

**Subject: Scholes cabin 5 (p): Fiona's experiment**

**30 January 2010 0102 UTM -60.5208, -5.2840**

Dear Stirling,

There are basically two ways of doing science. One observes the pattern in Nature, and then makes inferences (logical guesses) about what must be causing it. The other deliberately experiments with the controlling factors, and sees what the outcome is. Arguing that the one way of doing science is better than the other is a bit silly - rather like arguing that a hammer is better than a saw. Both are tools in the toolbox, and which one you select depends on what job you want to do.

Most of what we are doing on this voyage is the first type of science: we are measuring the pattern of carbon uptake across the ocean to help us to understand what is controlling it. But we already have some ideas about what the main factors might be, so we can also do experiments to test those ideas. Fiona Preston-Whyte is an Honours student in our team, and she has just finished an elegant experiment of that sort.

She took samples of seawater collected by the CTD and put them into dark plastic bottles. To each bottle she added a tiny amount of a different nutrient - nitrate to one, phosphate to another, silicate to a third and iron to a fourth. To the fifth she added the same dose of all four nutrients, and to the sixth, which we call a control, she added no nutrients at all. Then she left them for two hours in the dark and measured their photosystem II on the pulse fluorometer in my lab. She repeated the experiment on water collected from different places - the edge of the ice shelf, the polar waters, and either side of the polar front.

This is what she found. The photosynthesis measurements changed in only two bottles out of the six: the one with iron added, and the one with all the nutrients added. What could you deduce from this result? That iron was the limiting factor (in the short term - remember the experiment only lasted two hours). Furthermore, she found the same pattern at all the sample locations, even though the photosynthetic values differed between them. This suggests that although the phytoplankton communities changed between places, all of them were iron limited.

We might have guessed that result from the water analyses we are getting from those different places, but the additional evidence from the experiment is much more persuasive. It also confirms what many other people have argued: that carbon assimilation in the Southern Ocean is iron limited.

Love,

Dad