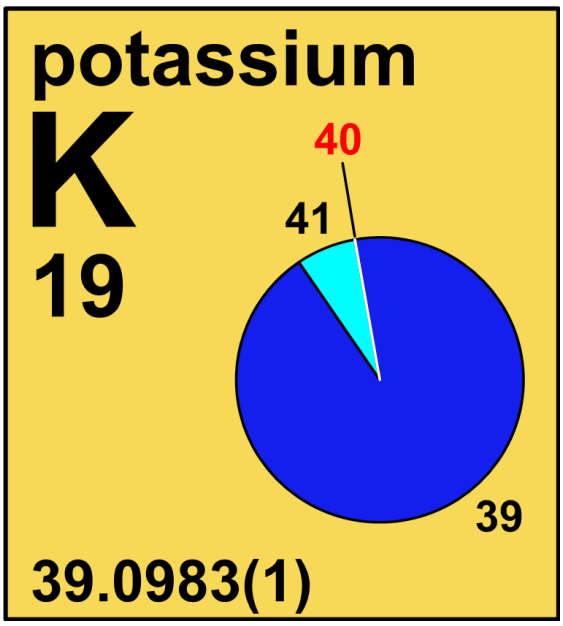
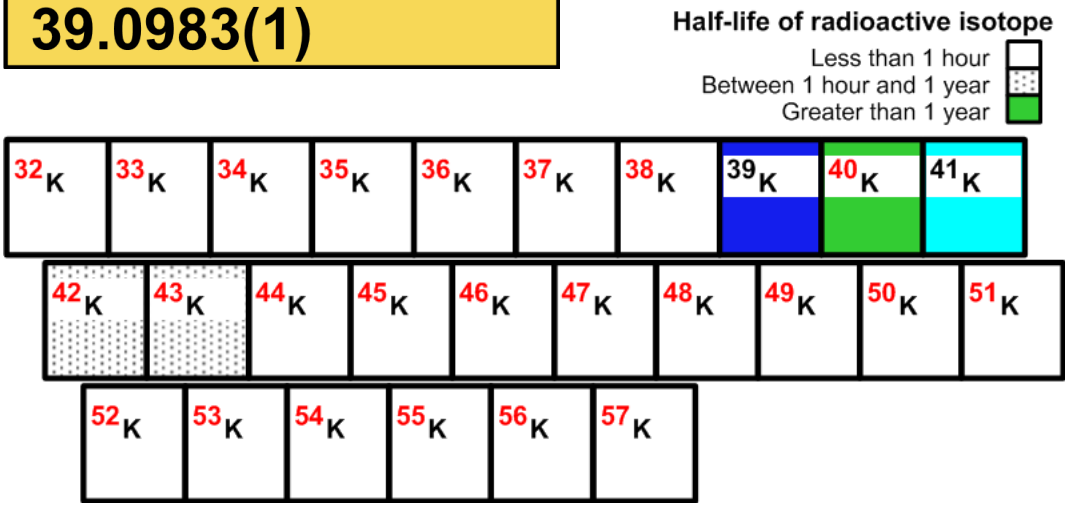
4.19 potassium



Stable isotope	Relative atomic mass	Mole fraction
^{39}K	38.963 706 49	0.932 581
^{40}K†	39.963 9982	0.000 117
^{41}K	40.961 825 26	0.067 302

† **Radioactive isotope** having a relatively long **half-life** (1.25×10^9 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**.



4.19.1 Potassium isotopes in biology

The **mole fraction** of ^{40}K ($n(^{40}\mathrm{K})/n(\mathrm{K})$) is used to study the effects of potassium in soil on the growth of plants. Plants need potassium to promote growth and reproduction, and potassium also helps plants resist drought and diseases. The mole fraction of ^{40}K is being studied at different depths in several soil types to determine how soil properties affect the fractionation of ^{40}K [175].

4.19.2 Potassium isotopes in geochronology

The **mole ratio** $n(^{40}\mathrm{K})/n(^{40}\mathrm{Ar})$ is used in potassium-argon dating by geologists, archaeologists, and paleoanthropologists to determine the age of rocks. This dating method is based on the

radioactive decay of ^{40}K, having a half-life of 1.248×10^9 years, to ^{40}Ar. When lava crystalizes, ^{40}Ar can no longer escape and begins increasing in concentration in a rock (Figure 4.19.1) [176, 177].

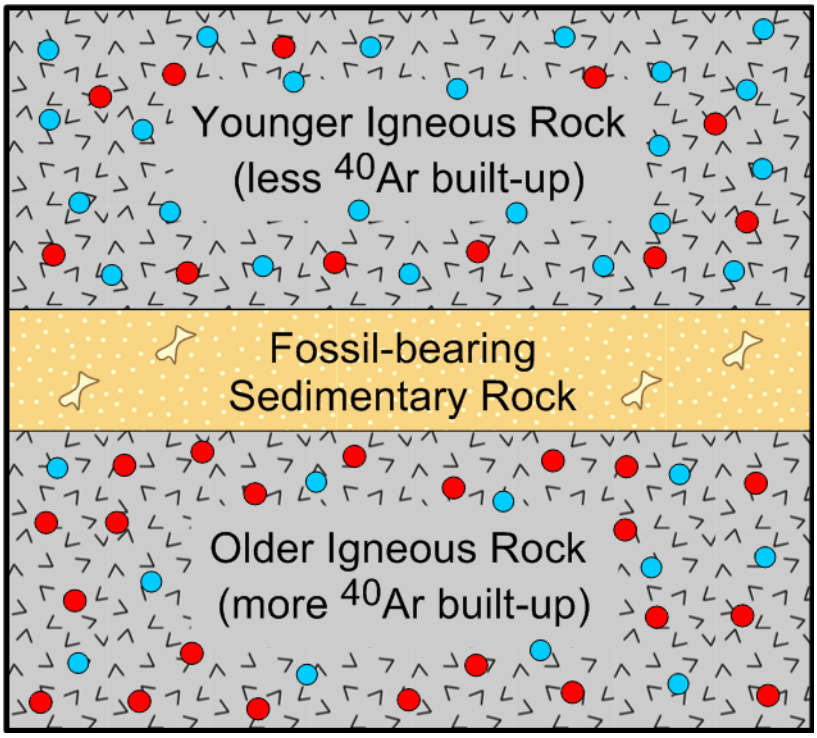


Fig. 4.19.1: Deeper, older **igneous** rocks will have a higher ^{40}Ar concentration than younger igneous rock, and this technique requires rocks older than 1×10^5 years in order that sufficient ^{40}Ar has accumulated.

4.19.3 Potassium isotopes in medicine

^{38}K, which has a half-life of 7.6 minutes and is produced by a nuclear reaction involving ^{38}Ar and ^{40}Ar as targets, is a widely used blood-flow **tracer**. Because ^{38}Ar is more expensive, ^{40}Ar, which also offers many additional advantages as a target, is more commonly used to produce ^{38}K for medical purposes [72, 173, 178].