4.19 potassium

### Potassium isotopes in biology

The mole fraction of $^{40}$K ($n(^{40}$K)/$n$(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].

### Potassium isotopes in geochronology

The mole ratio $n(^{40}$K)/$n$(^{40}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 $1.248 \times 10^9$ 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 $1 \times 10^5$ 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].