

## FINAL REPORT – ECORD Research Grant 2011

### Comparing sedimentation processes below the unproductive South Pacific Gyre with the highly productive central equatorial Pacific

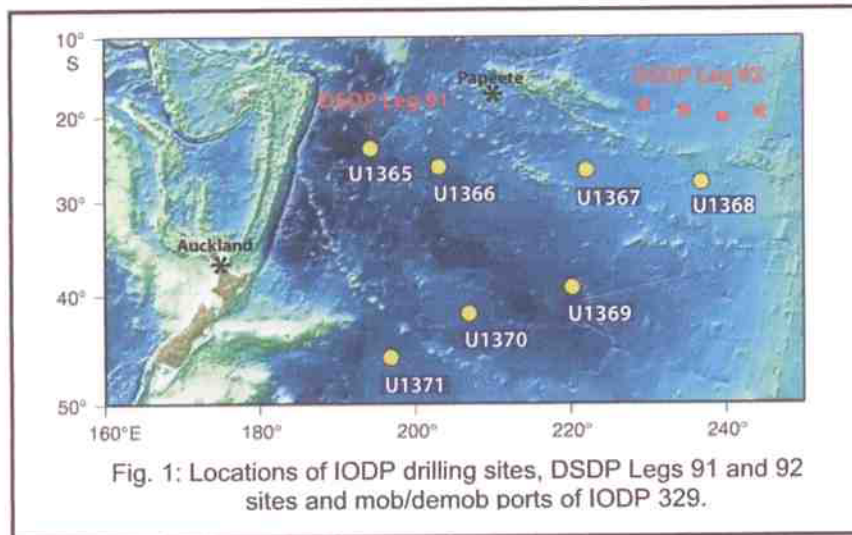
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#### Introduction

During IODP Expedition 329 to the center of the South Pacific Gyre, I recovered sediment samples from the 7 sites drilled (U1365 to U1371, see Fig. 1) to analyze the grain size distribution. Although Expedition 329 focused on microbiology, the recovered cores provide an unprecedented opportunity to document a sedimentary system that has never been explored by scientific ocean drilling. I applied for a 2011 ECORD Research Grant to cover travel and laboratory expenses to carry out the grain size analyses in Cardiff University. The following presents preliminary results from these grain size determinations, as more thorough data analysis will occur at a later stage (see below).



#### Aim

My aim is to document sedimentation processes below the South Pacific Gyre using grain size data in addition to the seismic and other site survey data. Grain-size data from this remote location will contribute to:

- Determine whether microbial life is supported to a significant extent by H<sub>2</sub> from in situ radiolysis of water, which is influenced by the particle size and clay content of sediments.
- Characterize the aeolian inputs and past atmospheric circulation patterns.
- Reveal changes in ocean deep-water movements.

### **Present stage**

In October 2010, I have analyzed the grain-size distribution of sediments in the clay to silt size range (~1 – 63µm) of 209 samples using a Micromeritics Sedigraph 5100 Particle

Size Analyzer at Cardiff University. The method involves disaggregating the samples and passing them through a Sedigraph, an instrument based on the settling principle and the attenuation in the intensity of an X-ray beam. Data analysis will take place in Fall 2012, during which time I will be supported by a 3-month post-cruise NERC grant.

### **Preliminary results**

As expected, the majority of samples are composed of clay-sized material, with some samples having more than 90 mass percent of particles finer than 1.9 µm. However, a number of samples, in particular at the sites further offshore, show an extraordinarily well-sorted particle size distribution, which reflects an almost exclusively aeolian input. Figure 2 illustrates preliminary results from site U1367B, with both silt/clay ratio (red square) and mean diameter (open black circle) shown. Samples with more than 50 wt% of particles finer than 1.9µm were attributed a mean diameter of 1 µm. The mass % finer and volume % distribution is shown for two characteristic samples, one consisting almost exclusively of very fine material (upper panel), while the other one has about 50 wt % of its particles in the 6-8 µm range.

### **Outlook**

Results will be presented and discussed with potential partners at the first IODP EXP 329 post-cruise meeting, which will take place in October or November 2012 in Hawaii. The grain size data generated will be shared with other scientists from the Expedition 329, in particular: (1) Dr. S. D'Hondt (co-chief scientist of IODP 329), who is investigating the radiolysis hypothesis. (2) Dr. R. Murray, who is investigating the geochemical provenance of wind-blown dust. (3) Dr. C Alvarez-Zarikian, who aims to characterize ocean water movement history, using Nd isotopes. Publication in peer-reviewed literature is planned for 2013.

### **Budget**

Note that the duration of the stay originally planned (1 week) had to be extended in order to complete the analysis of the entire set of samples by myself, as no technician was available to help in Cardiff. Dr. Hall accordingly reduced the analytical costs. All the receipts and invoices have been attached. Details on the balanced budget can be found on page 3 of this report.

