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The convective Stefan problem: Transitional shapes under natural convection SAM PEGLER, University of Leeds, MEGAN DAVIES WYKES, University of Cambridge — Fluids sculpt many of the shapes we see in the world around us, from melting ice cubes to "stone forests" of limestone rock spires. We present a new mathematical model describing the shape evolution of a body that dissolves or melts under gravitationally stable buoyancy-driven convection, driven by thermal or solutal transfer at the solid-fluid interface. For high Schmidt number, the system is reduced to a single integro-differential equation for the shape evolution. Focusing on the case of an initially conic or wedge-shaped body, we derive complete predictions for the underlying self-similar shapes, intrinsic scales and descent rates that apply to bodies that melt or dissolve in a quiescent ambient fluid. The theoretical predictions show excellent agreement with the results of a new series of laboratory experiments.

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