

Effects of boiling heat transfer on the cooling and morphology of lava

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Cooling of lava under shallow water takes place by boiling heat transfer, which forms stable film of vapor. Both heat flux and heat transfer coefficient are twice as high as, or even higher by more than an order of magnitude for cooling by natural convection + radiation than for cooling by boiling heat transfer + radiation at a given temperature except the temperature range from nucleus to transitional boiling. However, heat flux from the surface of cooling lava and depth of cooling front within lava do not differ significantly through time. This causes a smaller temperature gradient within the lava cooled by boiling heat transfer, resulting in comparatively thicker viscoelastic crust. Thus, subaqueous lava lobes under shallow water are unlikely to yield hollow flow lobes.