

unstable levels. When the clay is first fired in the kiln, each electron falls back to its stable position; this establishes the zero point on the time scale. Then much later, when a fragment of this ancient pottery is heated in the laboratory, the intensity of the photons of light (heat luminescence) emitted by the electrons as they fall back to their stable positions is representative of the accumulated radiation damage and hence of the time elapsed since the original firing of the pottery.

This technique has shown that some of the pots tested date back at least 8000 years, which is believed to be the beginning of pottery manufacture: The margin of error for pottery that old is plus or minus 300 years, but this range of uncertainty is expected to be reduced with continued development of the method.

Thermoluminescence dating has also been used on clay artifacts such as ancient Etruscan statues. Chemists at the University of Pennsylvania Museum, using this process, determined that one of their own treasures, the Etruscan Lady, was no lady in that her age was misrepresented. Tests proved that she was little more than 100 years old rather than the 2000 years claimed. A second figure tested, Diana the Huntress, owned by the St. Louis City Art Museum, was also found to be of modern origin. It is possible that both statues were made by a nineteenth-century Italian forger. The St. Louis case resulted in a lawsuit, which should be fair warning for future art dealers and collectors.

Cesium magnetometer

The more mechanical aspects of archaeology, such as excavation, also receive attention from those who develop isotopic applications. For example, a cesium magnetometer, used as a field instrument somewhat like a Geiger counter, can detect unusual archaeological remains located 20 feet underground. This highly sensitive instrument, originally designed for space research, is not strictly a nuclear device since it operates on the principle of the Zeeman effect in stable isotopes. It can measure changes in earth magnetism which would indicate the presence well below the surface of anomalous material such as tiles or bricks. If such irregularities are indicated on the magnetometer—and this instrument not only can detect but also can distinguish between stone, tile, brick, or glazed pottery—then drilling can take place in the designated area.