Appendix D. Mineralogical Index by Paul B. Barton

The mineralogy of the deposits is indicated in six categories describing the mode of occurrence of the mineral. Each category, which constitutes a column, is labeled as follows: "Ore mineral" (the mineral is commonly the source of the metal or other valuable product of the deposit), "Gangue mineral" (the mineral has no value but is closely associated in time and space with the ore minerals), "Host rock mineral" and "Associated rock mineral" (the mineral is characteristic of the rocks in which the deposit is found or with which it is genetically associated), "Alteration mineral" (the mineral is produced in rocks near the deposit by hydrothermal processes related to ore deposition or transport), and "Weathering mineral" (the mineral is produced by weathering or supergene enrichment).

An "ore" mineral is so designated if it is a mineral which under reasonable circumstances might be used to provide a concentrate of a valuable substance. Thus traces of bismuthinite are "ores", as are pyrite or arsenopyrite crystals that carry gold, and so is pyrite in sufficient abundance that it might be used as a source of sulfur. But accessory pyrite without economic values is "gangue" because neither iron nor sulfur would normally be produced from it; multiple entries for some minerals are expected. The "host" category is necessarily incomplete inasmuch as variations in host lithology are not necessarily critical parts of the model; for example a vein could cut a pegmatite containing minerals such as beryl or spodumene, neither of which would be very informative if added to the "host" minerals list.

Numerical values are given as a measure of the degree to which a mineral is present in the deposit of the type considered; the numbers are NOT the amount of mineral, but its universality anywhere in the deposit among all deposits of that class. The values "1", "2", "3", "4", and "5" correspond respectively to 0-10, 10-30, 30-70, 70-90, and 90-100 percent and, until definitive documentation for a given model type is available, will usually be no better than guesses based on experience. The numbers are modified by a letter suffix to give a qualitative estimate of the abundance of the mineral: "m" indicates a major component, which we define as 10 volume percent; "t" indicates traces, which we define as 1 volume percent; intermediate values are given no designation. Detail on the spatial distribution of minerals resides in the models themselves.

Mineral	Ore mineral	Gangue mineral	Host rock mineral	Associated rock mineral	Alteration mineral	Weathering mineral	Deposit type and model number
Adularia		4					Au-Ag-Te veins (22b)
(also see		3					polymetallic veins (22c)
feldspar)		4					hot-spring Au-Ag (25a)
		3			3		Creede epithermal vein (25b)
		3			3		Comstock epithermal vein (25c).
		3					Sado epithermal vein (25d)
		3			4		volcanogenic U (25f)
		4					rhyolite-hosted Sn (25h)
					4		hot-spring Hg (27a)
		2t					southeast Missouri Pb-Zn (32a)
Albite					4m		W veins (15a)
(also see					3		porphyry Cu (17)
feldspar)			4				Besshi massive sulfide (24b)
					4		volcanic-hosted magnetite (25i)
					3		kuroko massive sulfide (28a)
					3		sedimentary exhalative Zn-Pb (31a)
		4					emerald veins (31c)
		4					low-sulfide Au-quartz veins (36a)

Mineral	Ore mineral	Gangue mineral	Host rock mineral	Associated rock mineral	Alteration mineral	Weathering mineral	Deposit type and model number
Alleghenyite							
		2					volcanogenic Mn (24c)
Al oxides and hydroxides							
	5m					5m	bauxite, laterite type (38b)
	5m					5m	bauxite, karst type (38c)
Alunite							Alunite is a common result of the oxidation of sulfides in Al-bearing carbonate-poor rocks.
					3		porphyry Cu (17)
					4		volcanic-hosted Cu-As-Sb (22a)
		3					hot-spring Au-Ag (25a)
		2					Creede epithermal vein (25b)
					3		Sado epithermal vein (25d)
		3			5		epithermal quartz-alunite Au (25e)
					4		volcanogenic U (25f)
			4				hot-spring Hg (27a)
Amphibole							Amphibole is a common late-stage alteration in skarns of all types.
Mn-rich		4			4		Zn-Pb skarn (18c)
actinolite (includes tremolite)		3			3		porphyry Cu (17)
		3			4		porphyry Cu, skarn-related (18a)
		3			3		Cu skarn (18b)
					4		Zn-Pb skarn (18c)
		4				4	porphyry Cu-Au (20c)
			4				Besshi massive sulfide (24b)
					4		volcanic-hosted magnetite (25i)
			3				serpentine-hosted asbestos (8d)
anthophyllite				3	3		kuroko massive sulfide (28a)
cummingtonite			3m	3m			Homestake Au (28c)
Anatase			4			4	bauxite, laterite type (38b)
			4			4	bauxite, karst type (38c)
Andalusite						2	porphyry Cu (17)
					2		porphyry Cu-Mo (21a)
					4		volcanic-hosted Cu-As-Sb (22a.)
					3		epithermal quartz-alunite Au (25e)
Anhydrite				3m			Duluth Cu-Ni-PGE (5a)
				3m			Noril'sk Cu-Ni-PGE (5b)
		3			3		porphyry Cu (17)
		3			4		porphyry Cu-Au (20c)
		3			3		porphyry Cu-Mo (21a)
		2					Cyprus massive sulfide (24a)
		2m	1m	2m	2		kuroko massive sulfide (28a)
		2					Olympic Dam Cu-U-Au (29b)
		2					Appalachian Zn (32b)

