

Department of Terrestrial Magnetism General Files, 1904-Present



**Carnegie Institution of Washington
Department of Terrestrial Magnetism Archives
Washington, DC**

Finding aid written by:
Jennifer Snyder and Ann Mulfort
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DTM-2005-07

Introduction

Abstract: This collection contains the records of the Department of Terrestrial Magnetism (DTM) at the Carnegie Institution of Washington (CIW), established in 1904, continuing to the present. It contains directors' correspondence; site and building plans; drawings of equipment and apparatus; photographs; news clippings; biographical files; diaries and reminiscences; visitor logs; and audio recordings. Notable studies conducted by DTM highlighted in the collection include geomagnetism, nuclear physics, the development of the proximity fuze, seismology, astronomy and geochemistry.

Extent: 50 linear feet; 29 file drawers, 14 map case folders.

Acquisition: The records have been in the possession of the Department of Terrestrial Magnetism (DTM) since their creation.

Access Restrictions: There are no access restrictions to this collection.

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Processing: This collection was processed by Jennifer Snyder and Ann Mulfort in May 2005 through the generous support of the National Historical Publications and Records Commission.

During the processing of this collection, the archivists discovered that previous managers of the materials weeded the files of Series One: Chronological Files through 1965. Since no subsequent weeding occurred, later files were found to contain a greater volume of nonessential correspondence. To make the collection more useable, the archivists consolidated all of the purchase orders into one file for each subseries from 1963 on. Beginning with the 1965 files, correspondence lacking a specific folder title was consolidated in folders for each letter of the alphabet (e.g.: *A: Miscellaneous*).

Historical Note

The Department of Terrestrial Magnetism was established in 1904 by Louis Agricola Bauer, who became the Department's first director. The original mission of the Department was to measure the earth's magnetic field and its variations. Magnetic survey stations and observatories were established across the globe, and ocean survey expeditions began. Two ships were commissioned for these seafaring journeys—the *Galilee*, in 1905 and the *Carnegie* (named in honor of the Institution's founder), a completely non-magnetic ship, which took over the research, in 1909.

In the 1920s, the Department's research focus began to broaden. Merle Tuve and Gregory Breit, two DTM physicists, began working on verifying the existence of the earth's ionosphere in 1925. During the 1930s and 1940s the laboratory "became a world-class center for the study of nuclear physics, which made fundamental discoveries about atomic forces." (Trefil 54) In 1939 the uranium atom was split for the first time in the U.S. on DTM's campus in the Atomic Physics Observatory. In 1940, work began on the proximity fuze which would change the face of warfare for the United States. Later, fuze activities would move to the Johns Hopkins Applied Physics Laboratory, which was headed by Tuve. "After the war, departmental scientists branched off into new fields, including isotope geology, seismology, astronomy, and biophysics. The diverse efforts resulted in discoveries regarding the structure of the Earth, age-dating techniques, the properties of genomes, and the existence of dark matter." (Trefil 54)

Please see appended timeline for achievements at the Department.

A chronology of the directorships of the department is as follows:

- Louis A Bauer (1904-1929)
- John A. Fleming, Acting Director (1929-1934); Director (1935-1946)
- Merle A. Tuve (1946-1967)
- Ellis T. Bolton (1967-1974)
- George W. Wetherill (1974-1991)
- Louis Brown, Acting Director (1991-1992)
- Sean C. Solomon (1992-)

Scope and Content

This collection consists of records from over 100 years of scientific studies at DTM. The materials include correspondence, photographs, news clippings, equipment designs, blueprints, maps, site plans, diaries, visitor logs, and audio recordings. This collection documents the evolution of a program whose initial charge was to study the magnetic and electric condition of the earth and its atmosphere. Other programs of research, conducted for varying periods of time (some still active at present) include: radio and optical astronomy; nuclear physics; seismology; biophysics; ionosphere and cosmic ray studies; isotope geochemistry and cosmochemistry; and astrobiology.

Arrangement

This collection is arranged in two series and maintains the organization developed by the original managers of these materials. The files are arranged alphabetically within the subseries of Series 1 and Series 2.

