architectural or Historic Interest it was refurbished in 1988. A model of Mallet's original seismoscope and a modern, sensitive BGS seismometer and chart recorder were installed; these can be viewed through the window of Earthquake House, and information on significant earthquakes is displayed in the local Post Office. A Forbes pendulum is currently displayed in the National Museum of Scotland, and a Mallet seismoscope was housed in the Edinburgh University museum. Photographs purporting to be of the Mallet equipment have been found, but picture the instrument on a stand. These are fakes; the original was set into dry sand on the floor of Earthquake House. Further details of the Comrie earthquake investigations are given by Dollar in the BAAS 1953 Report and by Musson (1993).



Earthquake House, Comrie (photo taken in 1938 by A.T.J. Dollar, in NSA).

**REFERENCES**

- British Association, 1841-1844. Report of the British Association for the Advancement of Science, 1841, pp46-50; 1842, pp92-98; 1843, pp120-127; 1844, pp85-90.
- British Association, 1870-1876. Reports of the Committee on Earthquakes in Scotland, Report of the British Association for the Advancement of Science, 1870, pp48-49; 1871, pp197-198; 1872, pp240-241; 1873, pp194-197; 1874, p241; 1875, pp64-65; 1876, p74.
- British Association 1953. Report of the Seismological Committee, British Association for the Advancement of Science.
- Burton, P.W., Musson, R.M.W., and Neilson, G., 1984. Studies of Historical British Earthquakes, Brit. Geol. Survey Glob. Seism. Unit, Report No 237.
- Milne\*, J., 1893. Earthquakes and Other Earth Movements, Kegan, Paul, Trench, Trubner & Co., London.
- Musson, R.M.W., 1993. Comrie: a historical Scottish earthquake sw arm and its place in the history of seismology. Terra Nova, v5 pp 477-480.

## APPENDIX: Historical Observatory Details

<b>NAME</b> Cheltenham?	<b>LOCATION</b> Cheltenham, Glocs.	<b>BGS IDENTITY CODE</b> <b>CHE?</b>
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<b>ORGANISATION</b> Unknown	<b>FIRST YEAR (seismology)</b>	<b>LATITUDE</b>	<b>LONGITUDE</b>	<b>INTERNATIONAL STATION CODE</b>
	<b>FINAL YEAR (seismology)</b>	<b>HEIGHT (approx in metres)</b>		

<b>INSTRUMENT ONE</b>	<b>FIRST YEAR Inst 1</b>	<b>FINAL YEAR Inst 1</b>	<b>OTHER INSTRUMENTS</b>
<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>	

**SEISMOGRAMS**

**BULLETINS**

Bulletins for Cheltenham (1926-1931) are recorded in NSA as held by IPG/CSEM

**OTHER MATERIAL**

**OBSERVATORY OVERVIEW**

Nothing has been found on a seismological observatory in Cheltenham, UK. There was possibly confusion with the Cheltenham, USA, station (Merlin & Somville 1910) that was built in 1901 and operated until about 1928. No bulletins for a Cheltenham station are held in NSA, and investigations so far have not solved the mystery.

**CHE?**

**REFERENCES**

Merlin E. & O. Somville, 1910. Liste des Observatoires Magnetiques et des Observatoires Seismologiques, Observatoire Royal de Belgique, Brussels.

## APPENDIX: Historical Observatory Details

<b>NAME</b> Comrie	<b>LOCATION</b> Comrie, Perthshire, Scotland, UK	<b>BGS IDENTITY CODE</b> <b>COM</b>
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<b>ORGANISATION</b> B.A.A.S. Special Committee	<b>FIRST YEAR (seismology)</b> 1840	<b>LATITUDE</b> 56.370	<b>LONGITUDE</b> -3.990	<b>INTERNATIONAL STATION CODE</b> 
	<b>FINAL YEAR (seismology)</b> 1876?	<b>HEIGHT (approx in metres)</b> 		

<b>INSTRUMENT ONE</b> Forbes seismometer	<b>FIRST YEAR Inst 1</b> 	<b>FINAL YEAR Inst 1</b> 	<b>OTHER INSTRUMENTS</b> 
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<b>INSTRUMENT TWO</b> Various pendulums and seismoscopes	<b>FIRST YEAR Inst 2</b> 1840	<b>FINAL YEAR Inst 2</b> 1867	<b>OTHER INSTRUMENTS</b> 
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**SEISMOGRAMS**

**BULLETINS**

**OTHER MATERIAL**

**OBSERVATORY OVERVIEW**

A series of experiments was carried out in this area by two British Association Committees between 1840 and the 1870s (references as for Earthquake House CEH but with the addition of Musson 1993b). Instruments consisting chiefly of Forbes type inverted pendulums, common pendulums and some mercury-filled seismoscopes were deployed in many locations in Comrie, for example in Comrie House, Comrie Church, and Garrichrew House; at Crieff, St. Fillans and Invergeldie; and as far afield as Strontian and Kinlochmoidart, in an effort to study the earthquakes (NB that the coordinates given above for Comrie refer to Comrie itself, and represent only the centre of activities). The results were inconclusive, but the whole exercise gave rise to the first instrumental network, the first purpose built seismological observatory, and a considerable amount of macroseismic work.

The illustration shows the Fingask Earthquake Pillar (Musson 1993b). This pillar of local sandstone about 1.3m high was erected somewhere in the Comrie area on the site where an earthquake was 'heard', and was eventually found at Fingask Castle and purchased by Perth Museum. The inscription reads 'Earthquake heard here January 19, 1840'. Research has revealed that an earthquake of around magnitude 3.2ML occurred on that date, and circumstantial evidence suggests that the pillar was originally erected at Stanley House, a little north of Perth.



The Fingask Earthquake Pillar, now in Perth Museum.

#### REFERENCES

- British Association, 1841-1844. Report of the British Association for the Advancement of Science, 1841, pp46-50; 1842, pp92-98; 1843, pp120-127; 1844, pp85-90.
- British Association, 1870-1876. Reports of the Committee on Earthquakes in Scotland, Report of the British Association for the Advancement of Science, 1870, pp48-49; 1871, pp197-198; 1872, pp240-241; 1873, pp194-197; 1874, p241; 1875, pp64-65; 1876, p74.
- British Association 1953. Report of the Seismological Committee, British Association for the Advancement of Science.
- Burton, P.W., Musson, R.M.W., and Neilson, G., 1984. Studies of Historical British Earthquakes, Brit. Geol. Survey Glob. Seism. Unit, Report No 237.
- Milne\*, J., 1893. Earthquakes and Other Earth Movements, Kegan, Paul, Trench, Trubner & Co., London.
- Musson, R.M.W., 1993a. Comrie: a historical Scottish earthquake sw arm and its place in the history of seismology. Terra Nova, v5 pp 477-480.

## APPENDIX: Historical Observatory Details

<b>NAME</b> Discovery, Antarctica	<b>LOCATION</b> Antarctica	<b>BGS IDENTITY CODE</b> <b>DIS</b>
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<b>ORGANISATION</b> Royal Society	<b>FIRST YEAR (seismology)</b> 1901	<b>LATITUDE</b> -77.842	<b>LONGITUDE</b> 166.745	<b>INTERNATIONAL STATION CODE</b> 
	<b>FINAL YEAR (seismology)</b> 1904	<b>HEIGHT (approx in metres)</b> 12		

<b>INSTRUMENT ONE</b> Milne boom	<b>FIRST YEAR Inst 1</b> 1902	<b>FINAL YEAR Inst 1</b> 1903	<b>OTHER INSTRUMENTS</b> 
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<b>INSTRUMENT TWO</b> 	<b>FIRST YEAR Inst 2</b> 	<b>FINAL YEAR Inst 2</b> 	
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**SEISMOGRAMS**  
not known at present, although some published in Bernacchi & Milne (1908)

**BULLETINS**  
not known at present

**OTHER MATERIAL**

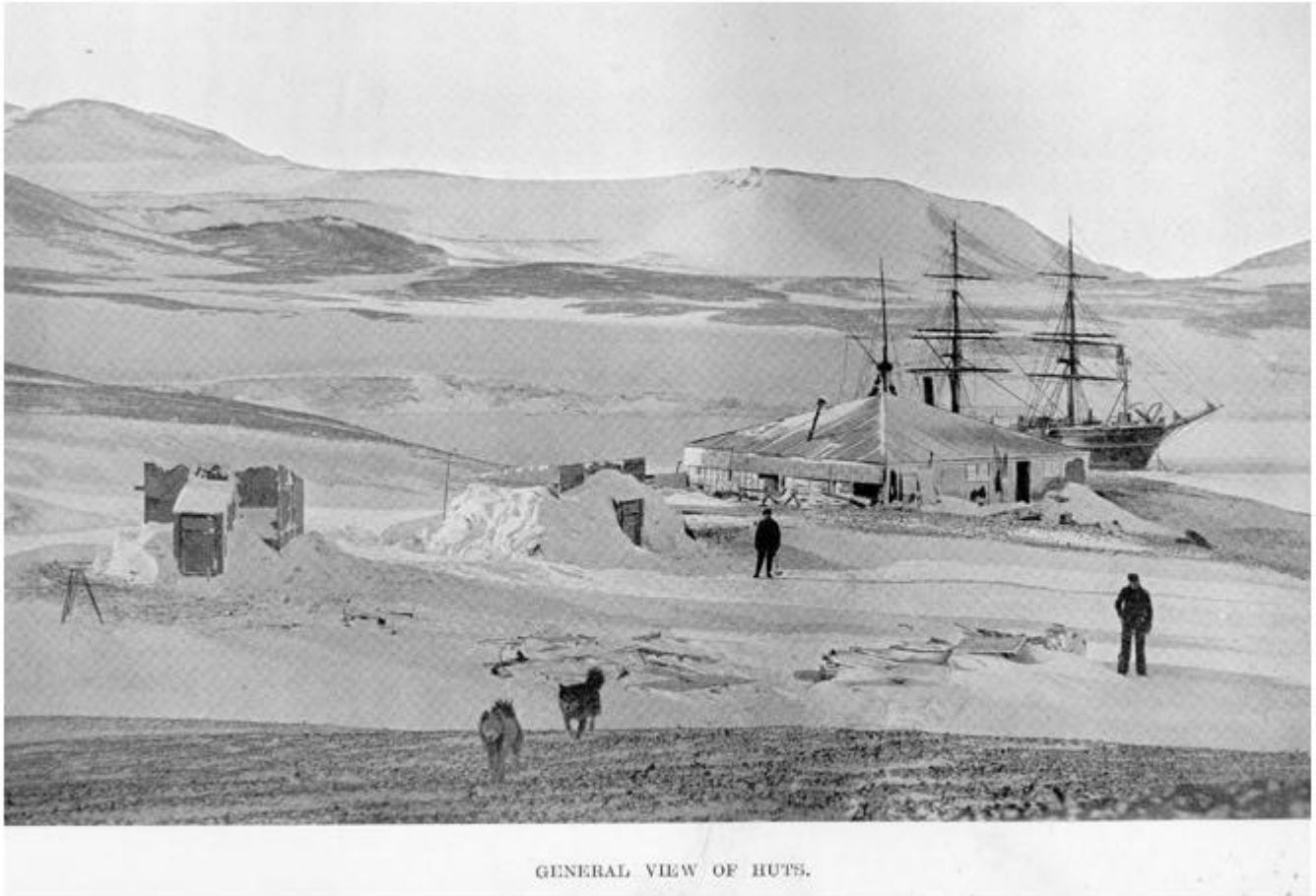
**OBSERVATORY OVERVIEW**

A brief discussion on this observatory is included because the expedition was British funded and equipped, and represented the enthusiasm for scientific observation of the time. In addition, although many observatories have since been established in Antarctica and have contributed data, this was the first.

In March 1902, Scott's Discovery expedition (1901-1904) set up a Milne seismograph (No. 37) in one of the magnetic huts on a drain pipe plinth resting on frozen gravel. The instrument's boom was oriented N-S, had a period of 15 secs, and it was operated by Mr Bernacchi, the expedition's geomagnetician who was also responsible for much of the other scientific observation. It was moved to a brick plinth in a larger hut in November 1902, with its orientation reversed, and ran until March 1903 when the plinth was used for pendulum measurements. 136 earthquakes were recorded (Bernacchi & Milne 1908), although none were felt by the Discovery staff, and the results were later analysed at Shide by Milne and his assistants Burgess and Hirota. The instrument plinth is still there, but the hut is in ruins. Scott (1905) remarks that he was surprised that more earthquakes were not recorded given the Antarctic station's proximity to two active volcanoes (Mts. Erebus and Terror).

The Milne instrument was later installed at Stonyhurst College in 1908. Unfortunately, no photographs of its use in the Antarctic appear to exist.





The magnetic huts in which the seismograph was housed (from Scott, 1905).

**REFERENCES**

- Bernacchi, L.C. & Milne, J., 1908. Earthquakes and other earth movements recorded in the Antarctic regions, 1902-1903, in National Antarctic Expedition 1901-1904. Physical Observations. London, Royal Society, 1908, pp 37-96.
- Scott, R.F., 1905. The voyage of the Discovery, Vol 1. John Murray, London.



## APPENDIX: Historical Observatory Details

<b>NAME</b>	<b>LOCATION</b>	<b>BGS IDENTITY CODE</b>
Dorking Observatory, Surrey	Two addresses used in Dorking: 1. Cliftonville (at approx 51.22N -0.33E c82m) 2. Longfield Rd (at approx 51.23N -0.34E c70m)	<b>DOR</b>

<b>ORGANISATION</b>	<b>FIRST YEAR (seismology)</b>	<b>LATITUDE</b>	<b>LONGITUDE</b>	<b>INTERNATIONAL STATION CODE</b>
	1948	51.230	-0.340	
	<b>FINAL YEAR (seismology)</b>	<b>HEIGHT (approx in metres)</b>		
	1960?	70		

<b>INSTRUMENT ONE</b>	<b>FIRST YEAR Inst 1</b>	<b>FINAL YEAR Inst 1</b>	<b>OTHER INSTRUMENTS</b>
Home built Milne-type?	1948	1960	

<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>

**SEISMOGRAMS**  
None known to survive from this observatory

**BULLETINS**  
Handwritten bulletins 1940-1959 held in Carisbrooke Castle Museum, copies in NSA. The last record is for March 29, 1960.

**OTHER MATERIAL**  
Some press cuttings of Pollard's comments on large earthquakes held in NSA. Other material held in Carisbrooke Castle Museum. Pollard's autobiographical and seismological notes have recently been acquired by NSA

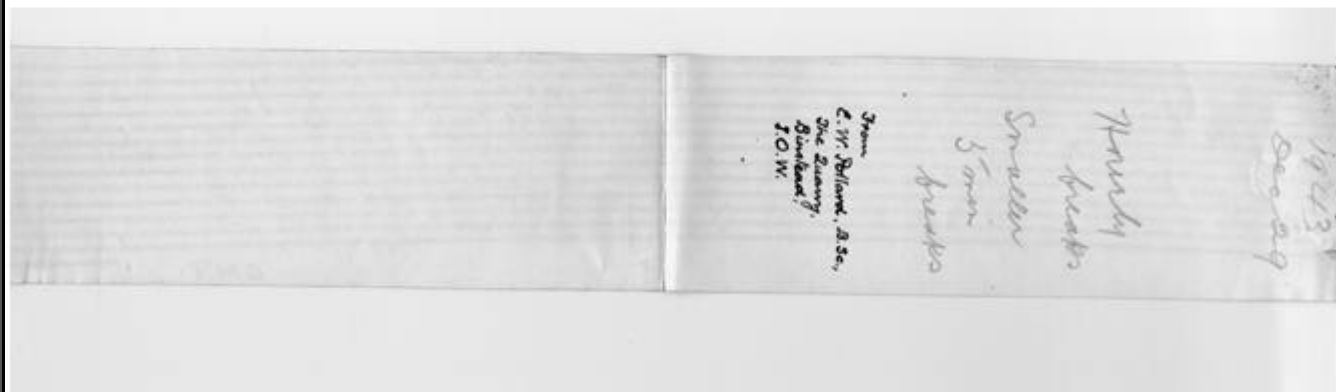
**OBSERVATORY OVERVIEW**

E.W. Pollard retired from his pharmacy business on the Isle of Wight (see BIN) to Dorking, Surrey, in mid-1947, and by January 1948 had an instrument working at his house The Brambles, Cliftonville. According to the present occupants, the remains of a plinth survive and the setup was described in a newspaper as a small wood-lined toolshed. This address was apparently too near a main road (the A2003 to Horsham), so he moved to a seismically quieter location - Merlewood, Longfield Road about 1km away, in August 1953. Curiously there is a building called The Observatory in a park just to the southwest of Longfield Road. Pollard continued his seismological work, writing articles for amateur seismologists and supplying details of British and worldwide earthquakes to the Media in the manner of J.J. Shaw who died in 1948. Press cuttings are held in the NSA of his comments on the 1956 10 January Ashby (which he did not record), the 5 May 1956 Lw orth, and the 1957 11 February Derby events, all apparently syndicated by the Press Association who, unfortunately, have no references to Pollard in their archives. He also became a member of the Seismological Society of America in 1946, grumbling in one of his articles that there was no British institution which catered for amateur seismologists, and remained a member until his resignation in 1959.

In the early 1950s, Mr Pollard was instrumental in the setting up of a Milne exhibition in Carisbrooke Castle on the Isle of Wight, after declining the British Association invitation to write a biography of Milne. The exhibition did not become permanent, as had been hoped, but Pollard gave to the Carisbrooke Castle Museum a model of a Milne seismograph of around 1898. The model, although incomplete, measures about 12" high and 15" long.

In 1961 at the age of 84, E.W. Pollard died, and was buried at Ryde. After his death, his son-in-law, Mr Buckingham, set up the seismograph in a shed at his home in Whetstone, North London. Members of the family remember seeing it there in the early 1970s, but its fate after Mr Buckingham's death is not known.

DOR



The only E.W. Pollard seismogram known to survive (held in NSA).

REFERENCES

- \*Pollard, E.W., 1951. Earth Movements and how recorded, The South-Eastern Naturalist and Antiquary, Vol. LVI.
- \*Pollard, E.W., undated autobiographical notes held in NSA

## APPENDIX: Historical Observatory Details

<b>NAME</b>	<b>LOCATION</b>	<b>BGS IDENTITY CODE</b>
Dow n House, Kent	Dow ne, nr Biggin Hill, Kent	DOW

<b>ORGANISATION</b>	<b>FIRST YEAR (seismology)</b>	<b>LATITUDE</b>	<b>LONGITUDE</b>	<b>INTERNATIONAL STATION CODE</b>
	<b>FINAL YEAR (seismology)</b>	<b>HEIGHT (approx in metres)</b>		
B.A. Seismological Committee	1947	51.330	0.050	
	1949?	172		

<b>INSTRUMENT ONE</b>	<b>FIRST YEAR Inst 1</b>	<b>FINAL YEAR Inst 1</b>	<b>OTHER INSTRUMENTS</b>
Milne-Shaw NS & EW	1947	1949?	

<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>

**SEISMOGRAMS**

None found

**BULLETINS**

None found

**OTHER MATERIAL**

Some Dow n House material w ith British Association archive in Bodleian Library, Oxford

**OBSERVATORY OVERVIEW**

The physician Dr Robert W.Darwin purchased Dow n house for his more famous son, Charles, who lived there betw een 1842 and 1882, and there w rote many of his famous w orks, including the 'Origin of Species'. After its use as a private school, Mr (later Sir) George Buckston Brow ne (a philanthropic surgeon) acquired Dow n House in about 1927 from Darwin' s grandson, and donated it to the British Association (BAAS 1928, Glasgow ) together w ith a generous endow ment to ensure its use for the benefit of science. The house w as restored w ith Darwiniana either donated by the family or purchased, and opened to the public in 1929.

Betw een 1933 and 1936, discussions took place w ithin the B.A. committees about the suitability of Minka, Wood-Anderson or Milne-Shaw seismographs for installation at Dow n House (B.A. material in the Bodleian Library). In 1947, after the closure of the Oxford station, the tw o Milne-Shaw s (nos. 1 & 4 ow ned by the BA) w ere set up in the Dow n House w ine cellar by Miss Bellamy of Oxford. There w as close collaboration then betw een Dow n House and Kew in the exchange of information. The seismographs w orked until about 1949 and w ere then put into store. References exist to the storage of seismograms in the w ine racks at Dow n House, and to the recording of events detected by other observatories, but so far these records remain undiscovered.

Dow n House passed to the Royal College of Surgeons in about 1953 w ith consequent clearout of British Association material - some w ent to the Bodleian Library, Oxford. One Milne-Shaw (No 1) w ent to the Science Museum; the fate of the second is uncertain but it w as still stored at Dow n House in 1964 (BAAS Rept 1964), although agreement w as reached by the BA Seismological Committee in 1950 to send No 4 to the University of Sydney for installation in Guadalcanal (committee minutes in Dollar's papers, NSA). Its ultimate fate is unknow n.

Dow n House became the property of the nation in 1996, and has recently been refurbished by English Heritage (Internet home pages at <http://www.english-heritage.org.uk/>) as a Charles Darwin museum. No seismological artefacts w ere in the inventory, and central heating boilers have been installed in the w ine cellars. A recent examination of the British Association archive in the Bodleian Library, Oxford, failed to reveal any new information on seismological activities in Dow n House, this material being principally administrative in nature.

**DOW**



Down House, Downe, Kent (photo supplied by Dr. P.W. Burton, but origin unknown)

**REFERENCES**

British Association, 1928, 1964. Annual Report, British Association for the Advancement of Science.

## APPENDIX: Historical Observatory Details

NAME	LOCATION	BGS IDENTITY CODE
Durham University Observatory	Durham University Observatory, Durham	DUR

ORGANISATION	FIRST YEAR (seismology)	LATITUDE	LONGITUDE	INTERNATIONAL STATION CODE
Durham University	1930	54.767	-1.583	DUR
	FINAL YEAR (seismology)	HEIGHT (approx in metres)		
	1976	103		

INSTRUMENT ONE	FIRST YEAR Inst 1	FINAL YEAR Inst 1	OTHER INSTRUMENTS
Milne-Shaw NS	1931	1976	Wilson-Lamison Vertical (1956-1976)

INSTRUMENT TWO	FIRST YEAR Inst 2	FINAL YEAR Inst 2	
Milne-Shaw EW	1938	1976	

**SEISMOGRAMS**  
 1930-1939, 1945-1976 held in NSA. Microfilmed.

**BULLETINS**  
 1930-1938, 1946-1975 held in NSA.

**OTHER MATERIAL**

**OBSERVATORY OVERVIEW**

Durham University Seismological Observatory was set up in 1930 after tests were performed with a borrowed Milne-Shaw. A Milne-Shaw (N-S component) seismograph started operation in January 1931 in the building formerly housing the almucantar (an instrument for making astronomical measurements) (BA 1930 p244). A second Milne-Shaw (E-W component) was added in January 1938. The station ceased operation in July 1939 and restarted in January 1946. A vault was constructed in 1955 and a Wilson-Lamison vertical instrument was installed, together with the two Milne-Shaws, in October 1956. These instruments remained in operation until 1976, then fell into disuse. The seismograms and bulletins are archived at BGS.

Eventually the University required the vault, so the seismographs and clock were sent to the Science Museum in 1992. That marked the end of the Durham Observatory, although, like many other university departments, the University installed arrays of short period instruments in various places. For example, an experimental instrument was installed by the MOD at the Rookhope borehole. This station was eventually taken over by Durham University who also installed an array of Willmore instruments in the area for experimental purposes.

