

LETTER

Akaogiite: An ultra-dense polymorph of TiO₂ with the baddeleyite-type structure, in shocked garnet gneiss from the Ries Crater, Germany

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ABSTRACT

Akaogiite, an ultra-dense polymorph of TiO₂ was encountered in heavily shocked garnet-cordierite-sillimanite gneiss in the Suevite breccia of the Ries meteorite impact crater in Germany. The chemical formula of akaogiite is TiO₂, containing (wt%) TiO₂ 97.6–97.7; Nb₂O₅ 0.15–0.20, and FeO 0.11–0.14. The empirical formula is: Ti_{0.998}Fe_{0.002}Nb_{0.001}O₂. Akaogiite is optically distinguishable from rutile only in reflected light microscopy, through its slightly higher brightness and the intense royal blue color of its internal reflections in crossed nicols. The mineral grains consist of countless randomly oriented submicrometer particles. In situ micro-beam X-ray diffraction established akaogiite to be monoclinic with the baddeleyite-type structure. Cell parameters are $a = 4.606(2)$ Å, $b = 4.896(3)$ Å, $c = 4.933(3)$ Å, and $\beta = 99.17(6)^\circ$; space group $P2_1/c$; molar volume = 16.82(2) cm³/mol; density = 4.72 g/cm³. Akaogiite coexists in the shocked gneiss with graphite-diamond phase transition assemblage, a second dense TiO₂ polymorph with the scrutinyite-type structure (TiO₂-II), liquidus idiomorphic jadeite inclusions in melt pockets in garnet, and a new FeTiO₃-polymorph with the Li-niobate structure. The high-pressure assemblage constrains the equilibrium peak-shock pressure to be ≤ 22 GPa and a post-shock temperature < 500 °C, thus correcting previous estimates. The name was approved by the Commission on New Minerals, Nomenclature and Classification of the International Mineralogical Association (IMA2007-058). The name is for Masaki Akaogi, Professor at the Department of Chemistry, Gakushuin University in Tokyo, Japan.

Keywords: Akaogiite, Ries Crater, suevite impact breccia, shock, rutile, TiO₂-II, graphite, diamond, Li-niobate structured FeTiO₃