Evidence of K-Fe metasomatism in the SW Scottish Highlands

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Metamorphosed basaltic lava flows, tuffs, sills and dykes are emplaced within metasedimentary rocks which are part of the Dalradian Supergroup (Argyll Group) in the SW Scottish Highlands [1]. These metabasaltic sills were affected by at least three fluid-rock interaction events during greenschist facies regional metamorphism: pre-metamorphic spilitisation, syn-metamorphic carbonation of metabasaltic sills and post-metamorphic quartz-carbonate-sulphide veins [2]. The infiltration of H_2O-CO_2 fluids during carbonation led to a mineral assemblage zonation within the metabasalt with carbonate-free interiors and carbonate-rich margins [3].

These three fluid events and an additional K-Fe metasomatic event of uncertain timing could be identified in alterated metabasalt on the island of Islay in the SW Scottish Highlands. At this locality, the alterated metabasaltic sills display a distinct change in mineral assemblage which seems to be coupled to brittle to ductile faulting. Only the areas close to the fault seems to be affected by the K-Fe metasomatism. The mineral assemblage pl+zoi+chl+qtz+cc changes into ep+chl+qtz+cc+ht+bt towards the fault system which cuts through the outcrop. These results were achieved by petrographic analysis, point counting of 1000 evenly spaced points in selected thin sections, XRF and SEM analyses.

The fact, that hematization took place and zoisite changes into the more Fe-bearing epidote, suggests that iron was added during the fluid event. The formation of biotite leads to the assumption that K-metasomatism is also coupled by this fluid-rock interaction.

Is it possible to constrain a sequence of fluid events in this area? The hematite phenocrysts are only slightly affected by the foliation of the metabasalt which suggests that the K-Fe metasomatism occured after peak metamorphism (400-530°C, 10 kbar) [3]. Also its spatial association with faulting suggests that K-Fe metasomatism was occured late during the fluid-infiltration history.

[1] Roberts & Treagus (1977) *Scottish Journal of Geology* **13**, 87–99. [2] Skelton *et al.* (2010) *Journal of the Geological Society of London* **167**, 1049–1061. [3] Skelton *et al.* (1995) *Journal of Petrology* **36**, 563–586.

Hf-W chronometry of angrites: Implications for ^{26}Al heterogeneity and core formation in protoplanets

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Angrites formed by some of the earliest igneous activity in the solar system and provide insights into the early stages of planetary melting and differentiation. Moreover, they are pivotal reference points for early solar system chronology [e.g. 1-3]. In order to study the processes and timescales of metal segregation in early protoplanets and to assess the distribution of short-lived radionuclides in the early solar system, the ^{182}Hf–^{182}W system was applied to a comprehensive suite of angrites. ^{182}Hf–^{182}W isochron ages for angrites are in excellent agreement with previously reported ^{207}Pb–^{206}Pb and ^{53}Mn–^{53}Cr results [e.g. 1] but are ~1 Myr older than ages obtained from ^{26}Al-^{26}Mg chronometry [e.g. 2]. These inconsistencies are best explained by a heterogeneous distribution of ^{26}Al in the early solar system, suggesting that at the time of CAI formation the angrite precursor material had an ^{26}Al/^{27}Al of $\sim 1.8 \times 10^{-5}$, substantially lower than values commonly measured for CAI. Based on the Hf–W results four texturally and temporally resolved groups of angrites can be identified that were derived from at least two distinct mantle sources. These mantle sources are the result of separate events of core formation, both of which took place within ~2 Myr of CAI formation. Thus, core formation in the angrite parent body did not occur as a single event of metal segregation from a global magma ocean but rather took place under varying conditions by several more local events. Heterogeneities in the Hf-W systematics of the two distinct angrite source regions may result from inefficient core formation in some areas of the angrite parent body or may reflect variable redox conditions during metal segregation. The absence of global melting and homogenization in spite of an early accretion is consistent with a relatively low initial ^{26}Al/^{27}Al inferred here for the angrite precursor material.

[1] Nyquist *et al.* (2009) *Geochim. Cosmochim. Acta* **73**, 5115–5136. [2] Schiller *et al.* (2010) *Geochim. Cosmochim. Acta* **74**, 4844–4864. [3] Kleine *et al.* (2009) *Geochim. Cosmochim. Acta* **73**, 5150–5188.