

Fertilizing the low-latitude oceans with iron: Carbon storage and marine ecological benefits

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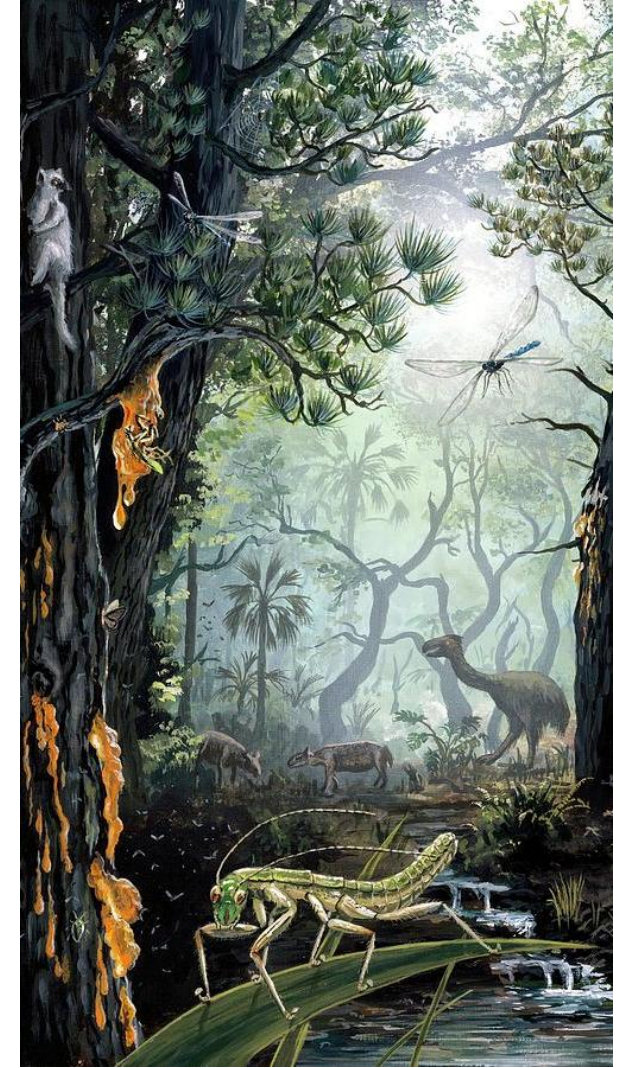
3 basic points about CDR



Imperfect



Insufficient



**Still
worthwhile**

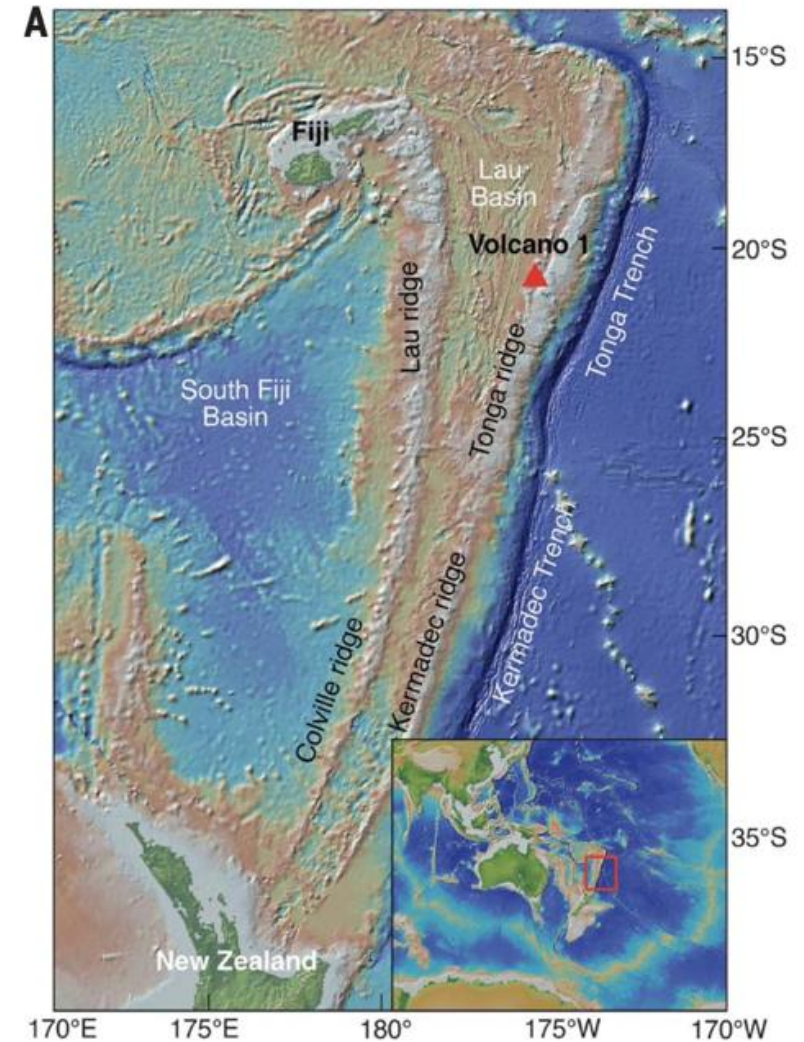
The Tonga-Kermadec Ridge underwater volcanos

