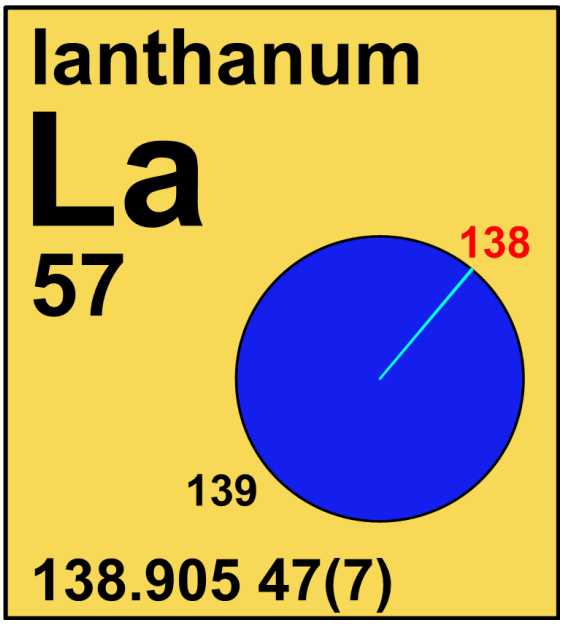
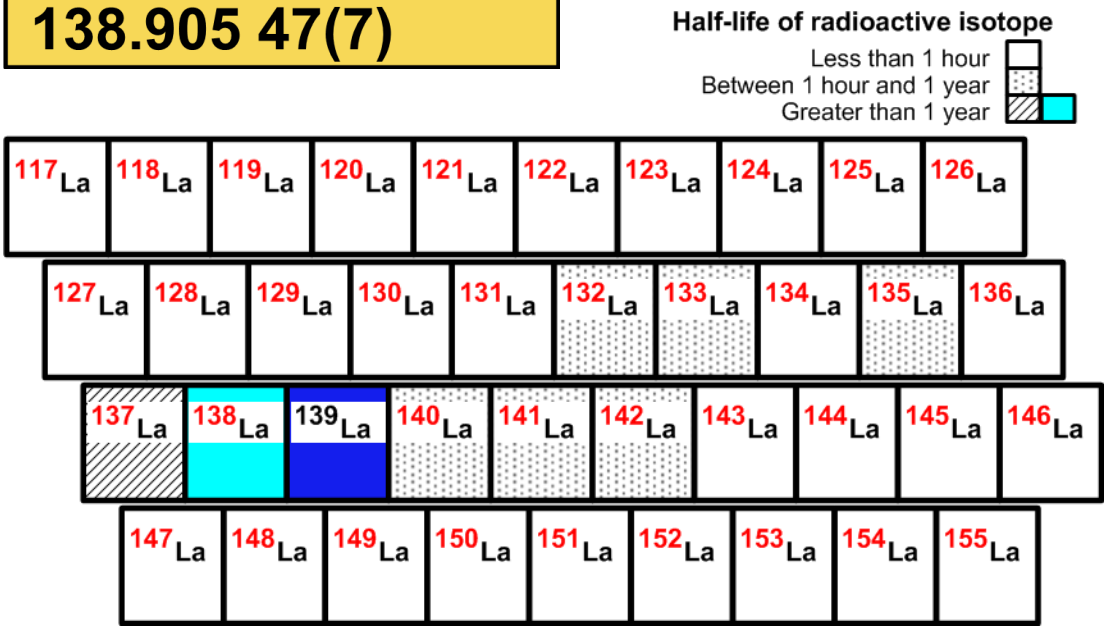
4.57 lanthanum



Stable isotope	Relative atomic mass	Mole fraction
^{138}La†	137.907 12	0.000 8881
^{139}La	138.906 36	0.999 1119

† **Radioactive isotope** having a relatively long **half-life** (1.06×10^{11} years) and a characteristic terrestrial **isotopic composition** that contributes significantly and reproducibly to the determination of the **standard atomic weight** of the **element** in **normal materials**.



4.57.1 Lanthanum isotopes in Earth/planetary science

Studies have shown that ^{138}La can be used along with ^{138}Ce and ^{136}Ce to measure time elapsed from a **supernova** explosion producing large numbers of **neutrinos** [412].

