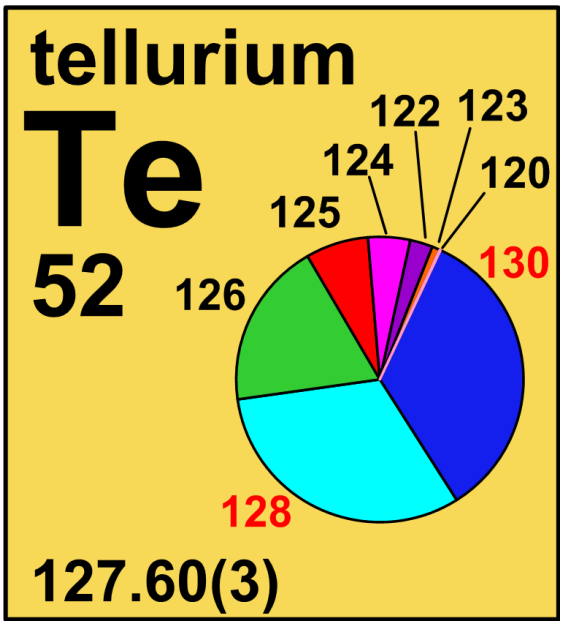
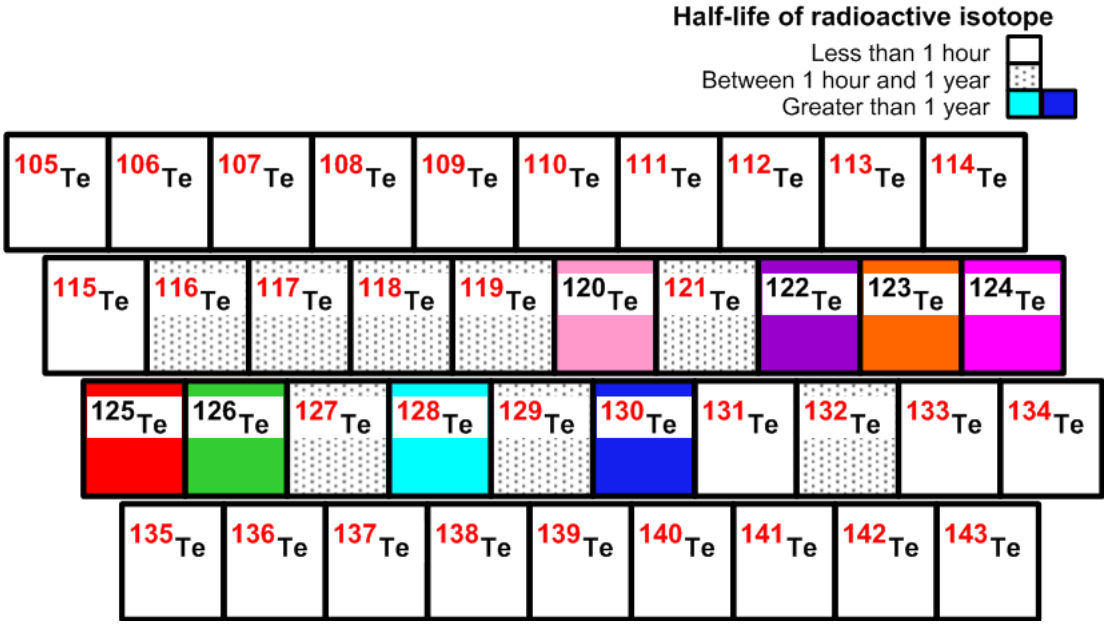
## 4.52 tellurium




| Stable isotope | Relative atomic mass | Mole fraction |
|---|---|---|
| $^{120}$Te | 119.904 06 | 0.0009 |
| $^{122}$Te | 121.903 04 | 0.0255 |
| $^{123}$Te | 122.904 27 | 0.0089 |
| $^{124}$Te | 123.902 82 | 0.0474 |
| $^{125}$Te | 124.904 43 | 0.0707 |
| $^{126}$Te | 125.903 31 | 0.1884 |
| $^{128}$Te† | 127.904 461 | 0.3174 |
| $^{130}$Te† | 129.906 222 75 | 0.3408 |

† **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**. The half-lives of $^{128}$Te and $^{130}$Te are $2.5 \times 10^{24}$ and $7 \times 10^{20}$ years, respectively.



