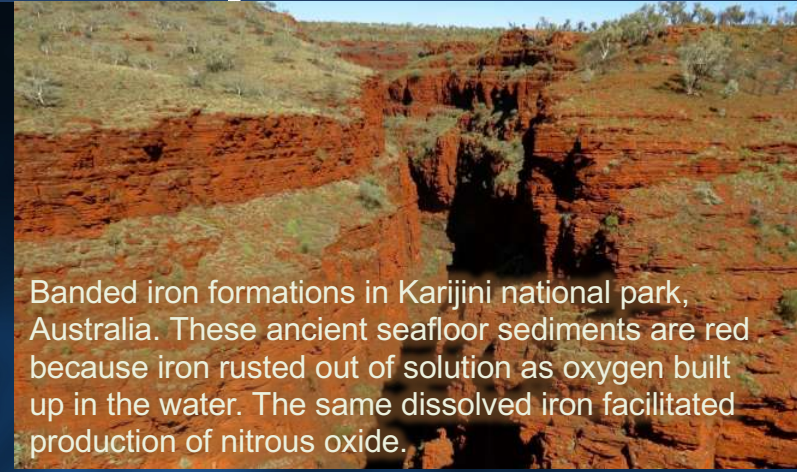


Laughing Gas Could Have Helped Warm Early Earth

Ancient, iron-rich seas could have fueled robust production of nitrous oxide, a potent greenhouse gas better known as a dental sedative—thus helping to reconcile how the young planet remained ice-free when the sun was much dimmer.

- Carbon dioxide and methane get partial credit for keeping the early Earth warm, but may not have always been sufficient, leaving a ‘greenhouse gap.’
- New research on ocean chemistry during Proterozoic Eon, ~2.4-0.5 billion years ago, show that a non-biological process, known as chemodenitrification, produces nitrous oxide only when seawater is high in dissolved iron and low in oxygen, conditions hypothesized for the oceans during this period.



Banded iron formations in Karijini national park, Australia. These ancient seafloor sediments are red because iron rusted out of solution as oxygen built up in the water. The same dissolved iron facilitated production of nitrous oxide.



Examples of stromatolitic ironstone.

- In lab experiments, ferrous iron dissolved in seawater reacted with nitrogen to yield unusually high fluxes of nitrous oxide; incorporating these fluxes into a model of the Proterozoic atmosphere yielded concentrations high enough to provide a significant greenhouse boost.
- Understanding how our planet regulates climate is critical for explaining the long-term habitability on early Earth and other worlds beyond our solar system.