Environmental Conditions during the Last Glacial Cycle in the Northern Harz Foreland

Lydia Krauß, Jörg Zens, Christian Zeeden & Frank Lehmkuhl

1. Introduction

For the reconstruction of past environmental and climatic conditions several archives can be investigated, e.g. for the global scale deep-sea sediment cores[1] or polar ice cores[2] and for a regional scale lake sediment cores[3]. One important type of regional terrestrial archives of the Quaternary are loess-paleosol-sequences (LPS)[4].

Loess is an aeolian, mainly silt sized (< 63 µm), usually calcareous and yellowish loose sediment which occupies 10 % of the land surface of the Earth. During cold and dry phases loess accumulates. On it soils develop during warmer periods. Through cyclic changes of climatic conditions a series of loess and paleosols develop on each other[5,6].

In comparison to lake sediments and ice cores LPS are archives close to archeological findings. Early humans walked, settled and lived on the soils developed on loess as we do today. This is no wonder because those soils have optimal conditions for vegetation to grow abundantly[7].

However, the modern humans arrived in Central Europe around 33,000 years ago for the first time, but disappeared again till around 14,000 years ago. After that they were permanently present in Central Europe[8].

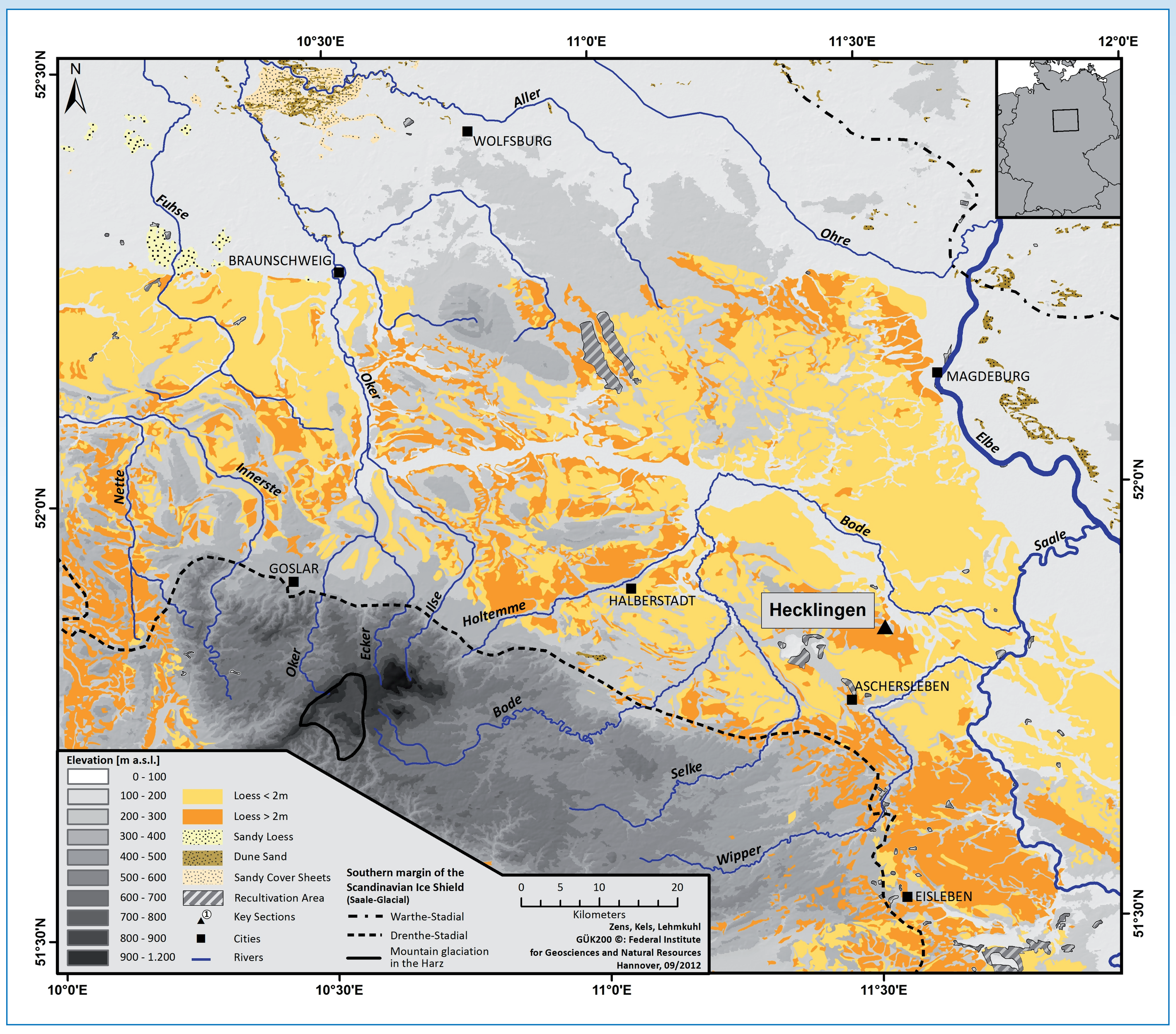

Figure 1: Map of the Northern Harz Foreland with the loess distribution

Within the CRC 806 – Our Way to Europe – that studies the dispersal of the modern Homo sapiens from Africa to Europe, we analyze LPS in Central Europe to reconstruct environmental conditions during the last glacial cycle, to find out if the environmental conditions were too rough for humans to settle here[9].

The Northern Harz Foreland represents a region that was close to the ice sheet during the last glacial cycle[10]. Here environmental conditions were probably pretty harsh, but to find that out, we analyzed a LPS in Hecklingen (fig.1).

2. Features of our profile

In Hecklingen we identified a recent soil of 1.2 m thickness, three around 30 cm thick tundra gleys with a typical grey matrix and red oxidation stains in 2.3, 3.6 and 4.3 m depth, an almost 2 m thick red-brownish soil with an additional 70 cm thick transition layer with krotovinas and an at least 80 cm thick tundra gley at the bottom of the sequence (fig.2).

