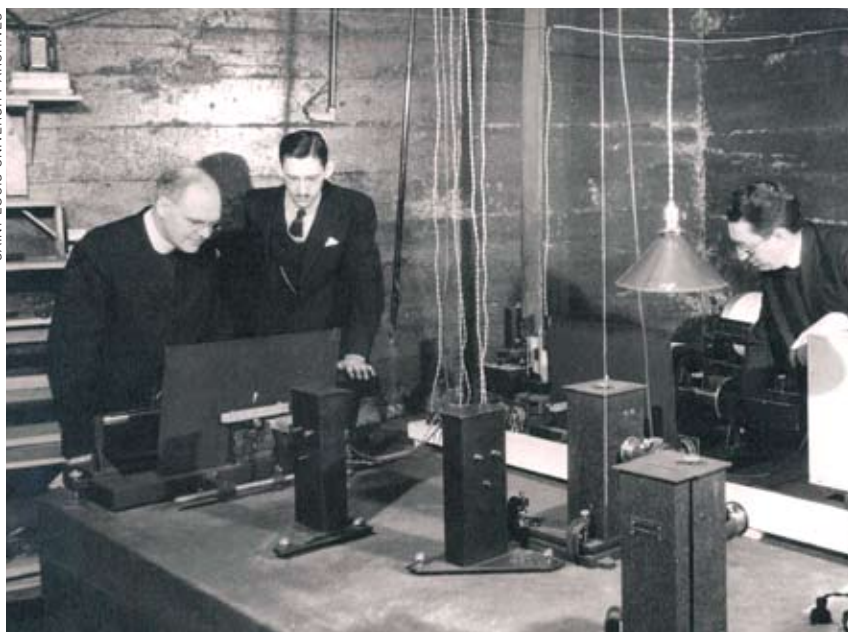


The Jesuit Science

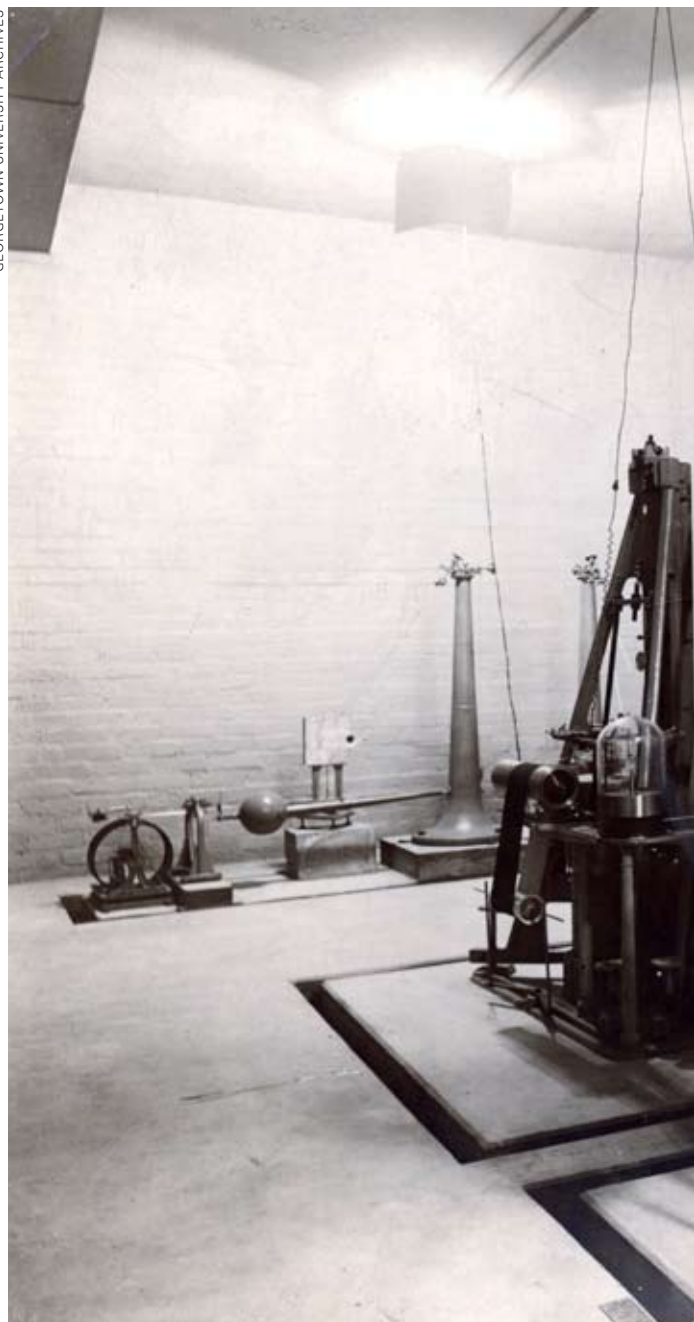
by John Ebel

SAINT LOUIS UNIVERSITY ARCHIVES



Seismologist Fr. James Macelwane, SJ (left), started his career at the University of California at Berkeley, his alma mater, in the early '20s. At Saint Louis University he worked to coordinate seismographic efforts at Jesuit schools across the country, the start of the Jesuit Seismological Association.

GEORGETOWN UNIVERSITY ARCHIVES



Seismology was used by Jesuits around the world not only to measure earthquakes, but

