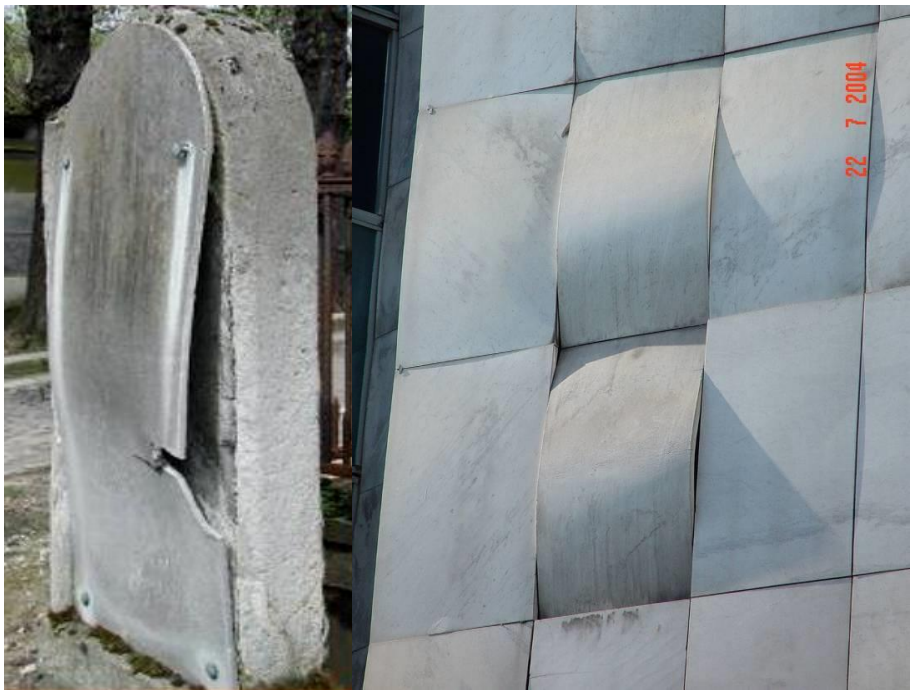
GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN
Geowissenschaftliches Zentrum der Universität Göttingen

Marble Bowing

For about four decades marble has been used as thin veneer cladding. The durability of such thin slabs (mostly 30-40 mm) is satisfactory at most constructions. However, on numerous buildings all over the world, the long-term deformation (expansion, bowing) of some claddings is associated with structural weakening and strength loss which led to an inevitable restoration of the affected facades and to an image problem of marble used as a structural building stone. Up to now, the existing knowledge about the causes for this special kind of marble weathering was mostly restricted to research on Carrara marble and to the effect of individual parameters. This talk summarises the combined influence of extrinsic (environmental) and intrinsic (material specific) parameters on marble bowing. The respective impact of these factors on the weathering process is elucidated by damage mapping of different marble facades. The work focuses on the influence of the microfabric on the damage dynamics of veneer marble and particularly considers moisture as an essential climatic parameter.

Generally, the weathering process is promoted by thermal-hygric microcrack propagation. In case of temperature variations, as occuring during day-night cycles, the anisotropic strain properties of the main components calcite and/or dolomite generate stress within the interconnection of grains. This finally leads to microcracking along fabric discontinuities such as grain boundaries, cleavage planes or pre-existing cracks. Irreversible residual strain serves as an indicator of the accumulated extension of microcracks.

Exemplary long-term field data from the facade of the University Library building in Göttingen as well as weathering simulations of the concerned veneer marble under laboratory conditions reveal an unbroken progress of slab bowing there. The detailed knowledge of long-term bowing dynamics and its correlation with strength loss of veneer panels can provide the basis for risk assessment and prediction of the service life of damaged marble facades.



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