PHYSICS

Society Honors Centenary Of First Magnetic Observatory

Just a Hundred Years Ago, Alexander Dallas Bache Started Observations Where Girard College Now Stands

COMPLETION of a century of scientific observations in the United States of the earth's magnetism were commemorated by the American Philosophical Society, oldest American scientific society, in a series of meetings on Feb. 14 and 15 in Philadelphia.

It was just about a century ago that Alexander Dallas Bache, one of the greatest scientific figures of the first part of the 19th century, started his systematic observations. These were made in a special non-magnetic building erected on the grounds of Girard College, of which he was then president.

Bache was born in Philadelphia in 1806, the great-grandson of Benjamin Franklin, grandson of Alexander J. Dallas, Madison's secretary of the treasury, and nephew of George M. Dallas, Vice-President under Polk, after whom Dallas, Texas, is named.

According to his report, the observatory was begun in 1838, and finished in 1840, though it was not until 1841 that the instruments were entirely in place and full measurements of the variation in the earth's magnetism were being made.

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Earth's Magnetism Same

MILLIONS of years ago, in long past geologic ages, the magnetism of the earth was essentially similar to what it is today, Dr. A. G. McNish, of the Carnegie Institution of Washington's Department of Terrestrial Magnetism told the Centenary meeting.

Dr. McNish has measured what he terms "fossil magnetism." As the particles which later hardened to form the sedimentary rock were laid down in past ages, in quiet bodies of water, tiny magnetic particles were among them. Their orientation was determined by the magnetic field of the earth at that time. As more material was deposited on top, they were locked in positions which they have held until now. Thus, by measuring their direction and magnetic intensity, some idea may be gained of the magnetic conditions of long ago.

"Measurement of this fossil magnetism reveals that the earth's field was not essentially different in past geologic ages from what it is today in the same locality," said the speaker. "Large changes have occurred but they seem to have been no greater than the changes which were observed during the past four centuries, and the rapidity with which they occurred corresponds to present-day rates.

"Thus, the evidence so far derived from study of fossil magnetism supports the belief that the earth's magnetism consists of a relatively constant uniform field upon which is superposed an irregular field of considerable magnitude which varies slowly as measured by human standards but extremely rapidly as measured by the standards of geological and astronomical time."

Most of the phenomena of the earth's magnetism and its electricity, which is related, are only observed with special instruments, Dr. O. H. Gish, of the Carnegie Institution, said. Occasionally, he explained, they are more noticeable, as was the case in the magnetic storm of last Easter Sunday.

Then, he stated, "an electromagnetic disturbance, beginning about two hours after Greenwich noon and lasting about twenty-four hours, attained unsurpassed severity at intervals. This was accompanied by unprecedented obstruction of transatlantic radio transmission, numerous interruptions of wired communication services, and, most surprisingly, some interference with operations of electric power systems. Also aurorae were seen farther than usual from the polar regions.

"The disruption of radio communication is attributable to changes in the electrical properties of the high atmosphere (ionosphere) which involve deterioration of the mirror-like reflection of radio waves from that region back to earth. The interference with wire communication and electric power transmission doubtless arose from intrusion of electric currents—induced in the earth by the magnetic variations—which on this occasion were more than one thousand times the usual intensity."

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Nazi Radio Is Aided

NAZI propaganda via the radio waves travels from Europe to South America better than it does to North America. Speaking at the meeting commemorating the centenary of the first American magnetic observatory, Dr. J. H. Dellinger, chief of the Radio Section of the National Bureau of Standards, told of ways in which the earth's magnetism affects wireless transmission.

"It has long been known," he stated, "that radio transmission on the high radio frequencies is markedly poorer between North America and Europe than over other transmission paths. A possible relation of the radio anomaly to the propinquity of the magnetic pole was suspected, but there were no data on which to base a positive conclusion.

"Following a discovery that this disparity existed at the broadcast frequencies also, a systematic study was begun in 1935 and is still in progress. Measurements have been made in Europe and in North and South America of the received intensities of broadcast stations in the other continents, each (northern) winter since 1935."

Disturbances in the ionosphere, the complicated layer more than fifty miles high from which radio waves are reflected back to earth, are associated with the magnetic storms at lower levels, said Dr. Dellinger.

These, he stated, "increase the variability of radio transmission between North America and Europe much more than between South America and either North America or Europe. The ionospheric and magnetic storminess, moreover, is prevalent much more of the time in the more northerly regions traversed by the radio waves between North America and Europe. Thus this transmission path is far more subject to the disturbing effects than the paths more remote from the polar regions."

Magnetic disturbances on the earth are closely connected with the activity of the sun. In addition to the effect of the general magnetic storminess, there is another. Dr. Dellinger described this as "a very sudden, relatively brief perturbation occurring simultaneously throughout the day hemisphere, the effect being a maximum at the subsolar point and a mini- (*Turn to page* 126)

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mum in the polar regions; it is directly caused by a solar eruption."

Dr. L. V. Berkner, of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington, explained to the meeting how the various layers of the ionosphere are measured by sending up radio waves and catching their echoes. There are three main layers, he stated, namely: the E-layer, 62 miles high; the F-1 layer at 140 miles and the F-2 layer at 220 miles. At night, or when the sun is low, the last two merge to form a single F layer at a level of 155 miles.

Apparently corpuscles shot out from the sun disturb the F layers in which, he stated, occur the chief ionospheric effects associated with magnetic storms.

