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(Li,Na)-P substitution in garnet as an indicator of UHP conditions

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Findings of coesite and diamond in quartzo-feldspathic rocks confirmed the idea that continental crust, despite its buoyancy, can be subducted to ultra-high pressure (UHP) conditions. In addition to these index minerals, UHP conditions can be reflected by specific minor elements incorporated in major minerals, which was well demonstrated in mantle rocks, but poorly explored in continental crust. Here, we investigate garnet with coesite inclusions from subducted metagranites of the Eger Crystalline Complex, Bohemian Massif. The garnet shows chemically distinct concentric domains with minor amounts of P, Na, and Li. From the correlation of these elements, we infer $(\text{Na,Li})_1\text{P}_1\text{M}^{2+}_{-1}\text{Si}_{-1}$ substitution, where the Na deficiency is compensated by Li in a 2:1 ratio. This is the first time that such coupled substitution in garnet has been defined and clearly connected to UHP conditions in natural samples, proving itself as a new tool to reveal UHP conditions in garnet. In addition, garnet in subduction zones needs to be considered as an important Li carrier, able to transport significant amounts of Li into the Earth's mantle.