DUR

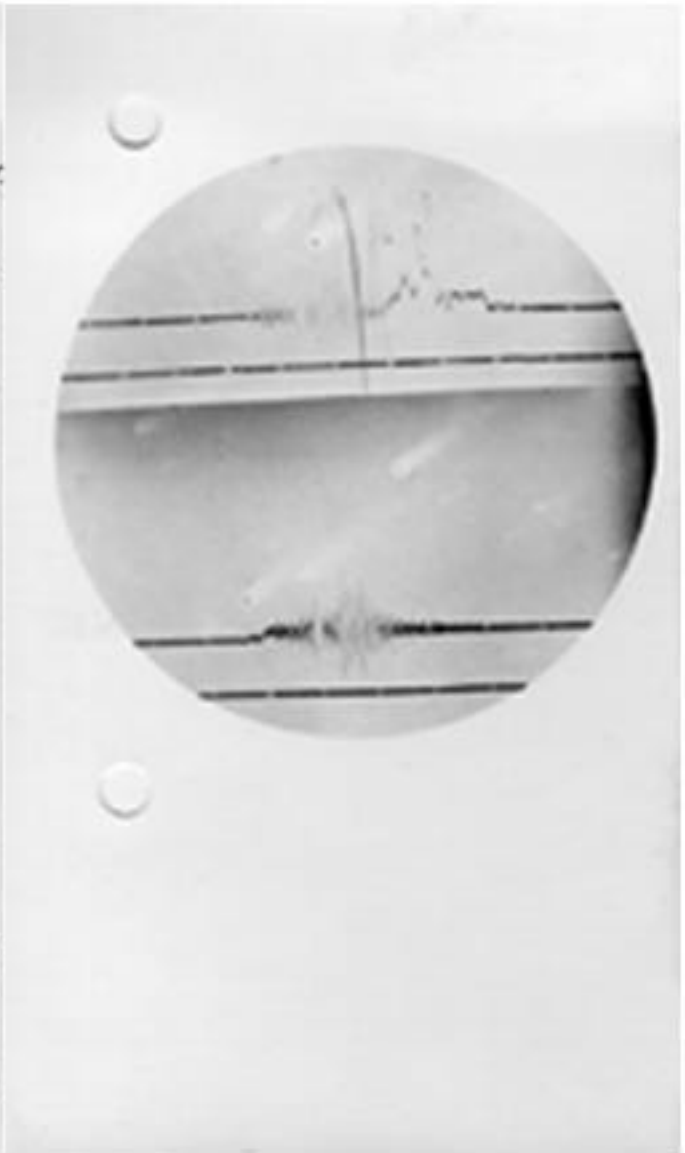
11 June 1938  
 Top = N.S.  
 Bottom = E.W.  
 Time corr. Nil.  
 Time of Seisimo  
  
 10-59 G.M.T.  
 (not Summer Time).  
 DURIHAM UNIVERSITY OBSERVATORY  
 (minute starts with weak)  
 Milne-Shaw instruments

27 JUN 1938

R S

POST CARD

ADDRESS



Seismogram and readings for the 5.8ML Belgian earthquake of 11 June 1938, sent by Dr Baxter of Durham Observatory to Dr Dollar (held in NSA).

REFERENCES

British Association 1930. Annual Report, British Association for the Advancement of Science.  
 Neilson, G. & P.W. Burton., 1988. A brief history of Seismological Observatories in the British Isles, 1896-1960 in Lee, W.H.K., Meyers, H. & Shimazaki, K., (eds.), Historical Seismograms and Earthquakes of the World, Academic Press Inc.

## APPENDIX: Historical Observatory Details

<b>NAME</b> Calton Hill Observatory, Edinburgh	<b>LOCATION</b> Calton Hill, Edinburgh, Scotland	<b>BGS IDENTITY CODE</b> <b>ECH</b>
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<b>ORGANISATION</b> Royal Observatory	<b>FIRST YEAR (seismology)</b> 1894	<b>LATITUDE</b> 55.960	<b>LONGITUDE</b> -3.180	<b>INTERNATIONAL STATION CODE</b> 
	<b>FINAL YEAR (seismology)</b> 1895	<b>HEIGHT (approx in metres)</b> 106		

<b>INSTRUMENT ONE</b> Darw in bifilar pendulum	<b>FIRST YEAR Inst 1</b> 1894	<b>FINAL YEAR Inst 1</b> 1895	<b>OTHER INSTRUMENTS</b>
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<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>	
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**SEISMOGRAMS**  
None known

**BULLETINS**

**OTHER MATERIAL**

**OBSERVATORY OVERVIEW**

Originally set up by the Astronomical Association in 1818 on an outcrop of volcanic rock east of the city centre, the Calton Hill Observatory was taken over by the government and became the Royal Observatory. The first seismograph to operate there was a Darw in bifilar pendulum, which was originally installed in March 1894. Owing to pollution, the Calton Hill astronomical and seismological equipment was moved to the Royal Observatory, Blackford Hill in October 1895. The original building is still used as a public observatory.





Aerial view of Calton Hill, (BGS photo).

**REFERENCES**

Neilson, G. & P.W. Burton., 1988. A brief history of Seismological Observatories in the British Isles, 1896-1960 in Lee, W.H.K., Meyers, H. & Shimazaki, K., (eds.), Historical Seismograms and Earthquakes of the World, Academic Press Inc.



## APPENDIX: Historical Observatory Details

<b>NAME</b>	<b>LOCATION</b>	<b>BGS IDENTITY CODE</b>
Royal Observatory, Edinburgh	Blackford Hill, Edinburgh, Scotland	<b>EDI</b>

<b>ORGANISATION</b>	<b>FIRST YEAR (seismology)</b>	<b>LATITUDE</b>	<b>LONGITUDE</b>	<b>INTERNATIONAL STATION CODE</b>
	<b>FINAL YEAR (seismology)</b>	<b>HEIGHT (approx in metres)</b>		
Royal Observatory	1896	55.925	-3.184	<b>EDI</b>
	present	131		

<b>INSTRUMENT ONE</b>	<b>FIRST YEAR Inst 1</b>	<b>FINAL YEAR Inst 1</b>	<b>OTHER INSTRUMENTS</b>
Darw in bifilar pendulum (1896-?), Second pendulum, type unspecified, (1898-?)	1896	?1902	Milne-Shaw (No. 3) 1919-1962
<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>	
Milne pendulum EW 1902-	1902	1908?	

**SEISMOGRAMS**  
Seismograms destroyed, except for Milne 1902-1908 held in NSA. Microfilm copies are held in the NSA for 1896-1962

**BULLETINS**  
1922-1962 bulletins held in NSA

**OTHER MATERIAL**  
Milne pendulum and Milne-Shaw now in National Museums of Scotland, Chambers Street, Edinburgh EH1 1JF

**OBSERVATORY OVERVIEW**

Equipment moved from the Calton Hill observatory was installed at the Royal Observatory, Blackford Hill. This observatory stands on a prominent andesitic crag-and-tail feature in the southern suburbs of Edinburgh, and was set up because the city lights hindered observation on Calton Hill. Photographic registration apparatus was added to the pendulum in August 1896 and a second pendulum was purchased in May 1898. In 1900 a Milne pendulum was installed. New recording drums were added in 1909, which gave a faster paper speed of 240 mm per hour. A Milne-Shaw seismograph, number 3, formerly at Eskdalemuir, was moved to Edinburgh and began recording on July 4, 1919. The E-W component had a static magnification of 250. After World War II, E. Tillotson took over the reading of the Edinburgh seismograms. During the period 1939-40 various interruptions to recordings occurred owing to defects of the drum drive and to quarry blasting. The Milne-Shaw instrument ceased operation in April 1962, when it was transferred to the National Museums of Scotland, along with the Milne (No 32). At least one of these instruments was operated there, and seismograms are held in the Museum.

The vault at Blackford Hill is currently occupied by a four-component set of Willmore instruments installed in 1969 by the BGS as part of its 'Low net' seismograph network; a broad band Guralp seismometer was added in 1989. Data are radio-linked to the nearby BGS office.



Royal Observatory, Blackford Hill, Edinburgh.

**REFERENCES**

Neilson, G. & P.W. Burton., 1988. A brief history of Seismological Observatories in the British Isles, 1896-1960 in Lee, W.H.K., Meyers, H. & Shimazaki, K., (eds.), Historical Seismograms and Earthquakes of the World, Academic Press Inc.

## APPENDIX: Historical Observatory Details

<b>NAME</b> Eskdalemuir Array	<b>LOCATION</b> Eskdalemuir Observatory, Langholm, Dumfries-shire	<b>BGS IDENTITY CODE</b> <b>EKA</b>
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<b>ORGANISATION</b> MOD/UKAEA/BGS	<b>FIRST YEAR (seismology)</b> 1962	<b>LATITUDE</b> 55.331	<b>LONGITUDE</b> -3.159	<b>INTERNATIONAL STATION CODE</b> <b>EKA</b>
	<b>FINAL YEAR (seismology)</b> present	<b>HEIGHT (approx in metres)</b> 263		

<b>INSTRUMENT ONE</b> Willmore vertical and horizontal	<b>FIRST YEAR Inst 1</b>	<b>FINAL YEAR Inst 1</b>	<b>OTHER INSTRUMENTS</b> Array consisting of a base station at Eskdalemuir, with two intersecting lines of seismometers.
<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>	

**SEISMOGRAMS**

**BULLETINS**

Some material held in NSA

**OTHER MATERIAL**

**OBSERVATORY OVERVIEW**

The Eskdalemuir array was one of four international arrays set up in the early 1960s to monitor the International Nuclear Test Ban Treaty. It was laid out on 100 sq. km. of ground north of the main Eskdalemuir observatory in a position originally chosen for its seismically quiet location, and consists of two straight intersecting 9 km lines of 11 instrument pits. Each pit is a steel tube set up to 3m deep and cemented to bedrock, and contains a Willmore seismometer, signal conditioning and transmission electronics, and lightning suppression. Data are transmitted down land lines to the operations centre (see illustration).

Since 1990, the recording centre at EKA has undergone a modernisation programme which has led to improved facilities for data recording, archiving and transmission. Internet connection allows rapid access to data by authorised users, including the International Monitoring System, established under the terms of the Comprehensive Test Ban Treaty. In 1998, BGS became a contractor to MOD, and assumed full operational responsibility.



Aerial view of Eskdalemuir Array operations centre (BGS photo).

**REFERENCES**

Neilson, G. & P.W. Burton., 1988. A brief history of Seismological Observatories in the British Isles, 1896-1960 in Lee, W.H.K., Meyers, H. & Shimazaki, K., (eds.), Historical Seismograms and Earthquakes of the World, Academic Press Inc.

## APPENDIX: Historical Observatory Details

<b>NAME</b> Eskdalemuir Observatory	<b>LOCATION</b> Eskdalemuir Observatory, Langholm, Dumfries-shire	<b>BGS IDENTITY CODE</b> <b>ESK</b>
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<b>ORGANISATION</b> Met. Office	<b>FIRST YEAR (seismology)</b> 1908	<b>LATITUDE</b> 55.312	<b>LONGITUDE</b> -3.206	<b>INTERNATIONAL STATION CODE</b> <b>ESK</b>
	<b>FINAL YEAR (seismology)</b> present	<b>HEIGHT (approx in metres)</b> 263		

<b>INSTRUMENT ONE</b> Galitzin 3 cpt	<b>FIRST YEAR Inst 1</b> 1912	<b>FINAL YEAR Inst 1</b> 1925	<b>OTHER INSTRUMENTS</b> Milne Tw in Boom (1908-?), Omori 1910-1921, Wiechert (1909-?)
<b>INSTRUMENT TWO</b> Milne-Shaw	<b>FIRST YEAR Inst 2</b> 1915	<b>FINAL YEAR Inst 2</b> 1919	

**SEISMOGRAMS**  
Galitzin 1910-1920, Milne-Shaw 1916-1918 held in the NSA

**BULLETINS**  
1913-1916, 1920-1925, 1965-1967 (WWSSN?) and 1969-1972 original notebooks are held in the NSA

**OTHER MATERIAL**  
Omori and Galitzin instruments in Science Museum, London; Milne-Shaw in Royal Museum of Scotland, Edinburgh

**OBSERVATORY OVERVIEW**

A magnetic observatory was sited at this remote spot initially because observation at Kew was being affected by magnetic fields generated by trains and trams, etc. An underground seismograph vault was constructed 1800ft north of and 70ft higher than the main observatory, and equipped with temperature and humidity control. The first seismographs at Eskdalemuir were a Milne tw in boom instrument which began operating in 1908 shortly after the observatory opened, and a Wiechert which was installed in 1909. In 1910, Eskdalemuir became the responsibility of the Met. Office, and meteorological observations became of prime importance. However, in the same year an Omori seismograph was installed, and Professor Schuster of Manchester University presented the observatory with two Galitzin horizontal seismographs, which were set up as N-S and E-W components. Two years later he donated a vertical instrument, and these three instruments remained for many years the only three component set of seismographs in operation in the United Kingdom. The instruments were made in St Petersburg by H. Masing and their installation was personally supervised by Prince Galitzin (who also signed John Milne's Visitors Book on the Isle of Wight in July 1910, presumably on the same visit to the UK). Recording with the Galitzins began in July 1910. In July 1915 a Milne-Shaw instrument was installed for comparison with the Galitzin. This instrument was transferred to the Royal Observatory, Edinburgh, in June 1919, but the fate of the original Milne is unknown. The Omori was donated to the Science Museum in 1921 and the Galitzins were transferred to Kew Observatory in 1925 where they were used until recording at Kew ceased in 1969 when they too were sent to the Science Museum.

Seismology resumed at Eskdalemuir in 1963 with the installation of the World Wide Standard Station which began continuous operation in March 1964. Instrumentation was the standard WWSSN arrangement of two three-component sets of short- and long-period instruments. In 1965 the installation by the British Geological Survey (then the Institute of Geological Sciences) of Willmore short-period instruments began in the area. One Willmore was installed in the Eskdalemuir vault.





Aerial view of Eskdalemuir Observatory. The seismometer vault is some distance away off the upper right edge of the photo (BGS photo).

**REFERENCES**

Neilson, G. & P.W. Burton., 1988. A brief history of Seismological Observatories in the British Isles, 1896-1960 in Lee, W.H.K., Meyers, H. & Shimazaki, K., (eds.), Historical Seismograms and Earthquakes of the World, Academic Press Inc.

## APPENDIX: Historical Observatory Details

<b>NAME</b> Eskdalemuir Observatory WWSSN	<b>LOCATION</b> Eskdalemuir Observatory, Langholm, Dumfries-shire	<b>BGS IDENTITY CODE</b> <b>EWW</b>
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<b>ORGANISATION</b> BGS	<b>FIRST YEAR (seismology)</b> 1964	<b>LATITUDE</b> 55.312	<b>LONGITUDE</b> -3.206	<b>INTERNATIONAL STATION CODE</b> <b>ESK</b>
	<b>FINAL YEAR (seismology)</b> 1995	<b>HEIGHT (approx in metres)</b> 263		

<b>INSTRUMENT ONE</b>	<b>FIRST YEAR Inst 1</b>	<b>FINAL YEAR Inst 1</b>	<b>OTHER INSTRUMENTS</b>
WWSSN standard arrangement of LP 3 comp Sprengnether, SP 3 comp Benioff	1964	1995	
<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>	

**SEISMOGRAMS**  
Original seismograms are kept at Esk (1965-1992?). Microfilmed by NEIC and held in NSA.

**BULLETINS**  
1965-1967 (WWSSN) held in NSA

**OTHER MATERIAL**

**OBSERVATORY OVERVIEW**  
Seismology ceased at Eskdalemuir between 1925, after the transfer of the last instrument to Kew, and 1963, when installation of the WWSSN station began. This station started recording in 1964, and was one of a worldwide network of standard analogue instruments contributing data to the USGS. These instruments were switched off in 1995, but remain in the vault which is situated a little way outside the Observatory boundary.



WWSSN equipment in Eskdalemuir vault (BGS photo)

**REFERENCES**

Neilson, G. & P.W. Burton., 1988. A brief history of Seismological Observatories in the British Isles, 1896-1960 in Lee, W.H.K., Meyers, H. & Shimazaki, K., (eds.), Historical Seismograms and Earthquakes of the World, Academic Press Inc.  
Powell, T. & Fries, D., 1964. Handbook: Worldwide Standard Seismograph Network, [Revised August 1965]. US Coast and Geodetic Survey/ University of Michigan - Institute of Science and Technology.



## APPENDIX: Historical Observatory Details

<b>NAME</b>	<b>LOCATION</b>	<b>BGS IDENTITY CODE</b>
Fort Augustus Abbey	Fort Augustus Abbey, Fort Augustus, Inverness-shire	FAG

<b>ORGANISATION</b>	<b>FIRST YEAR (seismology)</b>	<b>LATITUDE</b>	<b>LONGITUDE</b>	<b>INTERNATIONAL STATION CODE</b>
Order of Saint Benedict/British Association	1950	57.140	-4.680	
	<b>FINAL YEAR (seismology)</b>	<b>HEIGHT (approx in metres)</b>		
		21		

<b>INSTRUMENT ONE</b>	<b>FIRST YEAR Inst 1</b>	<b>FINAL YEAR Inst 1</b>	<b>OTHER INSTRUMENTS</b>
Jaggar shock recorder	1950	1998	

<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>	

**SEISMOGRAMS**

None ever recorded

**BULLETINS**

None published

**OTHER MATERIAL**

The Jaggar Shock recorder is held in the NSA.

**OBSERVATORY OVERVIEW**

Fort Augustus Abbey lies at the southern end of Loch Ness, and was founded in 1876 on land leased from Lord Lovat's family. Between the First World War and the 1980s meteorological measurements were made by Father Andrew McKillop, who also became responsible for seismological measurements in 1950. A letter from CP Corballis O.S.B. to Dr Tyrrell of Glasgow University is held in the NSA among the Dollar papers. It details his impressions at the Abbey of the 16 August 1934 Torridon earthquake which was widely felt in north west Scotland.

The BA Jaggar Shock Recorder formerly at Comrie (see CDU and KEW for further details) was installed in the Abbey in 1950 by Dollar who was keen to have instruments in the Great Glen area because of its supposed seismicity. Dollar also supplied cardboard recording discs. However, the BA annual reports for many years afterwards state merely '...Jaggar recorder at Fort Augustus', and no further reference to this site occurs after 1964.

Recent enquiries revealed that the Jaggar never worked satisfactorily at Fort Augustus, being much too susceptible to local seismic noise as it was installed in the monastery building near delivery entrances. It remained there until mid-1998 when it was moved to allow renovations to take place, and was about to be thrown out. Through the good offices of Father Francis Davidson it is now stored at the BGS office in Edinburgh, with plans being made to restore it to working order, and is thought to be the only Jaggar still in existence. The Abbey has now closed, with the staff being dispersed elsewhere. Plans for the future use of the Abbey buildings have not been finalised.



The Jaggard shock recorder originally installed at Dunira House, Comrie, and moved to Fort Augustus in 1950 (photo taken at Comrie in 1938 by A.T.J. Dollar, in NSA).

**REFERENCES**

British Association 1950-1964. Annual Reports, British Association for the Advancement of Science.

## APPENDIX: Historical Observatory Details

<b>NAME</b>	<b>LOCATION</b>	<b>BGS IDENTITY CODE</b>
Ben Nevis Summit Observatory	Summit of Ben Nevis	FWB

<b>ORGANISATION</b>	<b>FIRST YEAR (seismology)</b>	<b>LATITUDE</b>	<b>LONGITUDE</b>	<b>INTERNATIONAL STATION CODE</b>
Ben Nevis Observatory, Roy.Soc.Edin., Scot. Met. Soc.	1883	56.796	-5.002	
	<b>FINAL YEAR (seismology)</b>	<b>HEIGHT (approx in metres)</b>		
	1904	1343		

<b>INSTRUMENT ONE</b>	<b>FIRST YEAR Inst 1</b>	<b>FINAL YEAR Inst 1</b>	<b>OTHER INSTRUMENTS</b>
Ewing Duplex Pendulum	1886	1892	

<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>	

**SEISMOGRAMS**

No record of any

**BULLETINS**

No record of any; none were published with the meteorological observations.

**OTHER MATERIAL**

**OBSERVATORY OVERVIEW**

The observatory on the summit of Ben Nevis opened on 17 Oct 1883 (Paton, 1983), and hourly meteorological observations were taken for nearly 21 years, until 1904. This was organised by the Royal Society of Edinburgh and the Meteorological Societies of England and Scotland, and was paid for by public subscription (unlike many other countries' national meteorological observatories of the time which were government funded).

A Duplex Pendulum Seismograph, designed by Prof J.A. Ewing of University College, Dundee and commissioned by the Directors of Ben Nevis Observatory, was installed, initially in Ben Nevis Observatory and later in the Low-Level Observatory, Fort William. Ewing's seismographs are described by him (Ewing, 1886); and he mentions that they were built to a high standard by the Cambridge Scientific Instrument Company. The installation in summer 1886 is detailed in 'Notes on Instruments', Trans. Roy. Soc. Ed. vol. 34 p343. The instrument was mounted on a stone slab, but according to the next year's report no records were obtained owing to 'seismometer still unsatisfactorily mounted' (Trans. Roy. Soc. Ed. vol. 34 "Notes on Instruments 1887."). No further reference to it exists until vol. 42 p419 'Notes on instruments for 1892' in which it is stated that 'the seismograph was not used this year. In September it was sent away to be repaired with a view to its being erected at the Low-Level Observatory'. Ewing himself seems to have had reservations about the instrument and its situation (Ewing, 1885).



Ben Nevis Summit Observatory, (photo courtesy of Royal Meteorological Society).

#### REFERENCES

- \*Ewing, A.W., 1940. The man of room 40: the life of Sir Alfred Ewing, Hutchinson, London
- Ewing, J.A., 1885. On the measurement of movements of the Earth, with reference to proposed earthquake observations on Ben Nevis, Nature, Nov 19, 1885. Abs of paper read to Section A of British Association at Aberdeen by Prof Ewing of Dundee Univ. (The same abs appears in Proceedings of BA Aberdeen 1885 volume).
- Ewing, J.E., 1886, Earthquake-recorders for use in observatories, Nature, v XXXIV, May 1886-October 1886, pp 343-344.
- 'Notes on Instruments', in Transactions of the Royal Society of Edinburgh, vols 34,1890; v42 1902; v43 1907; & v44 Pts 1 & 2.
- Paton, J., 1983. Ben Nevis Observatory 1883-1904, Royal Meteorological Soc. James Glaisher House, Bracknell, Berkshire.

## APPENDIX: Historical Observatory Details

NAME	LOCATION	BGS IDENTITY CODE
Fort William Low Level Observatory	Low Level Fort William, Achintore Road, Fort William	FWL

ORGANISATION	FIRST YEAR (seismology)	LATITUDE	LONGITUDE	INTERNATIONAL STATION CODE
Ben Nevis Observatory, Roy.Soc.Edin., Scot. Met. Soc.	1893	56.800	-5.083	
	FINAL YEAR (seismology)	HEIGHT (approx in metres)		
	1904	11		

INSTRUMENT ONE	FIRST YEAR Inst 1	FINAL YEAR Inst 1	OTHER INSTRUMENTS
Ewing Duplex Pendulum	1893	1904	

INSTRUMENT TWO	FIRST YEAR Inst 2	FINAL YEAR Inst 2	OTHER INSTRUMENTS

**SEISMOGRAMS**  
no record of their fate

**BULLETINS**  
no record of any

**OTHER MATERIAL**

### OBSERVATORY OVERVIEW

Three observatories existed at Fort William: the Ben Nevis Summit; the Public School or School House; and Fort William (low -level). The Fort William Observatory, a more permanent, purpose built home for the School House instruments, was opened in 1890 (again by public subscription). Its location was about 150 yards from the School House, on the same side of the road alongside Loch Linnhe and at about the same elevation. After its repair, the Ewing Duplex Pendulum from the Summit Observatory (see FWB) was installed on a brick pillar in the low -level Fort William Observatory in autumn, 1893. Davison (1924) described dubious records obtained there of local earthquakes on 12 January 1894 and 5 June 1896 (see also Davison (1900, p168) but also note that Davison's papers were unfortunately destroyed after the death of his wife). There are pencilled references to these earthquakes in the observatory day books, although none to seismograms, and we are left with the impression that seismology there was never treated as seriously as it could have been.

