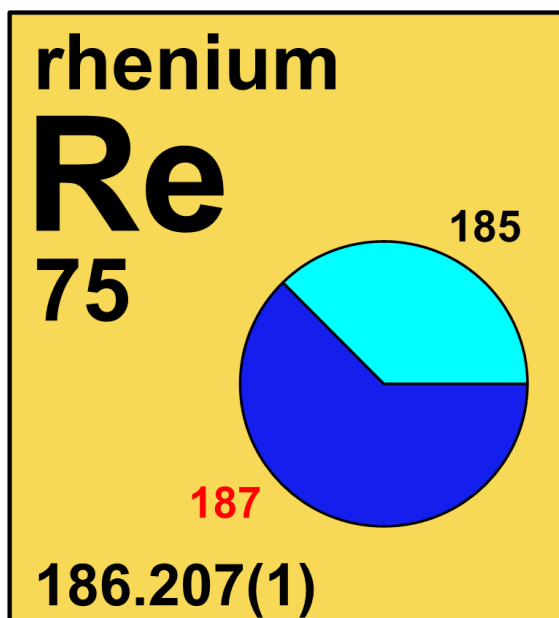


4.75 rhenium



Stable isotope	Relative atomic mass	Mole fraction
^{185}Re	184.952 955	0.3740
$^{187}\text{Re}^\dagger$	186.955 75	0.6260

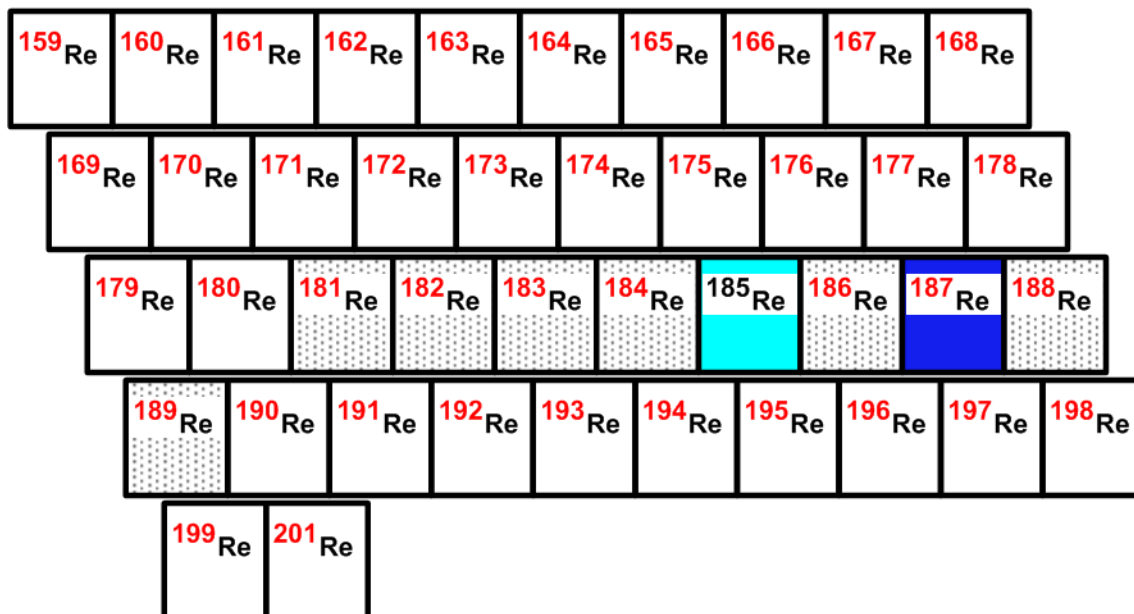
† **Radioactive isotope** having a relatively long **half-life** (4.16×10^{10} years) and a characteristic terrestrial **isotopic composition** that contributes significantly and reproducibly to the determination of the **standard atomic weight** of the element in **normal materials**.

Half-life of radioactive isotope

Less than 1 hour

Between 1 hour and 1 year

Greater than 1 year



4.75.1 Rhenium isotopes in geochronology

The rhenium-osmium dating method is of special interest for the dating of rhenium-bearing ores, gold deposits, copper-nickel deposits, and **meteorites**. This method is based on the **beta-decay** of ^{187}Re (having a **half-life** of 41.6×10^9 years) to ^{187}Os , an example of which appears in Figure 4.75.1 [512].

