The Petrophysics Summer/Autumn Special -Episode 1

Annette McGrath

When Sophie asked if I could write a logbook I thought long and hard about the approach I would take; would it be something serious like "A day in the life of an ESO Petrophysicist offshore" …umm, nah, that sounds boring. So what about something more frivolous like e.g. "The Secret Offshore Diary of Annette McGrath, aged ** and ¾" (age with-held to retain modesty and dignity, although the reference to "Adrian Mole" probably gives it away) or even a light-hearted "Annette McGrath's Diary…." But no, apart from being too flippant, it wouldn't be half so exciting as Bridget Jones's Diary, as I will not be smoking vast numbers of cigarettes, quaffing copious amounts of wine and, well, there's no point watching the scales because: i) exercise potential is limited on the ship, ii) food is copious and very hearty (and it's the main thing I look forward to every day) and iii) there aren't any scales on board (well not as far as I am aware, and if anybody knows of the whereabouts of any scales please keep it to yourself because I would rather not know).

So, coming back down to earth, and after pondering this issue for a while, I decided I would go for a serialisation and deal with the serious business first - what is my role on this expedition and what do I do? The next instalment will cover my first impressions having never sailed offshore before and what is life like on board the Greatship Manisha.

<u>What is my role and what do I actually do on this expedition....the serious bit</u>

My role on Expedition 347 is ESO (ECORD Science Operator) Petrophysicist. ESO comprises the British Geological Survey (BGS), the University of Bremen (MARUM) and the European Petrophysics Consortium (EPC). I work for the Borehole Research Group in the Department of Geology at the University of Leicester, who in partnership with the Universities of Aachen and Montpellier, make up the EPC. The main aim of Expedition 347 is to acquire the most complete record possible of the paleoceanographic and microbiological history preserved within the sediments of the Baltic Sea over the last 130,000 years, a period of major glacial/interglacial change. This will include an investigation of sedimentation, climate and sea level change over this period as well as the response of the deep biosphere to glacial-interglacial cycles. In order to accomplish this, a series of three offset holes will be cored at seven proposed drill-sites beneath the seabed of the Baltic Sea, each located within an individual sub-basin. This is to ensure that we capture as complete a composite section as possible at each site.

Serious bit over, so what's going on at the moment? We are currently coring the variable sedimentary succession preserved below the sea floor at site M0060A (BSB-1B). My day to day work consists of running the cores that are retrieved from the borehole on a Geotek Standard Multi Sensor Core Logger (MSCL-99), a machine that measures certain physical properties of the cores (core petrophysics). The cores consist of generally soft and mostly wet sediment that is encased in cylindrical plastic core liners, with caps at each end to contain the sediment. These "whole round" cores are placed on the MSCL track and horizontally pushed through or over the MSCL sensors. The MSCL is an efficient machine as it automatically and simultaneously records several measurements at once, controlled by a

user-friendly piece of software. There are four individual sensors on the MSCL-99: the Gamma Density (gamma-ray attenuation), P-Wave Velocity, Non-Contact Resistivity and Magnetic Susceptibility sensors and each measure a different physical property of the sediment (every 2 cm).

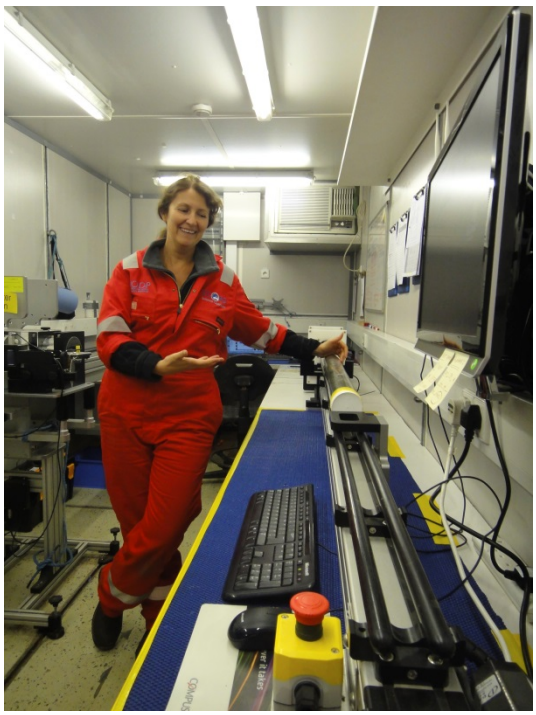
The Geotek Standard MSCL logging core in the Petrophysics Container. Photo AnnetteMcGrath©ECORD_IODP