At the School House or Public School, Fort William, Mr Colin Livingston made low -level meteorological observations five times a day when his teaching duties permitted, between December 1st 1883 and the end of 1891, to complement the high level observations made at the Summit. Mr Livingston kindly carried on throughout 1891 to enable instrumental comparisons to be made with the newly-built low -level Fort William Observatory, which was opened in Aug 1890 (Omond, 1902). No seismological instruments were installed in the Public School, which was about a hundred yards away from the Fort William observatory.

The original architects' plans for the Summit and Fort William observatories are presently deposited with the National Monuments Section of the Royal Commission, Edinburgh. They have been examined but reveal no detail of the seismograph installations, although various instrument locations marked on the plans could have been used. No trace has yet been found of readings or seismograms from this observatory, nor has any helpful reference to them been found in the British Association or Scottish Meteorological Society's bulletins at the time.

These observatories were closed in October 1904 after a long period of financial difficulties, having been kept open for the last year through the generosity of private individuals. The summit observatory is in ruins, but both School House and the Fort William Observatory buildings survive, the former a primary school but boarded up as unsafe, the latter an old folk's home in which no trace of history or instruments remains, although an inscription over the door reads 1891.



Fort William low -level Observatory, (photo courtesy of Royal Meteorological Society).

**REFERENCES**

Davison, C., 1900. On Some Minor British Earthquakes of the Years 1893-1899, Geol. Mag. vol. 7, pp164-177.

\*Davison, C., 1905. A Study of Recent Earthquakes, Walter Scott Publishing Co. Ltd., London & New castle-on-Tyne.

Davison, C., 1924. A History of British Earthquakes, CUP.

Omond, R.T., 1902, Abs of paper on a comparison of observations at the Observatory and at the Public School, Fort William, Trans. Roy. Soc. Edin., vol 42, p49.

## APPENDIX: Historical Observatory Details

NAME	LOCATION	BGS IDENTITY CODE
Woodbridge Hill Observatory, Guildford	Hill View , Woodbridge Hill, Guildford. Owner/observer F.Edw ard Norris	<b>GUI</b>

ORGANISATION	FIRST YEAR (seismology)	LATITUDE	LONGITUDE	INTERNATIONAL STATION CODE
F.E. Norris	1910	51.250	-0.590	
	FINAL YEAR (seismology)	HEIGHT (approx in metres)		
	1915?	57		

INSTRUMENT ONE	FIRST YEAR Inst 1	FINAL YEAR Inst 1	OTHER INSTRUMENTS
Tw in Milne type horiz pendulums, t=17.5 secs, L 3ft, mass 100lbs	1910	1915	
INSTRUMENT TWO	FIRST YEAR Inst 2	FINAL YEAR Inst 2	

**SEISMOGRAMS**

None found

**BULLETINS**

1910-1915 held in NSA

**OTHER MATERIAL**

Nothing found

**OBSERVATORY OVERVIEW**

In about 1909, Mr F Edw ard Norris, the ow ner of Hill View , Woodbridge Hill, Guildford, constructed an isolated observatory equipped w ith tw o Milne type horizontal booms. The installation and subsequent experiments carried out are described in great detail in the Annual Reports w hich he produced for the full years 1910-1915 (Norris, 1910-1915). Norris reported to Milne at Shide, and, after Milne' s death in 1913, acknow ledged Milne' s human qualities and contribution to science in a w arm tribute in his Annual Report for 1913.

Norris' s observatory w as specially built and resembled a large garage. His instruments, accurately orientated using a local astronomical observatory, w ere installed on a 3ft high, 3ft square, concrete base w hich extended 5ft dow n into the underlying London Clay, and w hich w as isolated from the observatory floor. A 4inch diameter cast iron mast w as sunk into the concrete to support the instrument booms. Tw o instruments w ere used, both modified Milne-type horizontal pendulums. The first w as a tw o component Milne, w ith 3ft booms, a 4ft mast, and 100lb masses. Its natural period w as 11secs, w ith 45 times magnification levers. A second Milne w ith a 5lb mass and 300 times magnification w as set up as a NS component. These seismographs w ere enclosed in glass cases and provided w ith heating and ventilation to eliminate problems w ith damp and ' air tremors' . The photographic recording apparatus w as constructed by a local jew eller, and the records developed by a colleague of Norris, Mr TL Inman, himself the subject of a tribute after his death in 1913 from Norris. No expense w as spared, and all w as designed to accommodate Norris's frequent absences (not detailed) from home. It is evident that Norris w as a very careful and ingenious experimenter. Norris remarks that traffic had little effect on his booms, but had trouble w ith long period tilting w hich he attributed to changes of humidity in the underlying London Clay. He also described experiments w ith lighter, shorter period instruments to obtain better P records, and w ith magnetic damping, and acknow ledged the influence of Milne & Shaw . Norris's name appears in Milne's Shide Observatory visitors book at least tw ice, the first time in December 1906, and the second in January 1914 after Milne's death together w ith the operators of several other seismological observatories.

In his final Report for 1915, duplicated to save cost, Mr Norris apologises to his collaborators and says that he w ill try to keep an instrument running (the NS component of the larger seismograph) but that his w ork w ith the Red Cross occupies most of his time. He also remarks, in October of that year, that ' lamp oil is bad and hard to procure' . No further readings from Guildford appear in the Shide Circulars. Wood (1921) states 'this station discontinued' from data collected in 1920, although the station w as still listed by the BA (BA 1937) in 1937. At the moment it is not know n if any artefacts survive.





Woodbridge Hill Observatory, Guildford, (photo from the Observatory's First Annual Report, held in NSA).

**REFERENCES**

- British Association, 1937. *The Constants of Seismological Observatories*, The County Press, New port.
- Norris, F.E., 1910-1915. *First to Sixth Annual Reports of the Seismograph Station at Woodbridge Hill, Guildford*, printed at the Observatory and by Curtis, Guildford.
- Wood, H.O., 1921. A list of Seismologic Stations of the World, *Bulletin of the National Research Council, National Academy of Sciences*, Washington D.C., Vol 2 Part 7, Number 15.



## APPENDIX: Historical Observatory Details

<b>NAME</b>	<b>LOCATION</b>	<b>BGS IDENTITY CODE</b>
Frensham Hall Observatory, Haslemere	Frensham Hall, Haslemere: observer in 1911 Samuel Kevan	<b>HAS</b>

<b>ORGANISATION</b>	<b>FIRST YEAR (seismology)</b>	<b>LATITUDE</b>	<b>LONGITUDE</b>	<b>INTERNATIONAL STATION CODE</b>
Privately-owned station, readings published by BAAS	1909?	51.080	-0.717	
	<b>FINAL YEAR (seismology)</b>	<b>HEIGHT (approx in metres)</b>		
	1916?	175		

<b>INSTRUMENT ONE</b>	<b>FIRST YEAR Inst 1</b>	<b>FINAL YEAR Inst 1</b>	<b>OTHER INSTRUMENTS</b>
Milne-type horizontal pendulum			

<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>	

**SEISMOGRAMS**

None found

**BULLETINS**

None found but readings reported in the Shide Circulars

**OTHER MATERIAL**

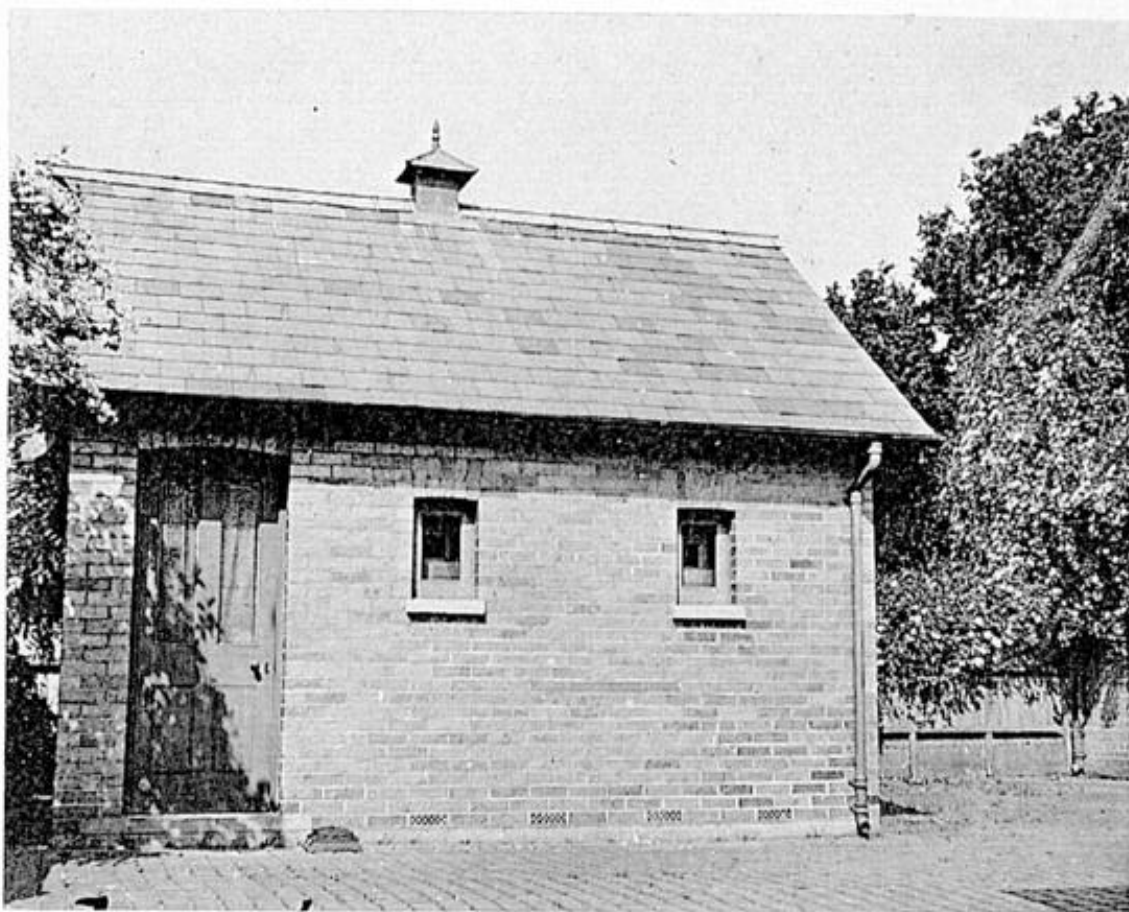
None known to exist

**OBSERVATORY OVERVIEW**

1. Between 1911 and 1916, the observer of Frensham Hall observatory is listed as Mr Samuel Kevan. He was steward firstly to the Hon. Charles Ellis, owner of the Hall, then to subsequent owners - Viscount Emlyn, later Earl Cawdor, and his successors. The coordinates given for the observatory in the British Association reports (BA 1912 et seq.) are for a place just to the west of Haslemere, about 10km distant from the Hall, so it is probable that Mr Kevan used another part of the estate for the observatory. His name appears in John Milne's Shide Observatory Visitors Book on 14 March 1906.

The only illustration found of the observatory is taken from Milne's photograph album, held with the Milne Library by the Science Museum, London. It suggests either a purpose-built or a very recent building judging by its condition, in a cobbled courtyard. In addition, the presence of air bricks and a small chimney strongly suggests that the building was designed to include ventilation for the instruments in a similar way to several other observatories erected at about the same time, as many operators had reported trouble with 'air tremors'. No other description of the building has been found, but the equipment was a standard Milne boom with a period of 15 secs, and this station reported to Shide until 1916, when records ceased. This coincides more or less with the death of the 4th Earl Cawdor, so it is possible that that event caused the demise of the observatory, but it is also quite possible that Mr Kevan was a victim of war. No indication exists in the BA reports of the time or elsewhere, and Wood (1921) states 'no station', although Haslemere was still listed by the BA in 1937 (BA 1937).

2. Haslemere was also mentioned much later as the proposed site for a borehole seismometer to be operated by NIO and intended for microseism work (BA 1962, p485).



FREN SHAM, HASLEMERE.

The Frensham, Haslemere, Observatory (photo from John Milne's photograph album, courtesy of the Science Museum/Science & Society Picture Library)

#### REFERENCES

- British Association, 1912. Annual Report.
- British Association, 1937. The Constants of Seismological Observatories, The County Press, New port.
- British Association, 1962. Annual Report of the Seismological Committee.
- Wood, H.O., 1921. A list of Seismologic Stations of the World, Bulletin of the National Research Council, National Academy of Sciences, Washington D.C., Vol 2 Part 7, Number 15.

## APPENDIX: Historical Observatory Details

<b>NAME</b>	<b>LOCATION</b>	<b>BGS IDENTITY CODE</b>
Turville Vicarage, Henley-on-Thames	Turville Vicarage, Henley-on-Thames	HEN

<b>ORGANISATION</b>	<b>FIRST YEAR (seismology)</b>	<b>LATITUDE</b>	<b>LONGITUDE</b>	<b>INTERNATIONAL STATION CODE</b>
Revd. H. Pain	1933?	51.610	-0.890	
	<b>FINAL YEAR (seismology)</b>	<b>HEIGHT (approx in metres)</b>		
	1946?	83		

<b>INSTRUMENT ONE</b>	<b>FIRST YEAR Inst 1</b>	<b>FINAL YEAR Inst 1</b>	<b>OTHER INSTRUMENTS</b>
Recycled Milne equipment, presumed Milne-type boom	1933	1946	
<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>	

**SEISMOGRAMS**

None known to exist

**BULLETINS**

None known to exist

**OTHER MATERIAL**

None known to survive

**OBSERVATORY OVERVIEW**

The Revd. Harold Pain (1873-1951) had a lifelong interest in astronomy, and was elected FRAS in 1919. He built observatories and telescopes during his early ministry in the Lewes and Eastbourne areas, and, on his arrival at Turville Vicarage, Henley-on-Thames in 1932, continued his astronomical work. Here he built two observatories in a field adjoining the Vicarage; we assume one was for astronomical purposes and the other for seismology. He did not discuss his work with local people, but collaborated with astronomical researchers, and after his retirement his telescope and one observatory (presumably the astronomical one) were sent to Nigeria for the use of a colleague.

The only reference to Revd. Pain's seismological activities comes from the British Association (1933). At that time, some of the parts of old instruments from John Milne's workshop were sent to the University Observatory in Oxford. Many, thought to be of no particular historic interest, were lent to the Revd. Pain, who constructed a seismograph and apparently obtained good results. At about the same time an attempt to reconstruct one of Milne's pendulums was made by the BA, who purchased from W.H. Bullock of the Isle of Wight some of his recording apparatus (BA 1933).

No further details of the Revd. Pain's seismological activities have yet been found in local archives. On his retirement to Bognor Regis in 1946 local people remember the dismantling of his observatories. No artefacts survive in the vicarage which was sold on by the Church Commissioners about 20 years ago.



**REFERENCES**

British Association 1933. Report of the British Association for Advancement of Science.

## APPENDIX: Historical Observatory Details

<b>NAME</b> Herstmonceux Castle, Sussex	<b>LOCATION</b> Herstmonceux Castle	<b>BGS IDENTITY CODE</b> <b>HER</b>
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<b>ORGANISATION</b> Royal Observatory/Blacknest	<b>FIRST YEAR (seismology)</b> 1960	<b>LATITUDE</b> 50.870	<b>LONGITUDE</b> 0.350	<b>INTERNATIONAL STATION CODE</b> 
	<b>FINAL YEAR (seismology)</b> 1960	<b>HEIGHT (approx in metres)</b> 90		

<b>INSTRUMENT ONE</b> Borehole seismograph	<b>FIRST YEAR Inst 1</b> 	<b>FINAL YEAR Inst 1</b> 	<b>OTHER INSTRUMENTS</b> 
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<b>INSTRUMENT TWO</b> 	<b>FIRST YEAR Inst 2</b> 	<b>FINAL YEAR Inst 2</b> 	
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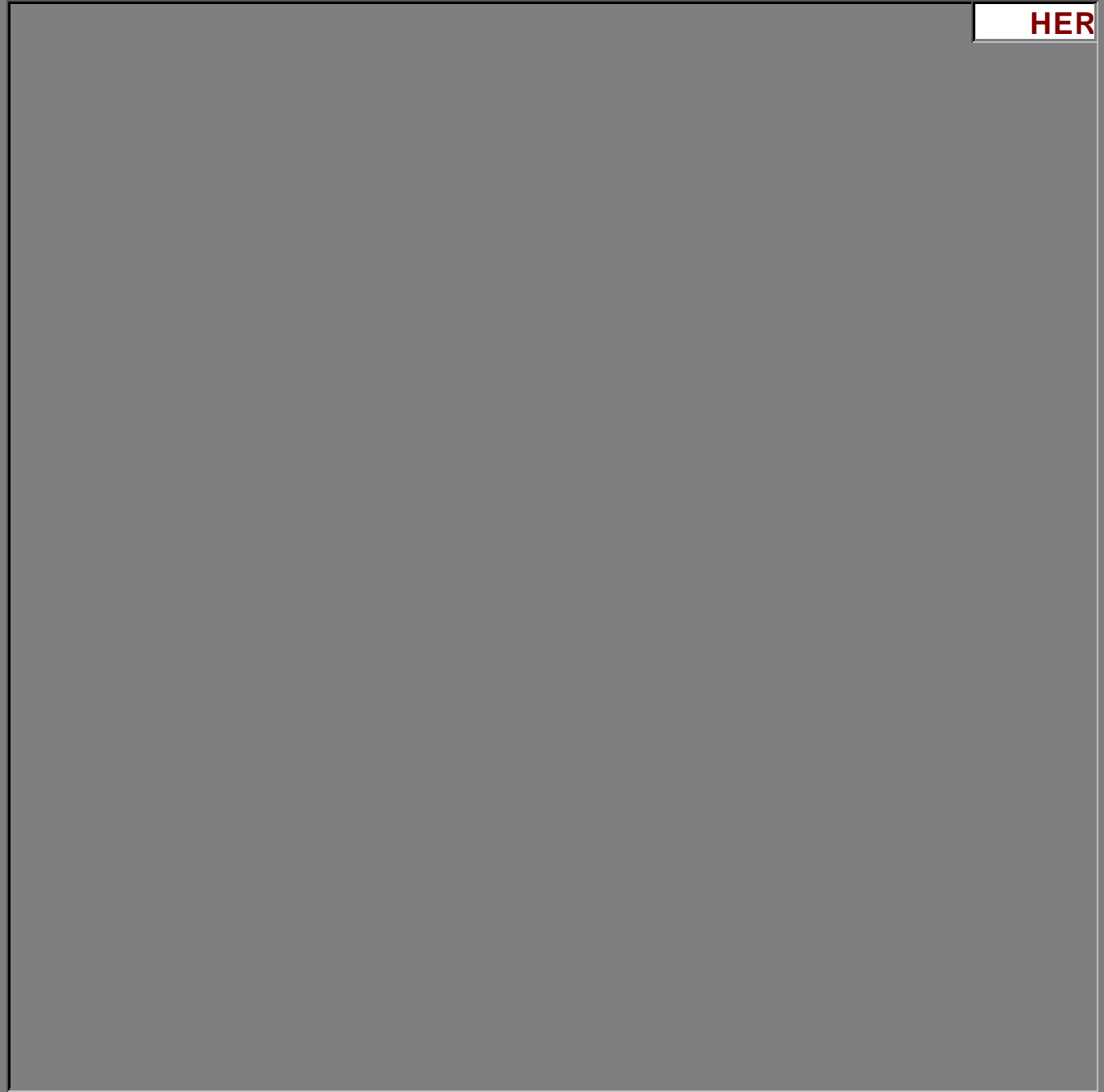
**SEISMOGRAMS**  
Almost all destroyed

**BULLETINS**

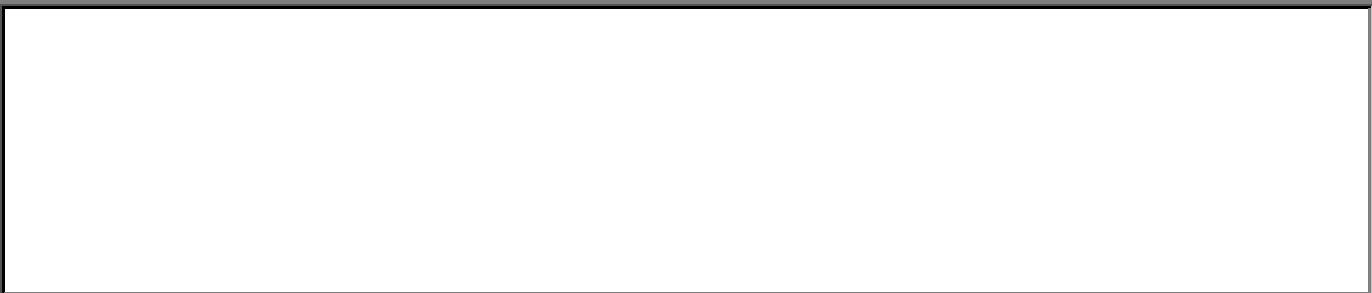
**OTHER MATERIAL**

**OBSERVATORY OVERVIEW**

A sensitive borehole seismograph developed by Dr H Thirlaway was used for a few months to test the construction site of the new Isaac Newton telescope for local earthquakes and microseisms. It was proposed to build the telescope on a 50ft pier, and it was feared that the pier would behave like an inverted pendulum in response to earthquake frequencies. A monitoring experiment was carried out for a few months in collaboration with the N.I.O. in 1960, in the tunnel now occupied by the Satellite Laser Ranging system at Herstmonceux Castle, but the results were inconclusive. The pen records were eventually destroyed except for the few retained for demonstration purposes by Prof. S. Malin.