Mineral	Ore mineral	Gangue mineral	Host rock mineral	Associated rock mineral	Alteration mineral	Weathering mineral	Deposit type and model number
Apatite							
apatite, (includes fluor francolite, collophane)							
		3					anorthosite-Ti (7b)
	1m	4					carbonatite (10)
		5					volcanic-hosted magnetite (25i)
	5m						phosphate, upwelling type (34c)
	5m						phosphate, warm-current type (34d)
Antimony (native)	2t						simple Sb (27d)
Argentite							
						5	Argentite is a common product of the supergene enrichment of silver ores.
	3t						polymetallic replacement (19a)
	3t						Sn-polymetallic veins (20b)
	3t						polymetallic veins (22c)
	3t						Creede epithermal vein (25b)
	5t						Comstock epithermal vein (25c)
	4t						Sado epithermal vein (25d)
	2t						simple Sb (27d)
Arsenates							
		3					rhyolite-hosted Sn (25h)
Arsenides							
	4t	2					Merensky Reef PGE (2b)
	3	3					Noril'sk Cu-Ni-PGE (5b)
	1t	3t					dunitic Ni (6b)
	4	4					Limassol Forest Co-Ni (8c)
	3t						Alaskan PGE (9)
		2					Cu skarn (18b)
Arsenopyrite							
		4t					W skarn (14a)
		3					Sn skarn (14b)
		4					replacement Sn (14c)
		5					W veins (15a)
		4					Sn veins (15b)
		5					Sn greisen (15c)
		3					Cu skarn (18b)
		3t					Zn-Pb skarn (18c)
		3					porphyry Sn (20a)
		4					Sn-polymetallic veins (20b)
		2					volcanic-hosted Cu-As-Sb (22a)
		3					polymetallic veins (22c)
		5					Blackbird Co-Cu (24d)
		3					hot-spring Au-Ag (25a)
		2					Creede epithermal vein (25b)
		2					Comstock epithermal vein (25c)
		3t					carbonate-hosted Au (26a)
		3t					simple Sb (27d)
		3t					sedimentary exhalative Zn-Pb (31a)
		1t					southeast Missouri Pb-Zn (32a)

Appendix D. Mineralogical Index--Continued

Mineral	Ore mineral	Gangue mineral	Host rock mineral	Associated rock mineral	Alteration mineral	Weathering mineral	Deposit type and model number
Arsenopyrite (cont.)		2					Kipushi Cu-Pb-Zn (32c)
		4					low-sulfide Au-quartz veins (36a)
		4					Homestake Au (36b)
		3					unconformity U (37a)
Asbestos (see chrysotile)							
Ba-silicates		4					sedimentary exhalative Zn-Pb (31a)
Barite		4					carbonatite (10)
		4					polymetallic replacement (19a)
		3					replacement Mn (19b)
		3					volcanic-hosted Cu-As-Sb (22a)
		3					Au-Ag-Te veins (22b)
		3					polymetallic veins (22c)
		4m					Creede epithermal vein (25b)
		4					Comstock epithermal vein (25c)
		3					Sado epithermal vein (25d)
		3					volcanogenic U (25f)
		5					epithermal Mn (25g)
		3					volcanic-hosted magnetite (25i)
		3					carbonate-hosted Au (26a)
		2					simple Sb (27d)
	1m	3m		1m			kuroko massive sulfide (28a)
		4			4		Olympic Dam Cu-U-Au (29b)
		3					sandstone-hosted Pb-Zn (30a)
	1m	3		3m			sedimentary exhalative Zn-Pb (31a)
	5m						bedded barite (31b)
		3					southeast Missouri Pb-Zn (32a)
		3					Appalachian Zn (32b)
		2					gold on flat faults (37b)
Berthierite							
	2t						simple Sb (27d)
Beryl		3					W veins (15a)
		3t					Sn veins (15b)
		4					Sn greisen (15c)
	5t						emerald veins (31c)
Biotite							
							Biotite is a common mineral in igneous and metamorphic rocks.
		4					carbonatite (10)
					4		low-sulfide Au-quartz veins (15d)
		3			4		porphyry Cu (17)
					3		porphyry Cu, skarn-related (18a)
		3			5		porphyry Cu-Au (20c)
		4			4		porphyry Cu-Mo (21a)
		4			4		porphyry Mo, low-F (21b)
					4		volcanic-hosted magnetite (25i)

