

ENGLISH

Topic/Title

Involving Paleobiology for the study of biological crises, from the deep past to the near future

Proposer (Tutor)

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Research proposal

In the last decade, the paleontological research is more and more focussing on the study of fossil assemblages to investigate the ecological dynamics behind the reaction of past communities to the most important biological crises. A deep understanding of these dynamics might provide useful insights to forecast the ecological reactions of living communities facing the ongoing quick climatic changes. Unfortunately, this very interesting field of paleontological research was always limited by the sparse and fragmentary nature of the fossil record and by the lack of statistical tools accounting the different sources of bias of the fossilization process at the base of the spatio-temporal uneven distribution of the fossil record. This project proposal aims at investigating the implementation of new statistical tools, involving Artificial Intelligence algorithms too, to allow a more accurate analysis of the past communities' ecological dynamics, even in the deep past! Further, even the modelling of living communities' response to the ongoing climate changes can be highly enhanced by the direct contribution of the information recorded in the fossils. Indeed, many living species have a fossil record, sometimes dated with radiometric methods, and recently new datasets of past climate were made available to the scientific community, like some temporal intervals of the Cenozoic and Mesozoic. Indeed, another aim of this project is to develop and test

a scientific protocol for merging information of the present and past time periods related to the species being studied to approximate the potential climatic requirements of the living communities in order to predict the communities' response to the ongoing and future climate changes. To this end, a very challenging aim of this project is to integrate climatic, morphological and phylogenetic information about the species being studied in order to have a better interpretation of the relationship between a single species and its physical environment and between all the species in the same community.

Research Plan

I° year

- Collecting of vertebrates' fossil record from specific papers and database in the temporal interval of the main deep past biological crises.
- Developing of statistical methods to account for the effect of the fossilization bias in the palaeontological information.
- Modelling the dynamics of fossil communities before and after the biological crises.

II° year

- Collecting fossil occurrences of living vertebrates.
- Collecting morphological information of species.
- Developing and testing a scientific protocol for integrating living and fossil information of vertebrate species.
- Developing machine-learning based technologies for the downscaling of past climates.
- Modelling the ecological niche of living species after integrating paleontological information.

III° year

- Use of Artificial Intelligence Algorithms for modelling the ecological dynamics of past and present communities.
- Projection onto future of the ecological response models as a reaction of the communities to the ongoing and near future climate changes.