

## **Calcium segregation at antiphase boundaries in pigeonite**

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### **ABSTRACT**

Over the past 30 years the cooling rates of terrestrial and extraterrestrial basaltic rocks have commonly been inferred from the size of antiphase domains (APDs) in pigeonite. However, the coarsening rate of APDs has been observed to deviate substantially from an ideal rate. It is believed that this deviation is caused by Ca segregation to the antiphase boundaries (APBs) of domains, since Ca is expected to substantially slow boundary migration rates due to solute drag.

This letter presents direct experimental evidence of Ca segregation to APBs in pigeonite. The local atomic structure and chemistry of APBs in pigeonite were examined using high-resolution and energy-filtered transmission electron microscopy. High-resolution images show that APBs in pigeonite have a structure similar to that of augite, and energy-filtered compositional images reveal that Ca segregates to APBs. These results have direct ramifications for the use of antiphase domain (APD) size as a marker for the thermal history of the rocks in which pigeonite crystallizes.