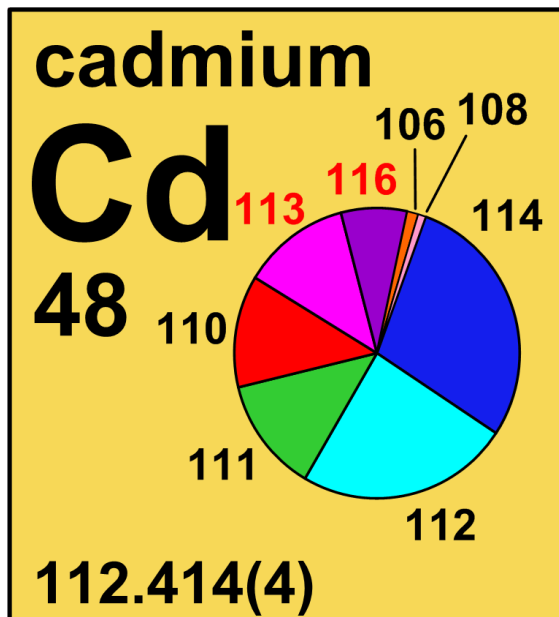





4.48 cadmium

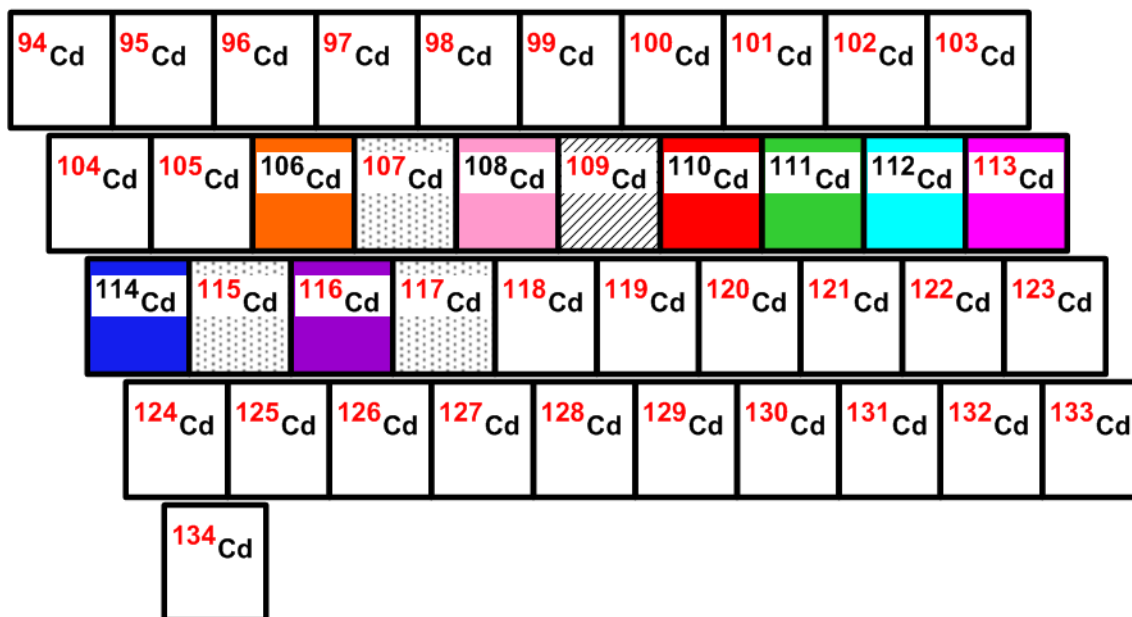


Stable isotope	Relative atomic mass	Mole fraction
^{106}Cd	105.906 460	0.012 45
^{108}Cd	107.904 183	0.008 88
^{110}Cd	109.903 007	0.124 70
^{111}Cd	110.904 183	0.127 95
^{112}Cd	111.902 763	0.241 09
$^{113}\text{Cd}^\dagger$	112.904 408	0.122 27
^{114}Cd	113.903 365	0.287 54
$^{116}\text{Cd}^\dagger$	115.904 763	0.075 12

† **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 ^{113}Cd and ^{116}Cd are 8.04×10^{15} years and 3×10^{19} years, respectively.

Half-life of radioactive isotope

Less than 1 hour 
Between 1 hour and 1 year 
Greater than 1 year 



4.48.1 Cadmium isotopes in biology

Metal accumulation is a threat to our world's water systems and wildlife. As a way to measure the influence of heavy metals on wildlife with mass spectrometric techniques, some researchers use animal food enriched in specific cadmium **isotopes**. These experiments work by exposing the animals to a diet enriched in ^{106}Cd and/or other **stable isotopes** of metals (for example, ^{65}Cu and/or ^{62}Ni) for a period of time. Depending on the purpose of the experiment, the **residence time** of the food in the gut is determined and **isotopic compositions** of the gut and/or feces are measured via **inductively coupled plasma mass spectrometry** (ICP-MS). This information is used to measure bio-uptake (absorption and incorporation of a substance by living tissue) and accumulation rates of metals in an exposed animal [352, 353].

