Research Networking Programmes

Short Visit Grant ☒ or Exchange Visit Grant ☐

(please tick the relevant box)

Scientific Report

Scientific report (one single document in WORD or PDF file) should be submitted online within one month of the event. It should not exceed eight A4 pages.

***Proposal Title**:* ECORD (Bremen) summer school

Application Reference N°: 6038

1) Purpose of the visit

The past September I took part in ECORD Summer School 2013 entitled "Deep Sea Sediments: From Stratigraphy to Age Models" realized in Bremen, Germany. Since my research regards to the paleoenvironmental changes in the Aegean Sea (Eastern Mediterranean) from Pleistocene to Holocene, I participated to the Summer School in order to get an integrate understanding of stratigraphy. Furthermore, my research is mainly conducted in deep sea sediments and the school was for me an opportunity to acquire fundamental knowledge on age models and cross correlations between different records.

2) Description of the work carried out during the visit

The school took place from 9 to 20 September and generally speaking, the daily program was divided in two main parts, so that the morning hours were dedicated to lectures and the afternoons to laboratory exercises. The lectures were structured in regards to the main course outline of the school, in order for us to examine closely the stratigraphic fields and to explore new methods and approaches concerning the analysis of geological records and age modeling.

On the first day we attended the introductory lectures of D. Hebbeln, H. Pälike and M. Cucera on the structure of the school and how its curriculum is connected to the scientific drilling, as well as informative speeches by J. Erbacher and U. Röhl about the structure of IODP and ECORD and ways to become involved. Additionally, W. Hale and D. Hebbeln

told us about the IODP core curation and guided us through MARUM and IODP Bremen Core Repository.

During the first two days, the lectures covered the 1st part of the school's course outline, dealing with key stratigraphic concepts, such as chemostratigraphy, magnetostratigraphy, biostratigraphy and chronostratigraphy. The development issues in the form of lesson, by leading scientists such as T. Frederichs, S. Voigt, M. Cucera, I. Raffi and S. Bohaty enabled me to enrich my knowledge on the subject and turned the lecture attendance to a delightful experience.

One of the points that M. Cucera stressed in his speech had to do with the uncertainty associated with the biostratigraphic data and the need to consider objective approaches in order to handle it. The quantitative methods have become a fundamental tool towards this direction and, for that reason, the following two days were devoted to two well-known quantitative methods, corresponding to two different approaches on how to achieve quantitative integrated stratigraphy. I must admit that apart from the name CONOP, the first of those methods was completely new to me. However, the enthusiastic speech of P. Sadler guided me to a new field of knowledge. On the other hand I was already familiar with the PAST as I have used some of its features several times in the past, and especially those regarding statistical processing. Nevertheless it was highly beneficial that Ø. Hammer himself explained the philosophy and operation of the method, giving me the opportunity to discover the possibilities it has to offer when solving biostratigraphic issues. The fact that during the first two days we mostly dealt with the practical side of CONOP and PAST was highly beneficial for me, as it is well known that a lot of questions and difficulties tend to arise during the application of each method. The willingness and patience of both Sadler and Hammer to respond to my questions helped me grasp in a limited period of time the differences of the two methods and, at the same time, their respective usefulness.
J. Shakun's speech dealt with the second part of the school's course outline, specifically the age models. With an impressive presentation, Shakun explained how observations from global temperature reconstructions together with transient global climate model simulations can shed light on whether CO2 was a cause rather than a consequence of past climate changes. Essentially the issue corresponded to a case study, in which the results of scientific research can be used as an argument in favor of the stakeholders, in the international debate for the global policy on climate change.

The search and management of stratigraphic information in databases was the subject of the sixth day of school and, in my opinion, it was one of the most interesting ones. The detailed description of D. Lazarus and H.-J. Wallrabe-Adams was more than a simple introduction, whilst their effort to explain the tools in practice, giving us even practical tips, was what turned the subject into a workable process.

The next couple of days were indeed the most ravishing, as we moved on to more complex subjects. At first, H. Pälike, starting from the Milankovich Theory, developed the subjects of cyclostratigraphy and orbital tuning, in an exemplary educational presentation of the much wider pool of astrochronology. Then, S. Meyers further developed the subject, highlighting the challenges on the quantification of the orbital influence on climate and sedimentation and presented specific analytical procedures for addressing those challenges. The next day, in a torrential but well-balanced speech, he

explained the mathematical concepts involved in time-series analyses of geological records and showed us the "astro", an R-Package for astrochronology. We even had the opportunity to see how the "astro" can be used in practice by testing some of its functions with real data. Despite the difficulty of these issues and the large amount of concentrated knowledge corresponding to these two days, I could not think of a better combination of speakers than Pälike and Meyers. These two school days were the most productive and rewarding of all.

On the penultimate day, we focused on probabilistic age – depth modeling, a subject I knew nothing about beforehand. The enlightening speech of R. Tellford and his clear instructions on the assignment that followed helped me understand, not only the importance of uncertainties, but also the need to estimate and integrate them within age – depth models.

One of the exciting elements of the school was that I had the opportunity not only to see up close the important IODP Bremen Core Repository, but also to get a realistic taste of on-board and off-shore operations and analyses carried out over the nuclei through the laboratory exercises.