THE YEAR WAS 1982, and I was a newly minted faculty member in geophysics at Boston College. Less than two years earlier, I had completed a PhD in seismology at Caltech, and now I was heading off to St. Louis for a meeting of a group about which I knew very little: the Jesuit Seismological Association (JSA).

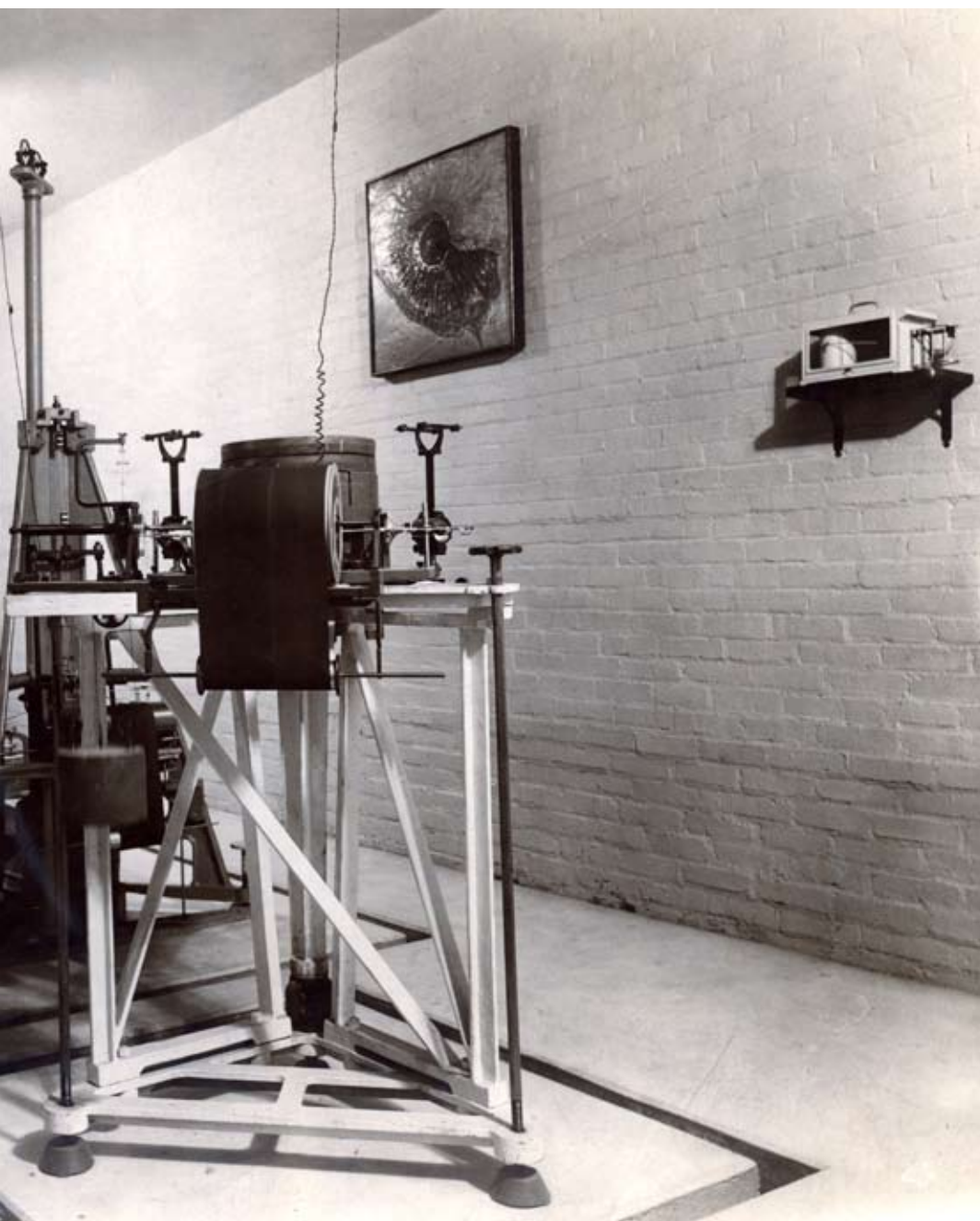
Fr. Jim Skehan, SJ, then the director of Boston College's Weston Observatory, asked me to attend this meeting. I didn't know that I was on my way to witness the end of an era in the science

