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Quantification of Fe-fluxes in metamorphic fluids in the SW Scottish Highlands

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Metamorphosed basaltic lava flows, tuffs, sills and dykes emplaced within metasedimentary rocks are abundant in the Dalradian Supergroup (Argyll Group) of 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].
All three fluid events can be identified in alterated metabasalt on the island of Islay in the SW Scottish Highlands. Hematitzation of the sill margins coupled with a distinct increase in iron content in both whole rock and mineral chemistry towards the margins suggest that iron was added by an iron-bearing fluid. Based on (1) point counting data, (2) whole rock chemistry, (3) mineral chemistry and (4) reactions textures, the iron-metasomatic event can be placed close to or at greenschist metamorphism.
Given that the reaction fronts of the iron-metasomatic event correspond to the reaction fronts of the previously identified syn-metamorphic carbonation fluid, we can assume that the fluid which causes carbonation is also responsible for iron metasomatism. Using fluid flux rates for the CO_2-H_2O fluid of the study area [3], we provide a new method of calculating elemental concentrations in particular iron concentration, in metamorphic fluids. These calculated values are consistant with those obtained by fluid inclusion studies.

[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.