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Laboratory experiments of magma emplacement during shortening

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Analogue experiments investigating the emplacement of granitic plutons in a shortening upper crust were performed at the Tectonic Modelling Laboratory of the CNR-IGG and of the the Earth Sciences Department of Florence University (Italy).

The models are made of quartz-sand (brittle crust) and a low viscosity mixture of silicone and oleic acid to simulate granitic magma. Shortening of the models was obtained by a moving wall driven by a stepper motor controlled by a central unit. Magma intrusion during deformation was allowed by a special injection apparatus consisting of a piston and a magma distribution system made of pipes joined to a fixed injection point at the models basal interface. Experimental results showed that: 1) Space was made for intrusions by the movement along thrust faults and by the development of low-pressure area into the thrust-anticlines. 2) Intrusion shapes are strictly dependent by the competition between shortening rate (Sh) and injection rate (Inj). In particular for high Sh/Inj values plutons were elongated in map view with the long axis parallel to thrust surfaces. 3) In static models, emplacement level is shallower with diminishing overburden thickness; whereas in model with syn-kinematic intrusion model thickness seems not to control the level of magma emplacement. Finally, 4) magma migrates horizontally away from the injection point and towards the external sector more powerfully for high Sh/Inj values.