The resulting ions are accelerated by an electric field, collimated, or restricted to a narrow beam, and the beam is then bent by a strong magnetic field.

In this magnetic field, the heavier ions (^{40}Ar) are bent in a slightly larger arc, owing to their greater momentum than the lighter ions (^{36}Ar). In this way isotopes of differing masses are separated from one another. A detector downstream of the bending magnet signals the counts of each isotope, allowing the determination of the relative abundances.

This new instrument achieved high detection sensitivity by measuring the same gas sample over and over. It was this concept and realization of design, which paid such meticulous attention to reduced contamination, that enabled the extremely small amount of argon gas contained within the young rocks to be measured accurately.

With this instrument, geologists ingeniously solved the problem of dating rocks near the spreading seafloor. They also exploited the fact that molten rock, as it solidifies, retains a remnant magnetism that records the direction of the earth's magnetic field at the time of its solidification.

The earth's magnetic field is in constant motion reversing itself at irregular intervals as many as a dozen times in the geologically short span of 5 million years. A plot of the reversals over time would show a highly unique and distinctive pattern.

Using the Basic Energy Sciences instrument, researchers sampled young rocks of volcanic (molten) origin from lava flows all over the world, dated them precisely, and recorded the remnant magnetism of each dated sample. They meticulously charted over time the changing direction of the earth's magnetic field. This research progressively built up, with increasing resolution as more samples were added, a time-sequenced plot of magnetic field reversals.

For the time period of interest—the last 5 million years—this research produced, with some missing segments, a diagram with unmistakable patterns. This diagram would serve as the reference. Any series of magnetic field reversals which matched these patterns, or a portion thereof, could thus be linked to the diagram and accurately placed on the scale of geologic time.

All the while, oceanographers continued to map the mid-ocean ridges. Using ship-towed magnetometers, they recorded the direction of the remnant magnetism of the seafloor rocks below. They, too, discovered distinct patterns of magnetic field reversals. Importantly, they formed mirrored images on both sides of the ridge.

Hampered by geologic faults and large discontinuities in the rough terrain of the mid-ocean ridges, the patterns which the researchers had hoped might be linked to the time-sequenced diagram were at first inconsistent and inconclusive. Eventually, however, perseverance yielded data with sharper resolution—and one surprise. A previously hidden, unusually brief, magnetic field reversal appeared like a distinctive, identifying "spike" in the magnetometer data from the seafloor. As perversity would have it, the geologic period during which this spike had occurred was one of the few missing segments in the time-sequenced diagram developed by the lava samplers.

Eventually, the lava sample which contained the "spiked" reversed field was found in the Jemez mountains of northern New Mexico, near a creek named Jaramillo. The magnetometer maps from the seafloor had suggested where to look—in lava flows of a certain age—with remnant magnetism pointing in a certain direction. The Basic Energy Sciences instrument confirmed the hunch by accurately dating the Jaramillo rock sample and placing it precisely in the expected position on the time-sequenced diagram of field reversals.

The diagram in this most crucial area was now complete. The data were conclusive. The irregular patterns of magnetic field reversals from the seafloor matched exactly those from the lava samples whose ages had been accurately determined. The identical patterns fixed the ages of seafloor rocks, proved that the youngest rocks were closest to the mid-ocean ridge, and showed that the age of all rocks increased with distance from the ridge. The magnetometers had already revealed the mirrored images on both sides, thus completing the three-pronged proof.

Based on this evidence, the conclusions were irrefutable. The continents, indeed, are adrift. Years later, improved drilling and coring of seafloor rocks independently confirmed these conclusions and extended their validity. With this crowning achievement, the broader theory of plate tectonics