Series 1: Chronological Files, 1910-1985

Subseries 1: To 1934

Subseries 2: 1935-1948

Subseries 3: 1949-1952

Subseries 4: 1953-1954

Subseries 5: 1955-1956

- Subseries 6: 1957-1958
 - Subseries 7: 1959-1960
 - Subseries 8: 1961-1962
 - Subseries 9: 1963-1964
 - Subseries 10: 1965-1966
 - Subseries 11: 1967-1968
 - Subseries 12: 1969-1970
 - Subseries 13: 1971-1972
 - Subseries 14: 1973-1974
 - Subseries 15: 1975-1980
- Series 2: Archives Files, 1904-Present

Series 1: Chronological Files, 1910-1985

This inactive series contains fifteen subseries organized by date. The materials include correspondence, photographs, maps, equipment designs, news clippings, and site plans derived chiefly from each director's office correspondence. Department communication with other research organizations include the Lowell Observatory, Mount Wilson Observatory, the National Institutes of Health (NIH), the National Science Foundation (NSF), the National Academy of Sciences (NAS), and the National Bureau of Standards. DTM's involvement in defense contracts throughout World War II is contained in the files of the U.S. Navy. The development of image tubes for optical telescopes is included in this series. All of these materials demonstrate DTM's cooperation with various organizations. Because the work in many fields of the department took place over several years, some topics can be found in multiple subseries.

Although the International Geophysical Year took place 1957-1958, details of DTM's preparation for and participation in this endeavor can be found in earlier years throughout this series. Key correspondents in this series include L. Thomas Aldrich, James P. Ault, Dean B. Cowie, Odd Dahl, Scott E. Forbush, Richard B. Roberts, and Vera C. Rubin.

Series 2: Archives Files, 1904-Present

This active series contains correspondence, photographs, maps, blueprints, and news clippings. These materials were maintained separately from the chronological files for permanent retention of topics of historical significance to the department. Materials continue to be added to this series.

Of interest in this series is the photographic collection of the *Carnegie VII* cruise taken by Floyd Melville Soule, the diary of the Trans-Saharan Expedition (1912-1913) by Darius W. Berky, the autobiographical materials by Richard B. Roberts, and reminiscences by former staff members and crew members serving on the department's research vessels. Extensive documentation concerning the department's operation of geophysical observatories at Huancayo, Peru and Watheroo, Australia is also present.

Folder Listing

Please see the DTM General Files database for a complete folder listing. There is also a printout of the folder titles in the collection's control file. Please inquire with the archivist for access to the printed list.

Subject Terms

Topics:

- Astronomy
- Geophysical observatories
- Geomagnetism
- Geophysics
- Image converters
- International Geophysical Year, 1957-1958
- Nuclear physics
- Oceanography
- Radio astronomy
- Scientific expeditions
- Seismology

Corporate Names:

- Carnegie Institution of Washington. Dept. of Terrestrial Magnetism
- Carnegie (Ship)
- Galilee (Ship)
- Johns Hopkins University. Applied Physics Laboratory
- Lowell Observatory
- Mount Wilson Observatory
- National Institutes of Health (U.S.)
- National Science Foundation (U.S.)
- United States. National Academy of Sciences
- United States. National Bureau of Standards
- United States. Navy

Personal Names:

- Aldrich, Lyman Thomas, 1917-
- Ault, J. P. (James Percy), 1881-1929
- Bauer, L. A. (Louis Agricola), 1865-1932
- Berky, Darius W.
- Bolton, Ellis T.
- Cowie, Dean B.
- Dahl, Odd, 1898-1994
- Fleming, J. A. (John Adam), 1877-1956
- Forbush, Scott E., 1904-
- Roberts, Richard B. (Richard Brooke), 1910-1980
- Rubin, Vera C., 1928-
- Soule, Floyd M. (Floyd Melville), 1901-

Tuve, Merle Antony, 1901-1982
Wetherill, George W.

Forms:

Administrative records
Audiotapes
Blueprints
Clippings
Correspondence
Diaries
Maps
Photographs
Plans (drawings)
Reminiscences
Site plans
Visitors' books

Bibliography

Trefil, James and Margaret Hindle Hazen. *Good Seeing: A Century of Science at the Carnegie Institution of Washington, 1902-2002*. Washington, D.C.: Joseph Henry Press, 2002.

Other Sources

Brown, Louis. *The Department of Terrestrial Magnetism*. Vol. 2 of *Centennial History of the Carnegie Institution of Washington*. 5 vols. Cambridge: Cambridge University Press, 2004.

