RUHR-UNIVERSITÄT BOCHUM

RUB

INVITATION TO THE PHD-COLLOQUIUM OF THE FACULTY OF GEOSCIENCE

Date: 14th June 2024 at **15:00**
Room: IA 1/131
Zoom: 662 8034 8490, passcode: 240331
Moderator: Roman Fritz

15:05 to 15:25 Lars Gruenhagen
– Ecosystem service Assessment of urban street trees in Bochum

15:30 to 15:50 Yisi Christine Zhong
– Microbe-sediment interaction controls the earliest stages of marine lithification

15:55 to 16:15 Christian Rivera
– Geogenic sources of arsenic, fluoride and uranium to groundwater flow systems in the Mexican Sierra Madre Occidental

16:20 to 16:40 Guangming Sun
– Metamorphic Evolution of Blueschist and Eclogite from the Lancang Orogenic Belt, Southeastern Tibetan Plateau

All interested parties are kindly invited to attend in the colloquium.

LIST OF ABSTRACTS

Lars Gruenhagen

The urban environment is currently confronted with multiple global environmental challenges. In reaction, cities are planning a sustainable transformation, a key component is the implementation of green infrastructure. One such action is the planting of street trees, which provide added value in the form of ecosystem services (ES), including the filtering of particulate matter (PM10) and carbon sequestration.
Two tree inventories of Bochum were used to assess these two ES with the program i-Tree Eco. The results demonstrate the critical role of urban street trees in improving city sustainability, providing hints for both the administration and residents. Moreover, these findings provide guidance for future improvement measures, such as the planting of trees that are more suited to local conditions.

Yisi Christine Zhong

The transition of unconsolidated carbonate sediment into limestones is a complex, multi-stage process commencing at the seafloor. Hence, much work has been dedicated to carbonate burial and cementation, eventually leading to fully lithified rocks. Conversely, the earliest marine carbonate stabilisation and cementation stages (occurring over periods of many weeks to a few years) are less well understood. In particular, the role of microbe-sediment interaction *versus* that of abiotic processes (seawater supersaturation, hydrodynamic levels etc.) is relevant. This presentation documents the earliest microbial stabilisation and cementation of carbonate grains from a near-beach environment in the modern lagoon of Abu Dhabi. Detailed SEM images from actively forming firmgrounds are used to exemplify processes and products. The aim is to provide evidence that microbially-mediated processes control the earliest stages of sediment stabilisation and cementation. Our data show that extracellular polymeric substances (EPS) and microbes stabilise sediment particles and trigger the nucleation and precipitation of nano-amorphous calcium carbonate grains (nano-ACC grains) following the EPS decay and synergistic microbe-microenvironment processes. Initial nano-ACC grains aggregate and evolve into micrite cement envelopes. Other nano-ACC grains above the micrite envelope align straight to form the initial aragonite needles with the fingerprint of granular texture. In addition, interacting with microbial consortia, some ACC grains are oriented spatially and assemble to form wheat-shape mesocrystals bundles on the micrite cement substratum. Initial aragonites or mesocrystals coherently fuse and form aragonite cement. Aragonite cements (forming bundles) radiate out from the nucleation centres with a range of crystal terminations (pointed, chisel, irregular and frequent twinning). These are the most common early marine cement phases in the study sites, resulting in porous but lithified carbonates. Subsequent stages include the formation of isopachous seams of elongated aragonite cements with different morphologies (hexagonal, tabular, bladed, etc.) on carbonate grains. These observations are significant in the context of seafloor lithification and question conventional hardground models invoking hydrodynamics and seawater supersaturation as main agents.

Christian Rivera

In the cities of Chihuahua, Zacatecas and San Luis Potosí, Mexico (Sierra Madre Occidental), concentrations of fluoride (F), arsenic (As) and uranium (U) have been detected in groundwater above drinking water standards. These elevated concentrations have been associated mainly with geogenic sources in volcanic rocks and basin-fill sediments. However, the specific host phases and mobilization processes that release these toxic elements into groundwater are rarely identified.

In a multi-method approach that combines the classical techniques of hydrochemistry, geochemistry and petrography with more advanced techniques such as Raman spectroscopy (RS), scanning electron microscopy (SEM), electron microprobe (EMP), laser ablation (LA)-ICP-MS, and sequential extraction procedures (SEP), this research proposes a methodology for the characterization and identification of As, F and U bearing phases in volcanic rocks and sediments, as well as some of the processes favoring the mobilization of these elements to groundwater.

The results obtained through the analysis of water-rock interaction in this research can be applied to other semi-arid regions with geogenically impacted aquifers, due to the geological and climatic similarity with numerous volcano-sedimentary basins around the world.

Guangming Sun

The Lancang orogenic belt (LOB) in the southeastern Tibetan Plateau is considered the main suture of the Paleozoic Paleo-Tethys that separates Gondwana-derived continental fragments from Eurasia-derived ones. The LOB preserves well-exposed blueschists and eclogites, although their tectonometamorphic history and protolith signatures remain poorly constrained. Here, we investigate the recently discovered blueschists and eclogites from this suture zone in terms of their petrological, geochemical, and geochronological features, with the aim of constraining the metamorphic evolution and protolith signature. The blueschists display N-MORB-like geochemical affinities. Magmatic zircon grains yield protolith ages of 262.2 Ma. The blueschists show a peak assemblage of garnet + ferroglaucophane + omphacite + lawsonite + phengite + rutile, with peak P–T conditions of 20.7–22.1 kbar and 480–506 °C. The eclogites have a geochemical affinity to E-MORB and display a peak assemblage of garnet + omphacite + lawsonite + glaucophane + phengite + rutile.

Thermodynamic modeling revealed that the eclogites record distinct UHP peak metamorphic conditions of 30.3–32.8 kbar and 595–620 °C.

Metamorphic zircons yielded a Triassic mean U–Pb age of 236.1 Ma, interpreted as the timing of the closure of the Palaeo-Tethys Ocean. The newly discovered blueschists and eclogites of the LOB, with their signatures of ocean-crust subduction, are petrologically, geochemically, and geochronologically comparable with those of the Longmu Co–Shuanghu suture. This provides strong support for the idea that a nearly 2000 km long HP metamorphic belt extends from the northern Tibetan Plateau to the southeastern Tibetan Plateau and represents the main boundary suture of the Palaeo-Tethyan domain.