*REFERENCES*



## APPENDIX: Historical Observatory Details

<b>NAME</b>	<b>LOCATION</b>	<b>BGS IDENTITY CODE</b>
University College, Cork, Ireland	Crawford Observatory, University College, Cork	I_COR

<b>ORGANISATION</b>	<b>FIRST YEAR (seismology)</b>	<b>LATITUDE</b>	<b>LONGITUDE</b>	<b>INTERNATIONAL STATION CODE</b>
	<b>FINAL YEAR (seismology)</b>	<b>HEIGHT (approx in metres)</b>		
University College, Cork	1911	51.883	-8.467	
	1919	20		

<b>INSTRUMENT ONE</b>	<b>FIRST YEAR Inst 1</b>	<b>FINAL YEAR Inst 1</b>	<b>OTHER INSTRUMENTS</b>
Milne tw in boom, 1910 pattern, N-S and E-W components, photographic recording	1911	1919?	
<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>	

**SEISMOGRAMS**

None known

**BULLETINS**

Readings reported to Shide and published in the Shide Circulars until December 1917, Annual Bulletins published by the University, 1912-1918

**OTHER MATERIAL**

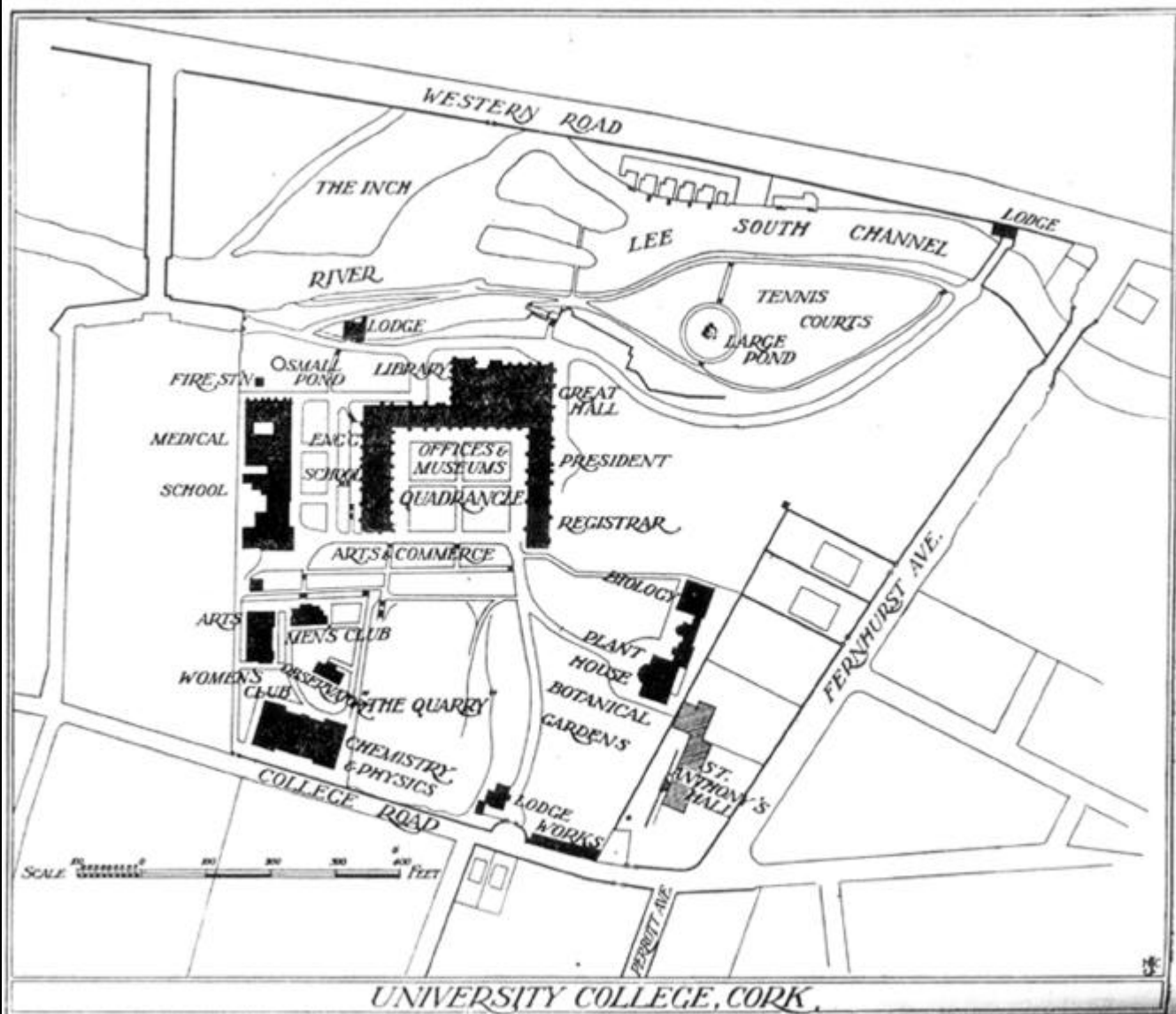
Nothing known

**OBSERVATORY OVERVIEW**

The opening of the University College, Cork, station equipped with a Milne boom was referred to in the BAAS Reports for 1911 and 1913, after two visits to Milne by Isaac Swain, Professor of Geography and Geology at the University from 1909 to 1944, in December 1910 and April 1912, presumably in connection with the station. A 1910-pattern Milne tw in-boom seismograph was installed in the Crawford Observatory which had been opened in 1880 and equipped by Grubb of Dublin with state-of-the-art astronomical and meteorological instruments. The seismograph pillar rested on a slate slab topping a cement-filled drain pipe concreted to solid limestone a foot below ground surface (University College, Cork 1912), and the whole was isolated from the floor and enclosed in a case. Photographic recordings were made, and the clock timing checked by a transit telescope except during the winter months when the proximity of a new science block prevented the sun's observation; a chronometer was then used.

Readings were reported to Milne and published in the Shide Circulars until the last reference found, on December 29, 1917. Annual bulletins were published by the University in the Official Gazette (University College, Cork 1912-1919), including the full bulletin for 1918, a year after the last readings were published by the BA. A contemporary postcard photograph of the University with the seismograph observatory's location indicated by an arrow (perhaps by Swain) is held in Milne's photograph album by the Science Museum, London. Descriptions of the Crawford Observatory containing references to the seismograph were published in the University College, Cork, Calendars until 1942-43. This coincides approximately with the end of Swain's professorship, and it is possible that the seismograph remained in the observatory until that date. However, it is more probable that the descriptive paragraph remained unamended for many years, and we emphasise the fact that no Cork readings are known after 1919.

The reason for the demise of the Cork station is not known at present. It could possibly have been a victim of WW1, or of the civil war which affected Ireland in the early 1920s and during which Cork was heavily damaged although the University remained unscathed. The Cork station is not listed by Wood (1921) whose data collection began in March 1920, but neither are Mungret and Rathfarnham, probably because of the civil unrest in Ireland at the time. No seismograms are known, nor is the fate of the seismograph. A conservation programme is currently in operation at the Crawford Observatory, and no seismological artefacts remain there.



Map showing the Crawford Observatory in the southwest of the University campus, reproduced from the University College, Cork, Official Gazette, Vol.2 No.6, July 1912.

**REFERENCES**

- British Association 1911, 1913. Report of the Seismological Committee, British Association for the Advancement of Science.
- University College, Cork, 1912-1919. University College, Cork, Official Gazette.
- Wood, H.O., 1921. A list of Seismologic Stations of the World, Bulletin of the National Research Council, National Academy of Sciences, Washington D.C., Vol 2 Part 7, Number 15.



## APPENDIX: Historical Observatory Details

<b>NAME</b>	<b>LOCATION</b>	<b>BGS IDENTITY CODE</b>
St Patrick's College, Maynooth, Ireland	St Patrick's College, Maynooth, Kildare	I_MAY

<b>ORGANISATION</b>	<b>FIRST YEAR (seismology)</b>	<b>LATITUDE</b>	<b>LONGITUDE</b>	<b>INTERNATIONAL STATION CODE</b>
National University of Ireland		53.383	-6.583	
	<b>FINAL YEAR (seismology)</b>	<b>HEIGHT (approx in metres)</b>		

<b>INSTRUMENT ONE</b>	<b>FIRST YEAR Inst 1</b>	<b>FINAL YEAR Inst 1</b>	<b>OTHER INSTRUMENTS</b>
<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>	

**SEISMOGRAMS**

**BULLETINS**

**OTHER MATERIAL**

Collection of Irish scientific instruments

**OBSERVATORY OVERVIEW**

This Roman Catholic seminary dates back to the late 1700s, and since 1997 has been part of the National University of Ireland. The College has never been a seismological observatory, but houses a collection of Irish scientific instruments (Mollan & Upton 1994), amongst which are the remains of the large O'Leary seismograph that was used between 1917 and the early 1960s at Rathfarnham Castle (see I\_RTH). Owing to vandalism after closure of that observatory, the remaining artefacts were rescued by Professor T. Murphy and staff of the Dublin Institute for Advanced Studies in 1976, and sent to Maynooth.

**REFERENCES**

Mollan, R.C. & Upton, J., 1994. The scientific apparatus of Nicholas Callan and other scientific instruments, Catalogues of historic scientific instruments in Irish collections No. 1, St Patrick's College, Maynooth: Blackrock, Co. Dublin, Samton.

Murphy, T., in press. The seismology observatories of Mungret and Rathfarnham, Ireland, Geophysical Bulletin Series, Dublin Institute for Advanced Studies, 1999.

## APPENDIX: Historical Observatory Details

<b>NAME</b> Mungret College, S.J., Limerick, Ireland	<b>LOCATION</b> Mungret College, S.J., Limerick, Ireland	<b>BGS IDENTITY CODE</b> <b>I_MUN</b>
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<b>ORGANISATION</b> Society of Jesus	<b>FIRST YEAR (seismology)</b> 1907?	<b>LATITUDE</b> 52.633	<b>LONGITUDE</b> -8.683	<b>INTERNATIONAL STATION CODE</b> 
	<b>FINAL YEAR (seismology)</b> 1915	<b>HEIGHT (approx in metres)</b> 15		

<b>INSTRUMENT ONE</b> Mainka	<b>FIRST YEAR Inst 1</b> 1907?	<b>FINAL YEAR Inst 1</b> 1915	<b>OTHER INSTRUMENTS</b>
<b>INSTRUMENT TWO</b> O'Leary?	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>	

**SEISMOGRAMS**  
Some published in new spapers, no originals found

**BULLETINS**  
None published

**OTHER MATERIAL**  
Nothing found

**OBSERVATORY OVERVIEW**

Mungret House and the surrounding lands and buildings (once the seat of early Christian learning in the area and an Augustinian monastery) were acquired by the Jesuit Order in 1882 and a school established. The meteorological observatory there was at one time the most westerly in Europe. Mungret was one of several seismological observatories set up by the Jesuits as a result of the 1906 San Francisco earthquake, others being Riverview in Australia and Stonyhurst (see STO), northern England.

Murphy (in press) confesses to great difficulty in unravelling the history of this observatory, and the following account is a précis of his investigations. In about 1907, in a purpose-built concrete building about 150 yards east of the main school (and probably financed by a benefactor) Mainka seismographs were installed on concrete pillars set upon bedrock, and run by Father W. O'Leary (B.A. 1908) encouraged by the Rector. O'Leary also performed seismic experiments and worked on his own inverted pendulum design, the 'New seismograph', which he exhibited at the Coronation Exhibition in London in 1911; this instrument was apparently ultimately in use at Mungret. Occasional references to seismology are found in the Mungret College Annuals (1909-1911), and some seismograms were posted on the observatory walls and published in new spapers, but none now survive. During his stay at Mungret, O'Leary visited John Milne at Shide and observatories at Strasbourg and Gottingen, and also probably attended BA annual conferences.

O'Leary transferred to Rathfarnham Castle (see I\_RTH) in 1915, and Mungret ceased operation as a seismological observatory. There is no record of the fate of the Mainkas, the 'New seismograph' or the model. It is said that they were sent to Rathfarnham. This would certainly have been logical, but there exists no record of any transaction, nor have any artefacts been found. Science apparently ceased at Mungret after O'Leary's departure, not to recommence until about 1934 under Revd Byrne. By 1979 the Mungret observatory was derelict when visited by Prof. Murphy, with no instruments or documents recovered.

**REFERENCES**

British Association 1908. Report of the Seismological Committee, British Association for the Advancement of Science.  
Murphy, T., in press. The seismology observatories of Mungret and Rathfarnham, Ireland, Geophysical Bulletin Series, Dublin Institute for Advanced Studies, 1999.  
Mungret College Annuals, 1909, 1910, 1911.

## APPENDIX: Historical Observatory Details

<b>NAME</b>	<b>LOCATION</b>	<b>BGS IDENTITY CODE</b>
Rathfarnham Castle, S.J., Dublin, Ireland	Rathfarnham Castle S.J., Dublin, Ireland	I_RTH

<b>ORGANISATION</b>	<b>FIRST YEAR (seismology)</b>	<b>LATITUDE</b>	<b>LONGITUDE</b>	<b>INTERNATIONAL STATION CODE</b>
Society of Jesus	1916	53.300	-6.283	
	<b>FINAL YEAR (seismology)</b>	<b>HEIGHT (approx in metres)</b>		
	1964	52		

<b>INSTRUMENT ONE</b>	<b>FIRST YEAR Inst 1</b>	<b>FINAL YEAR Inst 1</b>	<b>OTHER INSTRUMENTS</b>
O'Leary inverted pendulum NS & EW	1916	1967?	SP vertical (1950-1964)
<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>	
Milne-Shaw	1932	1964	

**SEISMOGRAMS**  
At Dublin Institute for Advanced Studies

**BULLETINS**  
1950-1960 held in NSA

**OTHER MATERIAL**  
The heavier parts of the O'Leary seismograph were sent to St Patrick's College, Maynooth by DIAS; the Milne-Shaw sent to St Mary's College, Belfast

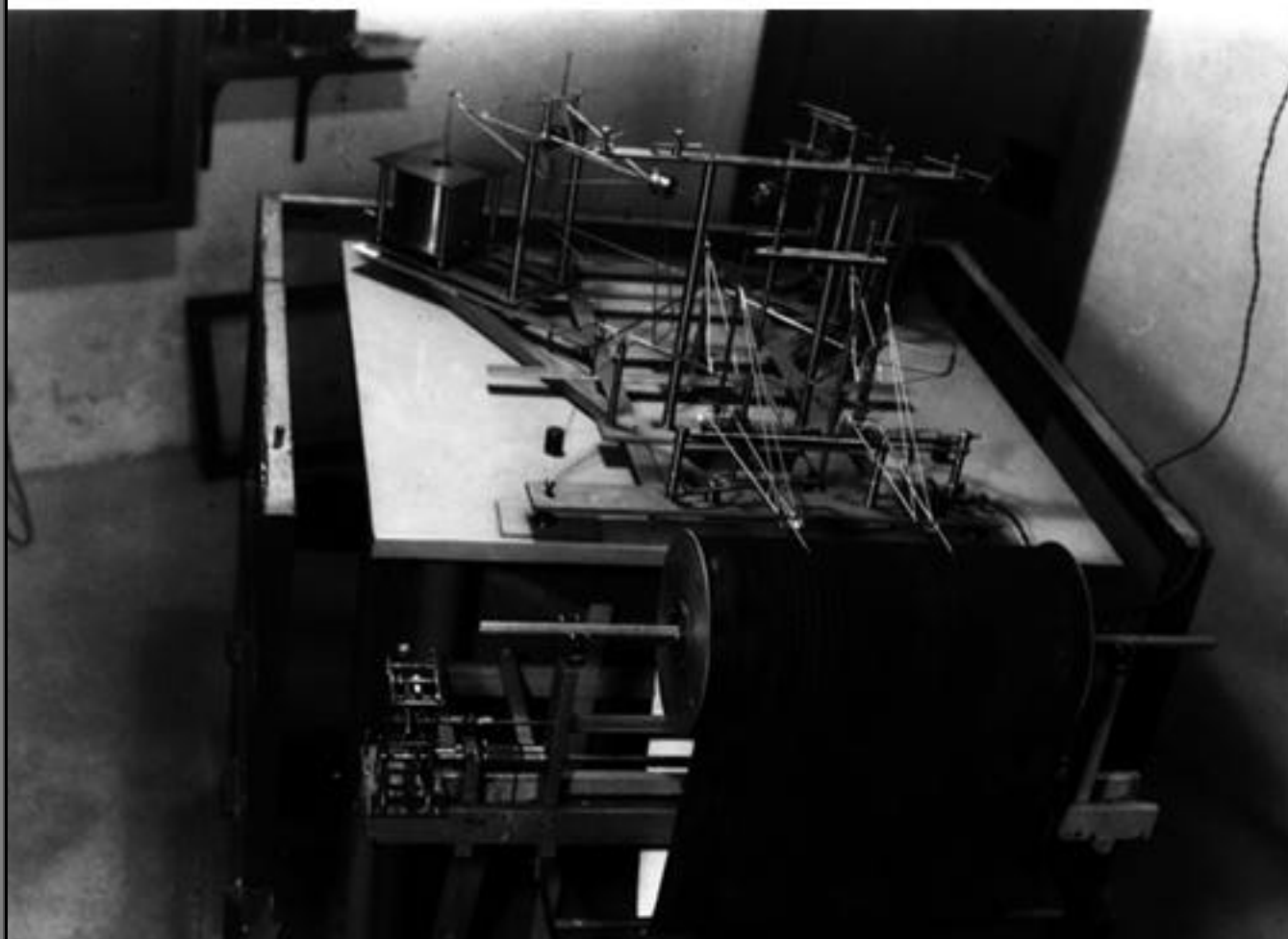
**OBSERVATORY OVERVIEW**

The original Rathfarnham Castle dates back to Norman times, but has been altered greatly since, and much of the present building dates from 1585. It was purchased by the Society of Jesus in 1913 and extended to form a study centre. It is now owned by the Irish nation. The observatory was originally described by Neilson & Burton (1988); more complete details have been added here by courtesy of Professor T. Murphy, formerly of the Dublin Institute for Advanced Studies, who has allowed the authors to include information from his research on Irish seismology.

The seismological observatory was set up in a converted farm steward's cottage, and had two downstairs and two upstairs rooms, an elaborate façade, and a marble plaque above the door commemorating its inauguration and the installation of the Milne-Shaw. Instruments were installed around 1915 or 16, with the arrival of the Jesuit seismologist and science teacher Father William J. O'Leary from Mungret (see I\_MUN), where he had been involved in the design and construction of seismographs. During his tenure at Rathfarnham, O'Leary designed and had built another very large seismograph, generally known as the 'Big O'Leary'. This has been described by Ingram & Timoney (1954) and Murphy (in press). It is not known whether the Mainkas used at Mungret were ever used at Rathfarnham.

Between 1918 and 1929 O'Leary taught elsewhere, and no seismological records are available perhaps because the instrument was not fully operational or staff fully conversant with observational techniques were not present. He left Rathfarnham for Riverview in Australia in 1929, and the instruments were run subsequently by the Jesuit Fathers, chiefly Fr. Ingram. 1934-36 smoked paper records are now at DIAS. A Milne-Shaw was purchased in 1932 and set up on a plinth. It operated until sometime in the 1960s, (probably 1962-3 when Fr. Ingram transferred to the Jesuit House in Dublin) and was then sent to St Mary's College in Belfast. It has not yet been located, although a current member of staff remembers the recording drum stored several years ago in a room that was awaiting refurbishment. Records on photographic paper are preserved at DIAS. A vertical instrument was also constructed by O'Leary, but was experimental only, and kept and used mainly at U.C. Dublin. A series of photographs (one of which is used here as an illustration) of the Rathfarnham instruments was taken by Fr. Browne, a Jesuit much interested in science and whose collection of over 40,000 photographs is held in Dublin as the Fr. Browne S.J. Collection ([www.fatherbrowne.com](http://www.fatherbrowne.com))

After the installation of WWSSN seismographs at Valentia (see I\_VAL) and Fr. Ingram's departure from Rathfarnham, the observatory gradually wound down, and by 1967 observations had ceased altogether. In 1976, DIAS staff removed all seismological artefacts because the observatory had been vandalised while in process of closure. Much was smashed beyond repair, but the larger parts of O'Leary's 2-ton seismograph were sent to the museum at Maynooth College (see I\_MAY). An unpublished listing of the remaining Rathfarnham papers was made by Burton & Neilson of the British Geological Survey in 1978 on behalf of the BA. The observatory is now boarded up and overgrown.



The recording apparatus of the 'Big O'Leary' seismograph at Rathfarnham Castle; photo taken in the late 1920s or early 1930s, © Fr. Browne S.J. Collection reproduced by permission of the Irish Picture Library.

#### REFERENCES

- \*Fr. Browne S.J. Collection at [www.fatherbrowne.com](http://www.fatherbrowne.com)
- Ingram, R.E., and Timoney, J.R., 1954. Theory of an Inverted Pendulum with Trifilar Suspension, Dublin Institute of Advanced Sciences, School of Cosmic Physics, Geophysical Bulletin No. 9.
- Murphy, T., in press. The seismology observatories of Mungret and Rathfarnham, Ireland, Geophysical Bulletin Series, Dublin Institute for Advanced Studies, 1999.
- Neilson, G. & P.W. Burton., 1988. A brief history of Seismological Observatories in the British Isles, 1896-1960 in Lee, W.H.K., Meyers, H. & Shimazaki, K., (eds.), Historical Seismograms and Earthquakes of the World, Academic Press Inc.

## APPENDIX: Historical Observatory Details

<b>NAME</b> University College, Galway, Ireland	<b>LOCATION</b> Basement of Physics lab.	<b>BGS IDENTITY CODE</b> <b>I_UCG</b>
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<b>ORGANISATION</b> University College, Galway	<b>FIRST YEAR (seismology)</b> 1960?	<b>LATITUDE</b> 53.266	<b>LONGITUDE</b> -9.050	<b>INTERNATIONAL STATION CODE</b> 
	<b>FINAL YEAR (seismology)</b> ?	<b>HEIGHT (approx in metres)</b> 		

<b>INSTRUMENT ONE</b> Willmore SPV	<b>FIRST YEAR Inst 1</b> 	<b>FINAL YEAR Inst 1</b> 	<b>OTHER INSTRUMENTS</b> 
<b>INSTRUMENT TWO</b> 	<b>FIRST YEAR Inst 2</b> 	<b>FINAL YEAR Inst 2</b> 	

**SEISMOGRAMS**

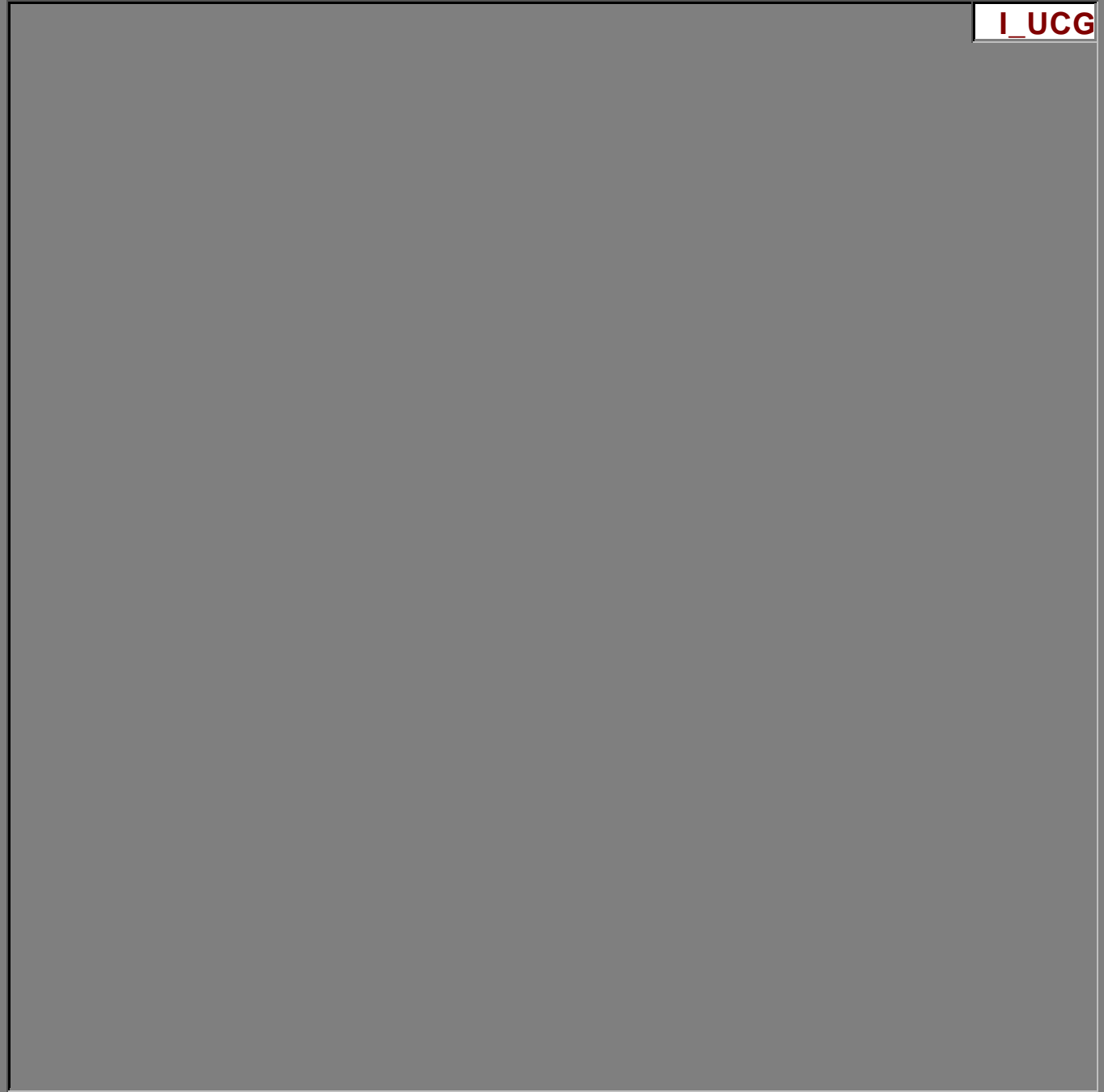
**BULLETINS**

**OTHER MATERIAL**

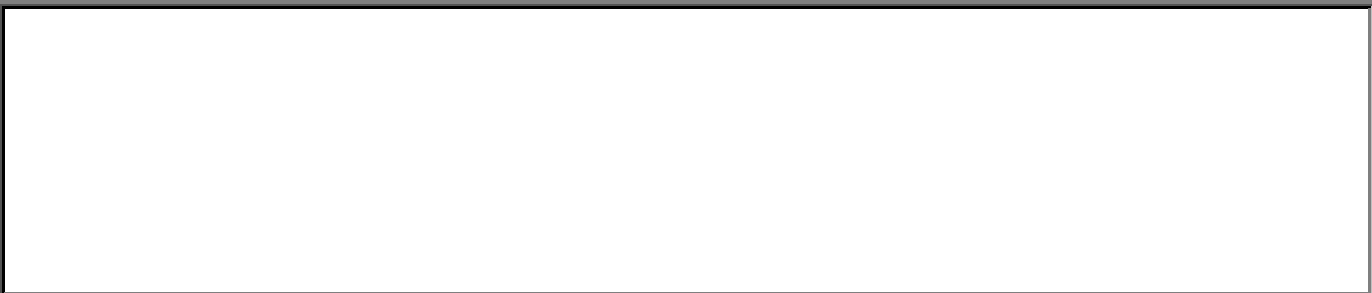
**OBSERVATORY OVERVIEW**

A notebook curated at DIAS, Dublin, mentions that a Willmore short period seismometer was installed in the University College, Galway, Physics Lab basement in the early 1960s. This appears to have been moved about as part of a seismic monitoring experiment, as Menlough Quarry and Loch Striven are also mentioned. No further information has yet come to light and there is confusion about these events, but Prof. T. Murphy (personal communication, 1999) states that there was no geophysics at Galway until the 1980s.