of seismology, which at one time had been known as the Jesuit science.

The meeting, an annual event held that year at Saint Louis University, comprised a group of elderly Jesuits and myself. Fr. Dan Linehan, SJ, also from Weston Observatory and the chair of the meeting, was a gentle yet adventurous person whose travels to the polar regions were legendary. The secretary (and general organizer) of the JSA was Fr. Don Roll, SJ, from Loyola University Chicago. Fr. Lou Eisele, SJ, from Spring Hill College in Mobile, was

very outgoing and had a great sense of humor. From Saint Louis University came quiet, thoughtful Fr. Bill Stauder, SJ, who had everyone's respect. He was the only one of the group besides me who had a PhD in geophysics. Regrets had been received from some others who had not been able to attend.

At the 1982 meeting, I learned that the JSA was a holdover from a bygone era. Except for Boston College and Saint Louis University, where strong academic programs in geophysics kept their seismology programs current, the other JSA



John Carroll University's Fr. Fredrick Odenbach, SJ (1857–1933), one of the early pioneers of seismology, created the Jesuit Seismological Service in 1911. This was a network of stations in North America that reported to an international center in Europe.

Georgetown University's seismo-graphic station, which consisted of three different seismographs, was in a basement insulated against temperature and moisture changes. It was the work of Fr. Francis Tondorf, SJ, a physics professor at Georgetown, in 1909, through the generosity of alumnus Patrick O'Donnell. Georgetown maintained seismographs until the '70s.

also to monitor nuclear tests and explore what's under St. Peter's

members were operating old seismic equipment, often on a shoestring budget. It was the cleverness and devotion of these Jesuits that kept their old seismic stations running, even as new and better equipment was being purchased and installed at the top seismological research institutions in the country.

Much of the business at that 1982 meeting concerned how to keep the old stations operating at Loyola and Spring Hill, as well as requests for suggestions on how to obtain supplies for old equipment at Regis in Denver and

John Carroll in Cleveland. The highlight of the meeting was a tour of Saint Louis University's seismic operation to learn how to operate a modern seismographic station.

Unfortunately, time caught up with the JSA within a few years. The deaths of Roll at Loyola and Eisele at Spring Hill led to the termination of those seismic stations, and Linehan from Weston Observatory also passed on.

By the end of the 1980s, the few remaining members of the JSA decided to dissolve the organization and donate

its assets to the Eastern Section of the Seismological Society of America. In its last act the JSA created an award for outstanding contributions in observational seismology. Since 1991 this award has been presented at the annual meeting of the Eastern Section of the JSA.

