Abstract Submitted
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Formation of Kinneyia via shear-induced instabilities in microbial mats KATHERINE THOMAS, STEPHAN HERMINGHAUS, MPI Dynamics and Self-Organization, HUBERTUS PORADA, Universitat Göttingen, LUCAS GOEHRING, MPI Dynamics and Self-Organization — Kinneyia are a class of microbially mediated sedimentary fossils. Characterised by clearly defined ripple structures, Kinneyia are generally found in areas that were formally littoral habitats and covered by microbial mats. To date there has been no conclusive explanation as to the processes involved in the formation of these fossils. Microbial mats behave like viscoelastic fluids. We propose that the key mechanism involved in the formation of Kinneyia is a Kelvin-Helmholtz instability induced in a viscoelastic film under flowing water. A ripple corrugation is spontaneously induced in the film and grows in amplitude over time. Theoretical predictions show that the ripple instability has a wavelength proportional to the thickness of the film. Experiments carried out using viscoelastic films confirm this prediction. The ripple pattern that forms has a wavelength roughly three times the thickness of the film. This behaviour is independent of the viscosity of the film and the flow conditions. Well-ordered patterns form, with both honeycomb-like and parallel ridges being observed, depending on the flow speed. These patterns correspond well with those found in Kinneyia fossils, with similar morphologies, wavelengths and amplitudes being observed.

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