Abstract Submitted for the DFD07 Meeting of The American Physical Society

Chevrons formation in laminar erosion OLIVIER DEVAUCHELLE, CHRISTOPHE JOSSERAND, PIERRE-YVES LAGREE, STEPHANE ZALESKI, KHANH-DANG NGUYEN, Institut JLR D'Alembert, CNRS/UPMC, LUCE MALVERTI, ERIC LAJEUNESSE, IPGP — When eroded by laminar free-surface flows, granular substrates may generate a rich variety of natural patterns. Among them are dunes, similar to the ones observed by Charru and Hinch in a Couette cell (Charru F, Hinch EJ; Ripple formation on a particle bed sheared by a viscous liquid. Part 1. Steady flow; JOURNAL OF FLUID MECHANICS 550: 111-121 MAR 10 2006). Chevron-shaped instabilities as those found on the sea-shore, can also be observed, sometimes in competition against dunes formation. These were first pointed out by Daerr et al. when pulling a plate covered with granular material out of a bath of water (Daerr A, Lee P, Lanuza J, et al.; Erosion patterns in a sediment layer; PHYSICAL REVIEW E 67 (6): Art. No. 065201 Part 2 JUN 2003). Both instabilities can grow in laminar open-channel flows, an experimental set-up which is more easily controlled. The mechanisms leading to the formation of these patterns are investigated and compared. Whereas dunes formation requires vertical inertia effects, we show that chevrons may result from the non-linear evolution of bars instability, which may grow even in purely viscous flows.

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Date submitted: 06 Aug 2007

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