RESEARCH ARTICLE

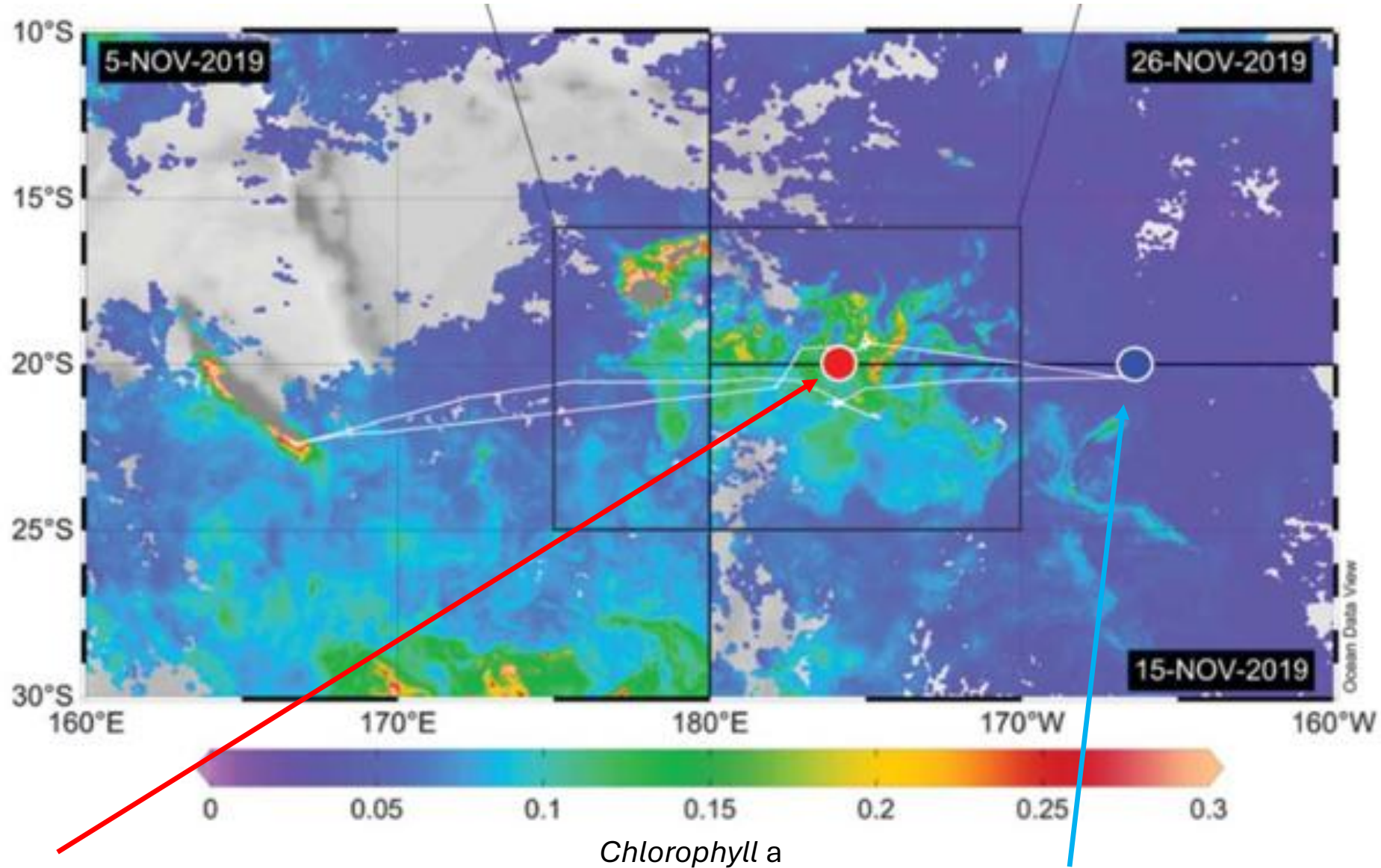
OCEAN NUTRIENTS

Natural iron fertilization by shallow hydrothermal sources fuels diazotroph blooms in the ocean