4.48.2 Cadmium isotopes in Earth/planetary science

Molecules, atoms, and ions of the stable isotopes of cadmium possess slightly different physical and chemical properties, and they commonly will be fractionated during physical, chemical, and biological processes, giving rise to variations in **isotopic abundances** and in **atomic weights**. There are small but measureable variations in the isotopic abundances of dissolved cadmium in ocean water, which are a consequence of isotopic fractionation associated with biological uptake (Figure 4.48.1) [354-356].

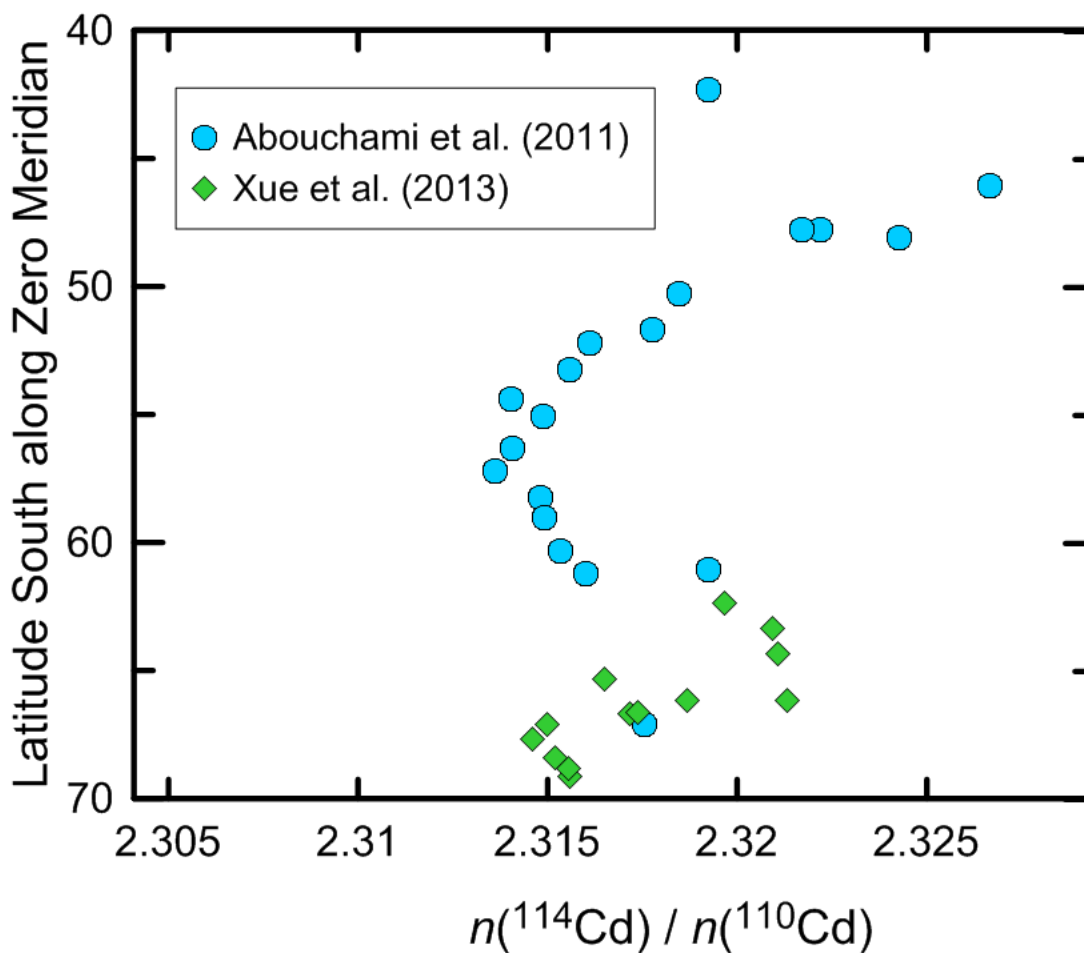


Fig. 4.48.1: Variations in the **isotope-amount ratio** $n(^{114}\text{Cd})/n(^{110}\text{Cd})$ of dissolved ocean cadmium as a function of latitude south for Zero Meridian surface water samples (modified from Xue *et al.* [356], with data from Abouchami *et al.* [355] assuming a $n(^{114}\text{Cd})/n(^{110}\text{Cd})$ value of isotopic reference material SRM 3108 of 2.304 07 [357]).

4.48.3 Cadmium isotopes used as a source of radioactive isotope(s)

^{112}Cd is used to produce the diagnostic **radioisotope** ^{111}In (with a half-life of 2.8 days) via the reaction $^{112}\text{Cd} (p, 2n) ^{111}\text{In}$ [91].