In the beginning

The history of Jesuit participation in seismology is long and storied, and many of the important advancements in earthquake science through the first half of the twentieth century are the

direct result of their work. Seismographic readings from Jesuit seismic stations were essential for locating earthquakes on a worldwide basis. Also, the widespread distribution of Jesuit seismic stations helped provide the necessary data to work out details of Earth's interior structure, such as the location and properties of the planet's crust, mantle, and core.

The first seismic instrument installed by the Jesuits was a very simple pendulum system at the observatory in Manila, the Philippines, in 1868, followed by better instruments in 1882 and 1889. In Europe the first Jesuit seismograph was made operational in 1888, and in 1899 some Jesuits installed seismographic instrumentation at Tanarive in Madagascar. The first U.S. Jesuit station was put into operation at St. Ignatius College (now John Carroll University) in Cleveland by Fr. Frederick Odenbach, SJ, in 1900.

Better instruments

During the first decade of the twentieth century, improved seismographic instruments were produced, and Jesuits took advantage of the new technology to establish seismographic stations in Spain, China, Cuba, England, Ireland, Australia, the United States, and several countries in South America. At one time, Jesuits were operating more than 50 seismic stations worldwide.

Odenbach had a vision of a cooperative organization of Jesuit seismographic stations in the United States and Canada. In 1909 he contacted all of the Jesuit colleges and universities throughout this region asking if they would take part. Fifteen agreed, and by 1911, seismographic instrumentation was operating at Santa Clara, Regis in Denver, Gonzaga, Holy Cross, Marquette, Georgetown, Canisius, Saint Louis, Fordham, Loyola New Orleans, Spring Hill, and St. Boniface in Manitoba. Odenbach had planned for Cleveland to be the hub of

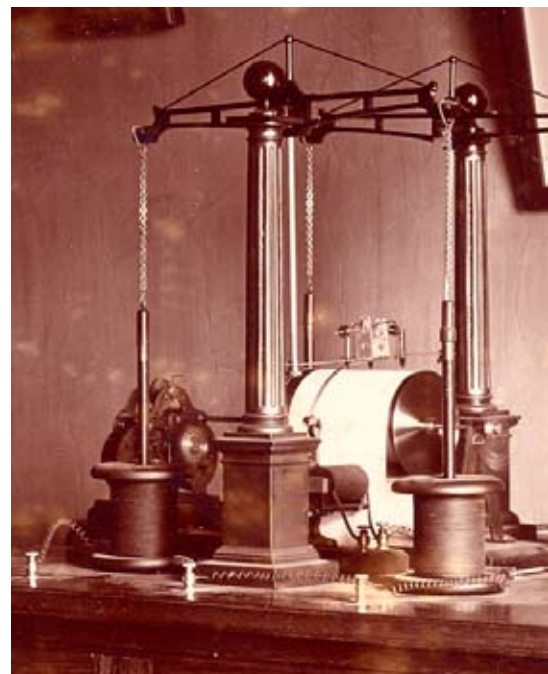


John Carroll University's Fr. Frederick Odenbach, SJ, established the university's seismology observatory, which collected a broad range of data: (clockwise, from upper left) a ceraunograph, which detects and records radio waves generated by lightning; a barograph, which measures and records barometric pressure; a seismograph, for movements of the earth; and a meteorograph, to record temperature, pressure, and humidity.

the new Jesuit stations, but this arrangement fell apart due to a difference of opinion between Fr. Odenbach and the U.S. Weather Bureau, which was also collecting seismographic data at the time. As a result, the new Jesuit seismic stations in the United States and Canada were left to fend for themselves for the rest of the decade. None of the stations was being operated by trained seismologists, so some of the stations operated well, but others deteriorated.

Macelwane's era

The history of Jesuit seismology in the United States took an important turn in the early 1920s when Fr. James Macelwane, SJ, earned a PhD in geophysics from the University of Califor-



nia at Berkeley and was appointed to the faculty there to develop a graduate program in geophysics and to run the seismographic stations there.