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A bloom of phytoplankton above the volcano

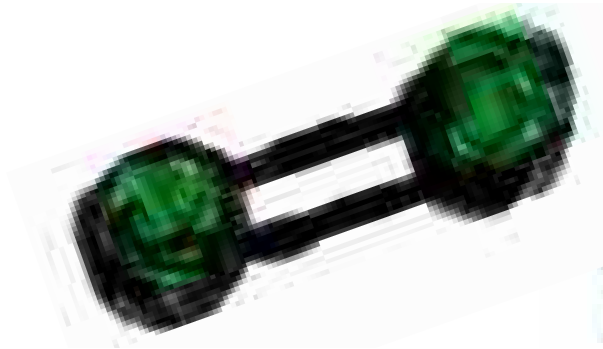


Tonga ridge volcano

Control site

Ammonia and nitrate fuel life in the oceans

Nitrogen gas



Nitrogenase enzyme



nitrogen fixation

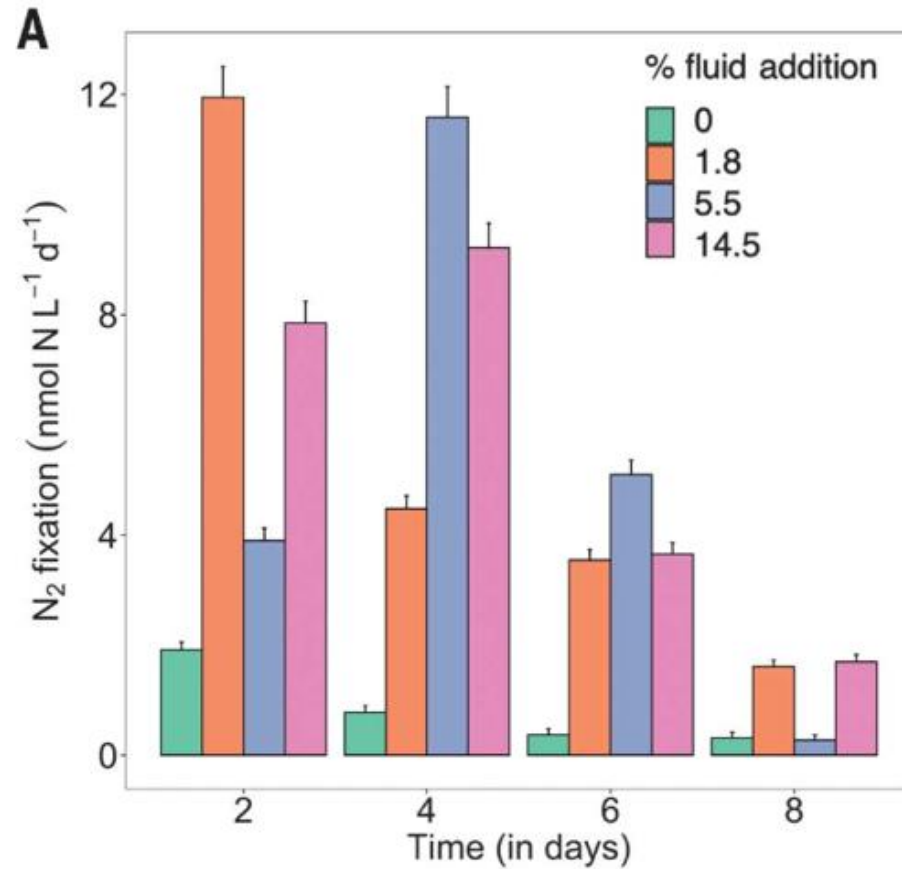
up to 50 iron atoms!!