4.57.2 Lanthanum isotopes in geochronology

^{138}La decays to ^{138}Ce and ^{138}Ba, respectively, by **beta decay** with a **half-life** of 1.06×10^{11} years and by electron capture with a half-life of 1.56×10^{11} years. The **isotope-amount ratio** $n(^{138}\text{Ce})/n(^{142}\text{Ce})$ has been used for dating rocks on long time scales (billions of years) and as a chemical **tracer** in geochemistry [413]. The increase in **radiogenic** ^{138}Ba in rocks enriched in rare earth **elements**, such as allanite, enables one to determine the age of such rocks (Figure 4.57.1) [414].

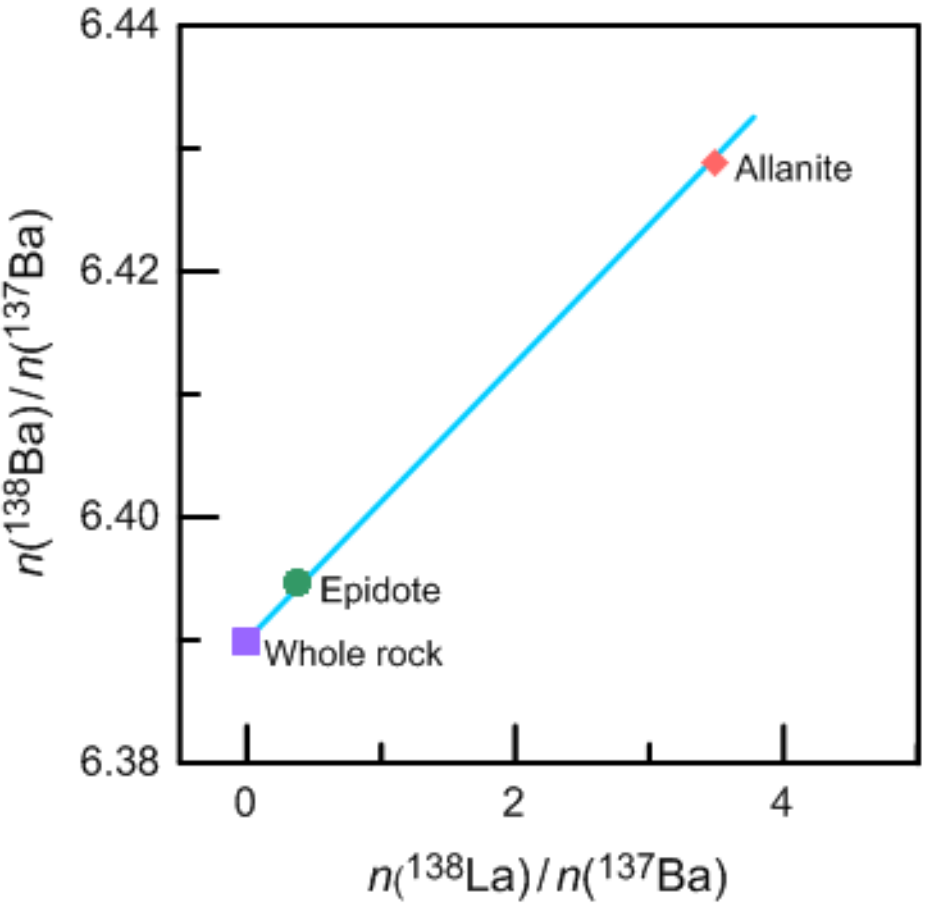


Fig. 4.57.1: Cross plot of the **isotope-amount ratio** $n(^{138}\text{Ba})/n(^{137}\text{Ba})$ and the **mole ratio** $n(^{138}\text{La})/n(^{137}\text{Ba})$ in rocks and minerals from Amîtsoq, West Greenland, which yield an age of 2.408×10^9 years [414].

4.57.3 Lanthanum isotopes used as a source of radioactive isotope(s)

^{139}La is used for the production of the medical **radioisotope** ^{139}Ce via the ^{139}La (p, n) ^{139}Ce reaction [415].