Wiechert Earthquake Station

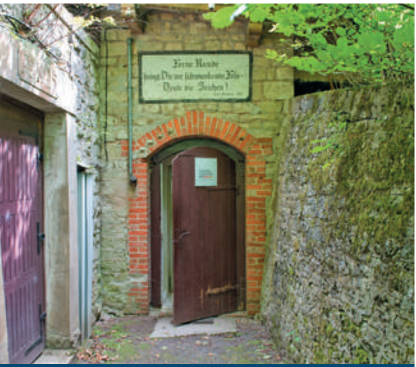
Living Science

- The Epitome of Seismology
- Research and Getting Rich
- Things that go Bang in the Forests of Göttingen

Göttingen – Creating Knowledge, Using Knowledge

The Oldest Working Seismograph

100-Years-Old, but still Fully Operational. Göttingen's seismological station is home to the world's oldest, fully functional seismograph, that can still be used for scientific purposes. The city of Göttingen has the geophysicist Emil Wiechert – who was appointed Göttingen's first professor of geophysics in 1898 – to thank for this.



Entrance to the "Old Earthquake Vault" dating from 1902.

Geophysics found a new home here between 1901 and 2005.

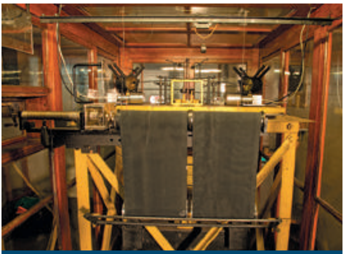
From 1901 onwards, Wiechert carried out research in the new field of geophysics on the hillside of Göttingen's Hainberg. It was here, in 1902, that he joined forces with the Göttingen companies *G. Bartels* and *Spindler & Hoyer* (today *LINOS*) and started to build instruments for recording earth tremors, i,e., seismographs. Since then, *not even the tinie*st movement escapes the notice of Göttingen's earthquake station. It became one of the main observatories in the international network for seismological research as early as 1905.

Emil Wiechert carried out research in the new field of geophysics, investigating seismology, geomagnetism, atmospheric electricity and meteorology.

The Earth is "Having a Scratch".

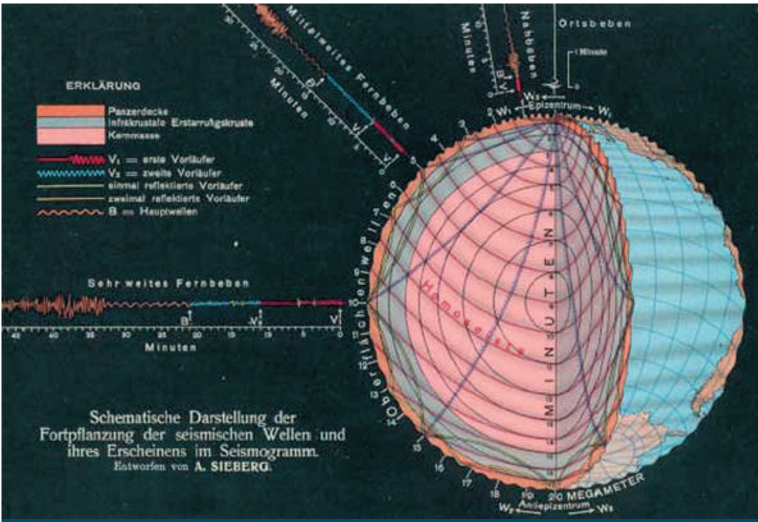
Our planet is constantly undergoing changes, above all, on the earth's crust, where the tectonic plates are in motion. The resulting stresses manifest themselves in earthquakes. Many small tremors go unnoticed, while stronger shocks cause larger earthquakes.