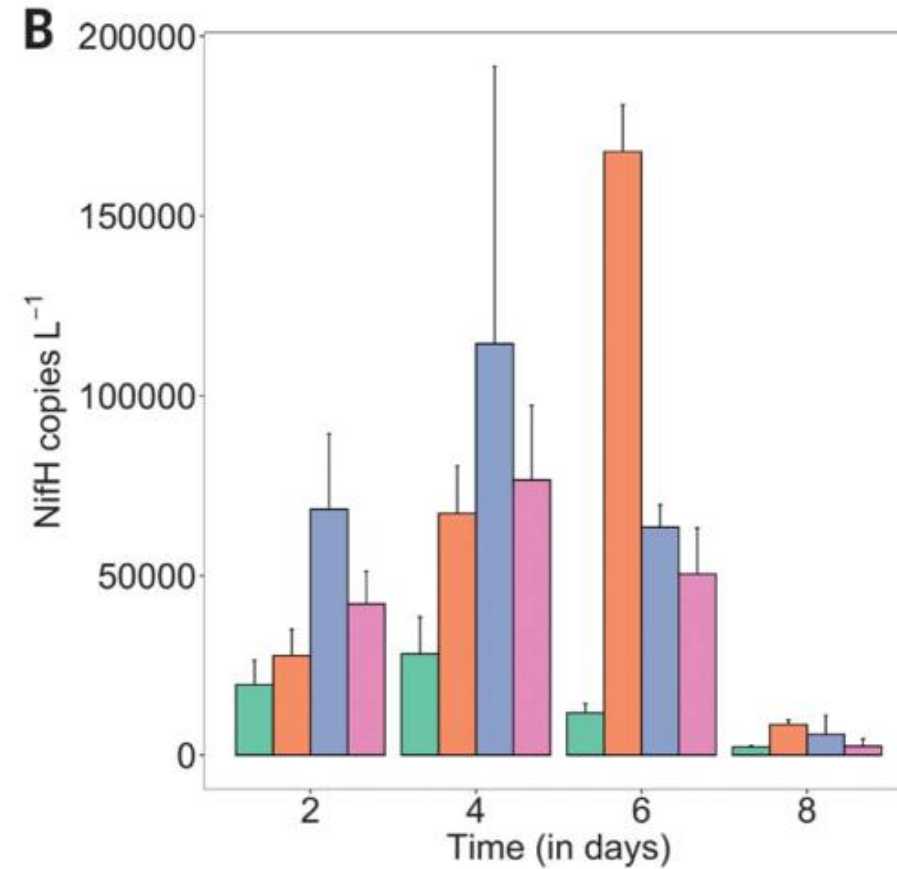
Ammonia

Fe addition with hydrothermal fluids stimulates N fixation

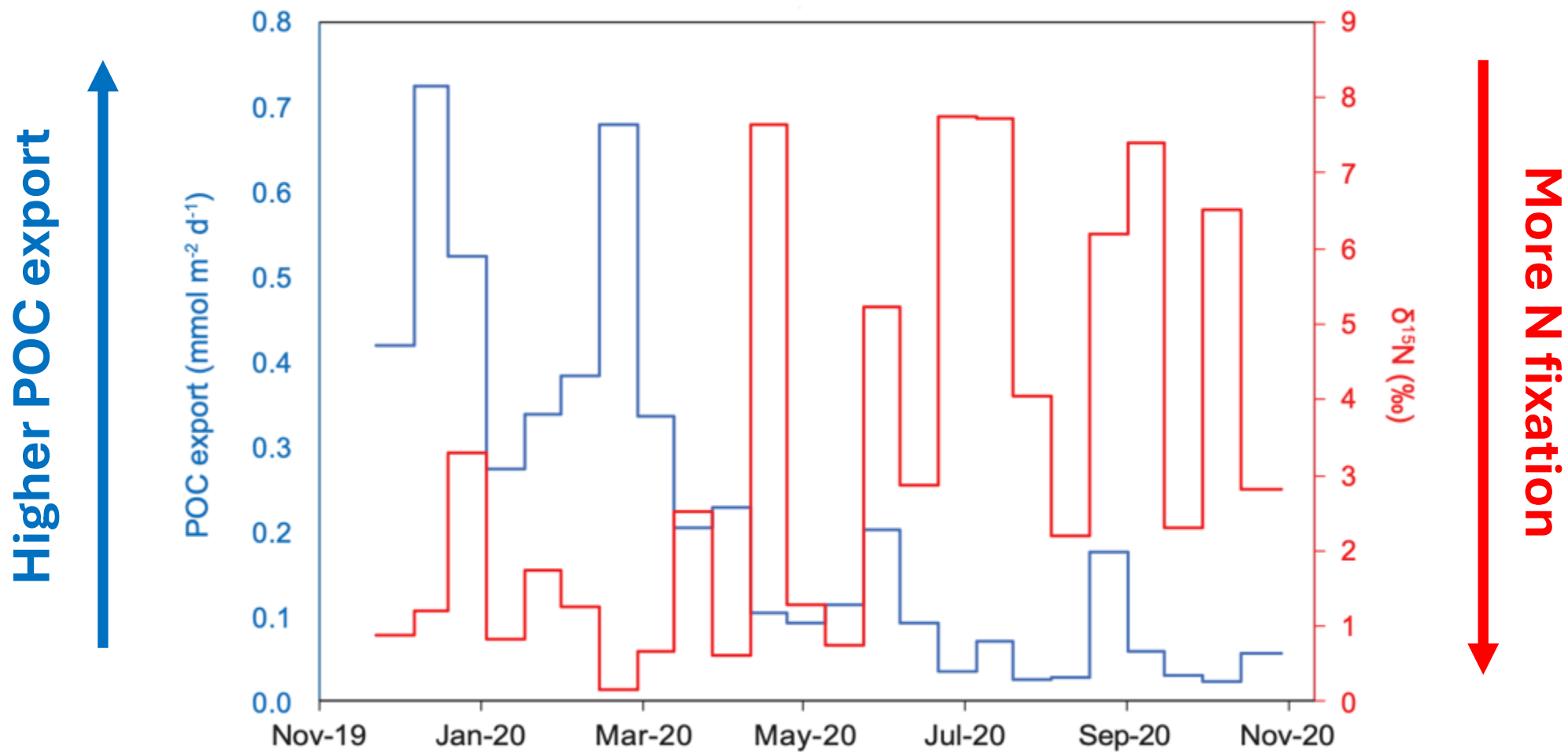
