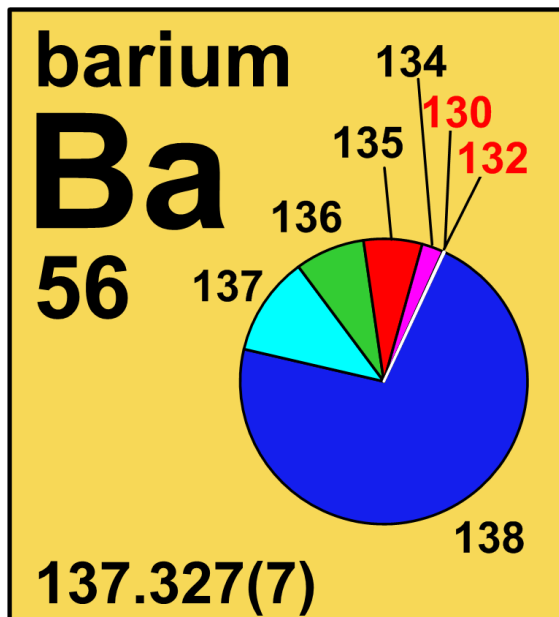


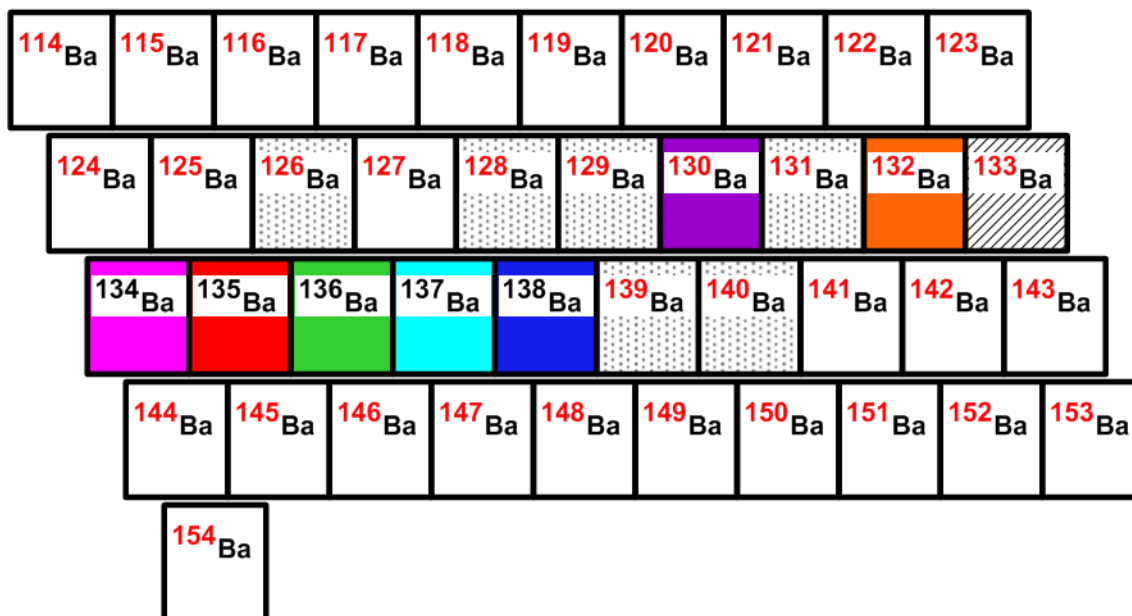
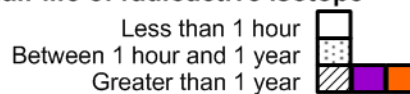
4.56 barium



Stable isotope	Relative atomic mass	Mole fraction
$^{130}\text{Ba}^\dagger$	129.906 32	0.0011
$^{132}\text{Ba}^\dagger$	131.905 061	0.0010
^{134}Ba	133.904 508	0.0242
^{135}Ba	134.905 688	0.0659
^{136}Ba	135.904 576	0.0785
^{137}Ba	136.905 827	0.1123
^{138}Ba	137.905 247	0.7170

† **Radioactive isotope** having a relatively long **half-life** 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**. Half-lives of ^{130}Ba and ^{132}Ba are 2.2×10^{21} years and 1.3×10^{21} years, respectively.

