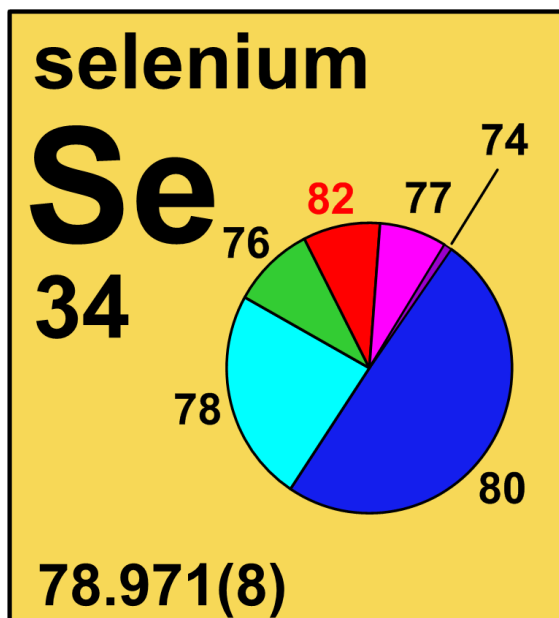





4.34 selenium

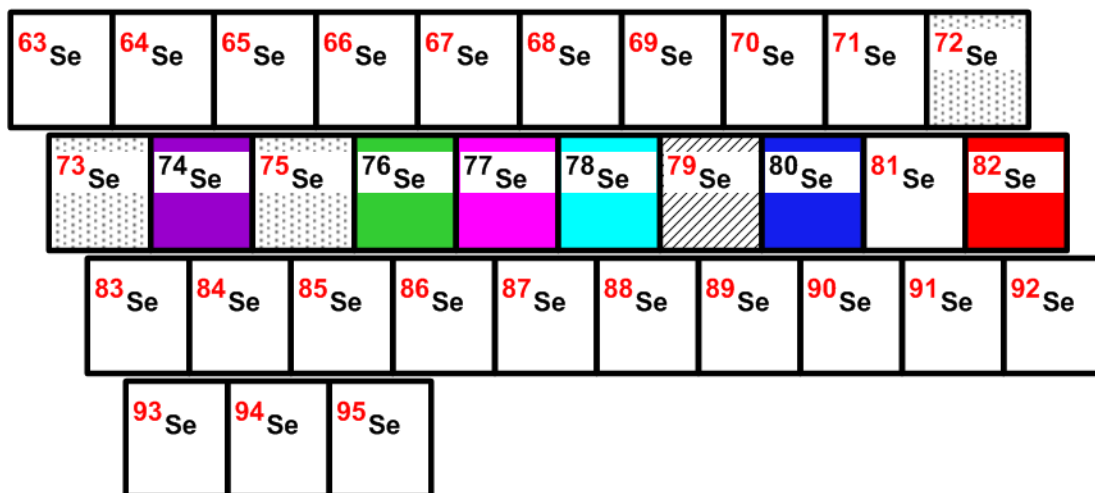


Stable isotope	Relative atomic mass	Mole fraction
^{74}Se	73.922 4759	0.0086
^{76}Se	75.919 2137	0.0923
^{77}Se	76.919 9142	0.0760
^{78}Se	77.917 309	0.2369
^{80}Se	79.916 522	0.4980
$^{82}\text{Se}^\dagger$	81.916 700	0.0882

† **Radioactive isotope** having a relatively long **half-life** (9×10^{19} 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**.

Half-life of radioactive isotope

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



4.34.1 Selenium isotopes in Earth/planetary science

Molecules, atoms, and ions of the **stable isotopes** of selenium 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**.

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There are measurable variations in the isotopic abundances of selenium in natural terrestrial materials (Figure 4.34.1).

