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Natural fertilisation of sea hints at effects of geoengineering projects

New research investigating the effects of naturally occurring iron fertilisation in the sea suggests that large scale geoengineering projects designed to sequester carbon in the deep sea could have a dramatic impact on marine ecosystems. The study found that the organic matter arriving at the sea floor and the species that live there are very different, depending on whether waters are fertilised by iron leached from nearby islands or not.

Ocean iron fertilisation is one of several different geoengineering approaches to tackling climate change that is receiving increasing attention from policymakers. Algae use iron as a nutrient. Thus, 'seeding' patches of ocean with iron increases algal growth and creates large blooms that absorb carbon through photosynthesis. As the algae die and sink to the ocean floor, it is thought they can take with them the carbon they have absorbed from the atmosphere and lock it away for hundreds of years. However, the effects on marine ecosystems are difficult to predict. So far, ocean fertilisation experiments have been limited to small scale studies – too small to accurately predict the effects of the large scale fertilisation activities needed to make any useful impact on global carbon emissions.

In the absence of large scale experiments, the effects of natural iron enrichment on deep-sea species may provide some clues as to the potential impacts of artificial fertilisation. In certain spots in the Southern Ocean, iron naturally leaches from nearby islands generating algal blooms at the surface during the summer.

In summer 2005/2006, researchers investigated the effects on deep-sea ecology of natural iron enrichment in the Crozet Plateau region of the Southern Indian Ocean. They collected samples from the seafloor in two geologically similar areas of ocean, 460 kilometres apart. Only one was iron-rich, however, so the researchers were able to compare the samples to understand the effects of iron fertilisation.

They analysed the samples in a number of ways, including looking at variations between the chemical composition of organic matter arriving at the seafloor, and identifying species present at the different sites.

Species, and their abundance, were markedly different at the iron-rich site and the authors suggest that this was related to higher levels of organic matter on the seafloor, including certain nutrients – in particular, polyunsaturated fatty acids and carotenoids. The most abundant species in the region was a type of sea cucumber called *Peniagone crozeti*, which is new to science and was only found at the iron-rich site, indicating that its distribution is strongly influenced by the productivity of the surface waters.

The authors say their results indicate that artificial fertilisation activities would lead to important and potentially long-term changes in deep sea ecosystems. Currently, further ocean fertilisation activities are restricted by international agreements under the London Convention and Protocol[1], but large scale studies would be possible – subject to rigorous prior assessment – for the purposes of collecting scientific data.

1. IMO. (2011). Ocean fertilization. International Maritime Organization. [Online]. Available: http://www.imo.org/OurWork/Environment/SpecialProgrammesAndInitiatives/Pages/London-Convention-and-Protocol.aspx [Accessed: 13th September 2011]

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