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LETTER

# Discovery of asimowite, the Fe-analog of wadsleyite, in shock-melted silicate droplets of the Suizhou L6 and the Quebrada Chimborazo 001 CB3.0 chondrites

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## ABSTRACT

We report the first natural occurrence and single-crystal X-ray diffraction study of the Fe-analog of wadsleyite [$a$ = 5.7485(4), $b$ = 11.5761(9), $c$ = 8.3630(7) Å, $V$ = 556.52(7) Å$^3$; space group *Imma*], spinelloid-structured $Fe_2SiO_4$, a missing phase among the predicted high-pressure polymorphs of ferroan olivine, with the composition $(Fe^{2+}_{1.10}Mg_{0.80}Cr^{3+}_{0.04}Mn^{2+}_{0.02}Ca_{0.02}Al_{0.02}Na_{0.01})_{\Sigma 2.01}(Si_{0.97}Al_{0.03})_{\Sigma 1.00}O_4$. The new mineral was approved by the International Mineralogical Association (No. 2018-102) and named asimowite in honor of Paul D. Asimow, the Eleanor and John R. McMillan Professor of Geology and Geochemistry at the California Institute of Technology. It was discovered in rare shock-melted silicate droplets embedded in Fe,Ni-metal in both the Suizhou L6 chondrite and the Quebrada Chimborazo (QC) 001 CB3.0 chondrite. Asimowite is rare, but the shock-melted silicate droplets are very frequent in both meteorites, and most of them contain Fe-rich wadsleyite ($Fa_{30–45}$). Although the existence of such Fe-rich wadsleyite in shock veins may be due to the kinetic reasons, new theoretical and experimental studies of the stability of $(Fe,Mg)_2SiO_4$ at high temperature (>1800 K) and pressure are clearly needed. This may also have a significant impact on the temperature and chemical estimates of the mantle's transition zone in Earth.

**Keywords:** Wadsleyite, iron, spinelloid, chondrite, meteorite, crystal structure, microprobe analysis, Earth's transition zone