Letter of intent to submit proposal to NSF

Verification and geodynamical assessment of carbon-sequestration from biomass iron-enrichment studies in the Southern Ocean

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Project Summary

Patch iron experiments are being carried out increasingly and concertedly by researchers in order to better understand whether the deep ocean is capable of sequestering an amount of carbon annually into its reservoir to reliably mitigate the effects of global warming. Iron enrichment (a limited trace-metal in the open ocean) serves to promote biomass production by the entrainment of atmospheric carbon-dioxide (CO_2) into the ocean surface. Carbon-dioxide is fixed through photosynthesis by symbiotic algae and released by respiration and calcification. Laboratory and field experiments indicate phytoplankton blooms do occur from single and multiple iron additions but, on the other hand, do not indicate whether the marine ecosystem's response is agreeable to laboratory studies. The goal is to provide a focus for study to definitively verify the effectiveness of iron-fertilization efforts and to elucidate the interaction among the diverse processes operating in the marine environment. The former will result in a real progress toward a science of the Earth-system, while the latter will serve to determine if carbon sequestration is a purposeful approach in reducing the effects of green-house gas emissions from the burning of fossil fuels.

Past results indicate that ecosystem experiments and geo-engineering interventions should be preceded by thorough analysis, taking into account the complete interactions between the biological, physical, chemical, and fluid processes to prevent any adverse affects on the marine environment or ineffectual commitments from the scientific community. Only through a careful mechanistic understanding of iron-enrichment in tandem with marine ecology dynamics will the science of iron-fertilization be able to resolve the time-scales needed to modulate global warming.

The project can lead to the solving of society's concerns and the establishment of a base of knowledge educating public and government officials, thereby saving time and costs while greatly reducing the risk of unintended environmental feedbacks. Successful efforts would signal new options, avoid the unnecessary use of scant resources and refocus attention on actual problems rather than seeking to contend with possible future scenarios. Conversely, failed

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efforts would underscore the importance of energy reduction and conservation, the proximal value of clean-energy technologies, and the social significance of a well-informed citizenry on the limitations of fossil-fuel uses. As a potential two-way conduit of information between the scientific community and society, the research would strengthen earth-system science education from the grammar to the secondary level community and spearhead potentially new opportunities in post-secondary research.

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