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D. Bureau , R. Mourgues , J. Cartwright

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Use of a new artificial cohesive material for physical modelling: application to sandstone intrusions and associated fracture networks

D. Bureau (*[1]), R. Mourgues[(1)], J. Cartwright[(2)]

(1) L.P.G., CNRS UMR 6112, Université du Maine, Avenue Olivier Messiaen, 72085 LE MANS CEDEX 9, France

(2) Department of Earth Sciences, University of Oxford, OX1 3AN, UK

*: corresponding author: denisbureau72@hotmail.fr

Université du Maine

Avenue Olivier Messiaen

72085 Le Mans Cedex 9

France

Tel: +33(0)2 43 83 35 22

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Abstract

Sandstone intrusions are formed by fluidisation and injection of sand into hydraulic fractures. To experimentally reproduce sandstone intrusion emplacement and to understand mechanisms governing their final morphology, it is necessary to employ a brittle, granular material simulating the intruded medium with water as a pore-fluid. We created a new analogue material made of a mixture of sand and gelatine to simulate overburden behaviour and which is capable of reproducing fracturing in water saturated sediments. The cohesion and frictional coefficient of this material is controlled by gelatine concentration. An increase of gelatine concentration of 1g/l results in an increase of 490Pa and 0.08 of cohesion and frictional coefficient, respectively. Permeability of sand is sufficiently reduced to prevent fluid-flow prior to hydraulic fracturing (10^{-14} to 10^{-17}m²). Oscillatory tests on sand/gelatine mixture suggest a visco-elastic behaviour with a dominant elastic behaviour. Initial experimental results are presented here and show that the main geometries of sandstone intrusions (sills, dykes, wing-like intrusions and cones) and their network geometry (dyke to