Dr. Carl W. Gartlein, curator of the Department of Physics at Cornell University, told of connections, which he has found, between the earth's magnetism and the aurora borealis. Auroras occur most frequently, he said, in a zone about 23 degrees from the magnetic pole, which is on the Boothia Peninsula in northern Canada. The 23 degree zone roughly follows the border between the United States and Canada.

"The disturbances of the geomagnetic field, or magnetic storms, occur most frequently near the equinoxes," Dr. Gartlein announced. "Auroras are likewise most frequent then in the middle latitudes (45 degrees to 60 degrees geomagnetic latitude). There is also an approximate eleven-year cycle in the number and intensity of magnetic storms which has its counterpart in displays of aurora. These cycles rise to a maximum about a year after the peak of the sunspot cycle. Large magnetic storms are always accompanied by auroral displays in middle latitudes and these displays move farther from the poles during more intense storms. Near the poles the magnetic storms and auroral displays are not always simultaneous."

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BOTANY

NATURE RAMBLINGS
by Frank Thone

Rosette Plants

SOME plants ages ago learned the trick adopted by modern soldiers, of lying down flat when exposed to enemy fire. The enemy fire, in their case, consists of snow and sleet of winter, and the plants lie down by forming mats or rosettes that hug the ground, gaining cover and protection from the very snow that would otherwise overwhelm them. We see perfect examples of such low-lying rosettes in dandelion, mullein, plantain and similar weeds. As a matter of fact, they are weeds simply because they are so successful as plants, gaining and keeping roothold in a million places where they are not wanted.

Plants able to produce leaves sufficiently tough to withstand winter's cold have a quite considerable advantage over less resistant species that must tuck next year's foliage tightly into buds, as most woody plants do, or hide beneath the ground surface, like most perennial herbs, or even pack the tiny beginnings of the whole plant away within seeds, after the manner of all annuals. A rosette plant has its leaves all there, spread out and ready to catch the sun, the moment the snow covering is thawed away That is the reason why the first spring flowers that adorn city dwellers' buttonholes are usually dandelions — precocious blooms that pop out, far ahead of the season, in sheltered sunny spots.

The rosette habit gives other advantages to early-starting plants. The circle of leaves preempts the ground beneath it, keeping it bare of the competition of other plants. At the same time, it affords a certain degree of protection against drying to the soil beneath, thus benefiting at least the more superficial part of its root system.

It is rather characteristic of plants that form winter rosettes, to forsake the meek humility of their beginnings and send their flower stalks aloft as far as they can reach, when time for reproduction comes. Thus, the tall, bare scapes of the dandelion, the ambitious, wiry spikes of the plantain, the truly towering growth of the mullein in its second year. It is truly a case of the meek inheriting the earth —by becoming self-assertive.

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The *Ross Shelf Ice,* sometimes called the barrier, in the Antarctic is a vast floating sheet of snow-ice rising cliff-like from the Ross Sea 20 to 200 feet.

● Earth Trembles

Information collected by Science Service from seismological observatories and relayed to the U. S. Coast and Geodetic Survey resulted in the location of the following preliminary epicenters:

Friday, Feb. 7, 10:13.1 a.m., EST

On Kamtchatka peninsula. Probably in region of Latitude, 56 degrees north; longitude, 158 degrees east.

Sunday, Feb. 9, 4:43.9 a.m., EST

Off coast of northern California. Latitude, 41 degrees north. Longitude, 127 degrees west. Strong.

Tuesday, Feb. 11, 9:35.5 a.m., EST

Probably about 100 miles off west coast of lower Mexico, near Guatemala boundary. In region of latitude, 14 degrees north; longitude, 94 degrees west. Strong shock.

Stations cooperating with Science Service in reporting earthquakes recorded on their seismographs are:

University of Alaska, College, Alaska; Apia Observatory, Apia, Western Samoa; University of California, Berkeley, Calif.; Dominion Observatory, Ottawa; Dominion Astrophysical Observatory, Victoria, B. C.; The Franklin Institute, Philadelphia; Harvard University Observatory, Harvard, Mass.; University of Hawaii, Honolulu; Magnetic Observatory of the Carnegie Institution of Washington, Huancayo, Peru; Massachusetts Institute of Technology, East Machias, Maine; University of Michigan, Ann Arbor, Mich.; Manila Observatory, Manila, P. I.; Montana School of Mines, Butte, Mont.; Montana State College, Bozeman, Mont.; Nebraska Wesleyan University, Lincoln, Neb.; Pennsylvania State College, State College, Pa.; Phu Lien Observatory, near Hanoi, French Indo-China; Seismological Observatory, Pasadena, Calif.; University of Pittsburgh, Pittsburgh, Pa.; University of South Carolina, Columbia, S. C.; University of Utah, Salt Lake City, Utah; Utah State Agricultural College, Logan, Utah; U. S. Weather Bureau, University of Chicago; Williams College, Williamstown, Mass.; Zikawei Observatory, near Shanghai, China; observatories of the Jesuit Seismological Association at Canisius College, Buffalo, N. Y.; Fordham University, New York City, Georgetown University, Washington, D. C., St. Louis University, St. Louis, St. Xavier College, Cincinnati, and Weston College, Weston, Mass.; observatories of the U. S. Coast and Geodetic Survey at San Juan, P. R., Sitka, Alaska, Tucson, Ariz., and Ukiah, Calif.