Soon after, Harry Wood from the National Research Council in Washington came to Berkeley, and he urged Macelwane to reorganize the U.S. and Canadian Jesuit seismographic stations. In 1925 Fr. Macelwane began to lay the groundwork for this new organization, even as he moved from Berkeley to Saint Louis University as professor of geophysics.

In August 1925, when a meeting of Jesuits from across the country was held at Loyola University Chicago, the Jesuit Seismological Association was born. Saint Louis University was established



as the central station, to which all the other stations would send by mail, telegraph, or telephone their readings of the arrival times and amplitudes of seismic waves. During the next three decades, the Saint Louis University station played an important role in assembling and disseminating earthquake data worldwide. The university issued regular reports listing the times, locations, and magnitudes of earthquakes occurring around the globe to individuals, government agencies, and the news media.

More pressing matters

During the 1960s and 1970s, the need to monitor underground nuclear testing and an effort to develop techniques to predict earthquakes greatly increased federal funding in the United States for seismological research. Though most of the Jesuit stations were staffed not by dedicated seismologists but by observers trained to keep the equipment running, many Jesuit seismological stations across the globe received new seismic equipment for nuclear test ban treaty monitoring purposes.

Earthquake monitoring was not the only branch of seismology that Jesuits practiced. At Weston Observatory, Fr. Dan Linehan, SJ, utilized the methods of “exploration seismology” to do site sur-

veys for construction projects and to look for groundwater resources. Linehan and his assistants would stretch out a long wire and attach small seismic instruments at intervals, such as every 10 or 100 feet. The end of the wire would be attached to a photographic recording system. Small explosions or the dropping of heavy weights would

generate seismic waves, which were then recorded by the seismographic spread. Analysis of the recorded seismic waves revealed the depths and seismic velocities of different layers in the Earth.

From pole to pole

Linehan conducted a number of seismic surveys throughout the northeastern United States. Many young New England Jesuits participated, both to learn how it was done and to get a break from their rigorous Jesuit training. In the mid '50s Linehan took his seismic equipment to the Arctic and Antarctic to use exploration seismology to measure the thickness of the polar ice caps. He also celebrated the first Mass in Antarctica on January 1, 1956.

It was also in the '50s that Linehan and Fr. Joseph Lynch, another Fordham Jesuit, carried out a number of seismic measurements around the Vatican and inside St. Peter's Basilica to determine its subsurface conditions in preparation for archaeological investigations under the Vatican. They located walls and rooms of a lower basilica and the buried remains of a Roman circus under the Vatican.


To minimize the effect of ground vibrations caused by foot traffic on their measurements, the Jesuits needed to momentarily stop the many Vatican visitors from moving about when they set off their seismic sources. Linehan later wrote, “Realizing that people from all nations are visiting the basilica, it was difficult to know just what language to use when you wished to yell *Stand still.*”

At one time, Jesuits were operating more than 50 seismic stations worldwide.

The end of an era

The expanded funding during these decades went primarily to research universities, where new seismological equipment and sophisticated analysis methods were being developed. By 1990, most of the Jesuits who operated seismic stations had died or retired, and most of their stations were closed.

Though Jesuit seismologists and Jesuit institutions no longer dominate the science of seismology, their influence is still felt. Several Jesuit universities around the world offer degree programs in geophysics with a specialty in seismology, and graduates from these programs populate many important positions in seismology research and administration. Eight Jesuit institutions in the United States, Spain, the Philippines, Bolivia, Colombia, and Canada continue to operate seismic stations, almost all of which are staffed entirely by lay personnel.

There are still a few active Jesuits in seismology, most notably Fr. Augustín Udías, SJ, at Universidad Complutense in Madrid. His *Principles of Seismology*, published in 1999, is the latest in a line of influential seismology books written by Jesuits, dating back to the two-volume set called *Introduction to Theoretical Seismology* published in 1936 by Georgetown University's S.J. Sohon and Saint Louis University's Macelwane. The latter's strong influence on seismology is remembered today in the Macelwane Award, which is given out annually by the American Geophysical Union to outstanding young scientists. 

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