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Fingers or fractures in viscoplastic gravity currents? Part II THOMASINA BALL, NEIL BALMFORTH, University of British Columbia, STEPHEN MORRIS, University of Toronto — Experiments in which viscoplastic fluid such as an aqueous suspension of Carbopol is extruded from a vent into a shallow ambient layer of water suffer a dramatic pattern-forming instability: if the Carbopol is extruded onto a dry surface, and the spreading dynamics is dominated by shear, the gravity current expands axisymmetrically. However, when the Carbopol is extruded onto a surface coated by an ambient layer of water, the outer radial edge becomes non-axisymmetrical and the current develops into a regular petal-like pattern. In view of a complementary theoretical analysis, one explanation for this phenomenon is an extensional flow instability of shear-thinning or yield-stress fluids, promoted by effective slip caused by water trapped underneath the Carbopol. However, the relatively early onset of the fractures and their elimination with an immiscible ambient fluid layer casts doubt on this explanation, suggesting instead that a different mechanism might be at play: the fracture under tension of the material, exacerbated by the presence of water.

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