Geophysicists record such shock waves with seismographs at various locations in the world and then “read” and interpret the graphic data collected, which can then be viewed as seismograms. First to appear, are the primary P-waves (longitudinal waves), followed by the secondary S-waves (transverse waves), and finally the surface waves. These different types of waves propagate themselves at varying speeds and in differing ways.



The astatic horizontal seismograph of 1902 is fully functional even today.

A Look into the Depths of the Earth. The properties of seismic waves vary, depending on whether they are passing through parts of the Earth that are solid or liquid. This is how geophysicists formed an idea of the structure of our planet over the years.



The structure of the Earth and the course of seismic waves in the Earth’s interior – as people imagined it – at the beginning of the 20th century. The earth’s core had not yet been clearly identified at this time.

Although today’s seismographs are far more powerful than before, it is still not possible to exactly predict the occurrence of earthquakes, even with the latest geophysical measuring instruments. Nevertheless, we are able to interpret phenomena acting as seismic precursors, and anticipate tremors with a certain degree of probability.

A Tour of the Site

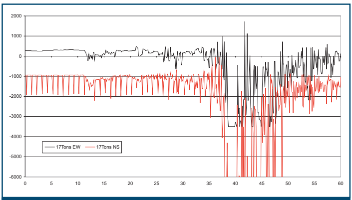
The "Old Earthquake Vault". Emil Wiechert's motto shown above hangs in a prominent position as a message to all above the entrance door to the "Old Earthquake Vault", which has been in service since 1902. The floor slab made of "tamped concrete" rests on a bedrock of shell limestone. This building was cleverly constructed, being designed to protect the delicate seismic instruments from heat and humidity.

The main chamber is full of measuring equipment that is still functional: the astatic horizontal seismograph, the 17-ton pendulum and the vertical seismograph. Seismographic needles trace the movements registered by the instrument on paper coated with soot.

The functional principle of a seismograph is based on the inertia of mass, which involves a spring-mounted mass. While the earth's movement is transmitted to the housing of the instrument, the mass initially remains at rest due to its inertia. The relative movement of the ground can thus be measured as a longitudinal change over time.

The "New Seismograph Vault". The so-called "New Seismograph Vault" was built on the north and east side of the Old Earthquake Vault in 1925. This building used to house other seismographs developed by the institute as well as calibration equipment, but nothing   of these instruments remains to be seen.

Since 2005, earth tremors have been registered by a modern broadband seismometer installed in the New Seismograph Vault. This allows comparisons to be made between old and new. Further, the station at Göttingen is a member of the network of German seismological stations. The data is continuously transmitted via the Internet to the Federal Institute for Geosciences and Natural Resources (BGR) in Hanover.



Earthquake Sichuan, China 12.05.2008 06:28:01 UTC, magnitude 7.9 – measured with the 17-ton pendulum.

The Seismographs in the “Old Earthquake Vault”

Astatic Horizontal Seismograph

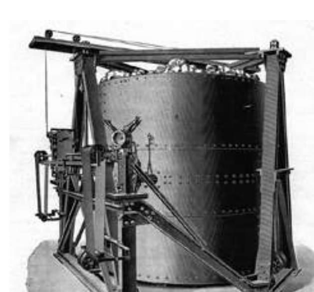
Built in: 1902
Built by: *G. Bartels*, Göttingen
Type: an inverse pendulum, stabilised with small springs, air-dampened
Mass: 1,200 kg steel cylinder, gimbal-mounted in labile equilibrium on flat springs
Mechanical magnification: 100 - 300x
Mechanical magnification: 100 – 300x
Dominant period of instrument: approx. 11 sec
Writing speed: 16 mm/min
Paper feed: controlled by mechanical movement
Miscellaneous: Prototype for similar instruments that set the standard worldwide for more than 100 observatories over 5 decades, and were described in detail in classical textbooks of seismology; subsequently going into serial production at *Spindler & Hoyer*, Göttingen.

The astatic horizontal seismograph features an inverse pendulum stabilised with springs.

