IN VIVO CALCIFICATION OF *VAUCHERIA* (XANTHOPHYCEAE) IN TUFA-PRECIPITATING SPRINGS OF THE EASTERN ALPS

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In Alpine tufa-precipitating creeks, the macroalga *Vaucheria* calcifies *in vivo* by progressive growth of calcite rhombohedra directly on the surface of the alga. Calcification of this alga results in a distinct microfacies observed in both active and fossil Alpine waterfall tufas.

Vaucheria is a xanthophycean macroalga common in springs, streams and rivers of temperate latitudes. Except in waters sufficiently supersaturated for calcium carbonate, this alga does not calcify. The calcification thus pertains to the induced type of biocalcification. In tufa-depositing creeks of the Alps, in low and mid-altitudes, mainly in waterfalls and in cascading reaches *Vaucheria* is fairly common. In these systems, the alga prefers well-lit locations subject to swift and persistent water flow, and forms dense monospecific tufts.

Calcification starts in the proximal (older) parts of algal filaments, by nucleation and growth of calcite rhombohedra directly on the surface of the alga. In most cases, the calcite crystals are of perfect or nearly perfect rhombohedral shape. In early stage of calcification, the calcite rhombohedra are loosely scattered over the surface of the alga. Progressive growth of rhombohedra coupled with continued nucleation of new calcite crystals in between results in a coating of the algal filament by a dense „crystal carpet". In late stage of calcification, the crystals merge with each other along competitive boundaries, resulting in a rigid tube in which the algal filament is completely encased. In standard light microscopy, the calcite crystals begin to be readily recognizable when they had attained microspar size, and they terminate their growth when they had attained a size of about 50-200 microns. We found no evidence for mediation of this style of calcification by other organisms. Although, in some cases, epiphytic diatoms and cyanobacteria were observed on partly calcified filaments of *Vaucheria*, these organisms clearly are not involved in nucleation and growth of the calcite crystals directly on the surface of the filaments. Complete encasement of algal filaments by calcite may impede the metabolic activity of the plant. As a result, the algal filaments die off in their proximal parts while continue to grow in the distal parts, leaving behind the empty crystal tubes of the former algal filament. Because *Vaucheria* grows in dense tufts and meadows, a specific type of cementstone microfacies is produced by the calcification of this alga.

In waterfalls, combined downward growth and contemporaneous calcification of *Vaucheria* may result in bizarrely-shaped, very delicate tufa curtains raging out. In thin section, these tufa curtains consist entirely of *Vaucheria* cementstone. In the shaded understorey of the tufa curtains, other organisms such as moss and/or cyanobacteria may thrive and calcify, giving rise to different microfacies. On the brink of creek cascades and on steep to vertical water-run surfaces, dense stands of this alga may form knobs that, in the resulting tufa, appear as the characteristic cementstone microfacies.