The diversity of carbonate minerals

	Bicarbonates (regardless of hydration)	Simple Carbonates	H_2O-bearing Carbonates	OH-bearing (or O-bearing) Carbonates	OH (or O)-and-H_2O-bearing Carbonates	Layered Hydroxyl - Carbonate Minerals	Carbonates with one other anion[d]	with Two or Three Other Anions
Monovalent cations only	5[c] e.g., Nahcolite $NaHCO_3$	2 e.g., Natrite Na_2CO_3	2 e.g. Natron $Na_2CO_3.10H_2O$	0	1 Peterbaylissite $Hg_3^{1+}(CO_3)(OH).2H_2O$	0	2 e.g., Burkeite $Na_6(CO_3)(SO_4)_2$	1 Hanksite $Na_{22}K(SO_4)_9(CO_3)_2Cl$
Monovalent + divalent cations only	0	8 e.g. Bütschliite $K_2Ca(CO_3)_2$	4 e.g. Gaylussite $Na_2Ca(CO_3)_2.5H_2O$	0	2 Kambaldaite $NaNi_4(CO_3)_3(OH)_3.3H_2O$	0	11 e.g., Northupite $Na_3Mg(CO_3)_2Cl$	1 Carletonite $KNa_4Ca_4Si_8O_{18}(CO_3)_4(OH,F)_2.H_2O$
Divalent cations only	0	24 e.g., Calcite $CaCO_3$	7 e.g. Nesquehonite $MgCO_3.3H_2O$	14 e.g. Hydrozincite $Zn_5(CO_3)_2(OH)_6$	11 e.g. Hydro-magnesite $Mg_5(CO_3)_4(OH)_24H_2O$	0	28 e.g., Rapidcreekite $Ca_2SO_4CO_34H_2O$	9 e.g., Tatarskite $Ca_6Mg_2(SO_4)_2(CO_3)_2Cl_4(OH)_4.7H_2O$
Trivalent cations: Rare-earths ± others[a]	0	8 e.g. Remondite-(Ce) $Na_3(Ce,La,Ca,Na,Sr)_3(CO_3)_5$	8 e.g. Lanthanite-(La) $(Ce,La)_2(CO_3)_3.8H_2O$	0	8 e.g.,Tengerite-(Y) $CaY_3(CO_3)_4(OH)_33H_2O$	0	24 e.g.,Bastnäsite-(Ce) $(Ce,La)(CO_3)F$	4 e.g., Reederite-(Y) $(Na,Mn,Fe)_{15}(Y,REE)_2(CO_3)_9(SO_3F)Cl$
Trivalent cations: Al^{3+} ± others[b]	0	0	0	1 Dawsonite $NaAlCO_3(OH)_2$	7 e.g., Dundasite $PbAl_2(CO_3)_2(OH)_4.H_2O$	8 e.g. Hydrotalcite $Mg_6Al_2CO_3(OH)_{16}.4H_2O$	14 e.g., Cancrinite $Na_6Ca_2Al_6Si_6O_{24}(CO_3)_2$	12 e.g., Davyne $(Na,Ca,K)_8Al_6Si_6O_{24}(Cl,SO_4,CO_3)_{2-3}$
Trivalent cations: Fe^{3+},Mn^{3+}, Co^{3+}, Cr^{3+} Bi^{3+} ± others	0	0	0	2 e.g. Bismutite $(BiO)_2CO_3$	0	9 e.g. Pyroaurite $Mg_6Fe^{3+}{}_2CO_3(OH)_{16}.4H_2O$	5 e.g., Gaudefroyite $Ca_4Mn^{3+}{}_{3-x}(BO_3)_3CO_3(O,OH)_3$	0
Tetra- to Hexa-valent cations: Zr^{4+},Mn^{4+}, Th^{4+}, Ta^{5+} ± others	0	0	2 e.g. Tuliokite $Na_6BaTh(CO_3)_6.6H_2O$	2 e.g., Sabinaite $Na_4Zr_2TiO_4(CO_3)_4$	0	0	5 e.g., Voggite $Na_2Zr(PO_4)CO_3(OH).2H_2O$	0
Tetra- to Hexa-valent cations: U ± others	0	0	0	2 e.g. Rutherfordine UO_2CO_3	21 e.g., Znucalite $Zn_{11}UO_2Ca(CO_3)_3(OH)_{20}.4H_2O$	0	2 e.g., Lepersonite-(Gd) $Ca(Gd,Dy)_2(UO_2)_{24}(CO_3)_8(Si_4O_{12})O_{16}.60H_2O$	1 Schröckingerite $NaCa_3(UO_2)(CO_3)_3(SO_4)F.10H_2O$

[a] Row includes all rare-earth-bearing carbonates, including those with mono- & divalent cations, but not those with tetravalent or hexavalent cations. [b] Row includes all Al-bearing carbonates, including those with mono- & divalent cations. [c] Includes teschemacherite (NH_4HCO_3). [d] "Other anions" include fluoride, choride, sulfate, phosphate, borate, arsenate, & silicate.
This table is derived from Figs. 1 & 2 of Railsback, L.B., 1999, Patterns in the compositions, properties, and geochemistry of carbonate minerals:*Carbonates and Evaporites*, v. 14, p. 1-20.

Previous pages in this series have focussed largely on the more common carbonate minerals, which are generally the anhydrous carbonates of divalent cations (e.g., calcite). This table shows that there are many more carbonate minerals. Most are volumetrically insignificant, but they are a reminder of the minor minerals that one may encounter.

The most striking pattern in this table is the abundance of zeroes to the lower left. They can be explained by consideration of charge and ionic potential: the cations of greater ionic potential lower in the table will not tolerate the presence of the positive charge of H^+ in bicarbonate, and in fact they require H_2O to buffer, and/or OH^- or O^{2-} to offset, their own intense positive charge.