



Seminario
Martedì 12 Maggio ore 16:00
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**The temperature of the Earth when life first appears:
conditions of emerging life.**



Life likely started in the Archean Ocean. What were the temperatures of these early oceans? Oxygen isotope compositions of different sediments have been used extensively to answer this question. The $\delta^{18}\text{O}$ values of Archean sediments are strikingly lower than their younger equivalents, but interpretations of these data are extremely varied. High ocean temperatures, low $\delta^{18}\text{O}$ values of the early oceans, or simply massive diagenesis of the sediments over the billions of ensuing years have all been considered. There is no consensus between the different camps. Here we use a completely different approach, using the triple oxygen isotope composition of mantle eclogites to define the $\delta^{18}\text{O}$ value of the Archean ocean. Mantle eclogites are subducted and metamorphosed equivalents of oceanic crust. Unlike sediments, which are subject to surficial alteration over billions of years, subducted ocean crust becomes metamorphosed and then isolated – isotopically ‘frozen’ – for billions of years. We find that the range of triple oxygen isotope values of fresh altered oceanic crust and those of Archean eclogites are nearly identical. Given that the temperatures of hydrothermal alteration have not changed through time, and the isotopic composition of the mantle has not changed through time, then the similar triple isotope range of modern and Archean metamorphosed oceanic crust indicates an unchanging ocean isotope composition over 3 Ga. Eliminating the oxygen isotope composition of the Archean ocean as a variable allows for better estimates of Earth’s early surficial conditions.