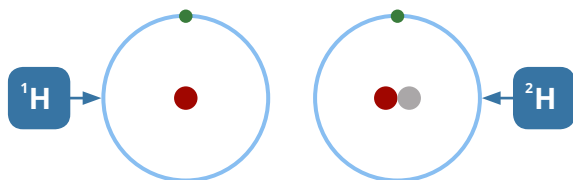


# ISOTOPE GEOCHEMISTRY

Chemistry isn't all about developing new drugs or reactions; it can also be used to look into the past. Isotope geochemistry allows us to do this, and can also detect the imprint of life in materials.

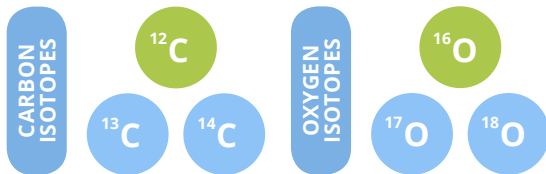
## WHAT IS AN ISOTOPE?



KEY: ● PROTON ● NEUTRON ● ELECTRON

Isotopes are atoms of an element that are made up of the same number of protons and electrons, but different numbers of neutrons. They undergo the same reactions, but due to their different masses can behave differently in physical processes.

## WHAT CAN ISOTOPES TELL US?



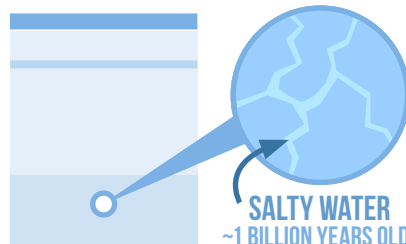
Living organisms prefer to take up lighter isotopes to heavier isotopes as it requires less energy. This allows us to detect the imprint of life in materials, known as biosignatures. It can help to detect life where it can't be detected by other means.

## ISOTOPE DATING & DETECTING LIFE



LOCATION: THE CANADIAN SHIELD  
HOME TO SOME OF THE OLDEST ROCKS ON EARTH

3KM DOWN



The salty water found within rocks deep beneath the earth's surface contains dissolved hydrogen and methane gas, which can be consumed and produced by microorganisms. Examining isotopic ratios allows us to determine the water's age, and detect the presence of these microorganisms.



How can these ratios indicate life? The lightest (most negative)  $^{13}\text{C}/^{12}\text{C}$  ratios in methane ( $\text{CH}_4$ ) are indicative of life. These values are plotted against hydrogen isotope ratio in diagnostic diagrams.