Panguite $(Ti^{4+},Sc,Al,Mg,Zr,Ca)_{1.8}O_3$

Crystal Data: Orthorhombic. *Point Group:* 2/*m* 2/*m* 2/*m.* As irregular grains, to 1.8 μm.

Physical Properties: *Cleavage:* n.d. *Tenacity*: n.d. *Fracture*: n.d. Hardness = n.d.
D(meas.) = n.d. D(calc.) = 3.746

Optical Properties: Opaque. *Color:* n.d. *Streak*: n.d. *Luster*: n.d.
Optical Class: n.d.

Cell Data: *Space Group: Pbca.* a = 9.781(1) b = 9.778(2) c = 9.815(1) Z = 16

X-ray Powder Pattern: Calculated pattern.
2.827 (100), 1.732 (20), 2.957 (12), 1.732 (11), 1.475 (9), 2.086 (8), 5.653 (7.5)

Chemistry:	(1)	(2)
TiO_2	47.97	30.68
ZrO_2	14.61	25.92
Sc_2O_3	10.67	5.97
Al_2O_3	7.58	5.94
MgO	5.54	1.98
Y_2O_3	5.38	10.16
CaO	3.34	8.73
SiO_2	1.89	5.04
FeO	0.81	2.21
V_2O_3	0.95	0.24
Cr_2O_3	0.54	
HfO_2	0.28	0.34
Total	100.56	97.24

(1) Allende meteorite; average of 5 electron microprobe analyses; corresponds to $[(Ti_{0.79}Zr_{0.16}Si_{0.04})^{4+}_{\Sigma=0.99}(Sc_{0.20}Al_{0.20}Y_{0.06}V_{0.02}Cr_{0.01})^{3+}_{\Sigma=0.49}(Mg_{0.18}Ca_{0.08}Fe_{0.03})^{2+}_{\Sigma=0.29}]_{\Sigma=1.77}O_3$.
(2) Allende meteorite; average of 4 electron microprobe analyses; corresponds to $[(Ti_{0.56}Zr_{0.31}Si_{0.12})^{4+}_{\Sigma=0.99}(Al_{0.17}Sc_{0.13}Y_{0.13}V_{0.01})^{3+}_{\Sigma=0.44}(Ca_{0.23}Mg_{0.07}Fe_{0.05})^{2+}_{\Sigma=0.35}]_{\Sigma=1.78}O_3$.

Occurrence: In an ultra-refractory inclusion within an amoeboid olivine inclusion from the Allende CV3 carbonaceous chondrite meteorite, likely formed by condensation and among the oldest solid materials in the solar system.

Association: Ti-rich davisite, Sc-Ti-rich diopside, olivine, troilite.

Distribution: From the Allende, Murchison, and SaU 290 meteorites, most likely widespread in carbonaceous chondrites.

Name: For Pan Gu, the giant in ancient Chinese mythology, who created the world by separating the heaven and earth from chaos in the beginning, in allusion to the ultra-refractory origin of this mineral being among the first solid materials in the solar system.

Type Material: National Museum of Natural History, Washington, D.C., USA (USNM 7602).

References: (1) Chi Ma, O. Tschauner, J.R. Beckett, G.R. Rossman, and Wenjun Liu (2012) Panguite, $(Ti^{4+},Sc,Al,Mg,Zr,Ca)_{1.8}O_3$, a new ultra-refractory titania mineral from the Allende meteorite: Synchrotron micro-diffraction and EBSD. Amer. Mineral., 97, 1219-1225.