17-Ton Pendulum

Built in: 1904
Built by: workshops of *G. Bartels* and *Spindler & Hoyer*, Göttingen
Type: short-period horizontal seismograph, air-dampened
Mass: 17,000 kg (barite), forming a cup-shaped pendulum
Mechanical magnification: 2,200x
Dominant period of instrument: approx. 1 sec
Writing speed: 60 mm/min
Registration north-south component: since 1905
Registration east-west component: since 1932
Miscellaneous: Prototype for several instruments built by *Spindler & Hoyer*, sophisticated mechanism: needle already moves if a strong breath of air is directed at the iron bucket. The astatic horizontal seismograph features an inverse pendulum stabilised with springs.

Seismograph with 17-ton pendulum. The iron bucket contains barite.



Design for a seismograph drawn by *Spindler & Hoyer*.

Vertical Seismograph

The vertical seismograph has acted as a prototype for many similar models in observatories all over the world.

Built in: 1904/05
Built by: *G. Bartels* and *Spindler & Hoyer*
Type: vertical seismograph, air-damp-ened
Mass: 1,300 kg suspended from eight spiral springs
Mechanical magnification: 230x
Dominant period of instrument: approx. 3.5 seconds
Writing speed: 16 mm/min
Miscellaneous: Records virtually non-stop, prototype for similar instruments at many observatories.

The Gaußhaus. In 1833, Carl Friedrich Gauß had a small building put up in the garden of Göttingen's observatory in Geismar Landstraße, so he could carry out experiments and geomagnetic studies, together with the physicist Wilhelm Weber. Assisted not only by Weber, but also Alexander von Humboldt, Gauß is considered to have played a pioneering role in geophysics with his investigations into the earth's magnetic field – not to mention other ground-breaking research. The Gaußhaus was moved to the site of the Earthquake Station in 1902. It also has a special design feature: to ensure that magnetic experiments went as smoothly as possible, it was built entirely out of wood and non-ferrous metals, e.g., using copper nails.

The Gaußhaus is only a stone's throw away from the scaffolding of the Mintrop ball.

The Samoa Hut. It is not possible to say if the structure is the original or a replica. In any event, it was set up on Samoa as an outpost of Göttingen's seismological station for use by German researchers. It was built in 1902 on the Mulinu'u Peninsula near Apia, the capital of Samoa. The measuring station was far enough away from Göttingen to register comparable values. The Samoa Observatory still exists today, and the Samoa Hut is a splendid reminder of that cooperation.


The Samoan peninsula was home to an outpost of Göttingen's Earthquake Station. Photo: Otto Tetens


Quite distinctive – the Samoa Hut at the site of the seismological station.


Photo: Otto Tetens
The scientists from the observatory on Samoa – here observing an eclipse of the sun, which can be seen as a shadow cast on a piece of paper.

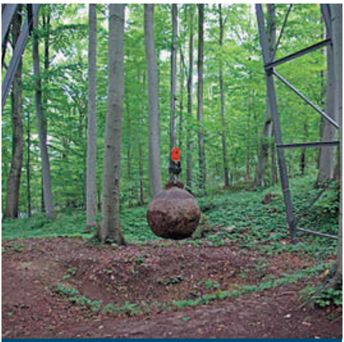
The Astronomical Hut.

The Astronomical Hut also dates from 1902. It houses a passage instrument installed on a large stone plinth. Although it is trained on the sky, it was used not so much for observing the stars as for the astronomical determination of time. An electrical pulse was amalgamated with the seismogram, allowing the seismic data acquired at different locations around the world to be synchronised.


Time synchronisation using a passage instrument in the Astronomical Hut.


Mintrop ball with a (modern) release mechanism.