### 4.52.1 Tellurium isotopes in Earth/planetary science

Tellurium **isotopes** are a mixture of **r-process**, **s-process**, and **p-process nucleosynthesis** products, making them useful for studying the contribution of stellar products to the molecular cloud from which the Sun and planets were formed (Figure 4.52.1) [375-377].

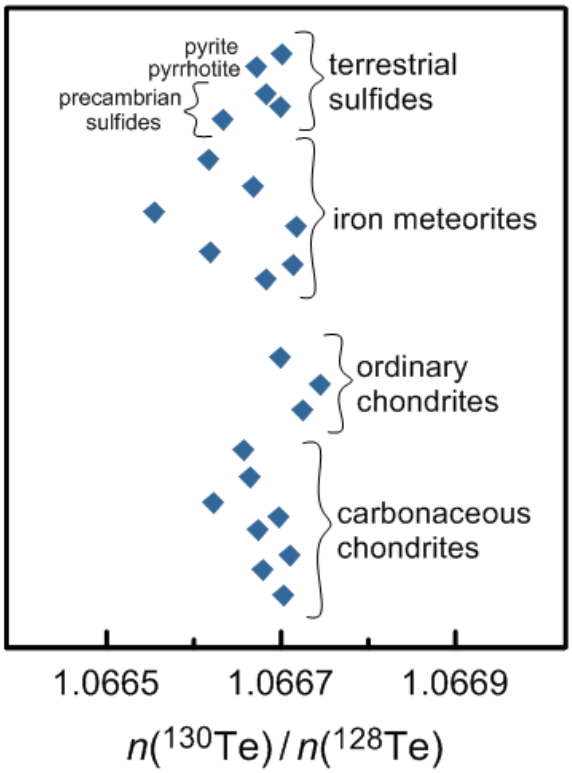



**Fig. 4.52.1:** Variation in **isotope-amount ratio** $n(^{130}\mathrm{Te})/n(^{128}\mathrm{Te})$ of tellurium in selected **meteorites** and terrestrial materials (modified from [377], assuming a measured isotope-amount ratio $n(^{130}\mathrm{Te})/n(^{128}\mathrm{Te})$ of 1.066 65 [378]. Based on these data, Fehr *et al.* [377] conclude that the regions of the solar disk that were sampled during accretion of meteorite parent bodies were well mixed and homogeneous on a large scale, with respect to tellurium **isotopes**.

### 4.52.2 Tellurium isotopes in geochronology

The **double beta decay** of $^{130}\mathrm{Te}$ has been used for the determination of gas-retention ages of tellurium minerals [379].

### 4.52.3 Tellurium isotopes used as a source of radioactive isotope(s)

$^{120}\mathrm{Te}$ is used for the production of $^{120g}\mathrm{I}$, where "g" indicates ground state, via the $^{120}\mathrm{Te}$ (p, n) $^{120g}\mathrm{I}$ reaction, which is used as a **positron emission tomography** (**PET**) and beta-emitting isotope

[380, 381]. $^{120g}$I has a half-life of 1.36 hours. $^{122}$Te is used in the production of the **radioisotope** $^{122}$I (with a half-life of 3.6 minutes) via the reaction $^{122}$Te (p, n) $^{122}$I, which is used in gamma imaging [382]. $^{123}$Te is used for the production of radioactive $^{123}$I (with a half-life of 0.55 day) via the $^{123}$Te (p, n) $^{123}$I reaction, which is used in thyroid imaging [383] and for ***in vivo*** medical studies using **single-photon emission computed tomography** (SPECT) [383]. $^{124}$Te is used for the production of both $^{123}$I and the PET isotope $^{124}$I via the $^{124}$Te (p, 2n) $^{123}$I and $^{124}$Te (p, n) $^{124}$I reactions, respectively [383-386]. The half-life of $^{124}$I is 100 hours.