Higher N-fixation rates



Higher abundance of NifH

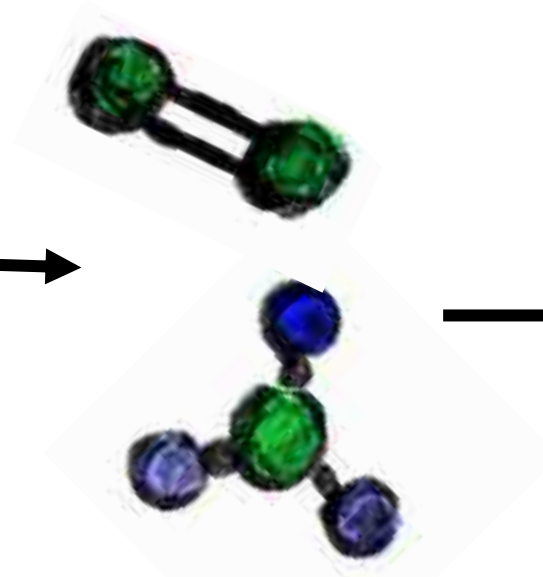
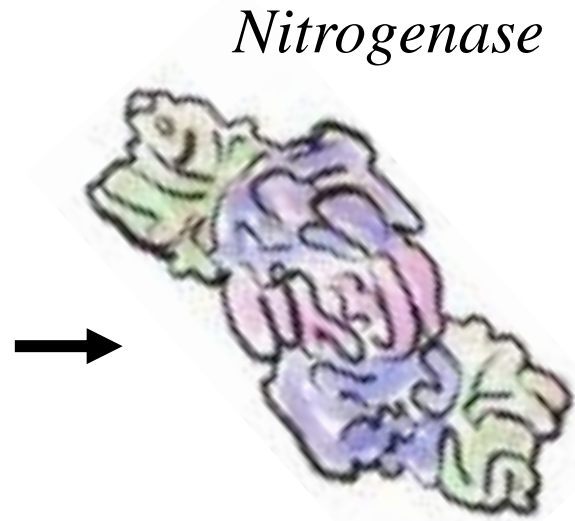


