Supplement 1: Capillary forces in gypsum

In this supplement the background of equation (A) is clarified.

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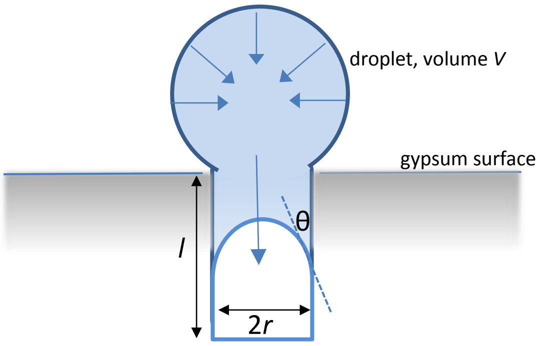

Fig. S1. Schematic view of a droplet on gypsum, the cylindrical tube represents a pore between gypsum needles that form interlocked edges with each other. Due to capillary forces the droplet is absorbed into the gypsum.

To be able to calculate the time for absorption of a droplet into the gypsum the following assumptions were made: a) Void spaces between the gypsum crystals can be considered as cylindrical tubes. b) The mechanism for absorption is capillary force, exerted by the cylindrical tubes in the gypsum surface.

The flow of a fluid through a cylindrical tube is described with Poiseulle's equation,

$$Q = \frac{\pi\, r^4\, \Delta p}{8\, \eta\, l}, \qquad \text{(b)}$$

where Q (in cubic meters per second) represents the flow rate of the fluid into the tube, r (meter) and l (meter) are respectively the radius and length of the tube, η (in pascal-second) is the viscosity of the fluid, Δp (in newton per square meter) is the pressure difference between ends of the tube.

The pressure difference Δp equals:

$$\Delta p = \frac{2\,\gamma}{r} \cos\theta \quad . \qquad \text{(c)}$$

In which γ (in pascal per meter) is the surface tension, and θ is the contact angle between the fluid and the cylinder. To calculate the time for absorption of the droplet we can re-write the equations (b) and (c) into (d)

$$\frac{d\,V_p}{d\,t} = Q = \frac{\pi^2 \cdot r^5 \cdot \gamma \cdot \cos\theta}{4\,\eta} \cdot \frac{1}{V_p}. \qquad \text{(d)}$$

Where V_p (in cubic meters) is the volume of the fluid in the cylindrical tube [$m^3 \pi \; r^2$], and t (in seconds) is the time. This equation can be solved leading to

$$V_p{}^2 = \frac{\pi^2 \cdot r^5 \cdot \gamma \cdot cos\theta}{2\eta} \cdot t \ . \qquad \text{(e)}$$

From equation (e) we can calculate the time it would take before the entire droplet with volume V (in cubic meters) is absorbed into the tube when $V = V_p$

$$t = V^2 \cdot \frac{2\,\eta}{\gamma \cdot \cos\theta \cdot \pi^2 \cdot r^5} \ . \qquad \text{(f)}$$