Kambaldaite $NaNi_4(CO_3)_3(OH)_3 \cdot 3H_2O$

Crystal Data: Hexagonal. *Point Group:* 6. As hexagonal prisms $\{10\bar{1}0\}$, terminated by $\{0001\}$ and $\{11\bar{2}1\}$, to about 50 μm, as individual crystals or in radiating spherical nodules; in cryptocrystalline veins, concretionary, chalky, massive.

Physical Properties: Hardness = ∼3 D(meas.) = 3.18 D(calc.) = 3.193

Optical Properties: Transparent to translucent. *Color:* Bright grass-green to emerald-green, crystals may be zoned with a clear core and translucent margins; pale green if massive.
Streak: Pale green. *Luster:* Silky on fractures.
Optical Class: Uniaxial (+). *Pleochroism:* O = pale green; E = emerald-green. $\omega = 1.65$ $\epsilon = 1.69$

Cell Data: *Space Group:* $P6_3$. $a = 10.340(3)$ $c = 6.097(2)$ $Z = 2$

X-ray Powder Pattern: Kambalda, Western Australia.
9.03 (10), 4.490 (9), 3.613 (4), 2.681 (4), 2.584 (4), 2.519 (4), 2.263 (4)

Chemistry:

	(1)	(2)
SO_3	0.3	
SiO_2	0.2	
CO_2	27.5	24.32
Al_2O_3	0.4	
NiO	52.9	55.04
MgO	1.3	
Na_2O	3.0	5.71
H_2O	12.5	14.93
Total	98.1	100.00

(1) Kambalda, Western Australia; by electron microprobe, C and H by microanalysis; corresponds to $Na_{0.52}(Ni_{3.90}Mg_{0.18})_{\Sigma=4.08}[(C_{1.15}Al_{0.01}Si_{0.01})_{\Sigma=1.17}O_{3.46}]_3(OH)_{1.98} \cdot 2.84H_2O$.
(2) $NaNi_4(CO_3)_3(OH)_3 \cdot 3H_2O$.

Occurrence: A secondary mineral in goethitic residues formed by oxidation of violarite–pyrite in the presence of wallrock carbonates and saline groundwater (Kambalda, Western Australia).

Association: Gaspéite, reevesite, aragonite, pyrite, goethite (Kambalda, Western Australia).

Distribution: In Australia, from the Otter Shoot, Kambalda, 56 km south of Kalgoorlie, and in the 132 North nickel mine, 4 km southwest of Widgiemooltha, Western Australia.

Name: For Kambalda, Western Australia, its locality of discovery.

Type Material: Western Australian Museum, Perth, M.62.1991; Museum Victoria, Melbourne, M37494; Australian Museum, Sydney, Australia, D48054; The Natural History Museum, London, England, 1985,497; National Museum of Natural History, Washington, D.C., USA, 162706.

References: (1) Nickel, E.H. and B.W. Robinson (1985) Kambaldaite–a new hydrated Ni–Na carbonate mineral from Kambalda, Western Australia. Amer. Mineral., 70, 419–422.
(2) Engelhardt, L.M., S.R. Hall, and A.H. White (1985) Crystal structure of kambaldaite, $Na_2Ni_8(CO_3)_6 \cdot 6H_2O$. Amer. Mineral., 70, 423–427.