**REFERENCES**



## APPENDIX: Historical Observatory Details

<b>NAME</b> Valentia Observatory WWSSN, Ireland	<b>LOCATION</b> Valentia Observatory, Co Kerry	<b>BGS IDENTITY CODE</b> <b>I_VAL</b>
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<b>ORGANISATION</b> Irish Meteorological Service	<b>FIRST YEAR (seismology)</b> 1962	<b>LATITUDE</b> 51.933	<b>LONGITUDE</b> -10.250	<b>INTERNATIONAL STATION CODE</b> <b>VAL</b>
	<b>FINAL YEAR (seismology)</b> present	<b>HEIGHT (approx in metres)</b> 13.7		

<b>INSTRUMENT ONE</b> WWSSN 3 component SP & LP sets	<b>FIRST YEAR Inst 1</b> 1962	<b>FINAL YEAR Inst 1</b> present	<b>OTHER INSTRUMENTS</b>
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<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>	
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**SEISMOGRAMS**  
Record duplicates 1965-1990 held in NSA on film and fiche

**BULLETINS**

**OTHER MATERIAL**

**OBSERVATORY OVERVIEW**

A meteorological observatory was established on Valentia Island in 1867 (Robinson 1982), measurements having formerly been taken by the manager of the telegraph station there. Magnetic measurements were made from 1888. In 1892 the whole observatory was transferred to the mainland and set up about 5km east of its former position.

In 1962 WWSSN instruments were installed at Valentia; this was supervised by Father Ingram of Rathfarnham Castle, after a campaign led by him to attract a WWSSN station to Ireland, and doubts about the suitability of the Rathfarnham site for this station due to increasing noise (Murphy, in press). Shortly afterwards, Rathfarnham ceased operation after Ingram's transfer as Superior to the Jesuit House in Dublin in 1964, and finally closed in 1967 on Ingram's death. The Valentia instruments are still operational.

**REFERENCES**

- Murphy, T., in press. The seismology observatories of Mungret and Rathfarnham, Ireland, Geophysical Bulletin Series, Dublin Institute for Advanced Studies, 1999.
- Robinson, P.R., 1982. Geomagnetic observatories in the British Isles, in *Vistas in Astronomy*, Vol 26, pp 347-367, Pergamon Press 1983.

## APPENDIX: Historical Observatory Details

<b>NAME</b> Gorthleck, Loch Ness	<b>LOCATION</b> One of several locations around Loch Ness used by Ahmad (1966) in his PhD studies of the Great Glen	<b>BGS IDENTITY CODE</b> <b>INV</b>
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<b>ORGANISATION</b> Birkbeck College/University London	<b>FIRST YEAR (seismology)</b> 1962	<b>LATITUDE</b>	<b>LONGITUDE</b>	<b>INTERNATIONAL STATION CODE</b>
	<b>FINAL YEAR (seismology)</b> 1964	<b>HEIGHT (approx in metres)</b>		

<b>INSTRUMENT ONE</b> Willmore Mk 1 portable recorders	<b>FIRST YEAR Inst 1</b>	<b>FINAL YEAR Inst 1</b>	<b>OTHER INSTRUMENTS</b>

<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>	

**SEISMOGRAMS**

**BULLETINS**

**OTHER MATERIAL**

**OBSERVATORY OVERVIEW**

A Willmore Mk 1 seismometer was installed in Kilmoniraig Junior School, Spean Bridge between 8 to 16 August 1962. It recorded the vertical and one horizontal component onto photographic paper. The same seismograph was installed in Fort Augustus Junior School between August 16 and 21st 1962. A portable magnetic seismic recorder developed by Willmore operated for 30 days between August and September 1964 at Gorthleck, Foyers. These instruments were used around Loch Ness by Ahmad (1966) for his PhD geophysical investigation of the Great Glen, supervised by Dollar.



**REFERENCES**

Ahmad, M.U., 1966. A geophysical study of the Great Glen Fault, unpub PhD thesis, Dept of Geology, Birkbeck College, University of London.

## APPENDIX: Historical Observatory Details

<b>NAME</b>	<b>LOCATION</b>	<b>BGS IDENTITY CODE</b>
New port Observatory, Isle of Wight	High Street, New port, IOW	IOW

<b>ORGANISATION</b>	<b>FIRST YEAR (seismology)</b>	<b>LATITUDE</b>	<b>LONGITUDE</b>	<b>INTERNATIONAL STATION CODE</b>
W.H. Bullock	c. 1915	50.683	-1.283	
	<b>FINAL YEAR (seismology)</b>	<b>HEIGHT (approx in metres)</b>		
		20		

<b>INSTRUMENT ONE</b>	<b>FIRST YEAR Inst 1</b>	<b>FINAL YEAR Inst 1</b>	<b>OTHER INSTRUMENTS</b>
Home built, w ith Milne suspension	not know n	not know n	

<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>	

**SEISMOGRAMS**

None know n to exist

**BULLETINS**

Published w ith the Shide Circulars

**OTHER MATERIAL**

A collection of glass negatives by W.H. Bullock is held in Carisbrooke Castle Museum among the Milne negatives.

**OBSERVATORY OVERVIEW**

William Henry Bullock w as an Isle of Wight builder and gifted amateur photographer, responsible for some of the construction w ork for Milne's observatory at Shide after setting up his ow n business in 1897. It is not know n w hen he commenced his seismological activities, but he built his ow n seismograph, situated either at his business address in High Street or at his home in Castle Road, New port, quite near Milne's house. He carried out various modifications to Milne's pendulums, eventually producing an instrument designated a Milne-Bullock by the British Association. Bullock contributed data to the Shide Circulars and B.A. under the station name New port (BA 1915). Mr Bullock, and his brother Alfred, both appear in the Carisbrooke Castle Museum collection of Milne negatives, many of w hich are undoubtedly Bullock's w ork.

No further reference to him has been found until 1933 (BA 1933), w hen the British Association purchased from him some of Milne's recording apparatus w ith w hich to make a replica Milne instrument. W.H. Bullock died on 30 December 1954, aged 89, and w as buried in New port. According to his w idow in the 1960s, his equipment and slide collection all w ent to Carisbrooke Castle Museum (Mr L. Herbert-Gustar, personal communication 1998). How ever, according to his grandson, Mr Bullock's seismograph w as given to a local school. Investigations have so far failed to reveal its present location.



**REFERENCES**

British Association 1915, 1933. Report of the Seismological Committee, British Association for the Advancement of Science.

## APPENDIX: Historical Observatory Details

<b>NAME</b> Maison St. Louis Observatory, S.J., Jersey	<b>LOCATION</b> Maison St Louis Observatory, St Helier, Jersey	<b>BGS IDENTITY CODE</b> <b>JRS</b>
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<b>ORGANISATION</b> Society of Jesus	<b>FIRST YEAR (seismology)</b> 1935	<b>LATITUDE</b> 49.192	<b>LONGITUDE</b> -2.099	<b>INTERNATIONAL STATION CODE</b> <b>JRS</b>
	<b>FINAL YEAR (seismology)</b> present	<b>HEIGHT (approx in metres)</b> 53		

<b>INSTRUMENT ONE</b> Mainka EW	<b>FIRST YEAR Inst 1</b> 1935	<b>FINAL YEAR Inst 1</b> 	<b>OTHER INSTRUMENTS</b>
<b>INSTRUMENT TWO</b> Willmores	<b>FIRST YEAR Inst 2</b> 1981	<b>FINAL YEAR Inst 2</b> 	

**SEISMOGRAMS**  
1936-1985, (missing 1942-45, 1968, 1972-74, 1980 Jan-Aug) held in NSA. Microfilmed.

**BULLETINS**  
1946-1965 held in NSA

**OTHER MATERIAL**

**OBSERVATORY OVERVIEW**

The observatory at this Jesuit training college was built in 1894, and originally used for magnetic and meteorological measurements (Robinson 1982). After the plans fell through to move one of J.E. Crombie's Mainka instruments from Dyce Observatory, Aberdeen, to Jersey, M.E. Rothé of the Institut de Physique du Globe, Strasbourg, lent an instrument of the same type to the St Louis Observatory. This seismograph was set up in the observatory vault in 1935. It has a mass of 450 kg, a static magnification of 140, a free period of 13.7 seconds, and a damping ratio of 2.9. The station began operating in June 1936 but was interrupted in 1940 by the German occupation of the Channel Islands. Recording recommenced in June 1946 and the station is still in operation, although since 1981 also equipped with a four-component set of Willmore seismometers operated by the BGS, and used as the base station for the BGS Jersey seismometer network.





The Mainka (left) and modern BGS Willmore seismometers in the vault, Maison St Louis, Jersey, (BGS photo).

**REFERENCES**

- Neilson, G. & P.W. Burton., 1988. A brief history of Seismological Observatories in the British Isles, 1896-1960 in Lee, W.H.K., Meyers, H. & Shimazaki, K., (eds.), Historical Seismograms and Earthquakes of the World, Academic Press Inc.
- Robinson, P.R., 1982. Geomagnetic observatories in the British Isles, in Vistas in Astronomy, Vol 26, pp 347-367, Pergamon Press 1983.

## APPENDIX: Historical Observatory Details

<b>NAME</b> Kenilworth	<b>LOCATION</b> Kenilworth	<b>BGS IDENTITY CODE</b> <b>KEN</b>
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<b>ORGANISATION</b> Not known	<b>FIRST YEAR (seismology)</b> ?1936	<b>LATITUDE</b> 52.350	<b>LONGITUDE</b> -1.583	<b>INTERNATIONAL STATION CODE</b> 
	<b>FINAL YEAR (seismology)</b> 	<b>HEIGHT (approx in metres)</b> 		

<b>INSTRUMENT ONE</b> Not known	<b>FIRST YEAR Inst 1</b> 	<b>FINAL YEAR Inst 1</b> 	<b>OTHER INSTRUMENTS</b> 
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<b>INSTRUMENT TWO</b> 	<b>FIRST YEAR Inst 2</b> 	<b>FINAL YEAR Inst 2</b> 	
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**SEISMOGRAMS**  
Not known

**BULLETINS**  
Not known

**OTHER MATERIAL**  
Nothing known

**OBSERVATORY OVERVIEW**

The coordinates given by the BA (1937) suggest a location very near Kenilworth Abbey, but enquiries locally have revealed no details. This observatory was not mentioned in the BA (1933) observatory list, so, like Leamington Spa, it is assumed that this station was set up between those dates but never reported data, perhaps becoming a victim of the Second World War.

However, the suggestion has been made recently that Kenilworth was the site of a seismograph used by a skier who was interested in avalanche triggering mechanisms. Enquiries have been made along these lines but have so far revealed little.



**REFERENCES**

British Association, 1937. The Constants of Seismological Observatories, The County Press, New port.

## APPENDIX: Historical Observatory Details

NAME	LOCATION	BGS IDENTITY CODE
Kew Observatory, London	Kew	KEW

ORGANISATION	FIRST YEAR (seismology)	LATITUDE	LONGITUDE	INTERNATIONAL STATION CODE
National Physical Laboratory, later the Met. Office	1898	51.468	-0.313	KEW
	FINAL YEAR (seismology)	HEIGHT (approx in metres)		
	1969	6		

INSTRUMENT ONE	FIRST YEAR Inst 1	FINAL YEAR Inst 1	OTHER INSTRUMENTS
Milne EW	1898	1925	Wood-Anderson (1933-1935), 1938 Short Period Vertical
INSTRUMENT TWO	FIRST YEAR Inst 2	FINAL YEAR Inst 2	
Galitzin 3 cpt	1925	1969	

**SEISMOGRAMS**  
 Milne 1904-1925, Galitzin/Wood-Anderson 1925-1965 seismograms held in NSA  
 1898-1965 Microfilm held in NSA.

**BULLETINS**  
 1899-1912, 1914, 1963-64, 1968-69 + Bound 1927-1962 (Span) held in NSA  
 Observatories Yearbook 1928-1962, held in NSA, contains Kew Bulletins

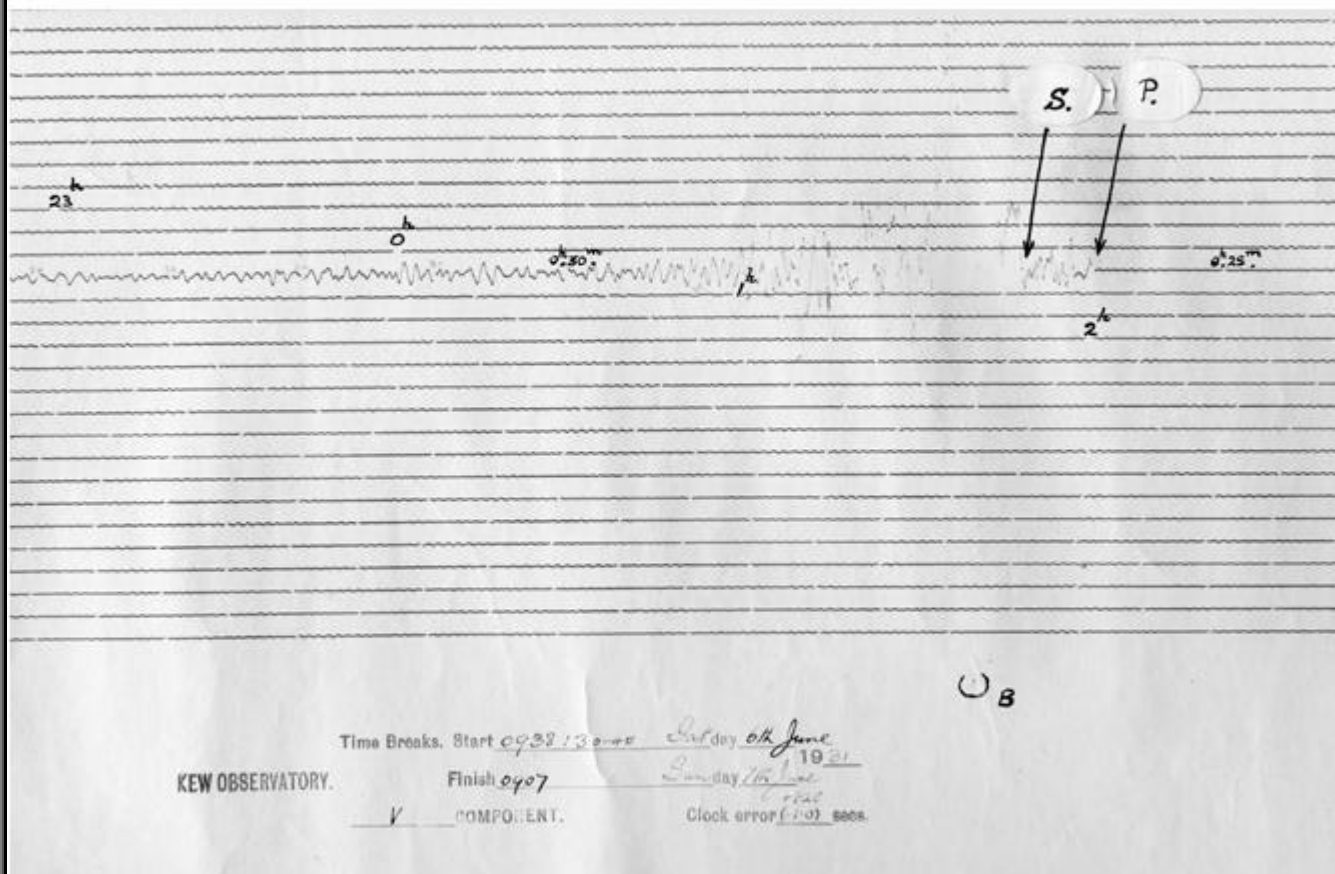
**OTHER MATERIAL**  
 Miscellaneous original hand written material, correspondence, and other files are held in the NSA

**OBSERVATORY OVERVIEW**

Kew Observatory was built in 1769 as an astronomical observatory for King George III. In 1842 it was taken over by the British Association for the Advancement of Science as an experimental station and repository (Jacobs 1969). The National Physical Laboratory (later the Met. Office) took initial responsibility for seismology at Kew, and were also responsible for seismology at Eskdalemuir.

The first seismograph installed at Kew was a Milne (E-W component), which began operation in 1898 and was the ninth to be manufactured. Operation of this was discontinued in 1925. In that year, the Galitzin three components were transferred from Eskdalemuir to Kew and were installed in the basement of the main building. Two Wood-Anderson torsion seismographs were constructed at the observatory in 1933 and 1935 and also installed there. This location was not satisfactory, because the instruments suffered severely from strong, wind-induced noise (Lee 1939), and experiments with a Milne-Shaw were carried out to devise a solution to this problem. In 1936 a new underground building designed to house all the seismographs was constructed. Instrument plinths were placed directly on the concrete floor which was 5 feet below ground level, and the walls and roof were heavily insulated. Heating, ventilation and a means of expelling water were provided, as the area was near the Thames and liable to flooding. In February 1937 the Wood-Anderson instruments were moved into this building, followed by the Galitzin horizontals in April and the Galitzin vertical in September of that year. For many years, this Galitzin was the only three-component instrument in the British Isles. A short period vertical instrument was installed in 1938, manufactured in the observatory workshops, and having a free period of 1.5 seconds. Seismological recording ceased in 1969 and the instruments were transferred to the Science Museum, London. Most of the seismograms and bulletins are now housed in the National Seismological Archive at BGS, Edinburgh.

A considerable amount of experimental work was carried out at Kew, and a single reference has been found to standardisation experiments at Plymouth with five Jaggars recorders. These were constructed at Kew, but their test location is not given. The original Jaggars was first described in 1929, and was in common use, particularly for the detection of volcano-related tremors. It is assumed that this experiment, dated March 1936, was in preparation for the installation by the B.A. of an 'improved Jaggars' at Dunira House, Comrie, in 1938 (see CDU), but it could also refer to C.F. Powell's installation and use of five Jaggars in Montserrat, West Indies (capital Plymouth) in late March, 1936, as part of the Royal Society expedition to monitor the volcanic eruption there (Powell 1938).



Kew seismogram of the 6.1ML North Sea earthquake of 7 June 1931 (held in NSA). NB that this should be read from right to left.

REFERENCES

- Jacobs, L., 1969. The 200-years history of Kew Observatory. Meteorological Magazine, v98, pp162-171.
- Lee, A.W., 1939. Seismology at Kew Observatory, Meteorological Office. Geophysical Memoirs No 78, H.M.S.O., London.
- Neilson, G. & P.W. Burton., 1988. A brief history of Seismological Observatories in the British Isles, 1896-1960 in Lee, W.H.K., Meyers, H. & Shimazaki, K., (eds.), Historical Seismograms and Earthquakes of the World, Academic Press Inc.
- Powell, C.F., 1938, The Royal Society Expedition to Montserrat, B.W.I., Final Report. Philosophical Transactions, Royal Society of London, Vol A 237, pp 1-34.
- Scrase, F.J., 1969. Some reminiscences of Kew Observatory in the Twenties. Met. Mag., v98, pp180-186.