Increased N fixation leads directly to POC export



**1 atom
of iron**

Iron



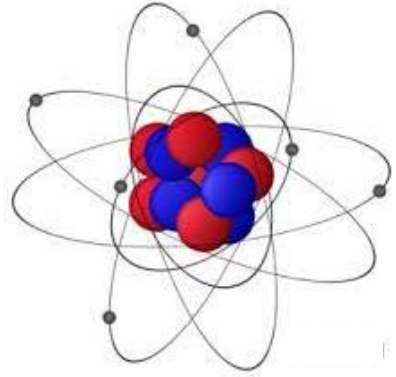
*Biologically
available
nitrogen*



Phytoplankton

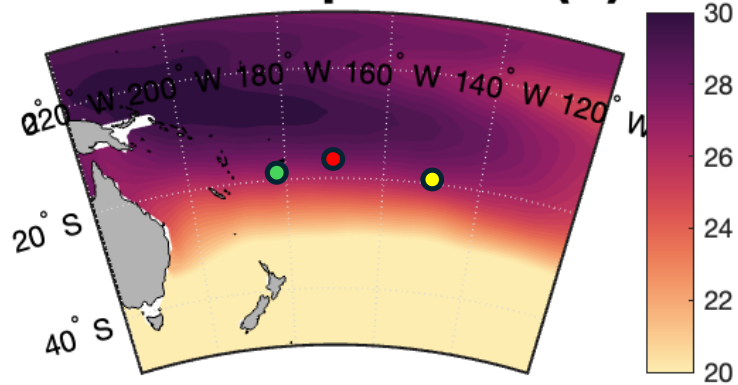
**15,000 atoms
of carbon**

Visualizing “atoms of carbon”

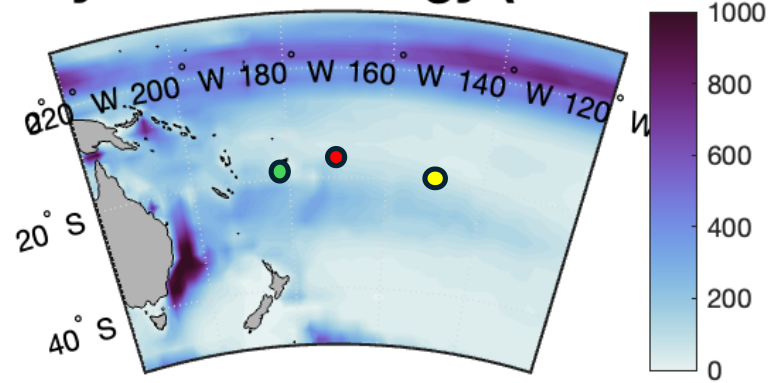


Physical setting of the South Pacific

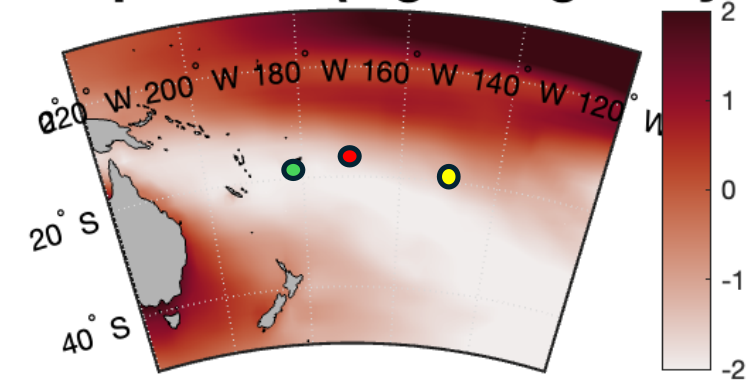
Ocean temperature (C)



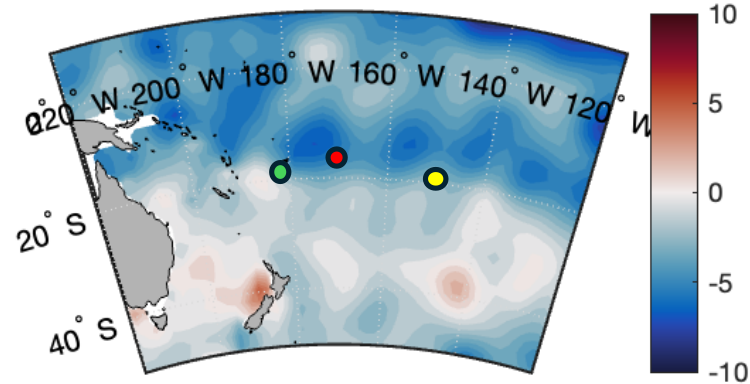
Eddy Kinetic Energy ($\text{cm}^2 \text{s}^{-1}$)