Celebrating 100 Years of Discovery at the Department of Terrestrial Magnetism, 1904-2004. Washington, D.C.: DTM, 2004.

Carnegie Institution: Department of Terrestrial Magnetism. Washington, D.C.: CIW, 2003.

Timeline of Selected Events and Achievements at the Department of Terrestrial Magnetism

Compiled in 2004 for the DTM Centennial

- 1902 - Louis A. Bauer submits proposal to establish an “international magnetic bureau” to coordinate research and conduct surveys in unexplored regions
- 1903 - Carnegie Board of Trustees approve proposal and allocate \$20,000 for the first year’s operations; Bauer named Director
- 1904 - *In conformity with the authority conveyed in the Secretary’s letter of March 29, 1904, the work of the [Department of International Research in Terrestrial Magnetism] was begun on April 1, 1904, and since then has been steadily prosecuted.*
-L. A. Bauer in the 1904 CIW Year Book
- 1905 - First land magnetic expeditions dispatched
- 1905 - Magnetic survey of the Pacific begun using the chartered vessel *Galilee*
- 1907 - Name shortened to “Department of Terrestrial Magnetism”
- 1909 - Launch of non-magnetic yacht *Carnegie*
- 1911-1913 - Participation in Australasian Antarctic Expedition
- 1913 - Experimental studies of magnetism and atmospheric electricity begin
- 1914 - DTM moves to Broad Branch Road site
- 1915-1916 - *Carnegie* circumnavigates Antarctica in a single season
- 1917-1918 - Staff conduct research on magnetic compasses for aircraft, anti-submarine devices, and magnetic mines during WWI
- 1918-1925 - Collaboration with Roald Amundsen on *Maud* Expedition
- 1919 - Watheroo Magnetic Observatory established by DTM in Western Australia
- 1920 - Experiment Building constructed
- 1921 - *Carnegie* decommissioned at conclusion of Cruise VI
- 1921-1924 - Temporary “igloo” observatories built on Baffin Island and Greenland during MacMillan *Bowdoin* expeditions
- 1922 - Huancayo Magnetic Observatory established in Peru
- 1925 - Height of the ionosphere measured using pulsed radio signals
- 1927 - *Carnegie* recommissioned and refitted for comprehensive oceanographic research on Cruise VII
- 1928 - High-voltage studies begin, using Tesla Coil as particle accelerator
- 1929 - *Carnegie* destroyed by explosion and fire in Apia, Samoa, November 29; Captain Ault killed
- 1930 - John A. Fleming becomes Acting Director; named Director in 1935
- 1930 - DTM magnetic instruments flown on board the airship *Graf Zeppelin*
- 1930 - Studies of radiation effects on lab animals and establishment of useful standards for radiation exposure
- 1931 - DTM participates in *Nautilus* Polar Expedition, first attempt to travel by submarine beneath Arctic ice-pack
- 1932 - Formation of “Committee on Coordination of Cosmic Ray Investigations,” centralized at DTM
- 1932-1933 - International Polar Year stations set up at Fairbanks and Point Barrow, Alaska
- 1932 - Atomic physics group abandons use of Tesla Coil, turns to Van de Graaff generators
- 1933 - Experiment Building extension built to house 2-meter Van de Graaff
- 1934 - Systematic monitoring of cosmic-rays begins, using Compton-Bennett meters