## APPENDIX: Historical Observatory Details

<b>NAME</b> Leamington Spa	<b>LOCATION</b> Leamington Spa, Warks.	<b>BGS IDENTITY CODE</b> <b>LSP</b>
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<b>ORGANISATION</b> Unknown	<b>FIRST YEAR (seismology)</b> ?1936	<b>LATITUDE</b> 52.283	<b>LONGITUDE</b> -1.533	<b>INTERNATIONAL STATION CODE</b> 
	<b>FINAL YEAR (seismology)</b> ?	<b>HEIGHT (approx in metres)</b> 		

<b>INSTRUMENT ONE</b> Not known	<b>FIRST YEAR Inst 1</b> 	<b>FINAL YEAR Inst 1</b> 	<b>OTHER INSTRUMENTS</b> 
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<b>INSTRUMENT TWO</b> 	<b>FIRST YEAR Inst 2</b> 	<b>FINAL YEAR Inst 2</b> 	
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**SEISMOGRAMS**

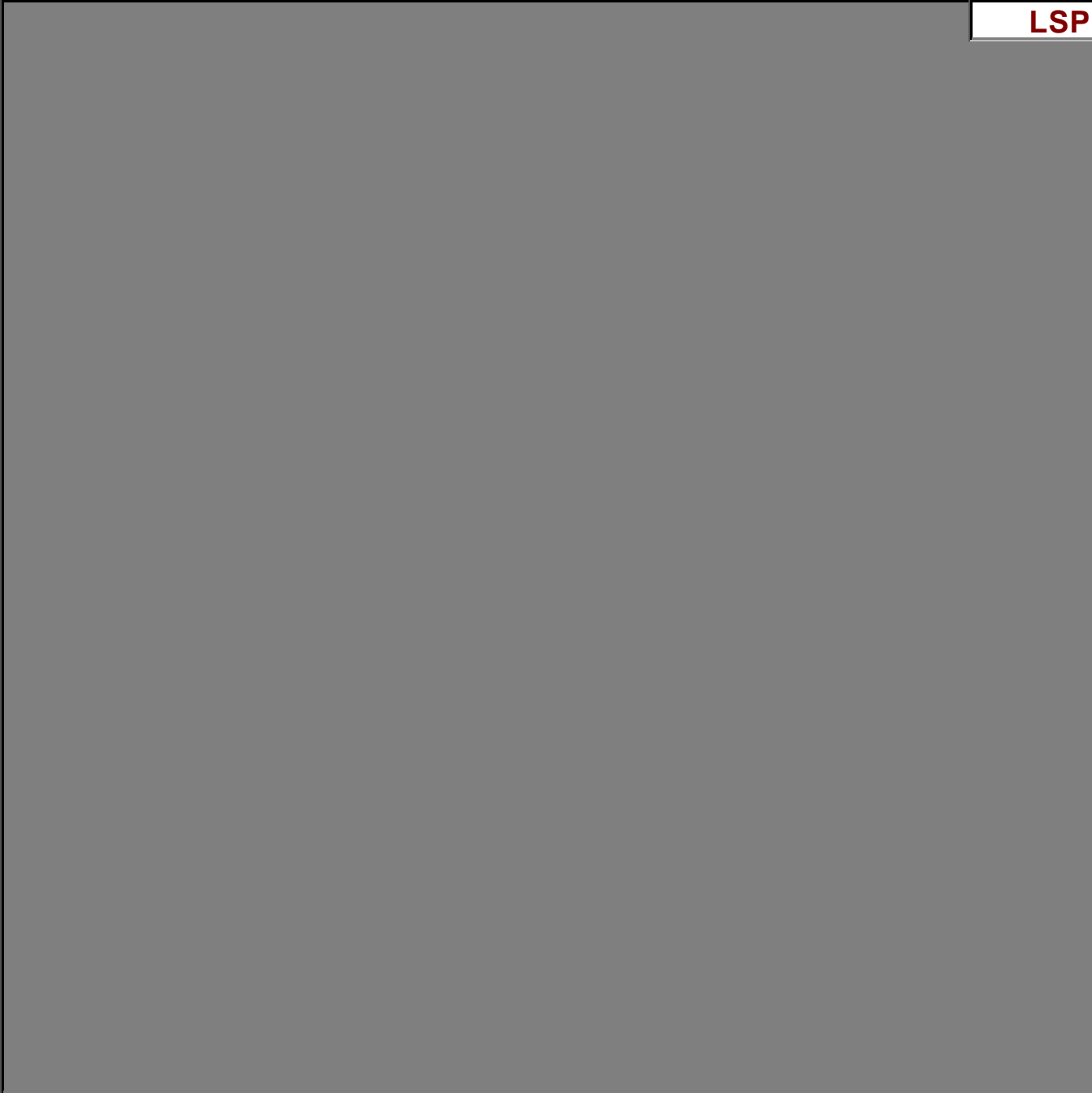
**BULLETINS**

**OTHER MATERIAL**

No material known

**OBSERVATORY OVERVIEW**

Plotting quite near the railway station in Leamington, the coordinates and constants of this observatory were first mentioned in the BA Constants of Seismological Observatories published in 1937, but not in the 1933 version of the same publication. Enquiries in the locality have revealed nothing. No reported readings have been found, nor has any correspondence relating to the observatory or its operator. At the moment it is assumed that the observatory was set up but never reported, perhaps because of the imminence of the Second World War.



**REFERENCES**

British Association, 1937. The Constants of Seismological Observatories, The County Press, New port.

## APPENDIX: Historical Observatory Details

<b>NAME</b>	<b>LOCATION</b>	<b>BGS IDENTITY CODE</b>
Marsden Colliery, Sunderland	Marsden Colliery, Co Durham, now Tyne & Wear	MAR

<b>ORGANISATION</b>	<b>FIRST YEAR (seismology)</b>	<b>LATITUDE</b>	<b>LONGITUDE</b>	<b>INTERNATIONAL STATION CODE</b>
North of England Institute of Mining and Mechanical Engineers	1886?	54.980	-1.380	
	<b>FINAL YEAR (seismology)</b>	<b>HEIGHT (approx in metres)</b>		
	1887?	40		

<b>INSTRUMENT ONE</b>	<b>FIRST YEAR Inst 1</b>	<b>FINAL YEAR Inst 1</b>	<b>OTHER INSTRUMENTS</b>
Ewing Duplex Pendulum			

<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>	
Pendulum type unspecified			

**SEISMOGRAMS**

Some published in Transactions

**BULLETINS**

**OTHER MATERIAL**

**OBSERVATORY OVERVIEW**

Prof Lebour of King's College, New castle, proposed the investigation of earth tremors to the Meeting of Corresponding Societies at the British Association meeting in Birmingham, 1886, although no reference to this appears in the published Report. By 1887, a Committee had been set up which recommended nationwide investigations into earth tremors, particularly those relating to gas emissions in coal mines, and had already received support from many sources (British Association 1886, 1887).

In the meantime, surface experiments had been conducted at Marsden Colliery, Co. Durham, by the North of England Institute of Mining and Mechanical Engineers (Anon 1888). The mine owner, Mr John Dalglish FGS, gave permission to use his colliery, and in 1886, after various instrument suppliers were unable to provide a satisfactory cheap instrument, a Ewing duplex pendulum seismoscope was supplied by the Cambridge Instrument Company to record horizontal motion onto a smoked glass plate. A primitive seismoscope was also used to obtain records of the passage of a tremor. Seismograms were obtained and published for a seven month recording period - Oct 19 1886 to April 30 1887. It was suggested that a series of disturbances between Feb 7 and March 12 was due to events a long way away, and various others were attributed to foreign earthquakes. This correlation has now been found to be false. In the event the gas sampling apparatus here and elsewhere proved insufficiently sensitive, although gas emanations from several pits were noted, so the results were inconclusive. Allusions were made at the time to similar experiments in Birmingham and Scotland but no details have yet been found. Experiments of a similar type were also performed in France (Walton Brown 1887).



*To illustrate the "Report of the Committee on observations of Earth tremors."*



COPY OF A RECORD MADE BY THE HORIZONTAL  
PENDULUM MACHINE SHOWN IN PLATE XV.

*Proceedings N<sup>o</sup> 41 of the N.E.I.M.E. 1887-88.*

*British Association*

Seismogram recorded by the Committee's horizontal pendulum (from Transactions of the North of England Institute of Mining and Mechanical Engineers, vol XXXV II, 1887-88).

#### REFERENCES

- Anon, 1888. Report of the Committee appointed to inquire into the observations of earth tremors with the view of determining their connection (if any) with the issue of gas in mines, Transactions of the North of England Institute of Mining Engineers, vol XXXVIII, 1887-88, pp 55-69.
- British Association 1886, 1887. Report of the Corresponding Societies, British Association for the Advancement of Science.
- Walton Brown, M., 1887. An account of experiments in France upon the possible connection between movements of the Earth's crust and the issues of gases in mines, Transactions of the North of England Institute of Mining Engineers, vol XXXVI, 1886-87, pp 43-45.

## APPENDIX: Historical Observatory Details

<b>NAME</b> Menai Bridge	<b>LOCATION</b> Menai Bridge (? Tides Building)	<b>BGS IDENTITY CODE</b> <b>MEN</b>
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<b>ORGANISATION</b> U. Coll., Bangor	<b>FIRST YEAR (seismology)</b>	<b>LATITUDE</b>	<b>LONGITUDE</b>	<b>INTERNATIONAL STATION CODE</b>
	<b>FINAL YEAR (seismology)</b>	<b>HEIGHT (approx in metres)</b>		

<b>INSTRUMENT ONE</b> Milne-Shaw (ex Bidston), used as tide gauge	<b>FIRST YEAR Inst 1</b>	<b>FINAL YEAR Inst 1</b>	<b>OTHER INSTRUMENTS</b>
<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>	

**SEISMOGRAMS**

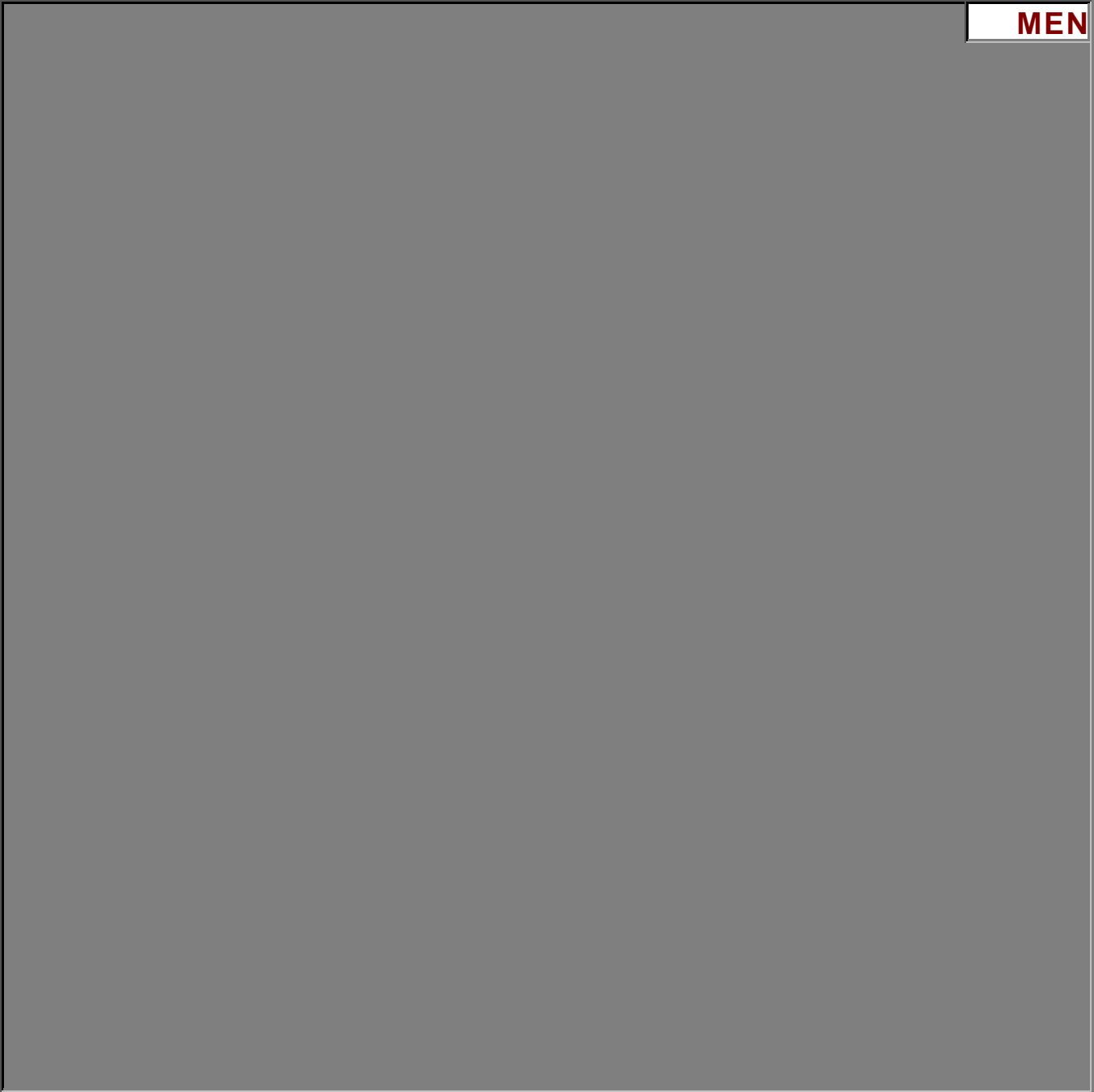
**BULLETINS**

**OTHER MATERIAL**

**OBSERVATORY OVERVIEW**

This site was the subject of a query (G. Neilson, personal communication 1997). Little information on this site has been found, but it was not a seismological observatory.

**MEN**



*REFERENCES*



## APPENDIX: Historical Observatory Details

<b>NAME</b> Milne Collection		<b>LOCATION</b>		<b>BGS IDENTITY CODE</b> <b>MILNE</b>	
<b>ORGANISATION</b> Carisbrooke Castle and IoW CRO		<b>FIRST YEAR (seismology)</b>	<b>LATITUDE</b>	<b>LONGITUDE</b>	<b>INTERNATIONAL STATION CODE</b>
		<b>FINAL YEAR (seismology)</b>	<b>HEIGHT (approx in metres)</b>		
<b>INSTRUMENT ONE</b>	<b>FIRST YEAR Inst 1</b>	<b>FINAL YEAR Inst 1</b>	<b>OTHER INSTRUMENTS</b>		
<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>			
<b>SEISMOGRAMS</b> Seismograms mixed held w ith the Milne material					
<b>BULLETINS</b>					
<b>OTHER MATERIAL</b>					
<b>OBSERVATORY OVERVIEW</b> Not really an observatory just a collection of material held.					

**MILNE**

*REFERENCES*

## APPENDIX: Historical Observatory Details

<b>NAME</b> New port, Gwent	<b>LOCATION</b> New port, Gwent	<b>BGS IDENTITY CODE</b> <b style="color: red; font-weight: bold;">NEW</b>
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<b>ORGANISATION</b> Mr Esdaile, optician, High Street, New port	<b>FIRST YEAR (seismology)</b> 1906?	<b>LATITUDE</b> 51.590	<b>LONGITUDE</b> -3.000	<b>INTERNATIONAL STATION CODE</b> 
	<b>FINAL YEAR (seismology)</b> ?	<b>HEIGHT (approx in metres)</b> 		

<b>INSTRUMENT ONE</b> Unspecified	<b>FIRST YEAR Inst 1</b> 	<b>FINAL YEAR Inst 1</b> 	<b>OTHER INSTRUMENTS</b> 
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<b>INSTRUMENT TWO</b> 	<b>FIRST YEAR Inst 2</b> 	<b>FINAL YEAR Inst 2</b> 	<b>OTHER INSTRUMENTS</b> 
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**SEISMOGRAMS**

**BULLETINS**

**OTHER MATERIAL**

**OBSERVATORY OVERVIEW**

So far the only reference found to Mr Esdaile is a press cutting from the South Wales Argus (New port) which records that Mr Esdaile's instrument did not record the Swansea earthquake of June 27th 1906. If this is so, since this event had a magnitude of 5.2ML, Mr Esdaile's seismograph was highly insensitive. Enquiries to descendants of Mr Esdaile have so far failed to elicit a response.

**NEW**

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*REFERENCES*

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## APPENDIX: Historical Observatory Details

<b>NAME</b> National Institute of Oceanography, Wormley	<b>LOCATION</b> Wormley, Surrey	<b>BGS IDENTITY CODE</b> <b style="color: red; font-weight: normal;">NIO</b>
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<b>ORGANISATION</b> National Institute of Oceanography	<b>FIRST YEAR (seismology)</b> 1957?	<b>LATITUDE</b> 51.130	<b>LONGITUDE</b> -0.640	<b>INTERNATIONAL STATION CODE</b> 
	<b>FINAL YEAR (seismology)</b> ?	<b>HEIGHT (approx in metres)</b> 		

<b>INSTRUMENT ONE</b>	<b>FIRST YEAR Inst 1</b>	<b>FINAL YEAR Inst 1</b>	<b>OTHER INSTRUMENTS</b>

<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>	

**SEISMOGRAMS**

**BULLETINS**

**OTHER MATERIAL**

**OBSERVATORY OVERVIEW**

Seismographs had been in use at N.I.O. since about 1957 (BAAS 1957). In 1963, according to a letter from B.J. Hinde of (and later Director of) the National Institute of Oceanography near Portsmouth, to Dollar regarding the South Coast earthquake of 25 October 1963, two 3-component instruments of their own design were deployed 4.5 miles apart, and were used to study storm-generated microseisms. Readings were taken for 20 minutes every 6 hours, and records were made on analogue pen recorders and digitally on punched paper (BAAS 1964, 69th Report of Seismological Committee) but the machines were useless for seismological purposes as they did not have absolute timing. They were, however, pushed out of adjustment by the earthquake.

The lat. and long. given above refer to the N.I.O. headquarters at Wormley. No definite location for the seismographs has been found.



**REFERENCES**

British Association 1957, 1964. Report of the Seismological Committee, British Association for the Advancement of Science.  
Dollar, A.T.J., papers held in National Seismological Archive, BGS, Edinburgh.

## APPENDIX: Historical Observatory Details

NAME	LOCATION	BGS IDENTITY CODE
National Museums of Scotland	Chambers Street, Edinburgh EH1 1JF	NMS

ORGANISATION	FIRST YEAR (seismology)	LATITUDE	LONGITUDE	INTERNATIONAL STATION CODE
National Museums of Scotland		55.950	-3.190	
	FINAL YEAR (seismology)	HEIGHT (approx in metres)		
		83		

INSTRUMENT ONE	FIRST YEAR Inst 1	FINAL YEAR Inst 1	OTHER INSTRUMENTS
Milne-Shaw No. 3	1962		Forbes pendulum Ewing seismoscope Selfridges Milne-Shaw acquired in 1961
INSTRUMENT TWO	FIRST YEAR Inst 2	FINAL YEAR Inst 2	
Milne boom No. 32	1962		

**SEISMOGRAMS**

A collection is held in the Museum of original seismograms recorded by the Milne-Shaw and the Selfridges instrument.

**BULLETINS**

No bulletins were issued

**OTHER MATERIAL**

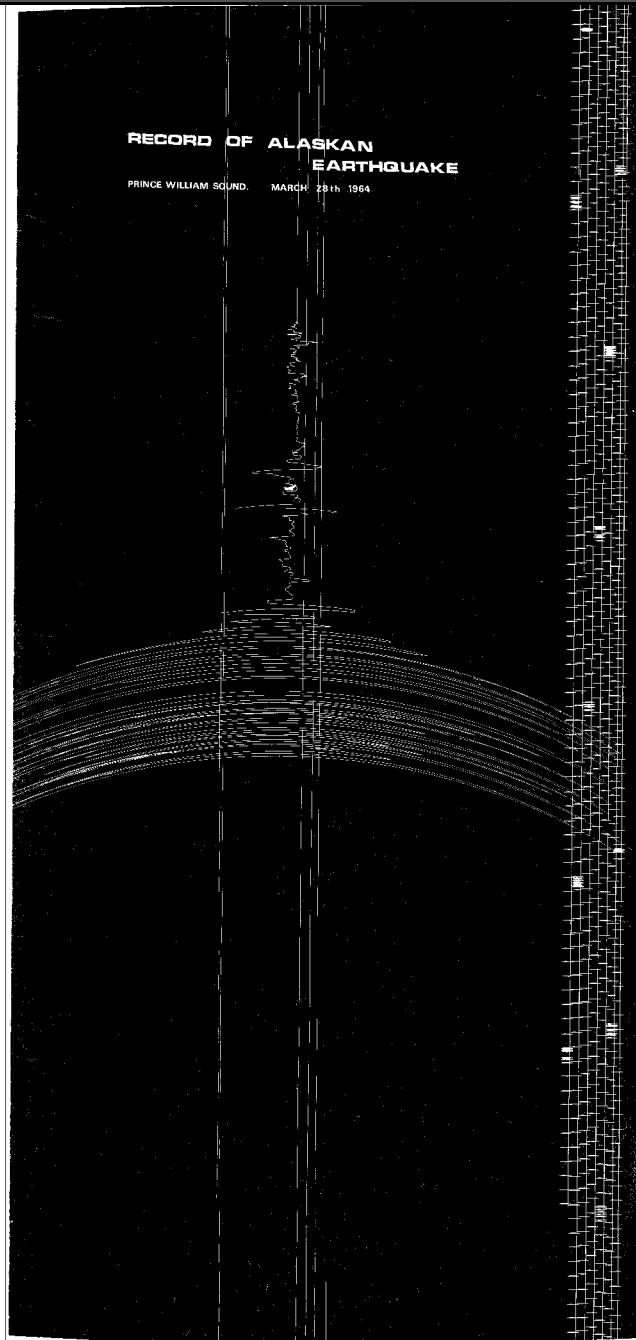
Large collection of scientific instruments

**OBSERVATORY OVERVIEW**

Although the National Museums of Scotland cannot be considered as a seismological observatory, the Royal Museum, part of the museum complex, has, for many years, had the largest display of scientific instruments of all kinds in Scotland, as well as other large collections devoted to Geology, Natural History, Art and Technology. At times these museum displays have included working seismographs, and although these were not calibrated or orientated, seismograms have been recorded. For this reason the National Museums of Scotland has been included in this Report.

The Milne-Shaw seismograph No 3, formerly used at Eskdalemuir (see ESK) between 1915 and 1919, and subsequently at the Royal Observatory, Blackford Hill, Edinburgh (see EDI), ceased operation there in April 1962, and, together with the Milne boom (No 32) which had also been used there between 1902 and about 1908, was transferred to the National Museums of Scotland. At least one of these instruments, probably the Milne-Shaw, was operated at the Museum in the mid-60s, but had ceased by about 1969. Some seismograms recorded on smoked paper are held in the Museum, but no official photographs are known. The Milne-Shaw is currently on display, together with an incomplete Forbes inverted pendulum of the type used by the BA Seismological Committee during their seismological investigations around Comrie (see COM). A Ewing seismoscope, used between about 1898 and 1918 at the Coats Observatory, Paisley (PAI), is also held (Inventory No. xxxx). It has been completely restored but not lacquered in its original colour because such colours are nowadays unobtainable.

After being acquired by the Science Museum in London in 1947, the Selfridges Milne-Shaw (see SEL) was sent to the National Museums of Scotland in Edinburgh in 1961, and, although not calibrated, it was displayed working with its boom aligned approximately east-west a few months later until the late 1980s in an area now converted to kitchens. It was eventually decommissioned when recording paper became unobtainable, and because the use of the carcinogen benzene in the smoking of the recording papers was forbidden by Health and Safety legislation. It is currently in store (inventory number NMS.T1985.131). Some seismograms recorded by the Selfridges instrument in Edinburgh are held by the Museum, but the installation was never officially photographed there. A small collection of photographs and press articles on seismology at the Museum is being copied to the NSA.



Seismogram of March 28 1964 magnitude 9.2 Mw Alaska earthquake, recorded in the Museum by the Selfridges Milne-Shaw instrument (photo courtesy of National Museums of Scotland).

**REFERENCES**

National Museums of Scotland Web Pages at: <http://www.nms.ac.uk/>

## APPENDIX: Historical Observatory Details

<b>NAME</b>	<b>LOCATION</b>	<b>BGS IDENTITY CODE</b>
Oxford University Observatory	Basement of Clarendon Labs, Oxford	OXF

<b>ORGANISATION</b>	<b>FIRST YEAR (seismology)</b>	<b>LATITUDE</b>	<b>LONGITUDE</b>	<b>INTERNATIONAL STATION CODE</b>
Oxford University/British Association	1918	51.767	-1.250	OXD
	<b>FINAL YEAR (seismology)</b>	<b>HEIGHT (approx in metres)</b>		
	1947	61		

<b>INSTRUMENT ONE</b>	<b>FIRST YEAR Inst 1</b>	<b>FINAL YEAR Inst 1</b>	<b>OTHER INSTRUMENTS</b>
Milne-Shaw	1918	1928	

<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>	<b>OTHER INSTRUMENTS</b>
Milne-Shaw nos. 1 & 4, horizontal components	1928	1947	

**SEISMOGRAMS**  
 Only three known to survive; two held in NSA, one (of the Sept 1, 1923 magnitude 8.3 Kanto earthquake in Japan) in the Isle of Wight County Record Office

**BULLETINS**  
 Published as International Seismological Summary

**OTHER MATERIAL**  
 Some of H.H. Turner's lantern slides held in NSA. Other Oxford records were ultimately sent to Eskdalemuir.

**OBSERVATORY OVERVIEW**

After his death in 1913, John Milne's observatory at Shide was operated by his assistants and supervised from Oxford University by Professor H.H. Turner. The difficulties caused by distance and the war became insurmountable, however, so the Shide work was gradually transferred to Oxford between 1918 and 1919. The International Seismological Summary was also transferred to the Oxford Observatory at this time. Both organisations were under the direction of Turner, who also later collated information accumulated during the war years.

The Oxford station was set up in 1918 to take over the work done by Milne at Shide. The first instrument, a Milne-Shaw seismograph, was set up in the basement of the Clarendon Laboratory on October 8, 1918 as an E-W component. Milne's library was also moved to Oxford in 1919, and most of it was housed in the Students' Observatory.

