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Supplementary Material

for "Multitude of dimple shapes can produce singular jets during the collapse of immiscible drop-impact craters"

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Transition of power-law exponents

We use the extreme frame-rates (up to 5 millin fps) to track the radius of the bottom dimple vs time approaching the pinch-off, or singular jet formation. There is a transition of power-law exponents from the capillary-inertial value of 2/3 to close to the purely inertial value of 1/2 during the final crater collapse. In Fig. S2, we plot the data, corresponding to Fig. 6 in the main text, on log-log scales of the dimple radius vs time. Closest to the pinch-off the exponent takes a value around 0.55, in good agreement with Eggers *et al.* (2007), who showed that the transition to 1/2 is very slow.

It is interesting to note that a similar transition of power-law exponents close to pinch off can also be observed in Thoroddsen *et al.* (2018), their Fig. 5(a) for the pinch-off of a conical dimple, with an exponent of $\beta = 0.58 \pm 0.02$ (blue line). In their study the drop and pool are of the same liquid. The cross-over to inertia dynamics controls for the critical pinch off, occurs there at ~ 100 μs, in reasonable agrees with our present study. The cross-over is therefore not limited to the immiscible case.

Crater radius

To compare the results for our collapsing crater to the jetting from a bursting bubble, we fit the maximum crater size with a circle, as is shown in Fig. S3. We use this crater radius R_c to estimate the value of the Ohnesorge number Oh and capillary-inertial velocity v_σ used in Gañán-Calvo (2018).

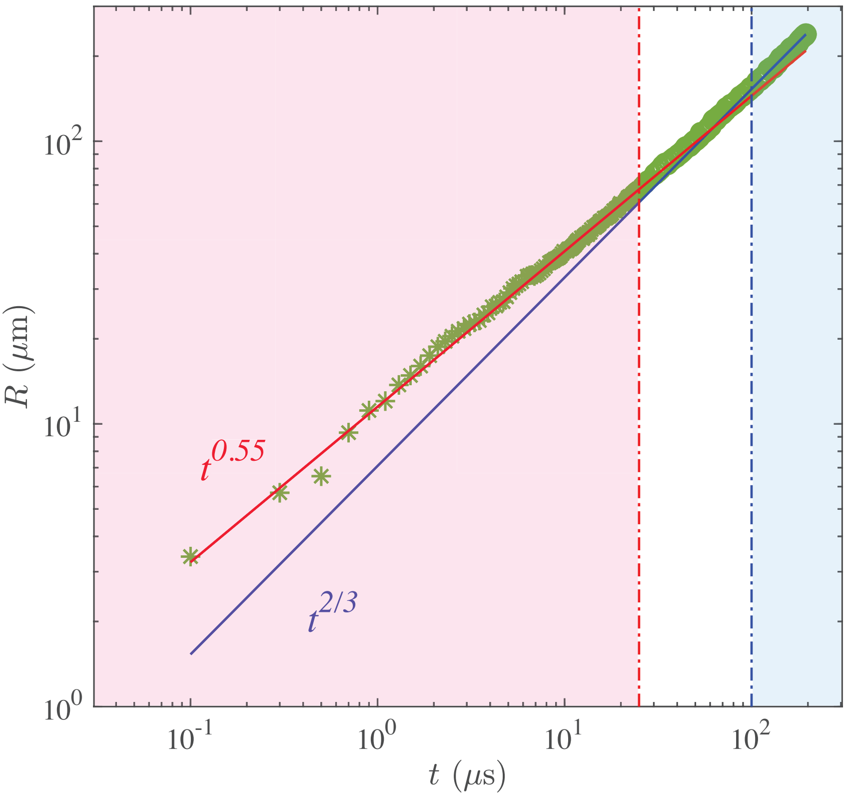

Figure S1. Log-log plot of the dimple radius vs time before pinch-off, corresponding to Figure 6 in the main text. There is a transition of power-law exponents from an initial 2/3 to 0.55 close to the pinch-off, at $t \simeq 65$ μs.

