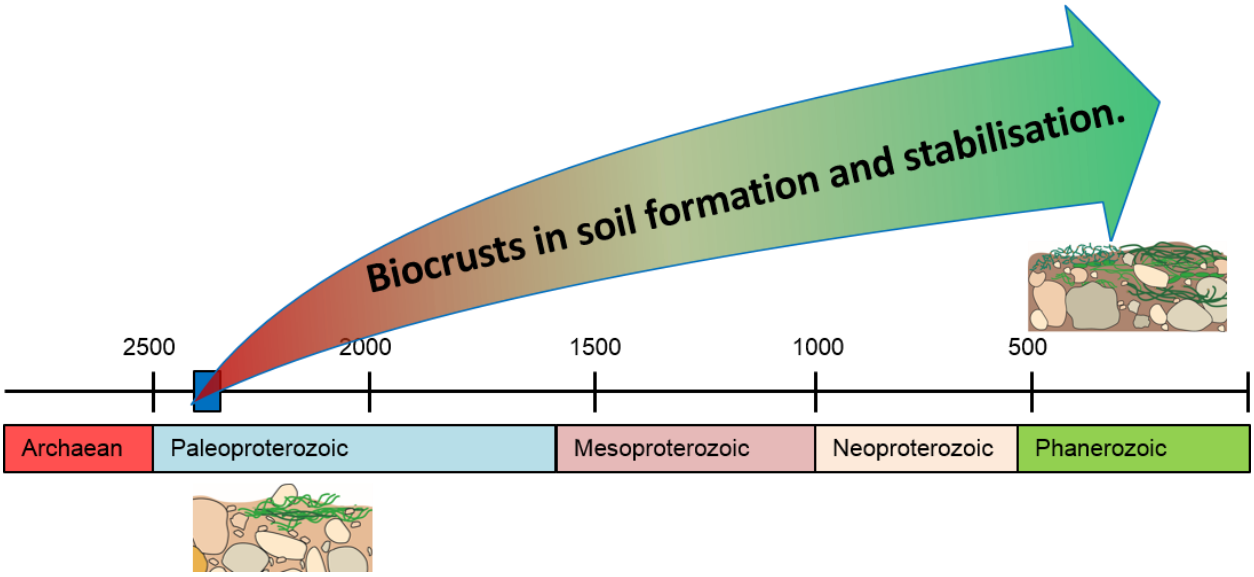
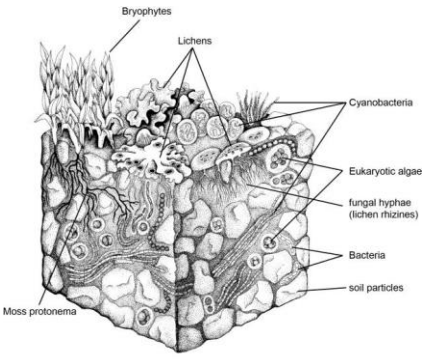
Earthshape

SPP 1803

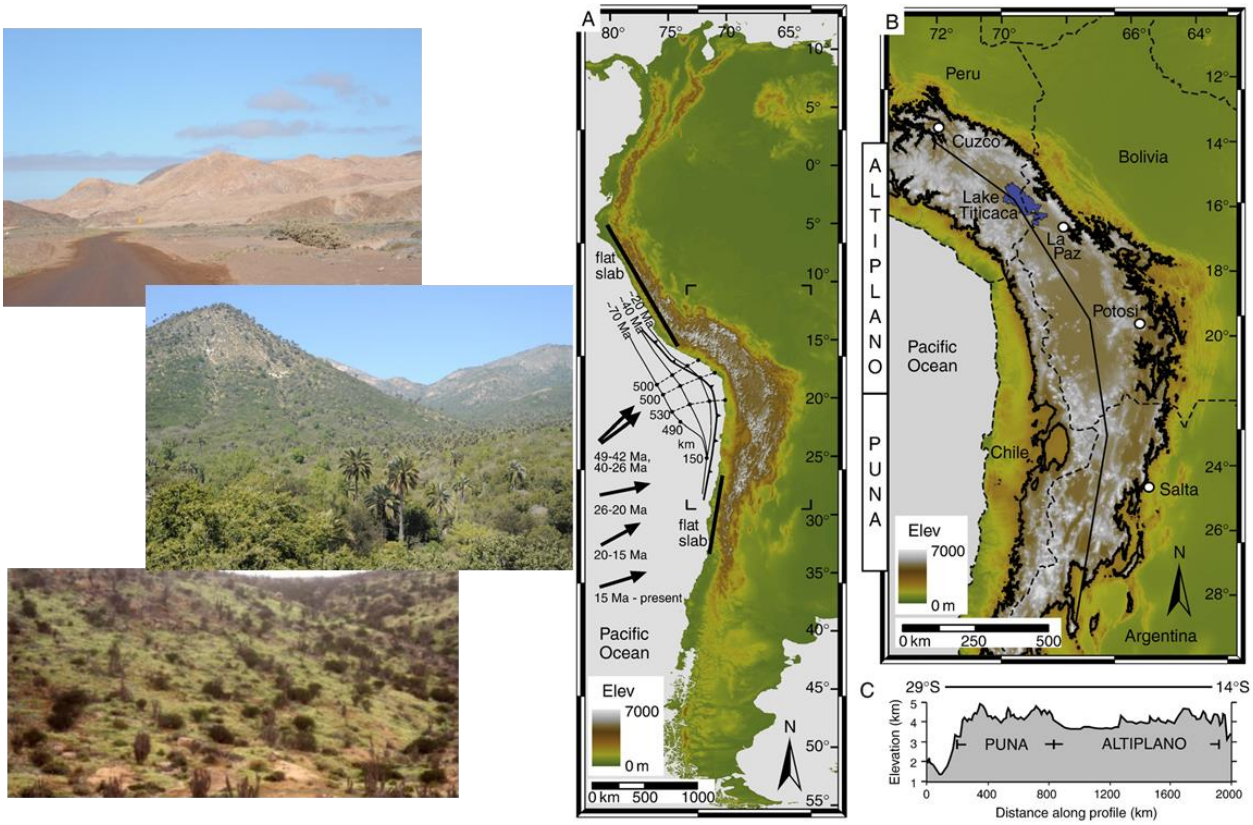
Prof. Burkhard Büdel
Project leader and grant holder.