Mintrop ball – Making Money in Texas. Ludger Mintrop was an able student of Wiechert's, and one of the founders of modern geophysics. In 1908, he became the first person to artificially produce sizeable earthquakes – an idea that would later make him a lot of money. He had a steel scaffolding built at the seismological station, and used it to drop a 4-ton steel ball (donated by Krupp), 14 metres onto the bedrock of shell limestone. Transportable seismographs were used to register the resulting artificial seismic ground waves at various distances with a magnification of up to 50,000.


A hoist is used to winch up the 4-ton ball.

These experiments soon gave rise to the seismic exploration method. Mintrop replaced the heavy balls with dynamite later on. The prospecting company *Seismos GmbH* was founded in 1921, with Mintrop taking a major stake in the business. With his method, Mintrop succeeded in creating a "3-D picture" under the Earth's surface, identifying distinctive boundaries in rock, and localising specific layers of solid or liquid matter. For example, crude oil and other mineral resources.

This pioneer of geophysics used his patented seismic measurement technique to search for deposits all over the world, in particular, oil – a course of action that not only brought him recognition, but also great business success.

Living Scientific History

The Wiechert Earthquake Station is a testimony to Göttingen's scientific history that can be experienced first-hand. Its importance in terms of both the past and the present has been kept alive for the general public by the association "Wiechert'sche Erdbebenwarte Göttingen e.V.", founded in 2005. It is thanks to the efforts of its members, and in its chairman, Wolfgang Brunk, in particular, that the entire site has been purchased by the association, and is thus being preserved for posterity. Without their efforts, it is likely the property would have been sold, and its equipment removed.

Visitors watched an experiment with the Mintrop ball on 21.6.2006 – scheduled to become a regular monthly event in future.

The association considers that the history of the Earthquake Station is also a good example of how science, a questing mind, and courage can lead to success in business. HAWK, Göttingen's state university of applied sciences and arts, the University of Göttingen, and long-established or newer companies based in the region, offer an ideal environment for entrepreneurs , especially firms from "Measurement Valley."

Wolfgang Brunk at the monitors of the new seismograph in the "New Seismograph Vault".

A look into the Gaußhaus. Udo Wedeken (right) explains the Gauß-Weber telegraph to visitors.

In 2006, the Earthquake Station was included as a landmark of the "Germany – Land of Ideas" image campaign. The Mintrop ball then fell to the ground again to produce artificial earth tremors for the first time in nearly a century, meeting with strong interest from the general public.

Public Demonstrations

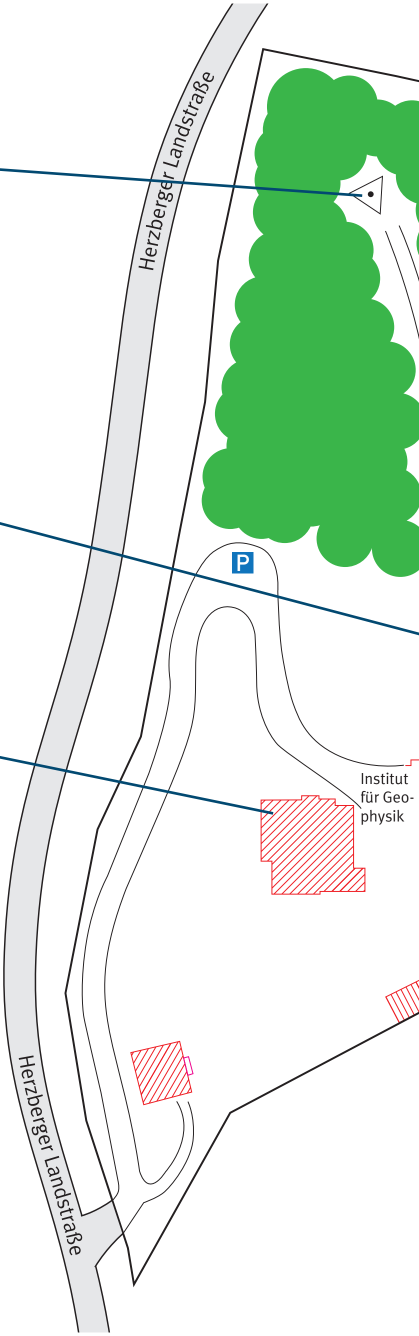
Visitors to the Earthquake Station will soon be able to witness the release and free fall of the Mintrop ball on the first Sunday of every month, between 2 and 5 pm, weather permitting. Public tours of the seismological station are also available.