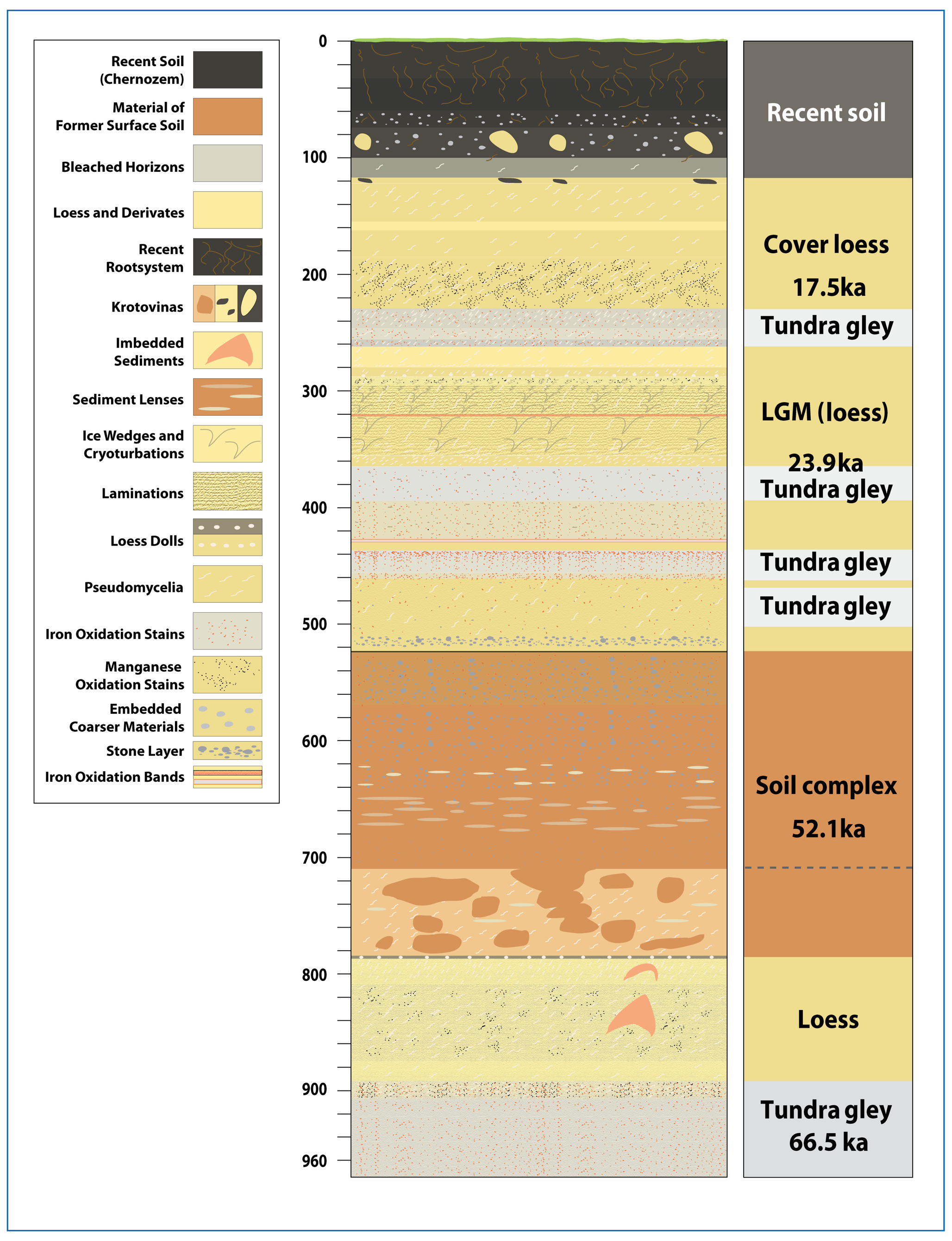

Figure 2: Detailed and generalized profile drawing with OSL ages after Reinecke (2006)[10]