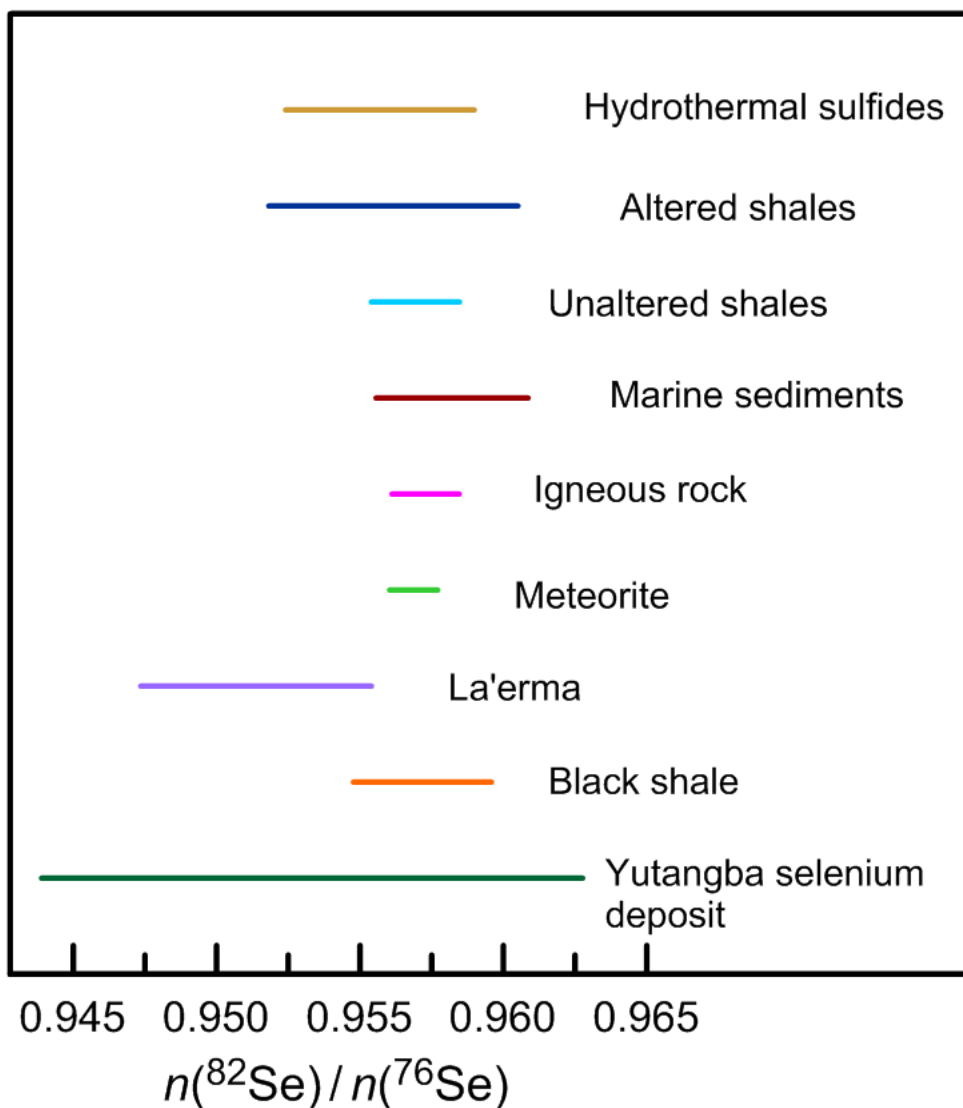


Fig. 4.34.1: Variation in the isotope-amount ratio $n(^{82}\text{Se})/n(^{76}\text{Se})$ of selected selenium-bearing materials (modified from [270]).

4.34.2 Selenium isotopes in industry

^{75}Se (with a half-life of 120 days) is used for **X-ray radiography** of welds to visualize welds and ensure that each weld is appropriate for its purpose [271].

4.34.3 Selenium isotopes in medicine

IUPAC

^{75}Se -selenomethionine (organic compound that combines to form proteins, found in Brazil nuts and soybeans) has been used to study the production of digestive enzymes (biological catalysts that accelerates chemical reactions) [272]. Selenium stable isotopes are used in metabolic studies to monitor selenium intake and output [273, 274].

4.34.4 Selenium isotopes used as a source of radioactive isotope(s)

^{77}Se and ^{78}Se are used to produce the therapeutic **radioisotope** ^{77}Br via the $^{77}\text{Se} (n, p) ^{77}\text{Br}$ and the $^{78}\text{Se} (n, 2p) ^{77}\text{Br}$ reactions, respectively. ^{80}Se is used to produce $^{80\text{m}}\text{Br}$ via the reaction $^{80}\text{Se} (n, p) ^{80\text{m}}\text{Br}$. The m the superscript of $^{80\text{m}}\text{Br}$ indicates a **metastable isotope**.