EARLY ACCRETION OF PLANETESIMALS UNRAVELED BY A CONVECTIVE MODEL OF THERMAL EVOLUTION

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Recent models [1-3] show that gravitational collapse of boulders in overdense regions of a dusty accretion disk can overcome the so-called meter-sized barrier and lead to rapid accretion of planetesimals of several kilometers in size. The timing of formation of 100-500 km size planetesimals in the solar accretion disk remains however largely unconstrained. The first to form are likely the parent bodies of magmatic iron meteorites, as indicated by the Hf/W ages recently determined for their metal-silicate differentiation [4]. These ages have been used so far to estimate the time at which accretion occurred based on two stringent hypotheses of (i) instantaneous accretion and (ii) purely conductive thermal regime. Here we overcome the limitations of previous model by using original analogue lab-scale experiments of convection in purely internally heated fluids to reconstruct the accretion history of the first planetesimals. We show that, independently of their location in the disk, all these bodies might have grown following a single accretion law with a nearly instantaneous formation of ≈50 km size nuclei growing subsequently by dust/pebbles accretion at a much slower pace to reach their final size in a few Myr. Their thermal evolution did not depend on their size and, likely, did not lead to complete differentiation. The resulting model is furthermore able to account for the characteristics of the parent bodies of the CV chondrites, although developed fully independently.

References: [1] Johansen A. et al. 2007. *Nature* 448: 1022-1025 ; [2] Cuzzi J. et al. 2008. *Astrophys. J.* 687:1432-1447 ; [3] Birnstiel T. et al. 2016. *Space Sci. Rev.* 205: 41-75 ; [4] Kruijer T. S.et al. 2014. *Science* 344: 1150-1154.