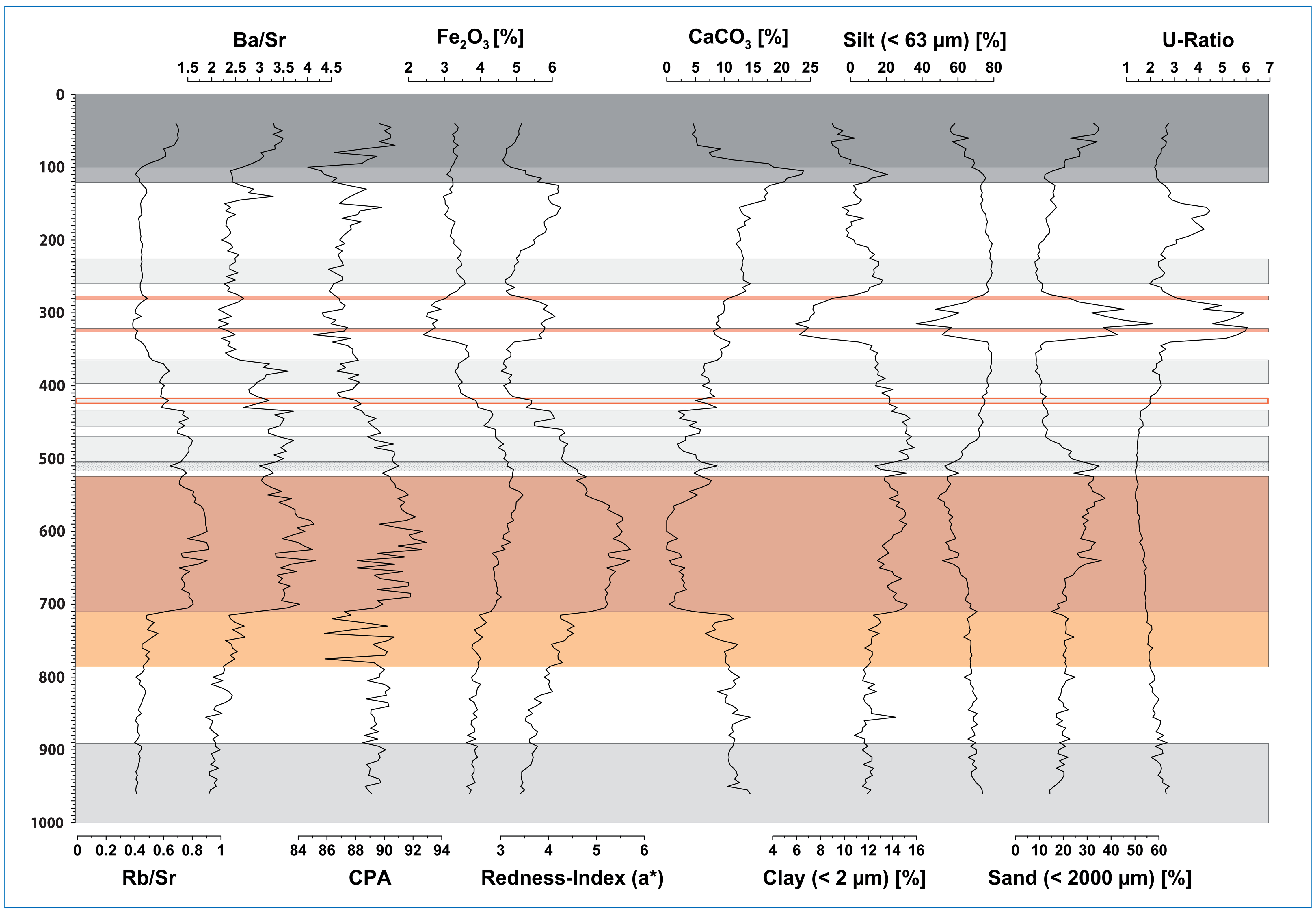

Figure 3: Results of geochemical, color and grain size measurements

In between those layers loess was embedded. The lowermost loess layer below the red-brownish soil material showed lamination. The 1 m thick loess layer below the first tundra gley was laminated, too, but additionally showed strong cryoturbations and ice wedges in some areas. Within the uppermost loess layer no lamination but pseudomycelia and manganese oxidation stains were visible (fig.2).

3. What do we analyze and why

For the reconstruction we use different proxies. The geochemical and color parameters show how strong the material is weathered. Is the sediment strongly weathered, we can assume that we have soil development. Further, this is indicating warmer and more humid climatic conditions.

Additionally, we look at the grain size distribution within the profile, e.g. if we have a lot of clay present, we can determine soil development, since most clay minerals are produced by pedogenic processes. If there is an increase in silt content, we can assume an aeolian material input with a long distance material transport. This speaks for dryer and colder conditions. Higher sand contents on the other hand indicate a close-by source input.

4. A brief summary of the results

The profile shows strong disturbances, here especially lamination and cryoturbation, which are common in central Europe and make the interpretation of the profile more challenging (fig.2).

The weathering indices, e.g. Rb/Sr, Ba/Sr and CPA, show higher values in the identified soils and soil like material, supporting the field observations (fig.3).

The grain size distribution show three phases of higher sand content, speaking for a closer source of the here accumulated material. The U-Ratio show two phases of increased aeolian material input (fig.3).

Acknowledgements

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Lydia Krauß
Physical Geography and Geoecology
Department of Geography, RWTH Aachen University
+49 241 80 96052

CRC 806

Deutsche Forschungsgemeinschaft

Physische Geographie and Geoökologie

RWTH AACHEN UNIVERSITY