During these exercises I first had the opportunity to learn about downhole logging from S. Davies, an expert on the field. I only had a generalized previous knowledge on the matter; I should say that, besides the analytical speech, the well-structured exercise that followed was particularly enlightening on the practical application of the method.

During the following days, the exercises had to do with core description, the measurement of physical parameters (e.g. magnetic susceptibility), and the chemical composition analysis of split sediment core sections with non-destructive methods (XRF), but also with core splicing. Before each round of laboratory sessions, there were detailed presentations of the techniques used in the form of introductory lectures, which helped me understand the procedures followed, along with the technical and other difficulties that exist in real time. The excellent presentations, paired with photos from previous cruises, as well as the guidance, advice and comments of Kucera, U. Röhl, S. Steinke and T. Westerhold during the exercises, were a determining factor in the transmission of the know-how and the creation of a virtual reality IODP expedition.

During each exercise, the process was described step by step, as well as the function of the instruments and, in the meantime, the fact that I had the opportunity to use the actual lab infrastructure of MARUM laboratories to perform analyses on IODP cores was of the utmost importance to me. One of the most interesting points was the utilization of actual measurements. The process of core splicing with the use of magnetic susceptibility as the primary parameter and the Correlator Data Manager software is one such example. However, I believe that the thing that caught my attention the most was the laboratory on inorganic geochemistry, as I am deeply interested in the biogeochemical processes in aquatic ecosystems. During the course of the exercise I had my first opportunity to do the sampling myself and see the method of pore water analysis in practice and under the excellent guidance of M. Kölling.

Two exercises were dedicated to biostratigraphy and they were performed using optical microscopies for assemblage analysis of 3 main microfossil groups, on deep-sea sediment

samples. I have extensively studied the field of biostratigraphy in the past and during these exercises I had the opportunity to learn from 3 leading scientists in their respective fields, so all in all, this was a unique experience. Thus I. Raffi helped me answer specific taxonomic and biostratigraphic questions on calcareous nannofossils, while S. Bohaty guided me to the recognition of a few key Southern Ocean diatoms taxa. Apart from the enthusiasm and their friendly attitude, I would also like to thank them because they let me keep some of the smear slides. Last but not least, Prof. M. Cucera introduced us to radiolaria, which he applied in order to show us the usefulness and importance of precise biostratigraphy for deep-sea coring. His attempt to carry us mentally on-board through a "role playing game" was an exciting moment of the learning process of the summer school.

The last day turned out to be special, as we focused on the preparation and presentation of an IODP proposal. After separating ourselves in random groups, we tried to develop an idea, potentially significant enough to constitute a drilling proposal in a concise manner, in order to be convincing and applicable. The process is wearing, time consuming and extremely complicated, as we eventually found out through our joint effort to complete this particular exercise. And although we simply scratched the surface of the subject, I think that the guide and the tools provided by H. Pälike, as well as the comments and advice of R. Stein were important for us to grasp the general idea and to understand how they eventually constructed such an ambitious and long term program, such as the Integrated Ocean Drilling Program.

In addition to the educational process described above, in the frameworks of the Summer School curriculum and specifically on Saturday, September 14, we took a full day field trip to the German Natural Oil Museum in Wietze. The visit included a very informative tour of both the open space of the museum, which is part of the oilfield with its original equipment conserved, as well as the interior depicting the development of industrial oil exploration with models and photos. One of the most startling facts was that there is a reconstructed roadway that shows how the oil was mined underground and where original equipment can partly be worked by the visitors themselves.

3) Description of the main results obtained

Making an overall assessment of the Summer School, I think that it has achieved its objectives and definitely exceeded my expectations. First of all, the organization was exemplary and the School provided us with all necessary logistical and laboratory support. Furthermore, the choice of speakers was really carefully thought out so as to construct a program with continuity and logical sequence. Moreover, the speakers themselves were in a genuine mentoring mood and everyone else who helped us during the workshops gave their best to teach us, responding to the real meaning of school.

After a reasonable amount of time has passed, I am now trying to provide an account of my participation in the Summer School. I now realize that I set my mind on the right track again. I completed my knowledge of scientific fields I had already dealt with and my understanding became deeper and, at the same time, I set the foundation for areas of expertise unknown to me, but I also acquired a number of tools, records and material for further elaboration. I learned firsthand about the IODP-style shipboard methodologies

from specialists and got a taste of how to write an IODP proposal, skills that will prove to be valuable for my future.

I should also mention that in my opinion, the School had another, adjoining success: that is that it brought together MSc and PhD students from different countries and backgrounds, giving them the opportunity to present their work with specially scheduled presentations and also to cooperate with each other. Through the process of reviewing the previous day, a task undertaken daily by a different group, all the participants had the opportunity to talk about issues of common interest, but also to learn about other fields of research, exchange ideas, concerns and information. The importance of this approach and of the network created among the participants will be made clearer in the future.

4) Future collaboration with host institution (if applicable)

Finally, I should say that one of my immediate plans after the Summer School is to contact MARUM and see if I have what it takes for an internship and of course I will be ready to exploit every possible opportunity for my personal involvement in IODP and for the advancement of my research work. The support I received from European Science Foundation (ESF) for the activity entitled 'EARTHTIME - The European Contribution' through this funding was a decisive factor for my participation in the Summer School.

5) **Projected publications / articles resulting or to result from the grant *(ESF must be acknowledged in publications resulting from the grantee's work in relation with the grant)***

6) Other comments (if any)