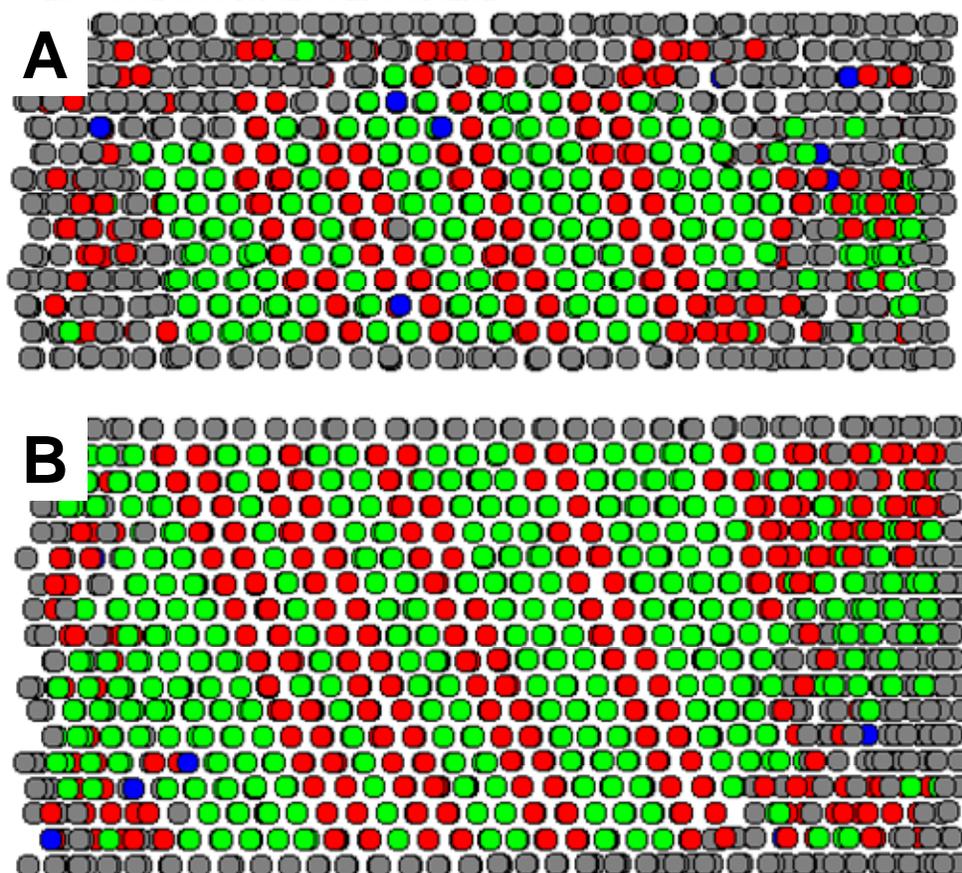


## Supporting Information

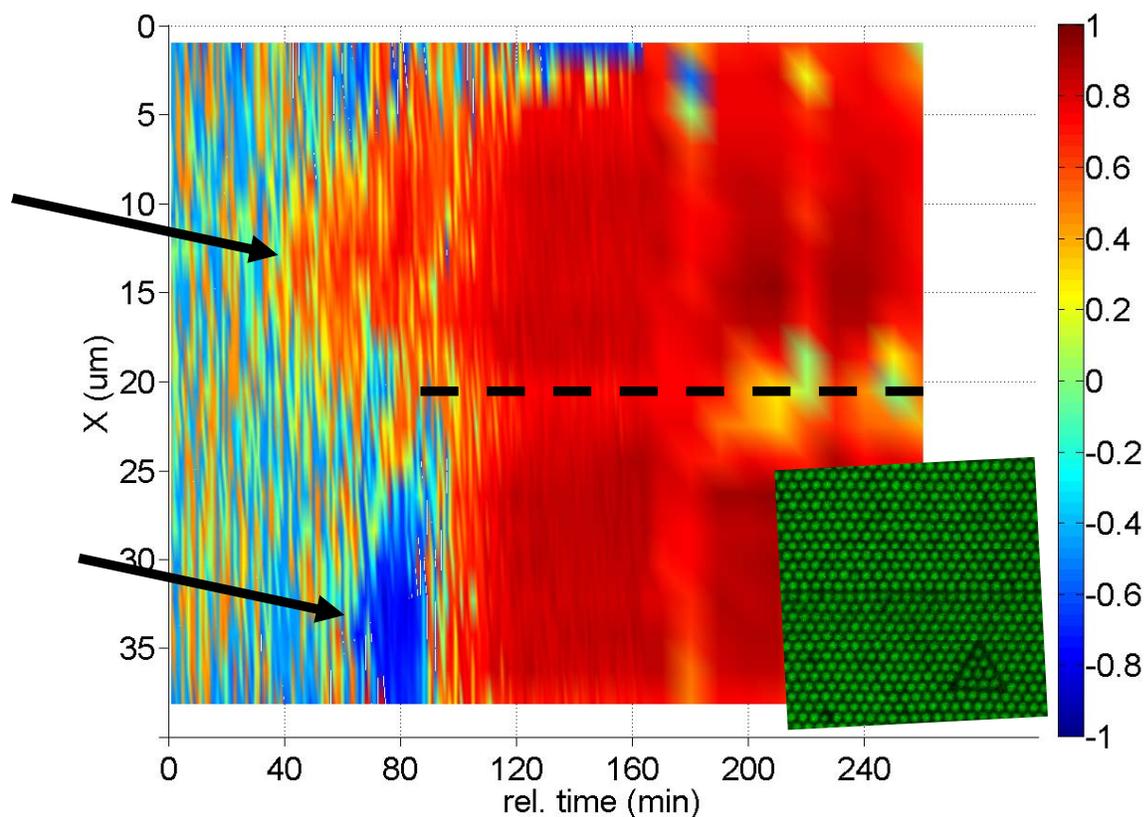
### Slanted Stacking Faults and Persistent Face Centered Cubic Crystal Growth in Sedimentary Colloidal Hard Sphere Crystals

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The following two pictures are added to support statements made in the main text about the presence of slanted faults during growth (Supp. Fig. 1) and the fast annealing of crystals towards fcc structure as a result of the presence of these faults (Supp. Fig. 2). Particles used here have a diameter of 1162 nm and a polydispersity of 2.5%. To achieve slower crystal growth, lower concentrations of 0.5-2.0 v% have been used for these measurements.



**Supporting Figure 1** Particle environment in a growing crystallite. These results are obtained from layer by layer scans of the crystal, so the z-positions within a single layer all seem equal and no height step is present across the slanted stacking faults. Nonetheless, the slanted stacking faults are still recognized by the “Ballviewer” algorithm. Panel a shows a reconstruction from a point in time shortly after the start of crystallization. It contains a small crystallite surrounded by disorder on all sides. The slanted faults are already present here. Panel B is a representation of the crystal after crystal growth (within the field of view) had finished. The same faults are still present and extend further through the lattice.