A new vault was constructed at the University Observatory in 1927; it was named the 'Crombie Basement', after J.E. Crombie who donated the two Milne-Shaw seismographs (nos. 1 and 4) with which it was equipped. These instruments had free periods of 12 seconds and a damping ratio of 20:1. After some initial problems with settlement of the 8 x 4 feet pier, the two instruments were installed in October 1928. A plaque on the wall of the Clarendon basement commemorates the previous instrument site (1918-1928) in the Clarendon on a plinth formerly used by Prof. C.V. Boys for his Cavendish experiments to measure the gravitational constant G.

In September 1939, Miss Ethel Bellamy, who appears to have been running the observatory single-handed, removed one of the Milne-Shaw's for safety, as changes were being made in the observatory owing to the outbreak of war. Correspondence between her and Dollar refers to these changes, and also to the general difficulty of keeping observatories operational in wartime. She managed to keep the E-W component in operation, however, and one of the three known surviving Oxford seismograms was recorded by this instrument (see illustration). Later, the Milne Library was moved into the specially strengthened basement for safety in 1942. The seismographs and the Milne Library were transferred from Oxford to Down House, Kent, on January 22, 1947. According to correspondence in NSA, the Oxford records were sent to Kew, and from there to Eskdalemuir. They have not so far been located there.

OXF

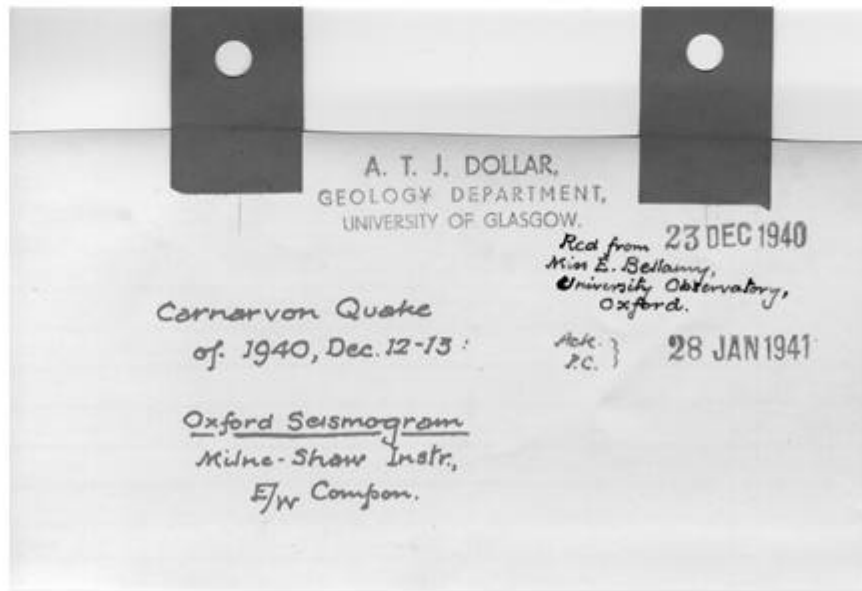
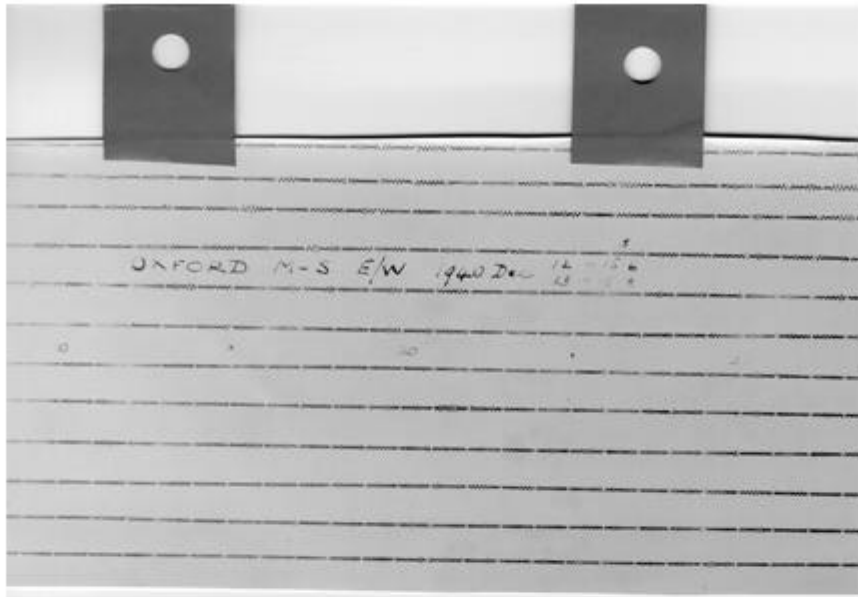


Photo of one of the three surviving Oxford seismograms - for the 12 Dec 1940 4.7ML Carnarvon earthquake (held in NSA).

REFERENCES

British Association 1927, 1928, 1929. Report of the British Association for the Advancement of Science.  
 Dollar, A.T.J., papers held in National Seismological Archive, BGS, Edinburgh.

## APPENDIX: Historical Observatory Details

NAME	LOCATION	BGS IDENTITY CODE
Coats Observatory, Paisley	Coats Observatory, Paisley, Scotland	PAI

ORGANISATION	FIRST YEAR (seismology)	LATITUDE	LONGITUDE	INTERNATIONAL STATION CODE
Coats Observatory/Paisley Philosophical Institution	1898	55.846	-4.431	
	FINAL YEAR (seismology)	HEIGHT (approx in metres)		
	1918	31		

INSTRUMENT ONE	FIRST YEAR Inst 1	FINAL YEAR Inst 1	OTHER INSTRUMENTS
Milne boom	1898	1918	Milne-Shaw (1912-1918) Milne? 1931?-1935?
INSTRUMENT TWO	FIRST YEAR Inst 2	FINAL YEAR Inst 2	
Ewing 3-component seismoscope	1898?	1918	

**SEISMOGRAMS**

Milne (small rolls) 1900-1919, Milne tw in boom 1914-1919 and Milne 1931-1935 at BGS Edinburgh

**BULLETINS**

Seismographic Register 1902-1909 held in NSA

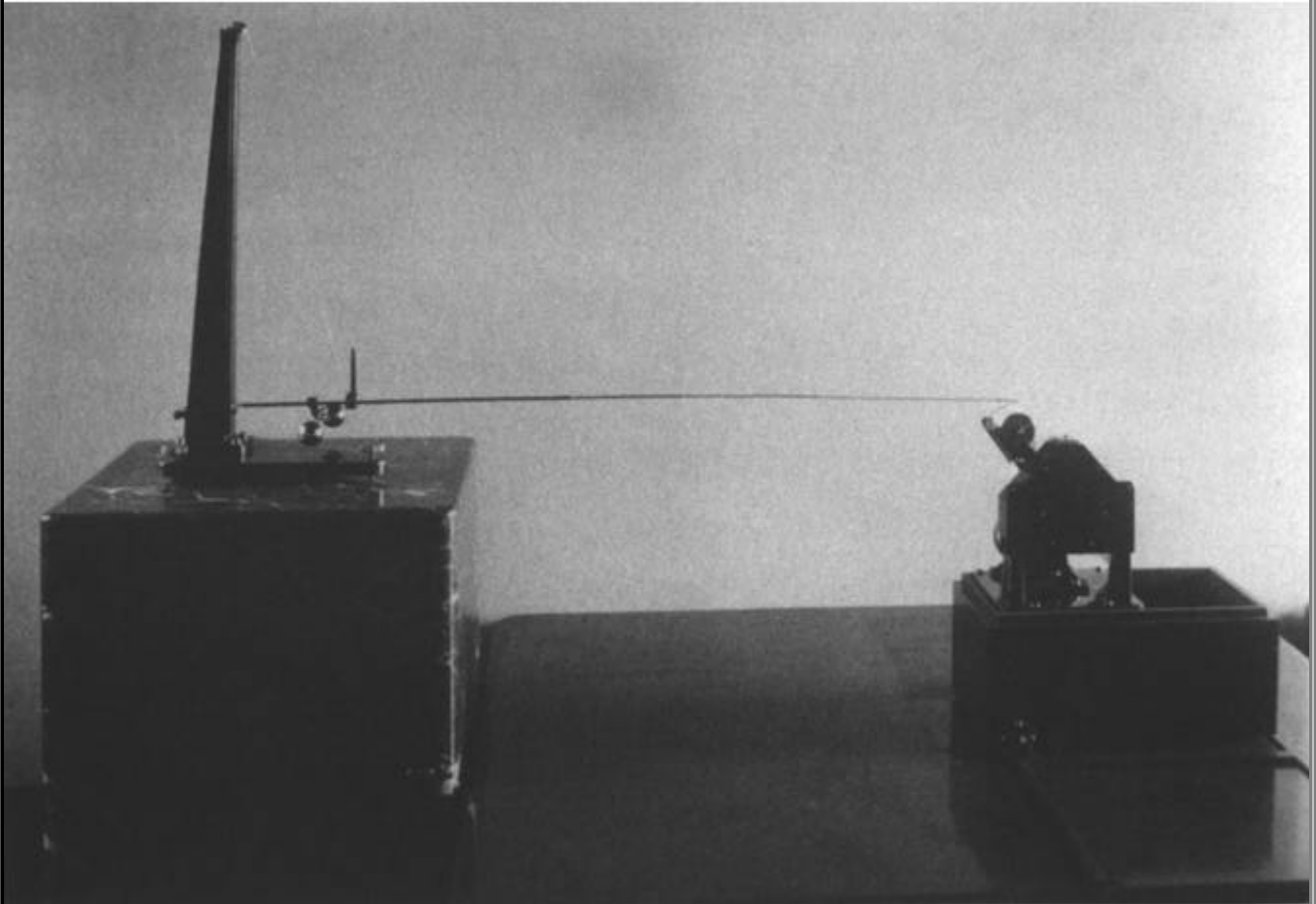
**OTHER MATERIAL**

A scrapbook kept by Mr Crilley, one of the operators in the early 1900s, is in the possession of his descendants.

**OBSERVATORY OVERVIEW**

A description of the observatory which was gifted to Paisley by Thomas Coats and which dates from 1883, is given in Henderson (1901). A special pavilion was built just outside the observatory in 1898 to house the seismographs. The first seismological instruments installed were a Ewing seismoscope and a Milne seismograph (no. 18) in that year. In 1912 an 'improved Milne', possibly an early Milne-Shaw seismograph, was installed. Continuous seismographic recording was carried out here until at least June 1918, but, in common with several other observatories of the time, trouble was experienced with 'tremors', and the Milne did not record the Messina earthquake of 28 December 1908. A modern extension of the Paisley Art Gallery and Museum now covers the original seismograph pavilion building and the piers on which the instruments stood. The Ewing seismoscope is now in the National Museums of Scotland in Edinburgh (see NMS), where restoration is almost complete, but the fate of the other instruments is at present unknown.

Modern seismic equipment consisting of Willmore seismometers and an analogue tape recording system were installed by the British Geological Survey in the original Observatory building in the early 1980s to coincide with the Observatory's centenary, and the observatory has since been used as the base for an event-triggered local seismometer network. A paper chart recorder is used for display purposes in the Museum.



The Coats Observatory Milne Boom (photo courtesy of Renfrew shire Council).

**REFERENCES**

- Henderson, A., 1901. The Coats Observatory, Its History and Equipment, J&R Parlane, Paisley.  
Neilson, G. & P.W. Burton., 1988. A brief history of Seismological Observatories in the British Isles, 1896-1960 in Lee, W.H.K., Meyers, H. & Shimazaki, K., (eds.), Historical Seismograms and Earthquakes of the World, Academic Press Inc.

## APPENDIX: Historical Observatory Details

NAME	LOCATION	BGS IDENTITY CODE
Plymouth Observatory	Various unknown locations in Plymouth	PLY

ORGANISATION	FIRST YEAR (seismology)	LATITUDE	LONGITUDE	INTERNATIONAL STATION CODE
Dr Herbert W. Fisher, also Kew Observatory/B.A.?	1923?	50.370	-4.150	
	FINAL YEAR (seismology)	HEIGHT (approx in metres)		
	?			

INSTRUMENT ONE	FIRST YEAR Inst 1	FINAL YEAR Inst 1	OTHER INSTRUMENTS
H.W. Fisher's seismograph	1923?	?1934	
INSTRUMENT TWO	FIRST YEAR Inst 2	FINAL YEAR Inst 2	
Jaggar shock recorders	1936		

**SEISMOGRAMS**  
None found although Dr Fisher is noted in press cuttings as having recorded earthquakes

**BULLETINS**  
None found

**OTHER MATERIAL**  
Correspondence in the Dollar papers (in NSA) revealed the existence of Dr Fisher's seismograph, and the BA experiments.

**OBSERVATORY OVERVIEW**

(1) In R Handford Worth's macroseismic survey papers for the Dec 25 1923 South Devon earthquake, it is written that 'the seismograph of H.W. Fisher of Plymouth not working'. Some of Handford Worth's papers are in Plymouth Local Studies Library, and investigations are proceeding. H Worth is well known in the area, having written extensively on numerous subjects, particularly the geology and industrial archaeology of the south west peninsula, in Trans. Dev. Ass.

Another reference to a Plymouth seismograph is in a press cutting about the above event held in the BGS archive. In it, Dr Fisher expressed his regrets that his seismograph was not working. The only other reference to a Plymouth seismograph at this time is a handwritten note in Dollar's papers referring to seismograms of the 24 January 1927 magnitude 5.7 North Sea event. This must surely refer to Dr Fisher's instrument, but the records have not been found, neither is there reference to Plymouth in papers published on the event so this note is probably a mistake as even at Kew the seismogram was little more than a thickening of the trace. Fisher was an enthusiastic meteorologist and reported to the Met. Soc. He is noted as having left Plymouth by 1935 to an unknown address; the informant was F S Blight, Hon. Sec. of the Plymouth Institution, Devon & Cornwall Natural History Society, in reply to Dollar's request for early 20th century earthquake information (see observatory BRI).

(2) A reference among Kew papers held in the NSA was found to experiments in 1936 with five Jaggar shock recorders at Plymouth. No precise location was given, although Plymouth, England, is given coordinates (B.A., 1937). It is assumed that this experiment was in preparation for the installation by the B.A. of an 'improved Jaggar' at Dunira House, Comrie, in 1938 (see observatory CDU), or that the instruments were being tested prior to or during their use by the Royal Society expedition to investigate volcanic eruptions on the West Indian island of Montserrat. 'Plymouth' could refer also to the capital of Montserrat.

(3) Plymouth was favoured by Dollar as a seismograph location in about 1938, when a home was being sought for Dr Vanderplank's Bristol seismographs (see observatory BRI). Dollar realised that central England was well served with instruments, and remembered that Dr Fisher had operated an instrument in Plymouth some years previously. He also favoured south west Wales as a location, and corresponded with a doctor in Tenby along those lines.

(4) Much later, Plymouth was suggested again as a possible site for a seismometer, as a letter from H Jeffreys to the B.A. Seismological Committee, dated 8 Sept 1945, and held in the NSA, states that the installation of more vertical instruments had been suggested, at Lerwick, somewhere in N Ireland, and Plymouth.



**REFERENCES**

British Association, 1937. The Constants of Seismological Observatories, The County Press, New port.  
Dollar, A.T.J., papers held in National Seismological Archive, BGS, Edinburgh.

## APPENDIX: Historical Observatory Details

<b>NAME</b>	<b>LOCATION</b>	<b>BGS IDENTITY CODE</b>
Science Museum, London	Exhibition Road, South Kensington, London	SCI

<b>ORGANISATION</b>	<b>FIRST YEAR (seismology)</b>	<b>LATITUDE</b>	<b>LONGITUDE</b>	<b>INTERNATIONAL STATION CODE</b>
Science Museum	1935	51.500	-0.180	
	<b>FINAL YEAR (seismology)</b>	<b>HEIGHT (approx in metres)</b>		
	present			

<b>INSTRUMENT ONE</b>	<b>FIRST YEAR Inst 1</b>	<b>FINAL YEAR Inst 1</b>	<b>OTHER INSTRUMENTS</b>
Milne-Shaw	1935	present	

<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>	

**SEISMOGRAMS**

Various seismograms held, detailed by McConnell (1986)

**BULLETINS**

None

**OTHER MATERIAL**

Large collection of scientific instruments (detailed by Wartnaby (1957) & McConnell (1986)); The John Milne Library

**OBSERVATORY OVERVIEW**

The founding of the Science Museum and various other institutions in that part of London dates back to the Great Exhibition of 1851, profits from which were used to purchase land for a South Kensington Museum. Ultimately the arts and science collections became so large that they were separated as the Science Museum and the Victoria and Albert Museums in 1909. The Science Museum was opened on its present site by King George V in 1928, and now houses one of the world's foremost collections of scientific and technological artefacts (Wartnaby 1957; McConnell 1986) which is continually updated to reflect modern trends. A large collection of seismographs and associated material is on display; many of these exhibits were formerly used in UK seismological observatories like Parkhill House, Durham, Kew, Down House and elsewhere; one seismograph has been displayed working at various locations in the museum, and for these reasons the Science Museum has been included in this report.

In 1935 the Science Museum purchased from J.J. Shaw one of his seismographs which was installed in the Museum for public viewing. The instrument was specially adapted with magnetic and oil-bath damping to compensate for temperature-induced tilting, and recorded on a smoked paper chart. Timing marks were provided by a separate stylus. Although intended for display purposes and not serious scientific use, many earthquakes have been recorded, including the Belgian event of June 11 1938 which was also recorded at Selfridges. The seismograph has been upgraded and maintained over the years, and is still in operation; the original smoked paper recording was discontinued owing to Health and Safety regulations forbidding the use of benzene, and a pen recorder has been substituted. A display is updated when good seismograms of significant world earthquakes are obtained.

The London Science Museum, picture © "Science Museum, London/Science & Society Picture Library".

**REFERENCES**

McConnell, A., 1986. Geophysics and Geomagnetism, Catalogue of the Science Museum Collection. London, HMSO. ISBN 0 11 290434 3  
Wartnaby, J., 1957. Seismology: A brief Historical Survey and a Catalogue of Exhibits in the Seismological Section of the Science Museum. Geophysics Handbook No. 1, HMSO, London.  
\*Science Museum Home Pages at <http://www.nmsi.ac.uk>

## APPENDIX: Historical Observatory Details

NAME	LOCATION	BGS IDENTITY CODE
Selfridges Store, London	Selfridges, Oxford Street, London	SEL

ORGANISATION	FIRST YEAR (seismology)	LATITUDE	LONGITUDE	INTERNATIONAL STATION CODE
Selfridge & Co.	1932	51.510	-0.150	
	FINAL YEAR (seismology)	HEIGHT (approx in metres)		
	1947	46		

INSTRUMENT ONE	FIRST YEAR Inst 1	FINAL YEAR Inst 1	OTHER INSTRUMENTS
Non-standard Milne-Shaw N-S	1932	1947	

INSTRUMENT TWO	FIRST YEAR Inst 2	FINAL YEAR Inst 2	OTHER INSTRUMENTS

### SEISMOGRAMS

One Selfridge seismogram held in NSA, others have been published in old magazine and newspaper articles. A few seismograms recorded during the instrument's display in Edinburgh are held by the National Museums of Scotland.

### BULLETINS

None located

### OTHER MATERIAL

Correspondence relating to the installation, records, and removal of the instrument are held in the NSA. Other relevant material is in the Selfridges Archive, currently being transferred to the History of Advertising Trust, Norwich.

### OBSERVATORY OVERVIEW

Although hardly an observatory, a Milne-Shaw instrument was set up on the Selfridge store's third floor in 1932 (BAAS 1932, 37th Report of Seismological Committee). It was one of three planned to be set up for the interest of the public (a second was located in the Science Museum; the location of the third is unknown at present but was probably to have been Down House in Kent). The instrument is not a standard Milne-Shaw, but appears to have been a 'one-off' specially designed by Shaw for attachment to buildings, and looks similar to the instrument in the Science Museum.

Mr H.Gordon Selfridge was genuinely interested in education and science, and believed that by attracting people into his store with educational and scientific exhibits he would induce them to spend time and money there, and perhaps return. In line with this philosophy he had on display at various times Blériot's monoplane just after its successful 1909 Channel crossing; other record-breaking cars and aeroplanes; new inventions including a demonstration of John Logie Baird's television; art exhibitions, and other topical attractions. The story of Selfridges is given by Honeycombe (1984), who describes these events in some detail.

As part of his philosophy Selfridge installed the seismograph in 1932, together with a notice board detailing recent earthquakes. This board was kept up-to-date, and generated considerable public interest. The seismograph boom was attached to one of the building's main stanchions, and was unaffected by traffic or people. It was adapted for public viewing, and recorded on smoked paper. It recorded the Belgian earthquake of 11 June 1938 which was also felt in London, but failed to record a small supposed tremor in Golders Green in that year (Dollar's papers in BGS archive). Reference exists in a letter to Dollar from Selfridges about 'Bulletins', which were presumably either records (timings or even seismograms) issued from time to time. None of these have ever been traced, although they may still exist in the unexamined portion of Selfridges archive at HAT, neither have any been found among Dollar's papers, although various press cuttings detail the recording of earthquakes by the Selfridge instrument. Correspondence also exists in the Dollar papers referring to a 'Bulletin Book' in which were stuck the seismograms. Copies were sometimes sent to Dollar, but none have been found. Some Selfridge seismograms were published in newspaper and magazine articles (Natural History and Wideawake magazines). A search will be made of the Selfridge archive when it becomes available for consultation.

At the outbreak of war the seismograph was moved from its original site near the Post Office to another part of the store, near the Information Bureau, but owing to subsequent building alterations neither site can now be traced. It did not record seriously there though, and was presented to the Science Museum, probably in 1947 from its Museum Inventory number (1947-121). After a period in the Science Museum, it was sent to the National Museum of Scotland in Edinburgh, where, although not calibrated, it was displayed working from 1961 until the late 1980s in an area now converted to kitchens. It was eventually decommissioned because the use of the carcinogen benzene in the smoking of the recording papers was forbidden by Health and Safety legislation, and it is currently in store. Its inventory number is NMS.T1985.131. Some seismograms recorded by the Selfridge instrument in Edinburgh are held by the Museum, but the installation was never officially photographed there.



The Selfridges seismograph around 1934, courtesy of the Selfridge Archive (now held at The History of Advertising Trust, Norwich). Several similar pictures were taken at the same time; postcards were made of some.

#### REFERENCES

- British Association 1932. Report of the Seismological Committee, British Association for the Advancement of Science.  
Dollar, A.T.J., papers held in National Seismological Archive, BGS, Edinburgh.  
\*Honeycombe, G., 1984. Selfridges Seventy-Five Years. The Story of the Store 1909-1984. Selfridges Limited.

## APPENDIX: Historical Observatory Details

<b>NAME</b>	<b>LOCATION</b>	<b>BGS IDENTITY CODE</b>
Shide Observatory, Isle of Wight	Shide Hill House, nr New port, Isle of Wight	SHI

<b>ORGANISATION</b>	<b>FIRST YEAR (seismology)</b>	<b>LATITUDE</b>	<b>LONGITUDE</b>	<b>INTERNATIONAL STATION CODE</b>
	<b>FINAL YEAR (seismology)</b>	<b>HEIGHT (approx in metres)</b>		
John Milne	1895	50.686	-1.286	
	1918?	15		

<b>INSTRUMENT ONE</b>	<b>FIRST YEAR Inst 1</b>	<b>FINAL YEAR Inst 1</b>	<b>OTHER INSTRUMENTS</b>
Milne horizontal pendulum	1895	1918?	

<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>	
Numerous instruments in use at different times			

**SEISMOGRAMS**

Some held on the Island (Lovell 1999)

**BULLETINS**

Published as the Shide Circulars by British Association.