Biocrusts are formed by living organisms and serve to bind and stabilise the soil surface. Cyanobacteria are thought to have formed the first biocrusts about 2.4 Ga on the edges of shallow ocean basins and freshwater lakes. Modernday Biocrusts evolved ~500 million years ago and are comprised of macroscopic lichens, bryophytes and microscopic organisms such as heterotrophic bacteria, archaea and fungi, with Cyanobacteria and green algae forming the most important phototrophic basis of the consortium. **This project challenges the Geoscience paradigm that earth surface processes are primarily controlled by climate and tectonic forces by demonstrating the importance of biocrusts in stabilising soil surfaces.**

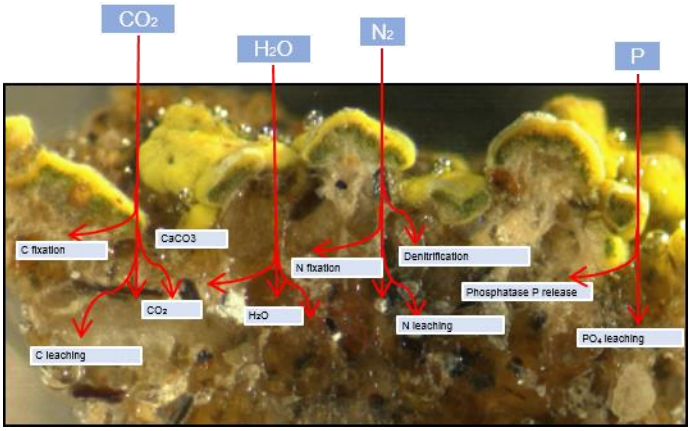


The biocrusts formed in the upper few centimetres of the soil / rock surface along the western coast of semiarid and arid Chile, South America form the basis of this investigation. These communities of crust forming organisms are underrepresented in biodiversity studies, with only 67 species of a potential worldwide number of 1550 of soil crust species of cyanobacteria, algae, lichens and bryophytes being described on this continent. The location of these biocrusts makes them the ideal outdoor laboratory to investigate the soil stabilisation properties of these consortia.



Study sites in Chile. (Photos courtesy of Tod Ehlers)

Biocrusts form an ecological boundary between the atmosphere and the bedrock / soil and regulate the transfer of materials / nutrients and energy from one side to the other. Together with the research groups of U Karsten (University of Rostock), P Leinweber (University of Rostock) and J Bendix (University of Marburg), this project will determine the biodiversity of the biocrusts at two primary study areas using morphological, culture and molecular based techniques. In addition, microclimate stations will provide constant monitoring of the environment, including fog and dew formation.



Cartoon of a typical soil crust illustrating some of the biogeochemical interactions occurring in the dynamic zone between soil and atmosphere. (Image courtesy of Claudia Colesie).

The functional role of biocrusts in the biogeochemistry of P-, C- and N compounds as well as physical slope stabilisation will be assessed by AG Leinweber (University of Rostock) and AG Bendix (University of Marburg). Basic physical, chemical and mineralogical analysis of the soil at the observation sites will allow derivation of indices such as weathering and the degree of sediment alteration. Of particular interest is the cycling of P, an essential and often limiting nutrient, in biocrust covered soils.

Finally, the data generated in this programme will be incorporated into a regression model to calculate the transfer of functions between the measured mineralogical composition and the hyperspectral remote sensing data. By applying derived functions to the entire catchment area, we will derive area-wide information on the target variables of weathering intensity and soil stabilisation in soil crust covered areas of Southern Chile.

While providing much needed basic information on biological soil crust composition and soil stabilisation benefits in Chile, this project will also provide insight into the establishment of Archaeal cyanobacterial biocrusts. By stabilising loose regolith, such as that observed at site 2 of this project, cyanobacteria furthered the establishment of fixed communities of bacteria, eventually laying the foundations for the evolution of higher plants.