

Mass Spectrometers

A Caltech History

Since the invention of the mass spectrograph nearly a century ago, scientists and engineers have worked to refine this versatile piece of instrumentation, and recent advancements in mass spectrometry have yielded new insights across and within a wide range of fields.

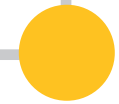
For example, the lab of John Eiler, Caltech's Robert P. Sharp Professor of Geology, has designed a prototype mass spectrometer, Thermo IRMS 253 Ultra, that allows researchers to determine the temperatures at which mineral samples from the distant past formed. The way rare isotopes bond with each other—or clump—depends on temperature, so measuring the clumping of specific isotopes provides a means of estimating the temperature of the environment in which a mineral was formed. With support from Caltech trustee Charlie Trimble (BS '63, MS '64) and a partnership with Thermo Fisher Scientific, Eiler and his team have determined that the temperature of early Mars would have been conducive to life, and that sauropods—the largest land animals to ever have lived on Earth—were not cold-blooded, as previously believed.

In another field, Michael Roukes, the Robert M. Abbey Professor of Physics, Applied Physics, and Bioengineering, is working on yet another iteration of mass spectrometry. Roukes and a team of researchers from France and from Caltech's Kavli Nanoscience Institute have created the first-ever mechanical device that can measure the mass of individual molecules, a development that may eventually help diagnose disease or measure air pollution.



1919

Francis Aston builds the first mass spectrograph, an apparatus that separates out charged ions.



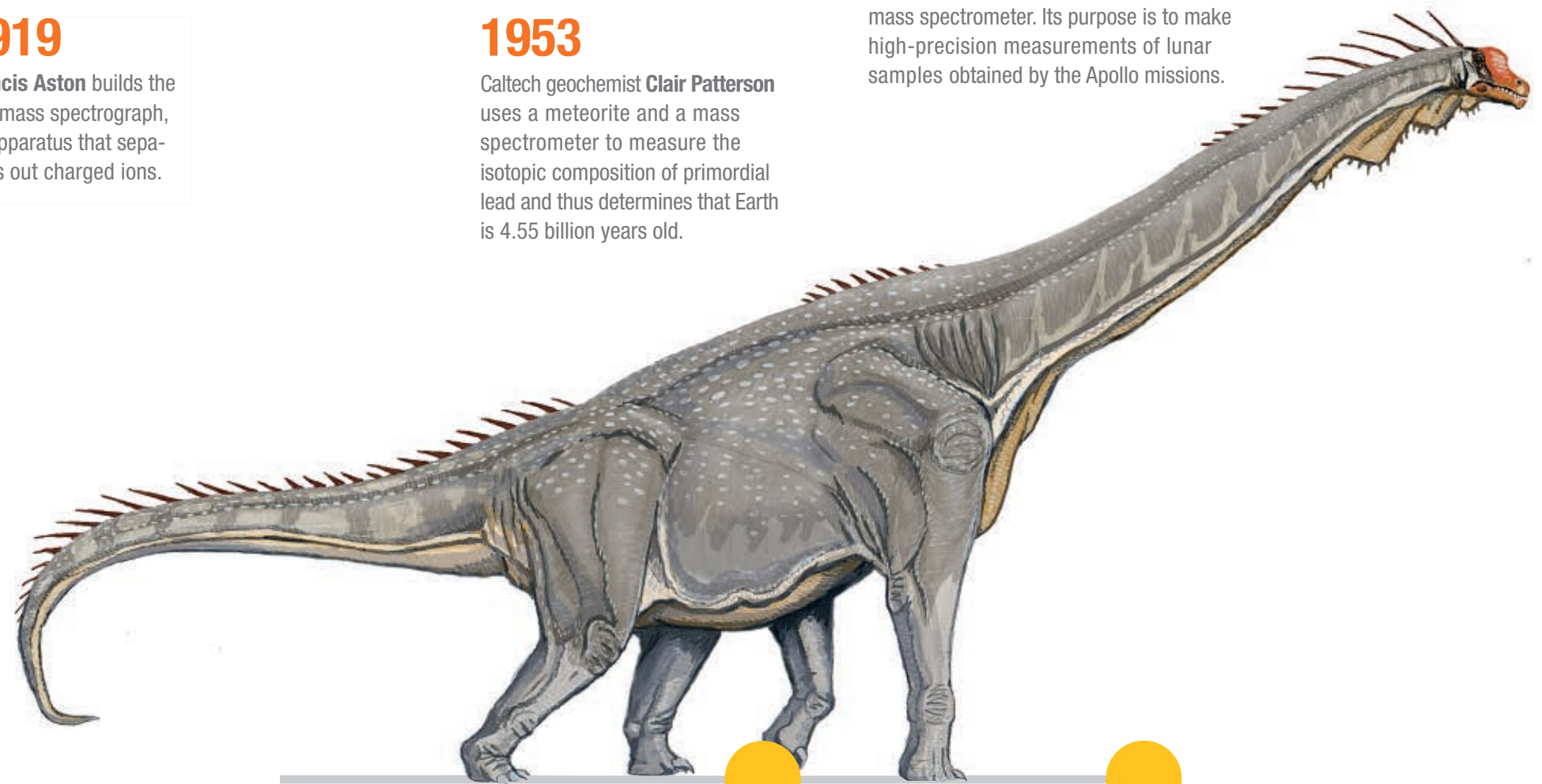
1953

Caltech geochemist Clair Patterson uses a meteorite and a mass spectrometer to measure the isotopic composition of primordial lead and thus determines that Earth is 4.55 billion years old.



1968

Caltech geologist Gerald Wasserburg completes Lunatic I, the first fully digital mass spectrometer. Its purpose is to make high-precision measurements of lunar samples obtained by the Apollo missions.



2011

Researchers in the lab of geochemist John Eiler design a prototype mass spectrometer that shows that sauropods were not cold-blooded.



2015

Physicist Michael Roukes and colleagues develop a nanodevice that can weigh a single molecule.