Ferromerrillite $Ca_9NaFe^{2+}(PO_4)_7$

Crystal Data: Hexagonal. *Point Group*: 3*m*. As anhedral grains to 50 μm.

Physical Properties: *Cleavage*: None. *Fracture*: n.d. *Tenacity*: n.d. Hardness = ~ 5
D(meas.) = 3.14 (Los Angeles) D(calc.) = 3.11

Optical Properties: Transparent. *Color*: Colorless. *Streak*: n.d. *Luster*: Vitreous.
Optical Class: Uniaxial (–). ω = 1.623 ε = 1.621 Also anomalously biaxial with 2V up to 20°.

Cell Data: *Space Group*: *R*3*c*. *a* = 10.372(2) *c* = 37.217(13) Z = 6

X-ray Powder Pattern: Shergotty meteorite/Los Angles meteorite.
2.861 (100)/2.86 (100), 3.191 (81)/3.19 (60), 2.594 (73)/2.594 (50), 6.46 (33)/6.42 (20), 2.741 (21)/2.747 (20), 1.710 (21)/1.713 (20), 5.196 (20)/5.24 (10)

Chemistry:	(1)	(2)
Na_2O	1.7	1.4
CaO	46.8	47.0
MgO	1.5	0.9
FeO	3.5	5.2
P_2O_5	46.2	45.7
Total	99.7	100.2

(1) Shergotty meteorite; average of 8 electron microprobe analyses; corresponds to $Ca_{9.00}(Na_{0.60}Ca_{0.07})_{\Sigma=0.67}(Fe^{2+}_{0.53}Mg_{0.40})_{\Sigma=0.93}P_{7.08}O_{28}$. (2) Los Angeles meteorite; average of 10 electron microprobe analyses; corresponds to $Ca_{9.00}(Na_{0.49}Ca_{0.15})_{\Sigma=0.64}(Fe^{2+}_{0.78}Mg_{0.23})_{\Sigma=1.02}P_{7.03}O_{28}$.

Occurrence: An accessory phase in the basaltic and olivine-phyric subgroups of shergottite meteorites.

Association: Clinopyroxene, maskelynite (impact-melted plagioclase glass).

Distribution: From the Shergotty and Los Angeles shergottite meteorites.

Name: The Fe^{2+}-dominant analogue of *merrillite*.

Type Material: A.E. Fersman Mineralogical Museum, Russian Academy of Sciences, Moscow, Russia (3514/1).

References: (1) Britvin, S.N., S.V. Krivovichev, and T. Armbruster (2016) Ferromerrillite, $Ca_9NaFe^{2+}(PO_4)_7$, a new mineral from the Martian meteorites, and some insights into merrillite-tuite transformation in shergottites. Eur. J. Mineral., 28, 125-136. (2) (2016) Amer. Mineral., 101, 2357 (abs. ref. 1, with comment on the oxidation state of iron).