### **Acknowledgements**

*First of all, I would like to thank the European Consortium for Ocean Research Drilling for awarding me a Research Grant, which was essential in allowing these analyses to be conducted. I am particularly indebted to Dr. I. Hall for his hospitality. He made his laboratory and scientific equipments available to me. Finally, I also wish to thank my supervisor, Dr. N. Mitchell, for his support in this project.*

**Balanced budget**

|  |           |
|--|-----------|
| <b><u>Funding</u></b>                      |           |
| ECORD Research Grant 2011 (2000.00 €)      | £ 1700.54 |
| <b><u>Expenses</u></b>                     |           |
| Return Train Ticket (Manchester-Cardiff)   | £ 67.50   |
| Taxi                                       | £ 4.10    |
| 209 Sedigraph analyses                     | £ 700.00  |
| Accommodation (Riverbank Hotel, 19 nights) | £ 839.00  |
| Subsistence                                | £ 90.84   |
| <hr/>                                      |           |
| Total                                      | £ 1701.44 |
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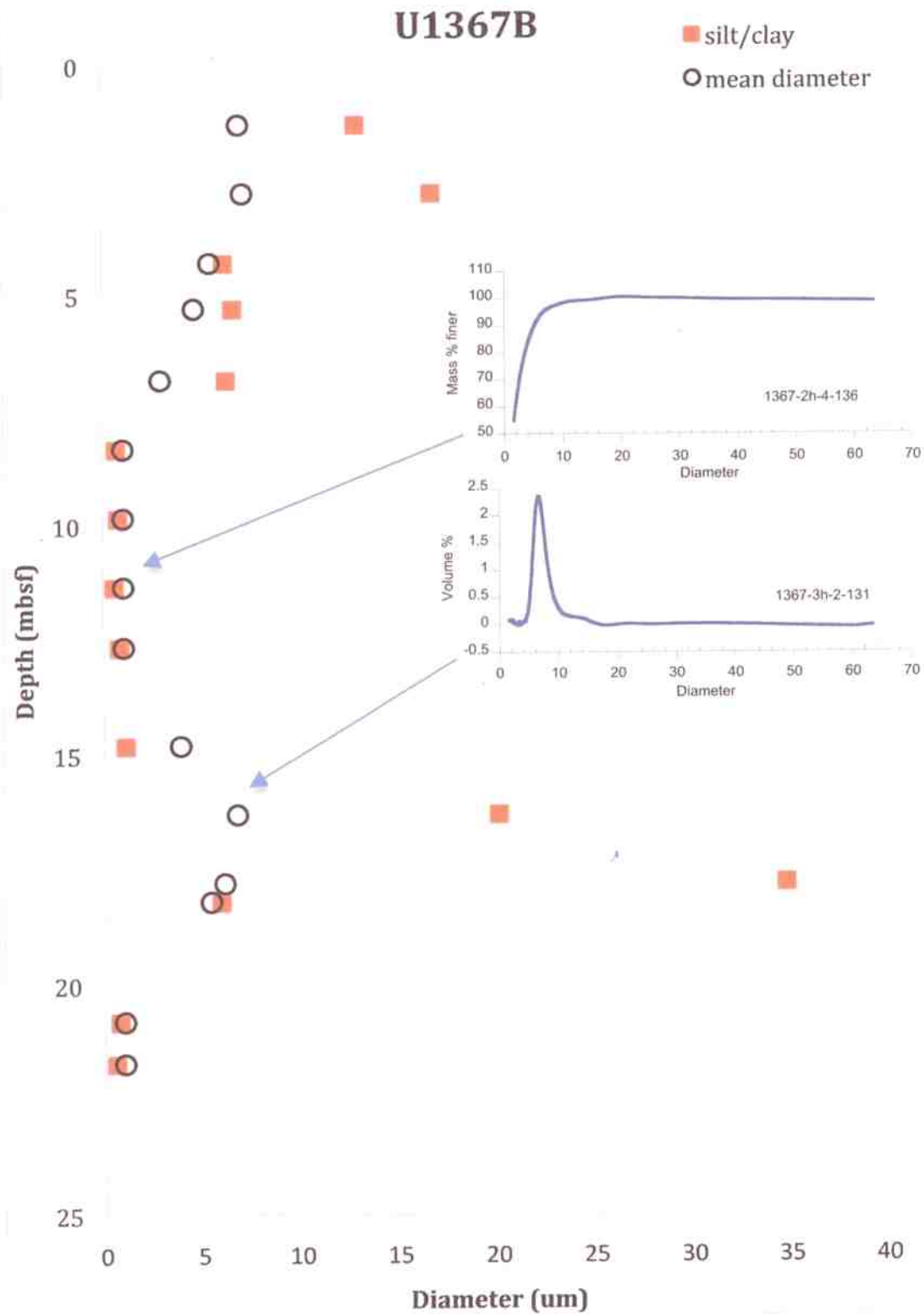


Figure 2. Grain size distribution versus depth in Hole U1367B. Silt/Clay ratio is shown by the red squares. Mean diameter of grains is shown by the open black circles. The mass percent finer distribution of sample 1367-2h-4-136 is shown in the upper right panel, while the volume percent distribution of sample 1367-3h-2-131 is shown in the lower right panel.