Gartrellite **$PbCu(Fe^{3+},Cu)(AsO_4)_2(OH,H_2O)_2$**

Crystal Data: Triclinic. *Point Group:* $\bar{1}$. Nearly cryptocrystalline, with platy crystallites to 10 μm, tabular on {111}, {010}, {112}, additional minor forms; in aggregates, fine-grained coatings and powdery incrustations. *Twinning:* Common, by reflection on {$1\bar{1}0$}.

Physical Properties: *Cleavage:* Perfect on {111}. *Tenacity:* Friable. Hardness = 4.5 D(meas.) = n.d. D(calc.) = 5.38–5.43

Optical Properties: Transparent. *Color:* Bright yellow, greenish yellow, green, brown; pale yellow in transmitted light. *Streak:* Bright yellow. *Luster:* Chalky.
Optical Class: Biaxial (+). *Pleochroism:* Weak; X = Y = pale yellow; Z = yellow. *Orientation:* X (45°,-22°); Y (48°,130°); Z (76°,-127°) [with a (90°,90°) and b (90°,0°) using (ϕ,ρ)].
$\alpha = 1.94(1)$ $\beta = [1.98]$ $\gamma = 2.06(2)$ 2V(meas.) = 78(4)°

Cell Data: *Space Group:* $P\bar{1}$. $a = 5.431$–5.460 $b = 5.628$–5.653 $c = 7.565$–7.589
$\alpha = 67.52°-67.77°$ $\beta = 69.27°-69.57°$ $\gamma = 70.04°-70.31°$ Z = 1

X-ray Powder Pattern: Anticline prospect, Australia.
2.962 (100), 3.203 (97), 4.612 (70), 3.339 (70), 2.915 (70), 2.522 (64), 4.847 (54)

Chemistry:

	(1)	(2)		(1)	(2)
SO_3	1.68	0.74	CuO	14.02	13.41
As_2O_5	33.11	32.50	ZnO	0.21	0.31
Al_2O_3	0.11	2.09	PbO	36.53	38.62
Fe_2O_3	10.33	7.74	H_2O	[4.47]	n.d.
			Total	[100.46]	95.41

(1) Anticline prospect, Australia; by electron microscope, average of 15 analyses, original total given as 100.47%, total Fe as Fe_2O_3, confirmed by IR and Mössbauer spectroscopy, H_2O calculated from theory; corresponds to $Pb_{1.04}Cu_{1.00}(Fe_{0.82}Cu_{0.12}Zn_{0.02}Al_{0.01})_{\Sigma=0.97}[(AsO_4)_{1.83}(SO_4)_{0.13}]_{\Sigma=1.96}[(OH)_{1.10}(H_2O)_{1.03}]_{\Sigma=2.13}$. (2) Broken Hill, Australia; by electron microprobe, average of two analyses; corresponds to $Pb_{1.07}Cu_{1.00}(Fe_{0.60}Al_{0.25}Cu_{0.05}Zn_{0.02})_{\Sigma=0.92}[(AsO_4)_{1.75}(SO_4)_{0.06}]_{\Sigma=1.81}[(OH),H_2O]_2$.

Mineral Group: Tsumcorite group.

Occurrence: A rare mineral in an oxidized mineralized shear zone cutting graywackes and shales (Anticline prospect, Australia); on fine-grained quartz-spessartine rocks (Broken Hill, Australia).

Association: Secondary copper minerals, quartz, clay minerals, iron oxides (Anticline prospect, Australia); hidalgoite–beudantite, quartz, spessartine (Broken Hill, Australia); mimetite, duftite, beudantite, bayldonite, quartz (Tsumeb, Namibia).

Distribution: From the Anticline and Bali Lo copper prospects, 11 km west-southwest of Ashburton Downs homestead, Capricorn Range, Western Australia, and in the Kintore open cut, Broken Hill, New South Wales, Australia. At Reichenbach, near Bensheim, Hesse, and in the Clara Mine, near Oberwolfach, Black Forest, Germany. From Tsumeb, Namibia. In the Centennial Eureka mine, Tintic district, Juab Co., Utah, USA.

Name: Honoring Blair J. Gartrell (1950–1994), Australian mineral collector of Beverley, Australia, who found the mineral.

Type Material: Western Australian Museum, Perth, M.61.1991; Museum Victoria, Melbourne, Australia, M39278.

References: (1) Nickel, E.H., B.W. Robinson, Ô. Fitz Gerald, and W.D. Birch (1989) Gartrellite, a new secondary arsenate mineral from Ashburton Downs, W.A. and Broken Hill, N.S.W. Australian Mineral., 4(3), 83–89. (2) (1990) Amer. Mineral., 75, 932 (abs. ref. 1). (3) Krause, W., K. Belendorff, H.-J. Bernhardt, C. McCammon, H. Effenberger, and W. Mikenda (1998) Crystal chemistry of the tsumcorite-group minerals. New data on ferrilotharmeyerite, tsumcorite, thometzekite, mounanaite, helmutwinklerite, and a redefinition of gartrellite. Eur. J. Mineral., 10, 179–206.