- 1935 - First of ten Washington Conferences on Theoretical Physics, co-sponsored by George Washington University and DTM
- 1935 - Studies of proton-proton scattering lead to understanding of strong nuclear force
- 1935 - Multi-frequency automatic ionospheric sounder built, becomes international standard
- 1935 - Manned balloon *Explorer II* carries DTM electrical conductivity experiments into stratosphere
- 1937 - Appointment of first DTM postdoctoral fellow, physicist Richard B. Roberts
- 1937 - Discovery of Forbush effect (cosmic-ray intensity decrease during magnetic storms)
- 1938 - Atomic Physics Observatory (APO), a 3 million-volt, pressure- tank, Van de Graaff accelerator, becomes operational
- 1939 - Uranium atom split at APO on January 28 with Bohr and Fermi present, following 5th Washington Conference on Theoretical Physics
- 1939 - Delayed neutron from uranium fission discovered
- 1939 - Tuve named to President Roosevelt's Uranium Committee
- 1940 - Proximity fuze development begins
- 1940 - Construction of 60-inch cyclotron starts
- 1940 - Research Associates Sydney Chapman and Julius Bartels publish classic treatise *Geomagnetism*
- 1941 - College Observatory (forerunner of today's University of Alaska Geophysical Institute) established in Fairbanks as joint DTM-University of Alaska facility
- 1942 - Fuze research and development transferred to Applied Physics Laboratory; 22 million fuzes manufactured by War's end
- 1943-1944 - Global network of ionosphere stations set up for wartime radio propagation studies
- 1943 - Cyclotron produces first beam, New Year's Eve; radioisotopes produced for biomedical research
- 1946 - Merle A. Tuve succeeds Fleming as Director and initiates modern DTM research directions in seismology, geochronology, and radio astronomy; geomagnetism research terminated
- With the completion of many volumes of survey and observatory results, and the transfer of the observatories to other agencies, the Department during this report year has begun to function effectively as a physics department with special research interests in geophysics and in laboratory physics....A deliberate aim to work as physicists, in reasonably fresh areas, on significant problems, however difficult and on problems directed toward philosophical goals without reference to possible applications, is the general policy adopted for guiding the selection and emphasis of the work carried forward.* -Merle A. Tuve, Year Book #47 (1947-1948)
- 1946 - Expansion of rock magnetism studies
- 1947 - Derwood (Maryland) Field Station established for ionospheric, cosmic-ray, and (later) radio astronomy work
- 1947 - Lunch Club established
- 1947-1948 - "Project Thunderstorm" measures air conductivity and potential gradient from B-29 bombers
- 1948 - Explosion seismology experiments begin, using war-surplus explosives; first shots in New Mexico and Chesapeake Bay region
- 1949 - Biophysics group begins studies of biosynthesis in *E. coli* bacteria

- 1950 - Mass spectrometry applied to geochronology in collaboration with Geophysical Lab
- 1951 - DTM-GL seismic expedition to Canadian Shield
- 1952 - Coulomb excitation opens new avenues for nuclear structure studies
- 1952 - Installation of DTM's first radio telescope, a 7.5-meter German radar dish, for studies of galactic hydrogen
- 1953 - Application of ion-exchange resins to chemical separation in geochronology
- 1954 - "Committee on Electronic Image Converters for Telescopes" begins work
- 1955 - Discovery of radio emissions from Jupiter
- 1956 - "Concordia" method makes U-Pb age determination accurate
- 1957 - Seismic expedition to Andes during International Geophysical Year, with shots fired in open-pit copper mines in Peru and Chile; first use of NSF funds for DTM field work
- 1958 - Paleomagnetism studies terminate
- 1959 - Control of *Journal of Geophysical Research*, edited and published at DTM since 1904, transferred to American Geophysical Union
- 1960 - 18-meter radio astronomy dish installed at Derwood
- 1960-1961 - Cooperative network of seismic stations established in Peru, Bolivia, and Chile
- 1961 - Polarized ion source installed in APO
- 1962 - 2-meter Van de Graaff donated to Smithsonian Institution
- 1963 - Agar column technique devised, transforming microbiology
- 1963 - Lake Superior seismic experiment involves 14 groups from 5 nations
- 1963 - "Carnegie Earthquake Seminar" brings South American researchers to DTM
- 1963-1964 - Recognition of long-lived isotope systems as tracers of geological processes
- 1964-1965 - 30-meter radio astronomy dishes erected at Derwood and La Plata, Argentina
- 1964 - Installation of "Carnegie image tubes" begins at observatories worldwide
- 1965 - East Coast Onshore-Offshore Experiment probes Appalachian crustal structure
- 1966 - Ellis T. Bolton becomes fourth Director; L. Thomas Aldrich named Associate Director
- 1966 - First non-human computer, an IBM 1130, installed at DTM
- 1966 - Broad-band seismograph developed
- 1968 - Sacks-Evertson borehole strainmeters developed
- 1968 - New "geochemistry" designation reflects geochronology group's growing interest in isotopes as tracers
- 1971 - First strainmeter installed off DTM campus, at Matsushiro, Japan
- 1971 - Geochemists introduce computer control of mass spectrometers
- 1971 - First plate tectonic model for formation and evolution of the Andes
- 1972 - Carnegie sponsors Airlie House Conference on "Plate Tectonics and the Evolution of Continents"
- 1973 - Carnegie sponsors Airlie House Conference on "Geochemical Transport and Kinetics," marking push to understanding diffusion and its role in geochemistry
- 1973 - Project Nariño, a multi-national explosion seismic project, confirms complexity of Andean crustal structure
- 1974 - George W. Wetherill becomes DTM's fifth Director, brings research direction in theoretical Solar System evolution and cosmochemistry to DTM
- 1974-1976 - Biophysics group phased out
- 1975 - Operation of Van de Graaff accelerator and radio telescopes terminated
- 1975 - Rb-Sr mantle isochrons show continental mantle is both different and old

