Flamite $(Ca,Na,K)_2(Si,P)O_4$

Crystal Data: Orthorhombic. *Point Group*: *mm*2. As 100-250 μm lamellar crystals filling interstitial areas within gehlenite or intergrown with rankinite and Ti-rich andradite.

Physical Properties: *Cleavage*: None. *Fracture*: Irregular. *Tenacity*: Brittle. *Hardness* = 5-5.5 VHN = 706 (50 g laod). D(meas.) = n.d. D(calc.) = 3.264

Optical Properties: Transparent. *Color*: Pale yellow or gray. *Streak*: White. *Luster*: Vitreous. *Optical Class*: Uniaxial (+). ω = 1.634(2) ε = 1.640(2) *Orientation*: *Z* = *E*.

Cell Data: *Space Group*: $Pnm2_1$. *a* = 9.3845(6) *b* = 21.7310(14) *c* = 6.8346(4) Z = 4

X-ray Powder Pattern: Calculated pattern.
2.713 (100), 2.765 (44), 2.759 (42), 1.762 (32), 2.518 (29), 2.402 (23), 2.897 (19)

Chemistry:	(1)
CaO	59.76
SiO_2	28.87
Al_2O_3	0.04
FeO	0.15
MgO	0.16
BaO	0.05
SrO	0.24
V_2O_5	0.10
P_2O_5	7.38
Na_2O	1.55
K_2O	1.73
Total	100.03

(1) Hatrurim Basin, Negev Desert, Israel; average of 21 electron microprobe analyses supplemented by Raman spectroscopy; corresponds to $[Ca_{1.82}Na_{0.09}K_{0.06}(Mg,Fe,Sr,Ba)_{0.02}]_{\Sigma=1.99}(Si_{0.82}P_{0.18})_{\Sigma=1.00}O_4$.

Occurrence: In Ca- and Al-rich paralava, an ultrahigh-temperature combustion metamorphic rock.

Association: Larnite (partially hydrated), gehlenite, rankinite, Ti-rich andradite, ferrian perovskite, magnesioferrite, hematite, ettringite.

Distribution: From the southern Hatrurim Basin, Negev Desert, Israel.

Name: Derived from "flame", in allusion to the origin of the mineral by ultrahigh-temperature metamorphism from the natural combustion of fossil fuel.

Type Material: Central Siberian Geological Museum, V.S. Sobolev Institute of Geology and Mineralogy, Novosibirsk, Russia (XIII-341/1).

References: (1) Sokol, E.V., Y.V. Seryotkin, S.N. Kokh, Y. Vapnik, E.N. Nigmatulina, S.V. Goryainov, E.V. Belogub, and V.V. Sharygin (2015) Flamite, $(Ca,Na,K)_2(Si,P)O_4$, a new mineral from ultrahigh-temperature combustion metamorphic rocks, Hatrurim Basin, Negev Desert, Israel. Mineral. Mag., 79(3), 583-596. (2) Gfeller, F., R. Widmer, B. Krüger, E.V. Galuskin, I.O. Galuskina, and T. Armbruster (2015) The crystal structure of flamite and its relation to Ca_2SiO_4 polymorphs and nagelschmidtite. Eur. J. Mineral., 27, 755-769. (3) (2016) Amer. Mineral., 101, 1713 (abs. refs. 1 & 2).