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 Summer School on Deep Sea Sediments: From Stratigraphy to Age Models

Application Reference N°: 6031

1)   Purpose of the visit

The purpose of the visit was to attend the ECORD Summer School on Deep Sea Sediments in order to gain knowledge of new and/or improved methods for state of the art stratigraphy and age modelling.

2)   Description of the work carried out during the visit

The stay at MARUM involved an introduction into differnet methodologies in the form of the ECORD summer school. Different methodologies were presented in both theoretical and practical excercises by specialits in the respective fields. Additionally practical work included the 'virtual ship', which was used to present on-board methodologies of an IODP cruise.

Theoretical courses included an introduction of new statistical methods for time series analysis in the statistics package 'R' using the package 'Astro'. 'Astro' offers a new approach for combining the multitaper method (MTM), which is now standard for time series analyses performed on geological records, whith the average spectral misfit (ASM) to significantly refine the identification and calibration of orbital cycles. This approach is combined with automated generation

and calibration of evolutive harmic analyses (EHA) in order to gain insight into possible changes of sedimentation rates that distort cycles over a large frequency pattern.

For biostratigraphical age modeling two methods were presented: CONOP and UAGraph integrated as a module in PAST, both of which allow the generation of biostratigraphic age models based on quantitative biostratigraphy. Both approaches intend to increase the transparency and reproducability of biostratigraphical data, while using the whole dataset instead of a correlation based on the selection of specific index taxa.

For an introduction into probabilistic age modeling the R-package 'Bacon' was used. Bacon uses Monte Carlo procedures to estimate uncertainies in radiometrically dated (radiocarbon isotopes) ages in oder to test chronolical hypothesis and age constraints of sections/cores.

The new biostratigraphical zonations for calcareos nannofossils based on the work of Backman et al. (2012)* were also introduced and extensively discussed in order to provide a better biostratigraphical resolution in both deep marine cores as well as land sections.

During the 'virtual ship' work on existing IODP cores was carried out in terms of sedimentological core description, pore-water analyses and physical properties using a multi-sensor core-logger (MSCL) and a XRF core-scanner. Additionally, micropaleontological studies (calcarous nannofossil and diatoms) in the scope of onboard biostratigraphy were indtroduced and an exercise was held, using radiolaria as an example. Proper core curation and core handling during analysis and sample taking was also covered.

*Backman, J., Raffi, I., Rio, D., Fornaciari, E., Pälike, H., 2012. Biozonation and biochronology of Miocene through Pleistocene calcareous nannofossils from low and middle latitudes. Newsletters on Stratigraphy 45(3), 221–244.

3) Description of the main results obtained

Main results obtain are new methods for the improvement of the orbital tuning of the Decontra section in central Italy (Maiella), in order to significantly improve the age model for this shallow marine carbonatic sucsession of Oligo-/Miocene age. Datasets were analysed with the MTM method, using an unpublished beta version of 'Astro', that was made available during the visit, in order to confirm the results previously obtained using REDFIT. The results are now in the process of being refined using new, improved correlation approaches suggested during the visit, to achieve a more accurate tuning results using the La04 orbital solution of the 100k and 400k eccentricity cycle.

4)   Future collaboration with host institution (if applicable)

At the time no collaborations are planned, although further scientific exchange can not be ruled out.

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)*

The orbitally tuned (400ky-Eccentricity) Decontra Section (Maiella, Central Apennines, Italy) as a stratigraphic reference for shallow marine carbonate successions in the Oligocene-Miocene Mediterranean (working title). ESF will be acknowledged in this forthcoming publication. Please notify me, if you should need further notification upon submission/acceptance of this work in a journal.

6)   Other comments (if any)