- 1976 - DTM *Dynamos* meet Geophysical Lab (GL) *Pistons* on the soccer field; *Dynamos* prevail 4-0
- 1977 - Geochemistry proposed as a way to constrain mantle circulation
- 1978 - Discovery of slow/silent earthquakes enabled by array of strainmeters in Japan
- 1978 - Evidence of dark matter found from galaxy rotation curves
- 1979 - Identification of role of subducted oceanic crust in mantle evolution
- 1979 - Strainmeters installed in Iceland
- 1983 - Purchase of commercial multicollector mass spectrometer
- 1984 - Carnegie fosters organization of PASSCAL seismic consortium
- 1984 - Carnegie becomes founding member of Incorporated Research Institutions for Seismology (IRIS)
- 1985 - Observations of very young stars and star-forming regions begin
- 1986 - Beryllium-10 studies demonstrate sediment involvement in subduction
- 1986-1987 - Mass spectrometer altered for laser ionization; research using Re-Os system initiated
- 1988 - First results on fossil anisotropy in the mantle
- 1988 - Penetrative convection proposed to explain both geochemistry and geophysics of mantle
- 1989 - Ground broken for new Research Building on January 30
- 1989 - First deployment of DTM portable seismic array in “APT89 Experiment,” 1500-km transect across US and Canada
- 1990 - Geophysical Laboratory moves to Broad Branch Road campus
- 1991 - Wetherill retires; Louis Brown named Acting Director
- 1992 - Sean C. Solomon becomes DTM’s sixth Director
- 1992-1999 - Brazilian Lithosphere Seismic Project employs 20+ portable broadband stations in joint DTM-University of São Paulo study
- 1993 - First strainmeter study of volcanic eruptive processes
- 1994-2001 - Collaboration in *Hubble Space Telescope* key project on Cepheid variables refines distance scale of the universe
- 1995-1996 - Ion Microprobe Laboratory built in former cyclotron vault; cosmochemistry strengthened in research program
- 1996 - “Mud Cup I” rekindles DTM-GL soccer rivalry
- 1996 - Research effort on planetary volatiles and interplanetary and interstellar grains begins with ion probe
- 1997 - *Hubble Space Telescope* photos of “antennae” galaxies bring national attention to work on merging galaxies
- 1997 - Automation of ion probe to hunt for isotopically anomalous interstellar grains
- 1997-1998 - Acquisition of inductively-coupled plasma mass spectrometers
- 1997 - Undergraduate summer intern program begins in collaboration with GL
- 1997-2002 - Kaapvaal Craton Project brings seismo-logists and geochemists together in multinational, multidisciplinary study of southern Africa’s cratons
- 1998 - Carnegie becomes founding member of NASA Astrobiology Institute
- 1998 - Identification of extra-Solar System oxide grains from supernova
- 1998 - Feasibility of using Re-Os on sulfide inclusions in diamonds demonstrated
- 1999 - DTM enters search for extrasolar planets, complementing ongoing theoretical work in planet formation
- 1999 - Two borehole geophysical observatories installed in ocean bottom off Tohoku, Japan

- 1999 - First transit of an extrasolar planet detected around HD 209458
- 2000 - Strainmeters predict eruption at Hekla
- 2001-2003 - Astronomy group changes its focus to planets and the Solar System
- 2002 - First volcano-specific strainmeter deployment captures Montserrat dome collapse
- 2004 - Launch of MESSENGER spacecraft to Mercury on August 3, a joint Carnegie-APL-NASA mission
- 2004 - Discovery of Neptune-mass exoplanets