**OTHER MATERIAL**

Mostly held on the Island (Lovell 1999)

**OBSERVATORY OVERVIEW**

John Milne's activities at his observatory at Shide and Carisbrooke Castle a mile and a half away, where he operated another instrument for comparison purposes from 22 June 1896, are documented by Herbert-Gustar & Nott (1980). On his return from Japan in 1895 with a world wide reputation as a seismologist, Milne quickly set up his observatory, which was expanded over the years, and was host to many visiting seismologists. His influence was so strong that by about 1910, and with the help of the British Association, he was effectively operating a world wide network of upwards of 50 stations, most using the standard Milne pendulum and reporting data to him. He also conducted many seismological experiments, and encouraged others to do likewise. On Milne's death in 1913, the Shide station was kept in operation for a few years by his assistants, until work was gradually transferred to Oxford under Prof. H.H. Turner by 1919. Milne's widow returned to Japan, and Shide Hill House and the contents were auctioned in 1919. The house eventually fell into disrepair and by the early 1970s had been demolished and most of the garden built on. The Observatory block and the house Annex, both constructed for Milne mainly by Mr Bullock (see IOW), were converted and are now private houses. A limestone plaque on one of the bedroom walls of the old Observatory block has been carefully preserved by the current owners, and reads 'Earthquake Observatory 1900', and is signed M.H. Gray (a local businessman, member of the British Association Seismological Committee, and benefactor of Milne) and J.Milne. The instrument cellars at the same location are now filled with rubble but excavation would undoubtedly reveal plinths and maybe other artefacts.

Milne also inspired other local enthusiastic amateurs (as well as J.J. Shaw of West Bromwich) who set up their own observing stations. One such was W.H.Bullock (see also IOW), a builder partially responsible for the erection of Milne's own observatory, who had his own instrument at New port (Herbert-Gustar & Nott 1980 p 143). Another was E.W. Pollard, an Isle of Wight pharmacist and keen amateur seismologist (see also BIN and DOR) who operated his own simple horizontal pendulum (Herbert-Gustar & Nott 1980, p 169). During the 1940s Pollard corresponded with ATJ Dollar, to whom he sent a seismogram and a short article entitled 'Earthquakes for the Amateur'. In the 1950s, Pollard was instrumental in the setting up of a Milne exhibition in Carisbrooke Castle. It was hoped to make this exhibition permanent, but it did not turn out so. Bullock's observatory reported to Milne at Shide for a few years under the name of New port (BA report, 1915, Manchester; 20th Report of the Seismological Committee). His instrument had a Milne suspension, smoked paper drum and high magnification. Some of his equipment was later purchased in about 1933 by the BA who hoped to erect a replica of an original Milne pendulum.

Some artefacts, especially a large collection of glass negatives, of Milne's work are held in the Carisbrooke Castle Museum, together with a model of a Milne seismograph of about 1898 given by E.W. Pollard. Other paper material is held in the County Record Office and the Lord Louis Library in New port. The John Milne Library is in the Science Museum, London, and two private collections of Milne slides and other material are held on the Island by Messrs. Herbert-Gustar and Nott, the co-authors of several books and articles on Milne. Extant holdings of Milne material have been summarised by Lovell (1999).

# The Daily Mirror

THE MORNING JOURNAL WITH THE SECOND LARGEST NET SALE.

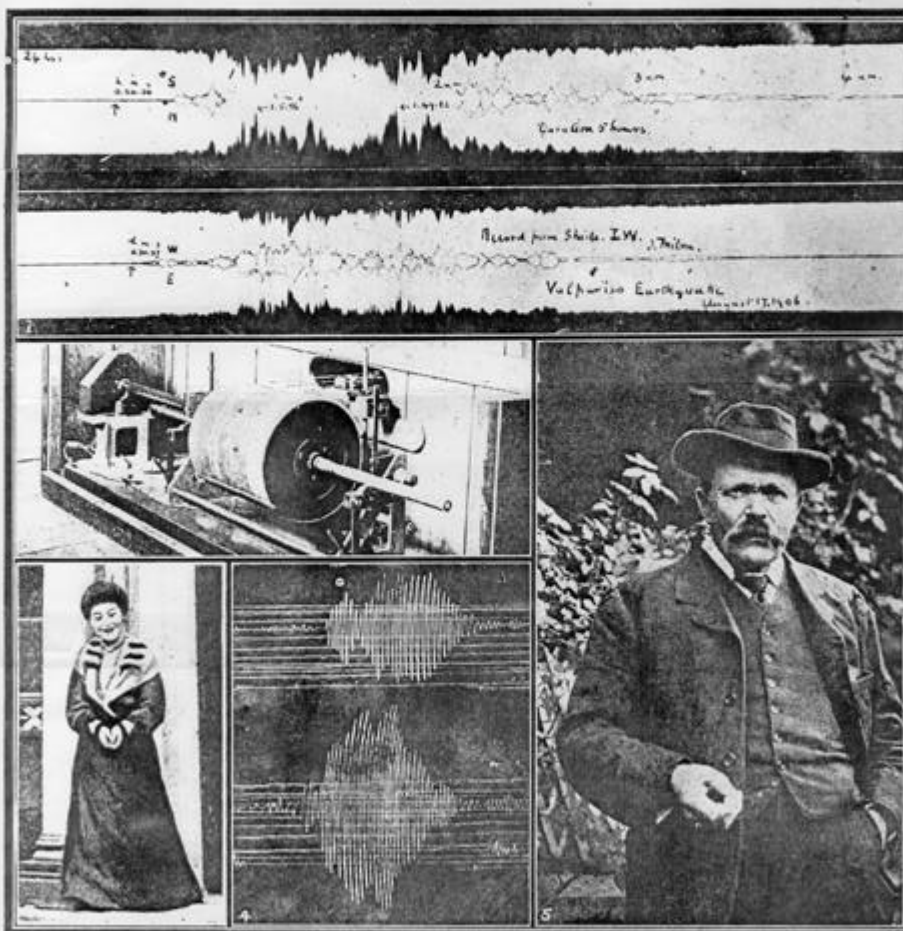
No. 3,049.

Printed at the D.P.M. in Finsbury.

FRIDAY, AUGUST 1, 1913

One Halfpenny.

DEATH OF PROFESSOR JOHN MILNE, THE FAMOUS ENGLISH INVENTOR OF INSTRUMENTS TO DETECT EARTHQUAKES AND REGISTER THEIR MOVEMENTS.



Professor John Milne, the eminent seismologist, died on Wednesday night at his residence, Shide Hill House, Newport, Isle of Wight. He achieved fame in seismology, the science of earthquakes, by inventing wonderful instruments of precision that detected and recorded in graphic lines the movements of earthquakes. These percussive power is so delicate that they frequently record earthquakes occurring in the remotest corners of the earth. While a professor in Tokio Uni-

versity, Professor Milne married an accomplished Japanese woman, Tose Nishikawa, the daughter of the Abbot of Gampo-ji. (1) One of Professor Milne's seismograph records of the destructive Valparaiso earthquake of 1906. (2) Professor Milne's seismograph, the detecting and recording instrument. (3) Professor Milne's widow. (4) Seismograph record, the broad transverse lines showing an earthquake's severity. (5) Professor Milne.—(Daily Mirror photographs.)

Montage published by the Daily Mirror after the death of John Milne on Thursday July 31, 1913.

## REFERENCES

- British Association 1915, 1933. Report of the Seismological Committee, British Association for the Advancement of Science.
- Herbert-Gustar, L.K. & Nott, P.A., 1980. John Milne, father of modern seismology. Paul Norbury, Tenterden.
- \*Herbert-Gustar, L & Nott, P.A., 1983. Was seismology lucky to acquire John Milne? in USGS Earthquake information Bulletin, Volume 15, no.5, pp 164-176.
- Lovell, J.H., 1999. A Catalogue of Archive Material associated with John Milne, F.R.S. British Geological Survey, Global Seismology Series, Technical Report WL/99/14.



## APPENDIX: Historical Observatory Details

<b>NAME</b>	<b>LOCATION</b>	<b>BGS IDENTITY CODE</b>
Stonyhurst College Observatory, S.J., Blackburn	Stonyhurst College, about 5km SW of Clitheroe, Lancs, 11 km N of Blackburn	<b>STO</b>

<b>ORGANISATION</b>	<b>FIRST YEAR (seismology)</b>	<b>LATITUDE</b>	<b>LONGITUDE</b>	<b>INTERNATIONAL STATION CODE</b>
Stonyhurst College, Society of Jesus	1908	53.844	-2.470	<b>STO</b>
	<b>FINAL YEAR (seismology)</b>	<b>HEIGHT (approx in metres)</b>		
	1947	111		

<b>INSTRUMENT ONE</b>	<b>FIRST YEAR Inst 1</b>	<b>FINAL YEAR Inst 1</b>	<b>OTHER INSTRUMENTS</b>
Milne EW	1908	1924	
<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>	
Milne-Shaw EW	1928	1947	

**SEISMOGRAMS**

Never found despite extensive searches

**BULLETINS**

1909-1917, 1920-1924, 1927-1929 and 1933 held in NSA.

**OTHER MATERIAL**

Some correspondence and press cuttings held in NSA.

**OBSERVATORY OVERVIEW**

The observatory built at this Jesuit school, founded in 1794, carried out meteorological measurements from about 1838, and geomagnetic observations from 1863 (Robinson 1982). Its original seismograph was a Milne pendulum 'through favour of the Royal Geographic Society' which was installed in 1908 and set up as an E-W component. It was mounted in the north corner of the underground magnetic chamber on a stone pillar in a concrete foundation. This instrument had previously been used in the Antarctic by Scott's 'Discovery' expedition in 1901-04 (Scott 1905), and 'cost the College £36 to have it furnished with the latest improvements' (Stonyhurst College Observatory, 1909). Recording with the Milne ceased in 1924, and it was replaced by a Milne-Shaw instrument in 1928. This was also set up as an E-W component.

Recording here was suspended in 1947 on the retirement and death of Father Rowland who had carried out observations for many years. Despite extensive searches no trace of the records has ever been found, although correspondence between Father Rowland and observers at various other seismological observatories in the UK, and press cuttings containing his comments on various earthquakes, are held in NSA.





Stonyhurst College Observatory c. 1914 (photo courtesy of Stonyhurst College). The seismograph was housed in the transept nearest the camera.

**REFERENCES**

- Robinson, P.R., 1982. Geomagnetic observatories in the British Isles, in *Vistas in Astronomy*, Vol 26, pp 347-367, Pergamon Press 1983.  
Scott, R.F., 1905. *The voyage of the Discovery*, Vol 1. John Murray, London.  
Stonyhurst College Observatory, 1909. *Results of Meteorological and Magnetical Observations*, Philip, Son & Nephew Ltd., Liverpool.

## APPENDIX: Historical Observatory Details

<b>NAME</b>	<b>LOCATION</b>	<b>BGS IDENTITY CODE</b>
University of Liverpool Observatory	Basement of Geology Department	ULIV

<b>ORGANISATION</b>	<b>FIRST YEAR (seismology)</b>	<b>LATITUDE</b>	<b>LONGITUDE</b>	<b>INTERNATIONAL STATION CODE</b>
University of Liverpool	1932	53.417	-2.933	
	<b>FINAL YEAR (seismology)</b>	<b>HEIGHT (approx in metres)</b>		
	1950?	60		

<b>INSTRUMENT ONE</b>	<b>FIRST YEAR Inst 1</b>	<b>FINAL YEAR Inst 1</b>	<b>OTHER INSTRUMENTS</b>
Milne-Shaw	1932	1950?	
<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>	

**SEISMOGRAMS**

Several from 1933 archived at University

**BULLETINS**

Some handw ritten bulletin material in NSA

**OTHER MATERIAL**

Various notes, diagrams, correspondence betw een JJ Shaw and Prof HH Read, etc. are archived at the University.

**OBSERVATORY OVERVIEW**

In 1932 JJ Shaw supplied a Milne-Shaw instrument to the Dept. of Geology, University of Liverpool, w ith the intention of bringing it into operation in September of that year (BAAS 1932). It w as brought into operation the same year (BAAS 1933) by Prof. H.H. Read, but details are very sketchy. It sometimes reported w ith Bidston, and this may have led to confusion betw een it and Bidston although its coordinates are for a location in Liverpool, on the other side of the Mersey. A letter survives from Prof. R.M. Shackleton to H.V. Shaw dated 12 December, 1949, requesting spare parts for the Milne-Shaw , suggesting that it w as still in use at that date. The plinth still remains in the Geology Department basement (Dr A.E. Mussett, personal communication 1998) and has been used for many years as a coffee table.

Some material, including seismograms from events in 1933, are preserved in the University archives. The seismograph fell into disuse around 1950, and w as sent to Nairobi in about 1955 and used for a few years. Its eventual fate is not recorded.

APPENDIX: Historical Observatory Details

ULIV

LIVERPOOL UNIVERSITY (Geology Dept)

M/S. N/S. Lat. 53° 25' 20" N  
Long. 2° 56' 29" W.

Date	Phase	G. M. T.			Period	Amplitude			Remarks
		N	S	T		N	S	Δ	
Dec. 1932	i	4	12	24	200.	mm	mm		
	i	4	15	44					
	eL?	4	17	4					
	M	4	19	50	15	3	2		
Dec. 2 1932	eP	18	30	00					
	eS	18	40	04				80.2	To = 08.17.54
	eL	18	47		20				Δ = 5500 miles
	M <sub>1</sub>	19	17	06	20	3	3		= 8800 Km.
	M <sub>2</sub>	19	23	30	20	3	3		
Jan 21 1933	eP	19	39	15					
	S.P.	19	45	30					
	i	19	46	50					
	eL?	19	55	20	25				
	M	20	25	30	25	4	4		
Feb. 13	e	03	18	30					
	eL	03	19	00					
	M	03	28	10	12	2	2		
Mar 11	eP	02	15	50					85.4
	eS	02	26	20					Placed only in distance
	L	02	33						To = 02-03-17.
1933. Mar 11	eP	14	44	30					
	eL	20	12						
	e	14	32						
1933. Mar 11	i	14	44	30					
	eL	15	12						
1933. Mar 11	i	19	54	50					
	e	16	16	10					Small waves marked by microseisms.
Mar 9.	eP	02	59	15					
	eS	03	09	35	7.8				85.1 To = 02-06-17
	P.R.	03	02	20					
	L	03	30						

35 sec. Part

Readings from the Liverpool University Milne-Shaw (in NSA)

REFERENCES

British Association 1932, 1933. Report of the Seismological Committee, British Association for the Advancement of Science.

## APPENDIX: Historical Observatory Details

NAME	LOCATION	BGS IDENTITY CODE
West Bromw ich Observatory	Cellar of JJ Shaw 's house, Hill Top, West Bromw ich and later Sunnyside, Birmingham Rd, W. Brom	WBE

ORGANISATION	FIRST YEAR (seismology)	LATITUDE	LONGITUDE	INTERNATIONAL STATION CODE
JJ Shaw	1908	52.517	-1.983	WBE
	FINAL YEAR (seismology)	HEIGHT (approx in metres)		
	1948?	156		

INSTRUMENT ONE	FIRST YEAR Inst 1	FINAL YEAR Inst 1	OTHER INSTRUMENTS
Milne/Milne-Shaw	1908?	1948?	

INSTRUMENT TWO	FIRST YEAR Inst 2	FINAL YEAR Inst 2	OTHER INSTRUMENTS
Omori NS & EW			

**SEISMOGRAMS**  
 About 40 mixed records from 1908 to 1926 (not sequential) are held in the Lapw orth Museum and w ill be microfilmed for NSA.

**BULLETINS**  
 Earthquake notebooks (September 1908 to January 1909) and Station Bulletins (February 1909 to June 1911) are held in the Lapw orth Museum.

**OTHER MATERIAL**  
 Photographs, correspondence, press cuttings, some seismograms from overseas stations (about 13 spanning 1909 to 1920) and some details of UK earthquake felt effects, also held in the Lapw orth Museum.

**OBSERVATORY OVERVIEW**

This observatory w as established by John Johnson Shaw (1873-1948) in 1908, and w as one of many w ith Milne-type pendulums reporting to Milne at Shide. The first instrument in use w as a tw in boom Omori horizontal pendulum and the tw o components w ere N-S and E-W. The static magnification w as 60 and the free period w as 12 seconds, although according to BAAS Circulars Vol 11 the free period w as 16 secs and mass 240 lbs, but this apparent discrepancy could be explained by Shaw 's experimental w ork. By 1916 tw o Milne-Shaw instruments w ere in operation. Shaw used this observatory mainly for experimental w ork on instruments.

J.J. Shaw w as responsible for introducing electromagnetic damping and certain other detail improvements to the Milne seismograph thus producing the Milne-Shaw in about 1912-1913. This instrument rapidly became the standard for observatory use, and over 50 w ere produced either by Shaw himself or closely supervised by him, many for construction costs only. He also supplied comment to the press on major earthquakes. Tw o addresses are given for Shaw ' s observatories in West Bromw ich - Hill Top (to 1911) and Sunnyside, Birmingham Road, from 1911 on. Only the latter address has escaped demolition. Both are quite near the Edgbaston observatory run by Charles Davison, but there is no evidence that the tw o ever collaborated. The observatory ceased operation shortly after Shaw ' s death in 1948, although Shaw ' s son, H.V. Shaw , did carry on the w ork for some time. According to a cutting (in Dollar's papers) the first earthquake experienced by Shaw w as the 24 October 1924 Birmingham event. Shaw ' s w ork is summarised by Lester (1995a & b).

The remnants of Shaw 's material are held in the Lapw orth Museum, School of Earth Sciences, University of Birmingham (Internet address <http://w w w .bham.ac.uk/EarthSciences/texts/museum.html>), curated by Dr. Paul Smith and detailed in Musson (1995). Microfilming of relevant material is being carried out by the NSA. Artefacts include an unassembled Milne-Shaw seismograph. The fate of the Omori is unknow n, and it is presumed lost.

In 1915 the Birmingham Daily Mail stated that a large Japanese earthquake w as recorded by the seismographs of J.J. Shaw and Mr Malcolm J. Round of Warley. It is not clear w hether the tw o w ere collaborators or if Mr Round operated his ow n instrument. The only other reference to Mr Round is in the follow ing year, w hen both men recorded a local earthquake.





J.J. Shaw at work in September 1923 after the great Kanto earthquake, Japan (photo from The Times)

**REFERENCES**

- Lester, J., 1995a. A Black Country Scientist, *The Blackcountryman*, v28 No 2, pp51-56.  
Lester, J., 1995b. A Black Country Scientist (Conclusion), *The Blackcountryman*, v28 No 3, pp59-63.  
Musson, R.M.W., 1995. Report on the Relicts of West Bromwich Observatory, Brit. Geol. Survey, Technical Report WL/95/20, Global Seismology Series.  
\*Lapworth Museum Internet address: <http://www.bham.ac.uk/EarthSciences/texts/museum.html>

## APPENDIX: Historical Observatory Details

<b>NAME</b>	<b>LOCATION</b>	<b>BGS IDENTITY CODE</b>
Wolverton, Hampshire	4 km S of Blacknest, between Newbury & Basingstoke on A339	<b>WOL</b>

<b>ORGANISATION</b>	<b>FIRST YEAR (seismology)</b>	<b>LATITUDE</b>	<b>LONGITUDE</b>	<b>INTERNATIONAL STATION CODE</b>
AWRE/MOD/AWE	1909?	51.310	-1.220	<b>WOL</b>
	<b>FINAL YEAR (seismology)</b>	<b>HEIGHT (approx in metres)</b>		
	present	156		

<b>INSTRUMENT ONE</b>	<b>FIRST YEAR Inst 1</b>	<b>FINAL YEAR Inst 1</b>	<b>OTHER INSTRUMENTS</b>
<b>INSTRUMENT TWO</b>	<b>FIRST YEAR Inst 2</b>	<b>FINAL YEAR Inst 2</b>	
single short period seismometer	1961	present	

**SEISMOGRAMS**

**BULLETINS**

Data reported to Blacknest

**OTHER MATERIAL**

**OBSERVATORY OVERVIEW**

Little has been found about the early history of this station.

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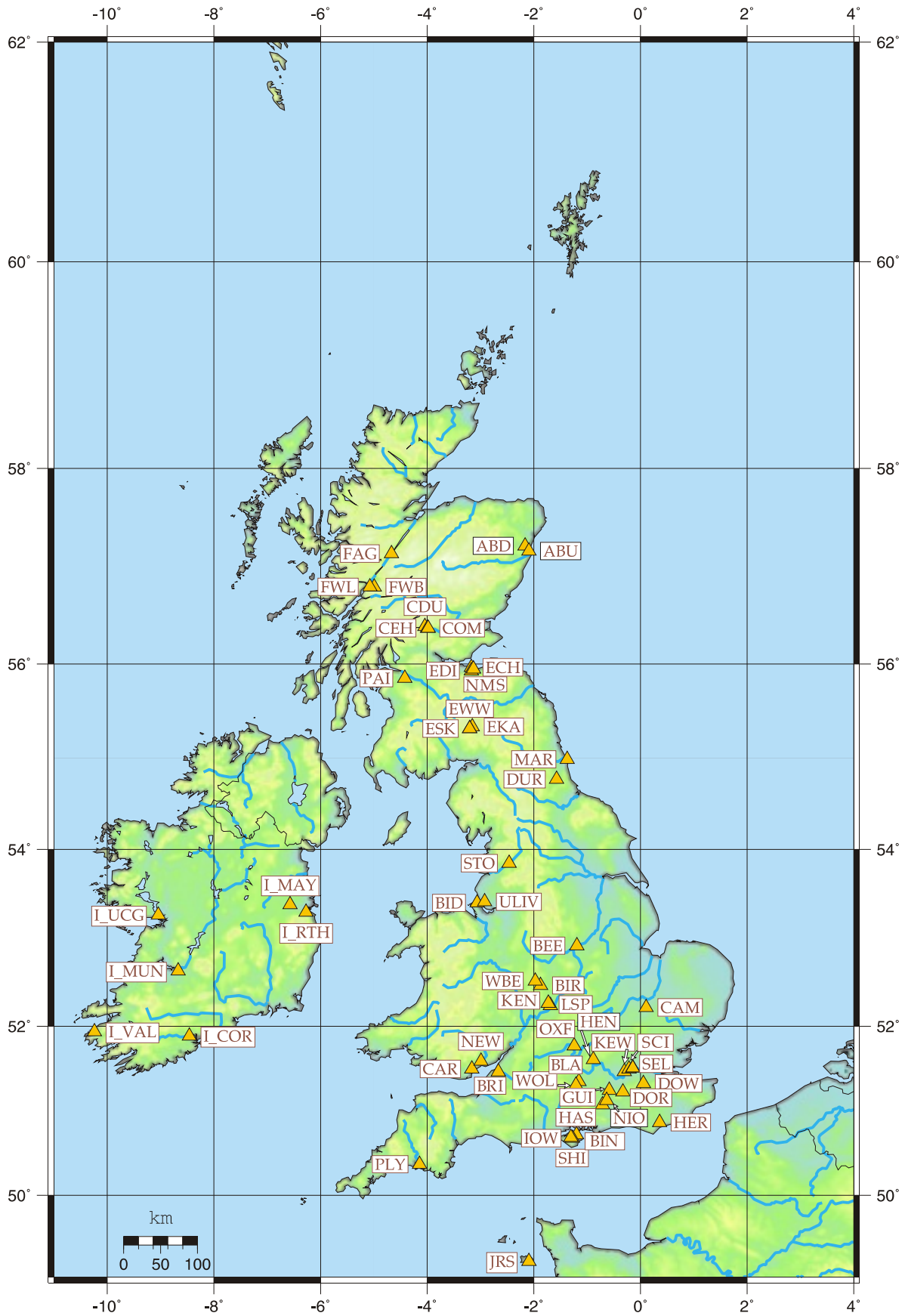
*REFERENCES*

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Historical seismological observatories in the British Isles, pre-1970.