This information helps us to further characterise the physical nature of the individual cores but also provides an insight into the overall sedimentary succession over the length of the borehole. The MSCL data can also be correlated to the in-situ measurements of the same sediments taken during downhole logging (where similar sensors or "tools" are lowered down through the drill pipe and into the open hole below the sea bed). This information all helps to aid understanding and correlation of the geological boundaries encountered over the entire cored length of the boreholes at each site. But wait, there's more….because unique to this expedition is the "Fast Track" MSCL (MSCL-152), comprising just two offset 90 mm magnetic susceptibility loops, that in combination rapidly provide data at 2 cm resolution. Why do we want this as well? In essence it is to provide a rapid logging record of the microbiology cores immediately after they are curated, as the sediments need to be sampled by the Microbiologists as soon as possible after retrieval from the borehole. The Fast Track MSCL therefore provides the only opportunity to obtain a complete record of petrophysical measurements on these sediments that will facilitate correlation between the sediment recovered from the holes at each site. This will aid stratigraphic correlation, which will hopefully enhance the coring strategy and optimise recovery both at each site and across all the sites in general. It will also help the scientists to know if they have captured the most accurate and complete sedimentary record that they possibly can.

The job is extremely multi-tasking. Anne Sophie Fanget (University of Perpignan Via Domitia (UPVD), France) is my alter-ego and partner in crime, and she runs the MSCL on the opposite shift to me (midday to midnight). She is doing an excellent job, and is very methodical and 100% committed to the job in hand. Whilst operating both MSCLs, we both

carry out our observations with a technical and scientific eye, take detailed notes and keep accurate records, whilst ensuring that all is functioning properly both in terms of electronics and software. But just as important is the careful verification and validation of the quality of the data after the measurements are made - we do this by regularly re-logging specific sections for QA/QC (Quality Assurance and Quality Control).

Anne Sophie Fanget hard at work processing MSCL data in the Petrophysics container. Photo AnnetteMcGrath©ECORD_IODP



The Standard MSCL (left) with a core moving through the magnetic susceptibility loop, and (right) I just love the Fast-Track MSCL (Both photos MaryMowat©ECORD_IODP).

There are certain problems during logging, such as squashed (or “banana” cores”) that can’t run safely through the magnetic susceptibility sensors on the MSCL.


(Left) A squashed "banana" core. (Right) A large section of a metal core catcher within the core liner - it produced some interesting magnetic susceptibility results. (Photo on the left Photo AnnetteMcGrath©ECORD_IODP Photo on the right AnneSophieFanget©ECORD_IODP).

We are also continually on the look-out for pieces of metal in the cores, and one unusual example was a large piece of metal found in the liner of core 33H from Hole 60A, which was either a section of a core catcher, or a remnant of a Transformer or the alien spacecraft that purportedly crashed in to the Baltic Sea! It is also sometimes difficult to acquire good readings of the P-Wave velocity in some of the sediments, either because they contain little water or have lots of gas bubbles, e.g. the “Gyttja” Holocene muds encountered so far at sites 59 and 60……but apart from that, they are also extremely smelly sediments! We have also had a few technical and software issues, including an inexplicable communication problem between the monitor and computer, which crashed the entire MSCL system (I aged 20 years in 4 hours), but this was quickly resolved without problem in the end!