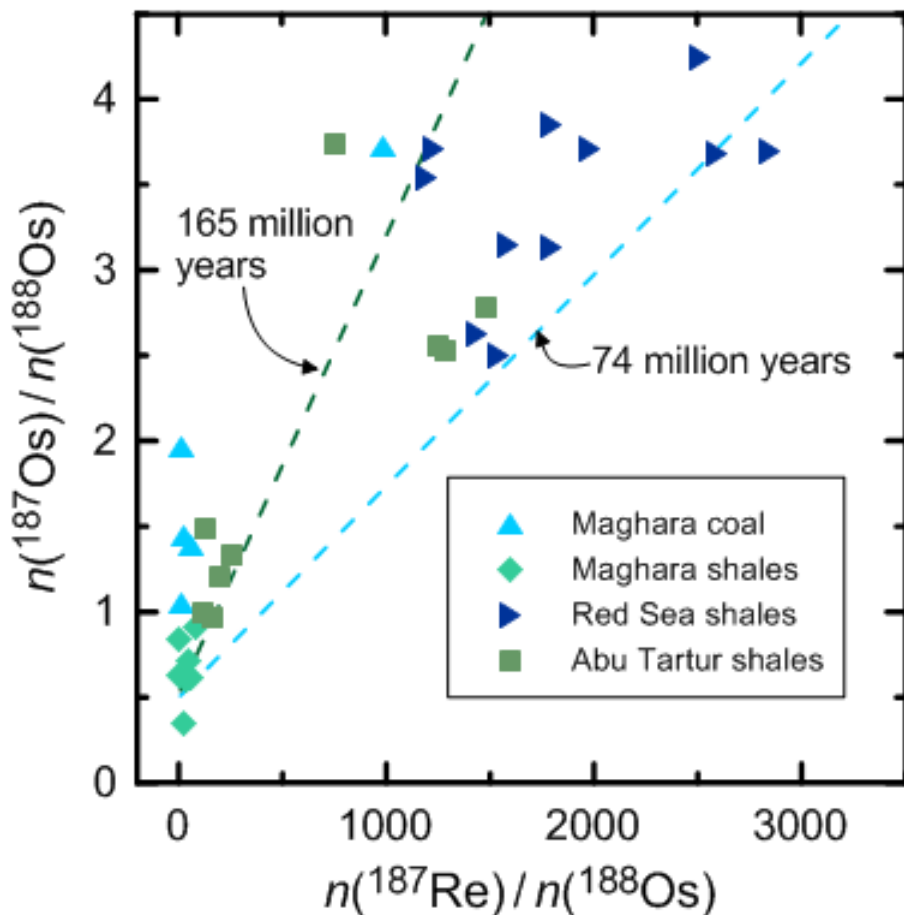


Fig. 4.75.1: Cross plot of $n(^{187}\text{Os})/n(^{188}\text{Os})$ isotope-amount ratio and $n(^{187}\text{Re})/n(^{188}\text{Os})$ mole ratio of marine and non-marine organic-rich sediments and coals from Egypt (modified from [512]). The Maghara area (~200 km east of Cairo) has middle-Jurassic coal beds ($\sim 165 \times 10^6$ years old, identified by the green dotted line). The age of marine black shales in the Red Sea area was previously estimated as 74×10^6 years old, identified by the blue dotted line. ^{187}Os is produced by decay of ^{187}Re . Samples from an older formation will have proportionally more ^{187}Os because of the longer accumulation time for ^{187}Os ; thus, the slope of the line for the Maghara coals (turquoise triangles), having an age of 165×10^6 years, is substantially higher than the slope of the Red Sea specimens. Note the analytical challenges in obtaining isotope-amount values that plot near the 165- and 74-million-year isochrons. Many of the values plot between the isochrons.

IUPAC

4.75.2 Rhenium isotopes in medicine

^{186}Re (with a half-life of 89 hours) is a beta-emitting **radioisotope** that is used for cancer treatment, in particular for pain relief in bone cancer and in rheumatoid arthritis (see **radiosynovectomy**). It is produced from the stable isotope ^{185}Re via the $^{185}\text{Re} (n, \gamma) ^{186}\text{Re}$ reaction [185]. ^{186}Re is also used for **radiolabeling** of cancer therapeutic agents [185]. ^{188}Re is used to irradiate coronary arteries with beta particles during insertion of an angioplasty balloon (a tiny balloon that is inserted into an artery and inflated to flatten plaque build-up and improve blood flow) and in **palliative** therapy, particularly for bone **metastases**. The beta irradiation can decrease scar tissue formation after the overstretching of arteries by angioplasty.