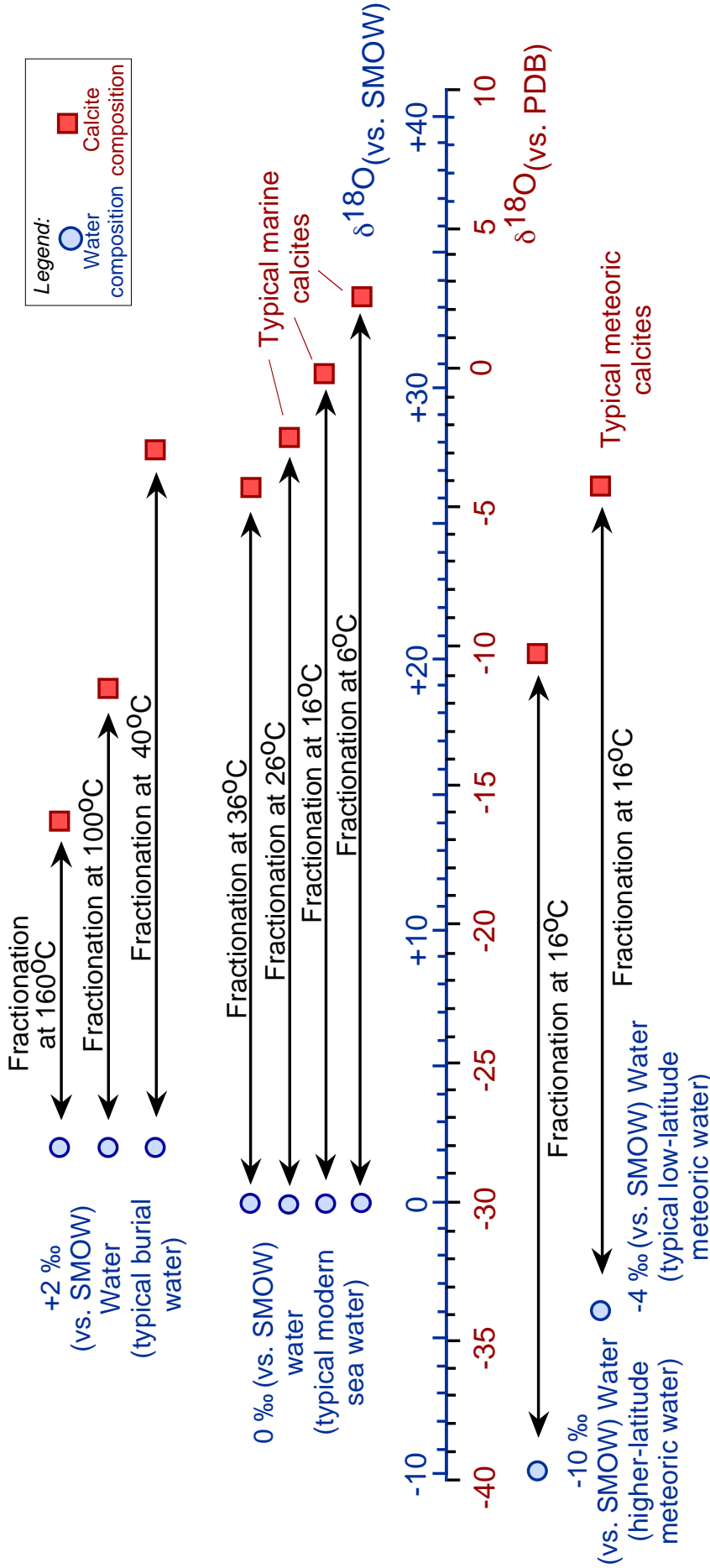


A graphic explanation of fractionation of oxygen isotopes between water and calcite



home of the International Atomic Energy Agency and thus the source for modern standards.

- At ~15°C, the δ¹⁸O of a calcite relative to PDB is the same as the δ¹⁸O of the precipitating water relative to SMOW. (This temperature is 15.7°C if one uses the equation of Friedman and O'Neil (1977), but it is 13.7°C if one uses the equation of Kim and O'Neil (1997)).
- At temperatures of more than ~15°C, a calcite's δ¹⁸O relative to PDB is less than the precipitating water's δ¹⁸O relative to SMOW. However, at **all** temperatures the calcite is inevitably enriched in ¹⁸O relative to the precipitating water.

Some key thoughts:

- When calcite is precipitated in isotopic equilibrium with water, the calcite is enriched in ¹⁸O relative to the water, but the extent of that enrichment or fractionation diminishes with increasing temperature.
- δ¹⁸O values of waters and (non-carbonate minerals) are commonly expressed relative to SMOW (Standard Mean Ocean Water) or, in modern usage, VSMOW. δ¹⁸O values of carbonate minerals are commonly expressed relative to PDB (the PeeDee Belemnite, a Cretaceous calcitic marine fossil) or, in modern usage, VPDB. The "V" in the modern usage stands for Vienna,