Potassium-rich regions in eucrite plagioclase: Evidence for volatile mobilization post crystallization

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The howardite-eucrite-diogenite (HED) clan of volatile-depleated igneous meteorites likely represents material from the asteroid 4 Vesta [1]. Within basaltic eucrites, the Stannern group is enriched in incompatible elements, including alkalis, relative to the main group. Because feldspar is frequently the host of alkalis, particularly K and Na, the distribution of alkali elements within feldspar may provide a clue as to the distribution and mobility of alkalis during and after formation. Feldspar in the HEDs is typically plagioclase in composition with $<Ab_{25}$ and $<Or_2$. However, K-feldspar and K-rich regions within plagioclase are noted in a few eucrites [2-5]. Small (~10 μm) grains of near-endmember K-feldspar are recognized in several Stannern-group eucrites [2-3] as well as two main-group eucrites [3]. Potassium-rich (Or_{4-11}) regions within calcic plagioclase grains are noted in the basaltic eucrites Stannern [4] and Berthoud [5].

We studied K-rich regions within plagioclase in two eucrites: Stannern and Berthoud. These regions have a mottled texture in BSE images and the higher-Z phase contains μm to sub-μm K-rich inclusions without a similar enrichment in Na. The inclusions are parallel to sub-parallel to one another indicating crystallographic preference or incorporation into fractures. The lack of discrete K-feldspar grains and corresponding Na enrichment in these two eucrites suggests that K was mobilized from previously existing K-feldspar grains post crystallization, possibly during a shock event. Potassium was then incorporated into plagioclase along mineral fractures and annealed during thermal metamorphism. Shock mobilization of K was also suggested by [6] to explain K-rich regions in Stannern plagioclase.

[1] Mittlefehldt D. W. (2015) *Chem. der Erde* 75, 2, 155-183.
[2] Barrat J. A. et al. (2007) *GCA* 71, 4108-4124.
[3] McQuaig D. R. et al. (2019) *LPSC* 50, Abstract #3000.
[4] Takeda H. et al. (1983) *NIPR Spec. Issue* 30, 181-205.
[5] Lewis J. A. et al. (2019) *LPSC* 50, Abstract #1876.
[6] Delaney J. S. et al. (1984) *JGR* 89, supp., C251-C288.