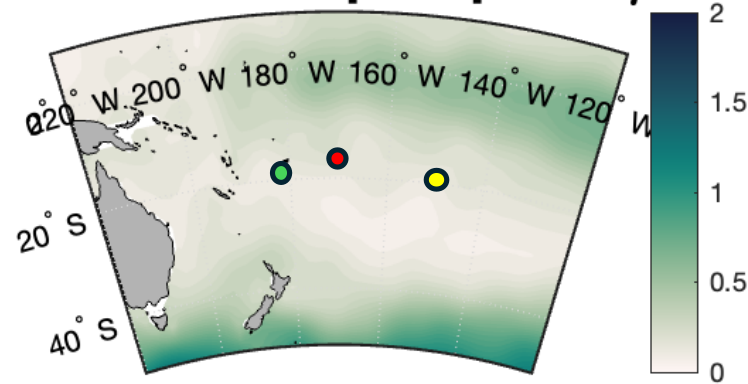
Dust deposition ($\log_{10} \text{mg m}^{-2} \text{y}^{-1}$)



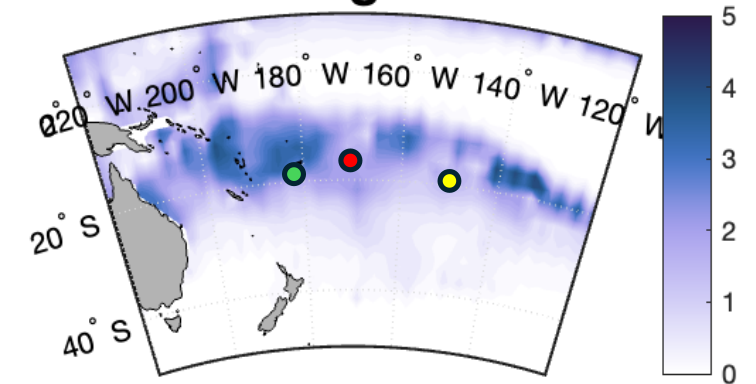
N^* at 400 m



Surface ocean phosphate μM

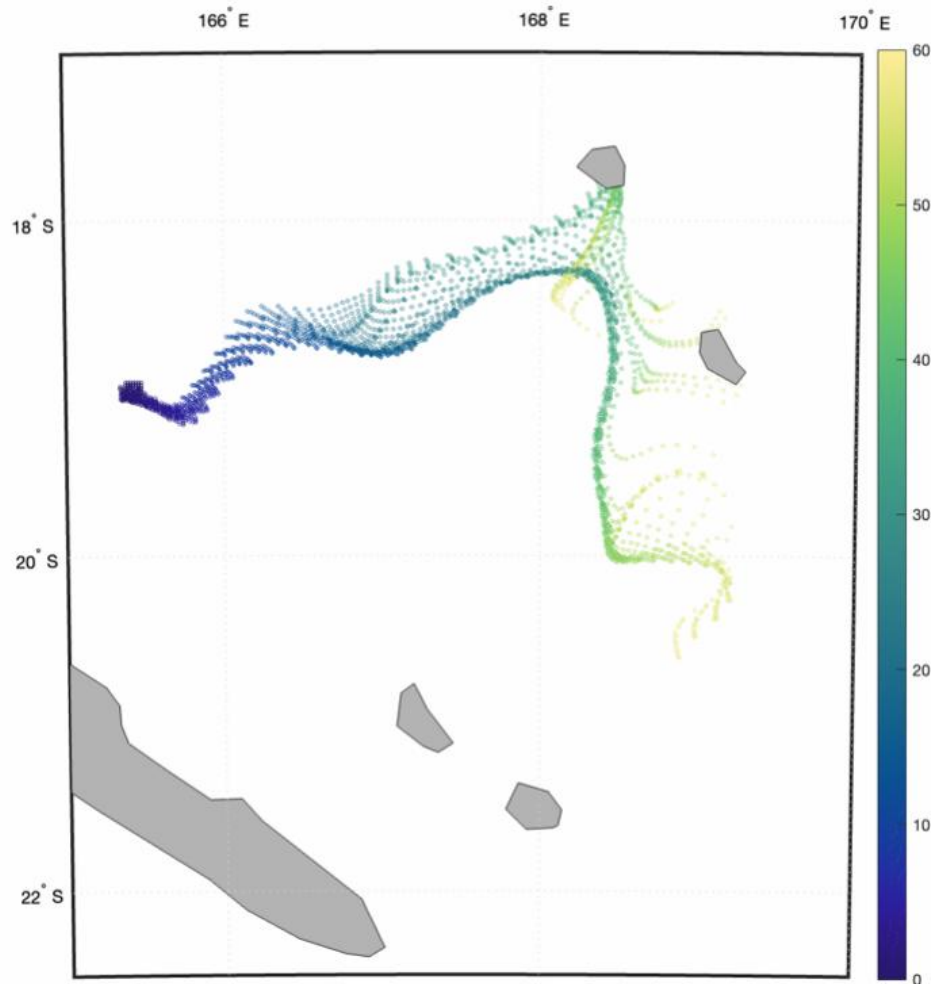


