

Crystal Data: Monoclinic. *Point Group:* $2/m$. *Twinning:* Polysynthetic, with $\{1\ 0\ 1\}$ as composition plane, seen in thin section. Crystals platy to fibrous, to 1 cm; usually radiating fibrous, in nodular aggregates; granular, massive.

Physical Properties: *Cleavage:* $\{010\}$, $\{110\}$, and $\{1\bar{1}\ 0\}$, good. Hardness = 5-5.5
D(meas.) = 3.45 D(calc.) = 3.62

Optical Properties: Subtranslucent to opaque. *Color:* Dirty yellow to brownish yellow, grayish green; superficially dull greenish black, brownish black, black, when altered; yellow to yellow-green in transmitted light. *Streak:* Dirty yellow.

Optical Class: Biaxial (+). *Pleochroism:* X = pale olive-green, straw-yellow to greenish yellow; Z = pale olive-greenish to brownish yellow. *Dispersion:* $r > v$, moderate, crossed.

Absorption: $Z \gg X$. $\alpha = 1.782(5)$ $\beta = 1.802(2)$ $\gamma = 1.835(1)$ $2V(\text{meas.}) = 79.2^\circ$

Cell Data: *Space Group:* $C2/c$. $a = 12.004(2)$ $b = 12.533(4)$ $c = 6.404(1)$ $\beta = 114^\circ 22'(5)$ $Z = 4$

X-ray Powder Pattern: Chanteloube, France.

2.73 (10), 6.36 (8), 3.51 (7), 2.74 (7), 3.08 (5), 5.52 (4), 2.53 (3)

Chemistry:	(1)	(2)	(1)	(2)	(1)	(2)	
P ₂ O ₅	44.14	45.15	MnO	16.17	13.42	F	0.72
Al ₂ O ₃	0.01	2.94	MgO	0.27	3.55	$\frac{-\text{O} = \text{F}_2}{\text{Total}}$	$\frac{0.30}{99.56}$
Fe ₂ O ₃	21.16	14.13	CaO	0.05	2.07		99.65
FeO	12.79	9.40	Na ₂ O	4.97	8.57		

(1) Mount Wills pegmatite field, Victoria, Australia; corresponds to $\square_{0.95}\text{Na}_{0.05}(\text{Na}_{0.72}\text{Mn}_{0.28})(\text{Mn}_{0.83}\text{Fe}^{2+}_{0.17})(\text{Fe}^{3+}_{0.67}\text{Fe}^{2+}_{0.30}\text{Mg}_{0.03})\text{Fe}^{3+}_{1.00}(\text{PO}_4)_3$. (2) Rapid Creek, Canada; by electron microprobe, Fe²⁺:Fe³⁺ from stoichiometry; corresponds to $(\text{Na}_{0.80}\text{Ca}_{0.18}\text{Fe}^{2+}_{0.02})_{\Sigma=1.00}\text{Na}_{0.50}(\text{Mn}^{2+}_{0.89}\text{Fe}^{2+}_{0.11})_{\Sigma=1.00}(\text{Fe}^{3+}_{0.84}\text{Fe}^{2+}_{0.48}\text{Mg}_{0.42}\text{Al}_{0.27})_{\Sigma=2.01}[(\text{PO}_4)_{2.96}\text{F}_{0.06}]_{\Sigma=3.02}$.

Polymorphism & Series: Forms a series with ferroalluaudite.

Mineral Group: Alluaudite supergroup, alluaudite group ($M2$ site = $(\text{Fe}^{3+}\text{Fe}^{3+})$).

Occurrence: Very common in granite pegmatites, formed by sodium metasomatism of triphylite-lithiophilite, heterosite-purpurite, or ferrisicklerite; in phosphatic nodules in shales.

Association: Triphylite, arrojadite, satterlyite, wicksite, wolfeite, pyrite.

Distribution: Numerous occurrences: in the La Vilate quarry, near Chanteloube, Haute-Vienne, France. At Dolní Bory, near Velkého Meziříčí, Czech Republic. From the Varuträsk pegmatite, Västerbotten, Sweden. In England, at the Tremearne pegmatite, Breage, Cornwall. From the G.E. Smith mine, near Newport, Sullivan Co., New Hampshire; at many localities in the Black Hills, Pennington and Custer Cos., South Dakota, USA. From Rapid Creek, Yukon Territory, Canada. At Sidi-Bou-Othmane, Morocco. From the Buranga pegmatite, near Gatumba, Rwanda. In Zimbabwe, at Mterikati, Miami. In Namibia, at the Tsaobismund pegmatite, 60 km south of Karibib. In the Mount Wills pegmatite field, Victoria, Australia.

Name: Honors François Alluaud, mining engineer of Limoges, France, who discovered the species.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 674-675. (2) Fisher, D.J. (1955) Alluaudite. *Amer. Mineral.*, 40, 1100-1109. (3) Moore, P.B. (1971) Crystal chemistry of the alluaudite structure type: contribution to the paragenesis of pegmatite phosphate giant crystals. *Amer. Mineral.*, 56, 1955-1975. (4) Moore, P.B. and J. Ito (1979) Alluaudites, wyllieites, arrojadites: crystal chemistry and nomenclature. *Mineral. Mag.*, 43, 227-235. (5) Robinson, G.W., J. Van Velthuizen, H.G. Ansell, and B.D. Sturman (1992) Mineralogy of the Rapid Creek and Big Fish River area, Yukon Territory. *Mineral. Record*, 23(4), 1-47, esp. 34-36. (6) Hatert, F. (2019) A new nomenclature scheme for the alluaudite supergroup. *Eur. J. Mineral.*, 31, 807-822. (7) Birch, W.D. (2018) Minerals in the arrojadite, alluaudite and jahnsite-whiteite groups from the Mount Wills pegmatite field, Victoria, Australia. *Eur. J. Mineral.*, 30, 635-645.