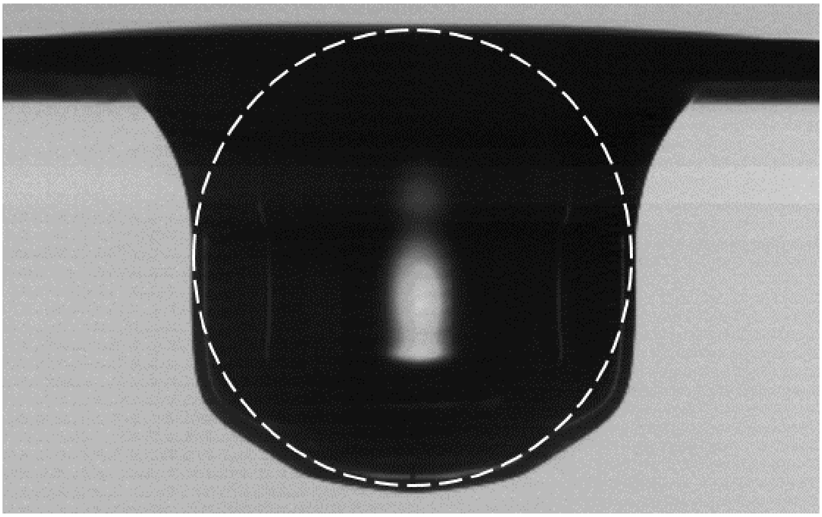

Figure S2. The circular fit to the impact crater at its maximum horizontal extent. The radius of this circle R_c is used in the comparison to the case of a bursting bubble.

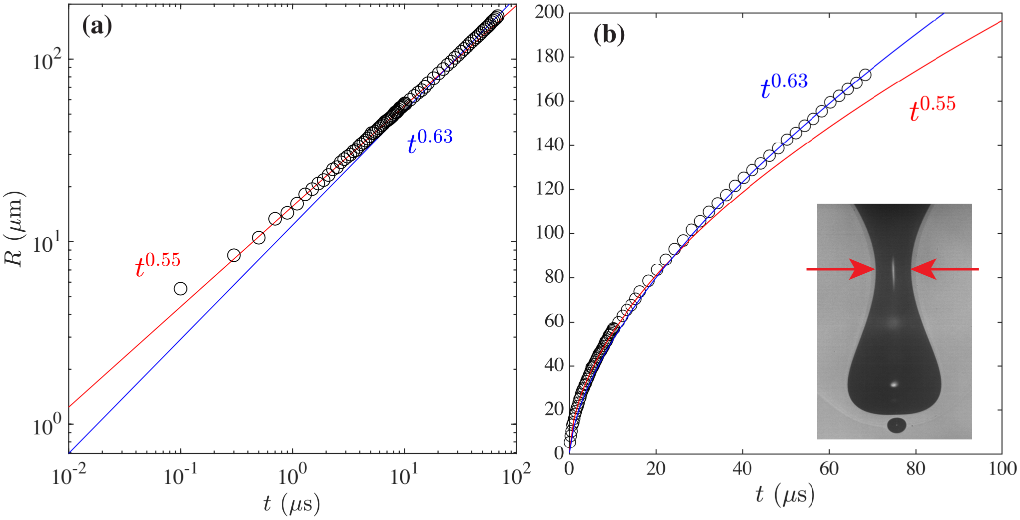

Figure S3. Radial collapse of a dimple pinch-off at the bottom of a crater from a drop impact on a pool, when they are of the same liquid. Glycerol/water mixture of viscosity 7.3 cP, surface tension $\sigma = 68$ mN/m, drop size $D = 3.5$ mm, giving $Re = 797$, $We = 126$, $Fr = 63$. (a) Logarithmic axes and (b) linear axes. The red lines correspond to a power-law exponent of 0.55, while the blue lines correspond to a slope of 0.63. There is a transition between the two power-laws. The inset shows the crater dimple and the tracked dimple radius which is indicated by red arrows.

Cross-over for the same drop and pool liquid impact

The cross-over from capillary-inertial to purely inertial collapse of the bottom dimple is not limited to drop impacts on an immiscible pool. It also occurs for the same liquid in both drop and pool. Figure S3 shows the $R-t$ transition of for such an impact. The liquid is water-glycerol mixture with $\rho = 1140$ kg/m^{3}, $\mu = 7.3$ cP and $\sigma = 68$ mN/m. The drop diameter is 3.5 mm with an impact velocity of 1.47 m/s. The power law for the dimple radius vs time is similar to that of immiscible liquid impact, which transitions from capillary-inertial to pure inertial contraction closer to the final pinch-off.

REFERENCES

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