Model nitrogen fixation

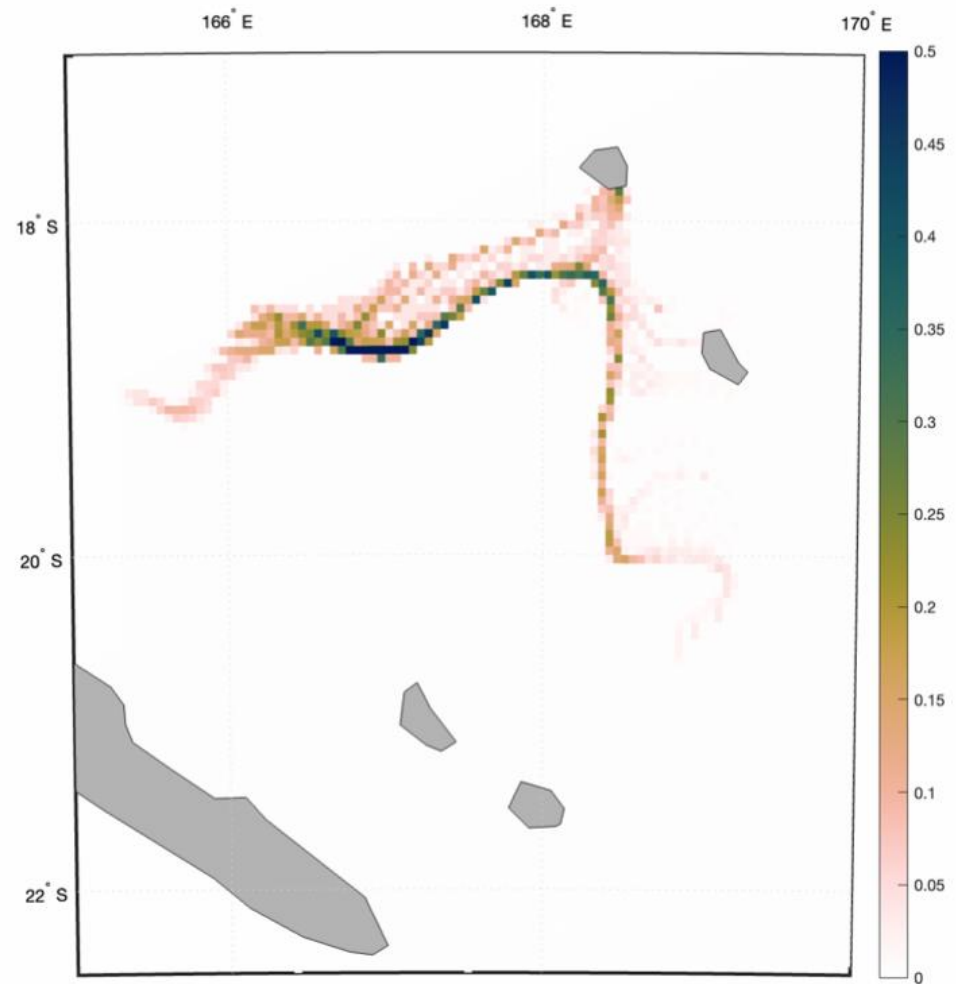


A modeled phytoplankton bloom

Particle tracing from a
release location for 2 months



A simulated LNLC-OIF bloom



Planning for a South Pacific experiment

