Carmeltazite $ZrAl_2Ti_4O_{11}$

Crystal Data: Orthorhombic. *Point Group*: 2/*m* 2/*m* 2/*m*. As irregular crystals to 80 μm.

Physical Properties: *Cleavage*: n.d. *Fracture*: n.d. *Tenacity*: n.d. Hardness = n.d.
D(meas.) = n.d. D(calc.) = 4.122

Optical Properties: Opaque. *Color*: Black. S*treak*: Reddish brown. *Luster*: Metallic.
Optical Class: Anisotropic. *Pleochroism:* Weak, dark brown to dark green. *Bireflectance*: Weak to moderate.
R_1-R_2: (471.1) 21.8-22.9, (548.3) 21.0-21.6, (586.6) 19.9-20.7, (652.3) 18.5-19.8

Cell Data: Space Group: *Pnma*. a = 14.0951(9) b = 5.8123(4) c = 10.0848(7) Z = 4

X-ray Powder Pattern: Near Mt Carmel, Kishon River, near Haifa, northern Israel.
2.961 (100), 5.04 (65), 4.09 (60), 2.047 (60), 2.885 (40), 2.732 (30), 1.456 (30)

Chemistry:

	(1)	(2)
SiO_2	1.50	
ZrO_2	24.9	24.03
HfO_2	0.53	
UO_2	0.16	
ThO_2	0.06	
Al_2O_3	18.8	19.88
Cr_2O_3	0.02	
Ti_2O_3	50.6	56.09
Sc_2O_3	0.76	
Y_2O_3	0.39	
MgO	1.89	
CaO	0.51	.
Total	100.12	100.00

(1) Near Mt Carmel, Kishon River, near Haifa, northern Israel; average of 8 electron microprobe analyses; corresponds to $(Ti^{3+}_{3.60}Al_{1.89}Zr_{1.04}Mg_{0.24}Si_{0.13}Sc^{3+}_{0.06}Ca_{0.05}Y_{0.02}Hf_{0.01})_{\Sigma=7.04}O_{11}$.
(2) $ZrAl_2Ti_4O_{11}$.

Occurrence: Interstitial to, or included in, skeletal corundum xenocrysts in mafic to ultramafic pyroclastic ejecta in volcanic rocks and associated alluvial placers. The silicate melts parental to this assemblage had previously been progressively desilicated by the exsolution of immiscible Fe-Ti-oxide melts and Fe-Ti-Zr-silicide melts (found also as inclusions in carmeltazite), and the crystallization of moissanite and khamrabaevite.

Association: Tistarite, corundum, anorthite, osbornite, spinel, Ca-Mg-Al-Si-O glass.

Distribution: From near Mt Carmel, Kishon River, near Haifa, northern Israel.

Name: For the locality, Mt *Carmel*, where the first specimens were collected and for the dominant metals in the mineral, *t*itanium, *a*luminum, and *z*irconium ("*taz*").

Type Material: Natural History Museum, University of Florence, Italy (3293/I).

References: (1) Griffin, W.L., S.E.M. Gain, L. Bindi, V. Toledo, F. Cámara, M. Saunders, and S.Y. O'Reilly (2018) Carmeltazite, $ZrAl_2Ti_4O_{11}$, a new mineral trapped in corundum from volcanic rocks of Mt Carmel, Northern Israel. Minerals, 8(12), 601. (2) (2020) Amer. Mineral., 105(8), 1276 (abs. ref. 1).