Linking Ordovician biodiversity dynamics to climate change: insights from organic-walled microfossils of Baltica

Summary

The Ordovician Period was characterised globally by a cooling climate and a significant diversification of life, punctuated by the end-Ordovician mass extinction. This project aims to document and understand how biodiversity trends are linked to climate change and environmental perturbations on the Baltica palaeocontinent. Two model groups of organisms will be studied: planktic chitinozoans and benthic jawed polychaetes (represented by scolecodonts). An integrated palaeontological database will be created and used to quantitatively analyse the distribution of faunas in time and space, distinguishing climatic effects and environmental changes from evolutionary and paleobiogeographic factors.

Research field:	Earth sciences
Supervisor:	Prof. Dr. Olle Hints
Availability:	This position is available.
Offered by:	School of Science Department of Geology
Application deadline:	Applications are accepted between June 01, 2024 00:00 and June 30, 2024 23:59 (Europe/Zurich)

Description

Deep-time reconstructions of biodiversity dynamics help to understand the history of life and the functioning of Earth systems. Based on the well-preserved sedimentary archives of Baltica, this project explores how the Earth transferred from the Cambrian greenhouse conditions to the Early Palaeozoic ice age during the Ordovician and how this transition influenced ecosystems and biodiversity.

In order to identify the effects of climate system transition and fluctuations on biota, this project focuses on two model groups of organisms: planktonic chitinozoans and benthic infaunal jawed polychaetes. These microfossil groups are abundant and well-known in the Baltic region, but few studies have addressed their distribution and diversification in the context of climate and environmental change. Moreover, they are poorly represented in palaeontological databases (such as the PaleoBiology DataBase) and thus not included in global analyses of Ordovician radiation and end-Ordovician biodiversity crises. In the project, an occurrence-level database for these groups will be created and integrated with geochemical and sedimentological archives. Additionally, the gaps in the distributional data need to be filled by collecting new material from critical and underrepresented intervals, for which reference sections will be selected and sampled. The project uses quantitative stratigraphic tools such as CONOP9 to analyse this dataset, create regional high-resolution biodiversity curves, and compare these directly with the palaeoclimate reconstructions.

The project aims to test if and how the climatic fluctuations are reflected in the faunal successions of different model groups and ecospaces and compare the results with the patterns identified in previously published data on, e.g., brachiopods. The project will also explore which environmental changes might have caused the Mid-Caradoc Event and look for possible environmental clues to the unique nature of the Middle Darriwilian Carbon Isotopic Excursion. The project will contribute the new and compiled Baltic data to the global databases to make them useful for other researchers and future analyses.

The PhD student will collaborate closely with other team members at TalTech and the University of Tartu who are experts on other fossil groups, biostratigraphy, oxygen and carbon isotope records, sedimentary geochemistry and sedimentology.

Responsibilities

The project will include:

- Participating in fieldwork targeting Ordovician sedimentary successions and collecting samples for integrated micropaleontological-chemostratigraphical-sedimentological research;
- Laboratory processing of microfossil samples for analytical work;
- Developing taxonomic expertise for one or two microfossil groups and identification of taxa in existing and new collections;

- Compiling an integrated palaeontological database and contributing data to global data sets;
- Running quantitative data analyses using CONOP9, PAST, R and other tools.
- Presenting the results in seminars, workshops and conferences;
- Writing scientific publications (three papers in international peer-reviewed journals are required) together with other team members;
- Taking part in PhD courses and being involved in teaching undergraduates according to the regulations of the doctoral study programme at TalTech.

Requirements and beneficial experiences

- MSc degree in palaeontology or geology, previous hands-on experiences with microfossils;
- a clear interest in the topic of the position;
- proficiency in English;
- strong and demonstrable writing and analytical skills;
- capacity to work both as an independent researcher and as part of an international team.

The successful candidate is expected to have a background in palaeontology and a good understanding of sedimentary geology and geochemistry. Prior in-depth knowledge of chitinozoans, scolecodonts, conodonts or other microfossils (taxonomy, biostratigraphy, sample processing), experiences in analytical techniques, and a good understanding of Early Palaeozoic Earth history are beneficial for the position.

We offer

- Friendly community and modern working environment within TalTech campus in Tallinn, capital of Estonia.
- Supervision by some of the best experts on Palaeozoic microfossils worldwide. Becoming a member of an Estonian national research project and multi-institutional team. Tight international collaboration and regular visits to other European research centres, participation in conferences and workshops annually for presenting the results and building a network of research contacts.
- Gross income starting from EUR 1850 per month (increase depending on performance).

TalTech Department of Geology

The Department of Geology is the centre of expertise in geology, mineral resources, and mining at TalTech. Our researchers focus on bedrock geology, paleoenvironments, mineral resources, mining engineering and circular economy. We are responsible for study programmes on Earth systems and resources and host various labs and the largest geoscience collections in Estonia.

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