**Supporting Figure 2** Schematic view of crystallization around a slanted stacking fault as a function of time. The inset shows the orientation of the crystal. The direction of gravity is into the plane. At every point in time, the average crystallinity as well as the crystalline environment were determined as a function of the position in the direction perpendicular to the defect line (vertical axis, the defect

is at  $X=20\mu\text{m}$ ). The crystallinity is determined using the bond order parameter  $\psi_{6,i} = \frac{1}{N} \sum_k e^{6i\theta(\vec{r}_{ik})}$ ,

which describes the angular distribution of nearest neighbors  $k$  around a central particle  $i$ . In a crystalline environment, the absolute value of  $\psi_6$  is close to 1, while in a fluid, it fluctuates strongly around a value of 0.4. The crystalline environment was determined for every particle and for each bin along the vertical axis, the average value of  $\alpha$  was determined ( $\alpha=1$  for fcc, 0 for hcp). To get a clearer picture, a parameter  $\beta$  ( $\beta = (2\alpha - 1)\psi_6$ ) was introduced. This parameter was plotted as a function of time and distance perpendicular to the defect in the above picture. Here, red (blue) indicates high crystallinity with fcc (hcp) structure.

Even though the defect was already present in the layers below, the new layer is found to nucleate at two separate positions away from the defect line: after 40 minutes at  $X\approx 13\mu\text{m}$  in fcc structure (top arrow) and after 60 minutes at  $X\approx 34\mu\text{m}$  in hcp structure (bottom arrow). The crystalline regions are found to grow over time, until they fill the whole picture at  $t\approx 100$  min. Around that moment, the whole hcp layer reorients to an fcc position. In other measurements, we observed similar behavior, although it could take a few hours before reorganization would occur.