Plan of the Site.

Drop tower for the Mintrop ball – view from a height of 14 m.

The Samoa Hut.

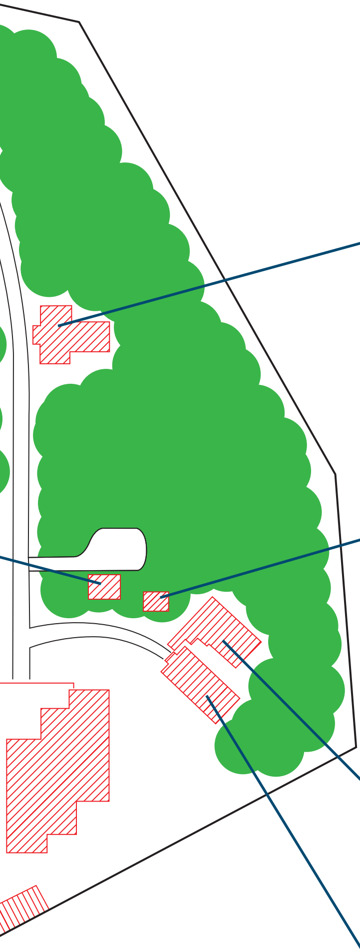
Former Institute of Geophysics (1901–2005).



The Address

Wiechert'sche Erdbebenwarte
Herzberger Landstraße 180
37075 Göttingen

The area of the Wiechert Earthquake Station.

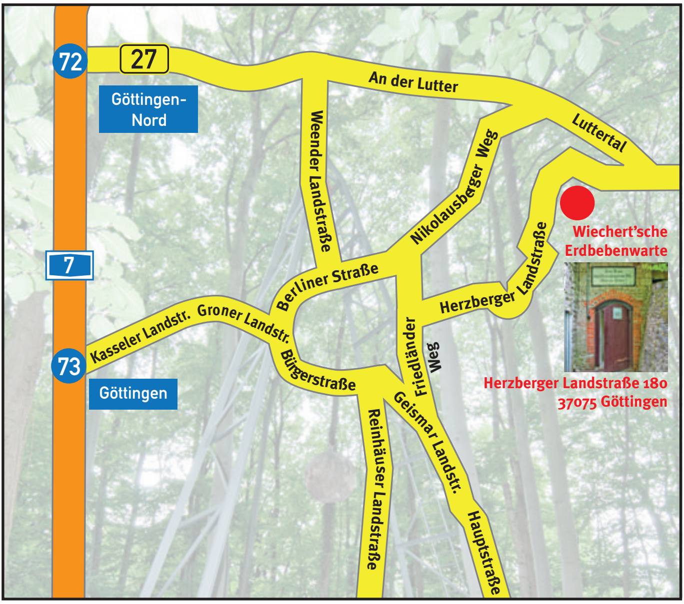


Gaußhaus.

The Astronomical Hut.

A look into the “New Seismograph Vault”.

A look into the “Old Earthquake Vault” when open to the public.



Wiechert'sche Erdbebenwarte

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Why Not Become a Member of the Association?

We'd also be delighted if you made a donation. Donations to:
Sparkasse Göttingen · bank code 260 500 01 · account No.137 570
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On the first Sunday of every Month:

Public Tours: Guided tours, and the dropping of the Mintrop ball, are available to the public on the first Sunday of every month between 2 and 5 pm, weather permitting.

The association thanks its sponsors for creation of this flyer:

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