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Production of mineral aggregates in quartz tumbling experiments

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Introduction
Tumbling experiments with quartz sand with the purpose of tracing the effect of broken bonds in mineral surfaces resulted in an unexpected production of aggregates. These aggregates are a few microns in diameter, spherical and resembling tiny white “snowballs.”
Particle comminution by aeolian and other natural weathering processes are known in soil science and is often seen as an increase of fine particles towards the top of soil profiles (Nørnberg, P. 1987, 1988, 2002, J.S. Wright 2007). When mineral grains collide in aeolian processes they break up along weakness zones in the crystal lattice. This mechanism causes broken bonds between atoms in the crystal lattice and results in reactive groups in the mineral surface. This mechanism provides the background for experiments to investigate the oxidation processes of magnetite on the planet Mars. The primary magnetic iron oxide phase on Mars is to day known to be magnetite and the colour of the dust on Mars is most likely due to hematite. To investigate if the oxidation process could take place without going over dissolution and precipitation in water, experiments with tumbling of quartz grains in sealed glass containers along with magnetite were started. The idea was that activated bonds at the surface of quartz could oxidize magnetite and convert it to hematite over time. This proved to be the case (Merrison, J.P. et al. 2010). However, in these experiments we observed the formation of the white aggregates which has been the subject of the study that we present here.
Results of tumbling experiments
Commercially available quarts (Merck) was sieved to obtain the fraction between 125 and 1000 μm. This fraction was tumbled in glass containers for months and resulted in production of a significant amount of fine grained material (Merrison, J.P et al. 2010). A part of this fine fraction consists of the “snowball”-like aggregates which is a fragile element with relatively high specific surface. The physical properties of these structures will be discussed in this paper.
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