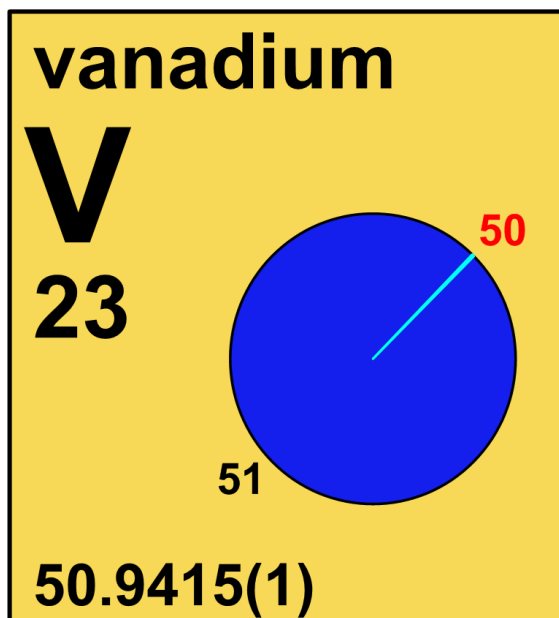


4.23 vanadium

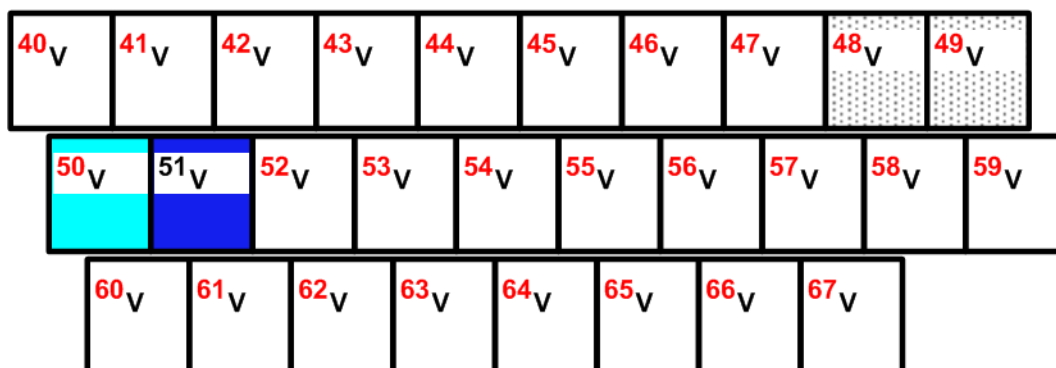


| Stable isotope | Relative atomic mass | Mole fraction |
|-------------------------|----------------------|---------------|
| $^{50}\text{V}^\dagger$ | 49.947 156 | 0.002 50 |
| ^{51}V | 50.943 957 | 0.997 50 |

† **Radioactive isotope** having a relatively long **half-life** (2×10^{17} 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 | |



4.23.1 Vanadium isotopes in Earth/planetary science

The **isotopic abundances** of ^{50}V and ^{51}V have been used as an indicator of planetary core formation processes (Figure 4.23.1). Vanadium is greatly depleted in the Earth's mantle compared with that in **chondritic meteorites (chondrites)**. It is assumed that the deficit of vanadium in the Earth's crust is accounted for by its partitioning into the core [199]. The ratios of ^{50}V and ^{51}V have been used as a test of the X-wind model, which accounts for a portion of the extinct radioactive nuclides present in the early Solar System by radiation from the young Sun [199]. ^{51}V is depleted in meteorites compared to Earth [200].

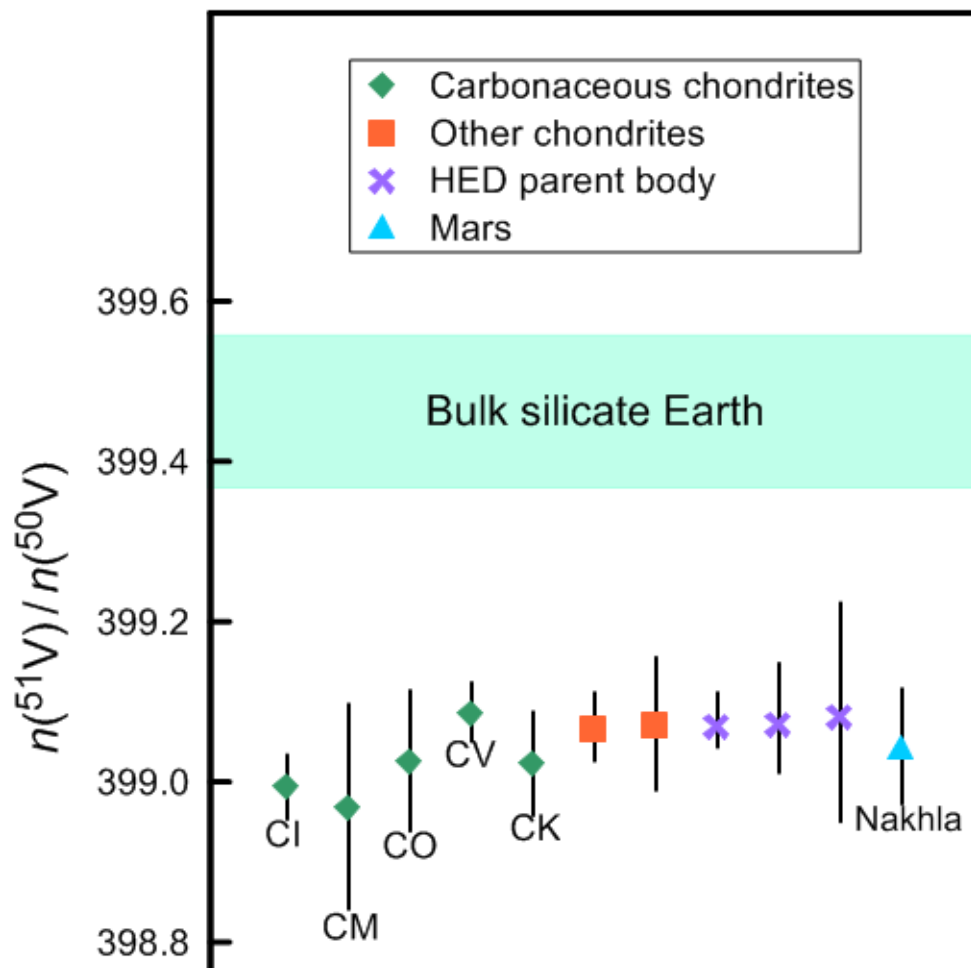


Fig. 4.23.1: Variation in the **isotope-amount ratio** $n(^{51}\text{V})/n(^{50}\text{V})$ of selected **meteorites** and that of bulk silicate Earth (modified from [200], assuming a measured $n(^{51}\text{V})/n(^{50}\text{V})$ isotope-amount ratio of 399.5 [201]).

4.23.2 Vanadium isotopes in industry

^{51}V is used in solid state **Nuclear Magnetic Resonance (NMR)** to provide information to material scientists about surface species of vanadium oxide catalysts (substances that increase the rate of chemical reactions without themselves undergoing any permanent chemical change), their interaction with the supporting material, and their reactions during catalytic processes [202].