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OPEN Incorporation mechanism of Fe and Al into bridgmanite in a subducting mid-ocean ridge basalt and its crystal chemistry

Akihiko Nakatsuka^{1⊠}, Hiroshi Fukui^{2,6}, Seiji Kamada^{3,4,5}, Naohisa Hirao⁶, Makio Ohkawa⁷, Kazumasa Sugiyama⁸ & Takashi Yoshino⁹

- The compositional difference between subducting slabs and their surrounding lower-mantle can yield the difference in incorporation mechanism of Fe and Al into bridgmanite between both regions, which cause heterogeneity in physical properties and rheology of the lower mantle.
- Mg_{0.66}Fe_{0.34}Si_{0.66}Al_{0.34}O₃ was characterized by a combination of singlecrystal X-ray diffraction and synchrotron ⁵⁷Fe-Mössbauer spectroscopy.
- The charge-coupled substitution ^AMg^{2++B}Si⁴⁺↔ ^AFe³⁺(high-spin)+^BAl³⁺ is predominant in the incorporation of Fe and Al into the eightfoldcoordinated A-site and the sixfold-coordinated B-site in bridgmanite structure.
- The phase transition behavior and the elasticity of bridgmanite in slabs subducting into deeper parts of the lower mantle, in terms of the relative compressibility of AO₁₂ and BO₆ polyhedrons.



Figure 1. Crystal structure of the present (Fe³⁺, Al)-bearing bridgmanite: (a) a view of corner-linked BO₆ octahedra and (b) displacement ellipsoids projected along [001]. In (b), atoms are drawn at 80% probability level. Symmetry codes for equivalent atoms are as in Table 5. The software ATOMS (Version 5.1, Shape Software, Kingsport, TN, USA, http://www.shapesoftware.com/00_Website_Homepage/) was used for the crystal-structural representation.