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Modelling the Effect of Bulk-Rock Composition on Garnet Interface-Coupled Dissolution-Reprecipitation during Eclogitization.

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Garnet compositional zoning in metamorphic rocks may provide valuable insight into fluid-rock interaction and quantitative constraints on pressure, temperature and reaction kinetics, therefore enabling the reconstruction of detailed metamorphic histories. An anorthosite-mangerite-charnockite-granite (AMCG) suite exposed on Holsnøy (Bergen Arcs, Norway) provides a range of bulk-rock compositions that preserve a local eclogite facies overprint over older dry granulite-facies mineral assemblages. During eclogite-facies metamorphism, granulite-facies garnets are replaced by eclogite-facies garnets via Interface-Coupled Dissolution-Reprecipitation [1] (ICDR). Here we explore the extent to which bulk-rock composition, and thus the initial granulite-facies garnet composition and the local metamorphic assemblage control the extent of ICDR and therefore the compositional zoning within the garnet. We observe that in all studied lithologies (pyroxenite, jotunite, and anorthosite) the granulite-to-eclogite transition in the garnets is associated with a decrease in X_{Prp} component and an increase of X_{Grs} and X_{Alm} components. However, the magnitude and length-scale of this exchange differ depending on the sample bulk composition. Based on that, we infer different local equilibrium length-scales for the lithologies and use this to define appropriate equilibrium compositions for thermodynamic modelling. Integrating equilibrium thermodynamic modelling from *Thermolab* [2] with the *MovingBoundaryPackage* [3] allows us to forward model coupled reaction and transport in garnet during ICDR. This combined approach aims to better understand how bulk-rock composition affects garnet reactivity and element mobility. Ultimately, we aim to constrain timescales of fluid-rock interactions during eclogite-facies metamorphism using garnet compositional zoning, replacement textures and local equilibrium assemblages.

References

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