Half-life of radioactive isotope



4.56.1 Barium isotopes in Earth/planetary science

Because molecules, atoms, and ions of the **stable isotopes** of barium possess slightly different physical and chemical properties, they can be fractionated during physical, chemical, and biological processes, giving rise to variations in **isotopic abundances** and in **atomic weights**. von Allmen *et al.* [407] observed barium isotopic fractionation in the global barium cycle (Figure 4.56.1).

High-precision barium **isotope** measurements reveal differences of up to 25 parts per million in the **isotope-amount ratio** $n(^{137}\text{Ba})/n(^{136}\text{Ba})$ and 60 parts per million in the $n(^{138}\text{Ba})/n(^{136}\text{Ba})$ ratio between **chondrites** and the Earth. These differences probably arose from incomplete mixing of **nucleosynthetic** material in the **solar nebula**. Barium isotopes may be the **decay products** of now-extinct ^{135}Cs (with a half-life of about 1.6×10^6 years), which is thought to be a nucleosynthetic component. **Chondritic meteorites** have a slight excess of **supernova-derived** material as compared to Earth, demonstrating that the solar nebula was not perfectly homogenized upon formation (Figure 4.56.1) [408-410].

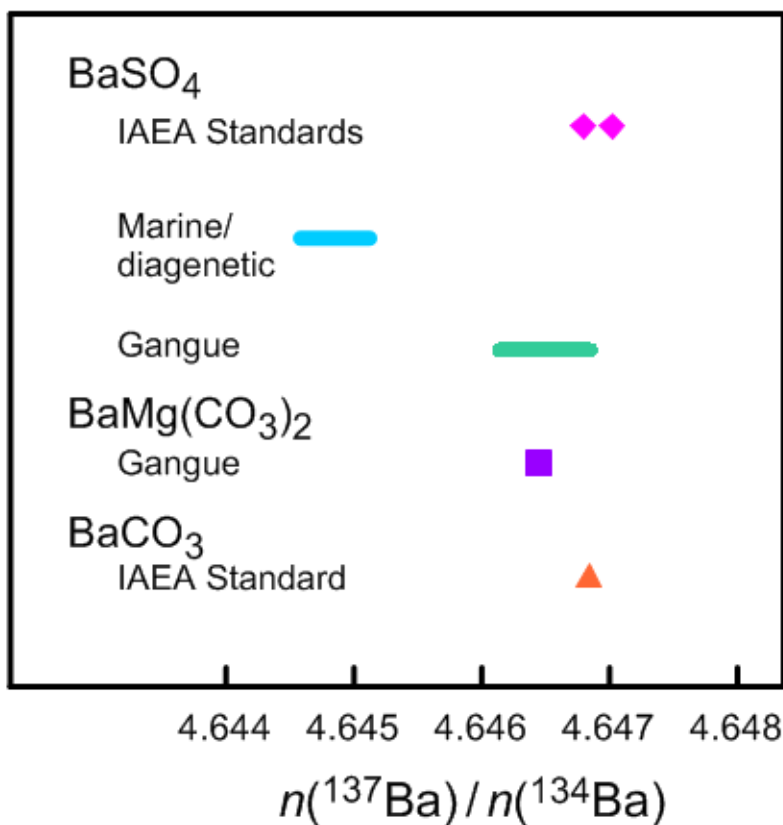


Fig. 4.56.1: Variation in **isotope-amount ratio** $n(^{137}\text{Ba})/n(^{130}\text{Ba})$ of selected barium-bearing substances (modified from [407], assuming a measured isotope-amount ratio $n(^{137}\text{Ba})/n(^{134}\text{Ba})$ of 4.6470 for mean terrestrial barium [411]).