Mineral	Ore mineral	Gangue mineral	Host rock mineral	Associated rock mineral	Alteration mineral	Weathering mineral	Deposit type and model number
Bismuth							
	3t						W skarn (14a)
	4t						Sn-polymetallic veins (20b)
	2t						Kipushi Cu-Pb-Zn (32c)
	3t						low-sulfide Au-quartz veins (36a)
Bismuthinite							
	4t						W veins (15a)
	3t						Sn veins (15b)
	4t						Sn greisen (15c)
	3t						Cu skarn (18b)
	3t						Zn-Pb skarn (18c)
	2t						polymetallic replacement (19a)
	4t						Sn-polymetallic veins (20b)
	2t						sedimentary exhalative Zn-Pb (31a)
Boehmite							
	4m						bauxite, karst type (38c)
Bornite							
							Bornite may be a supergene, as well as hypogene, copper mineral.
	3						Noril'sk Cu-Ni-PGE (5b)
	3t						Alaskan PGE (9)
	3t						W skarn (14a)
	3t						W veins (15a)
	2						porphyry Cu (17)
	3						porphyry Cu, skarn-related (18a)
	3						Cu skarn (18b)
	3						Zn-Pb skarn (18c)
	4						porphyry Cu-Au (20c)
	3						volcanic-hosted Cu-As-Sb (22a)
	3						basaltic Cu (23)
	2						Besshi massive sulfide (24b)
	2						Creede epithermal vein (25b)
	3						epithermal quartz-alunite Au (25e)
	3t						silica-carbonate Hg (27c)
	3						kuroko massive sulfide (28a)
	5						Olympic Dam Cu-U-Au (29b)
	3t						sandstone-hosted Pb-Zn (30a)
	4						sediment-hosted Cu (30b)
	2t						sandstone U (30c)
	2						southeast Missouri Pb-Zn (32a)
	5						Kipushi Cu-Pb-Zn (32c)
	2t						gold on flat faults (37b)
Brannerite							
	4t						volcanogenic U (25f)
	4t						quartz pebble conglomerate Au-U (29a)
	4t						Olympic Dam Cu-U-Au (29b)
Bravoite							
	2t						sandstone-hosted Pb-Zn (30a)
	2t						southeast Missouri Pb-Zn (32a)
Brucite							
		3					serpentine-hosted asbestos (8d)

Mineral	Ore mineral	Gangue mineral	Host rock mineral	Associated rock mineral	Alteration mineral	Weathering mineral	Deposit type and model number
Buddingtonite							
		3			3		hot-spring Au-Ag (25a)
Calaverite (see tellurides)							
Carbonates (see specific carbonates below)							Carbonates are very common gangue and host-rock minerals in a wide variety of ores.
					5m		Limassol Forest Co-Ni (8c)
		5m					carbonatite (10)
					5m		W skarn (14a)
				5m			Sn Skarn (14b)
		5m	5m				replacement Sn (14c)
			5m				porphyry Cu, skarn-related (18a)
			5m				Cu skarn (18b)
			5m				Zn-Pb skarn (18c)
			5m				Fe skarn (18d)
			5m				polymetallic replacement (19a)
		5m	5m				replacement Mn (19b)
		5			5		Au-Ag-Te veins (22b)
		4			3		polymetallic veins (22c)
		4			3		basaltic Cu (23)
			3				Besshi massive sulfide (24b)
	4						volcanogenic Mn (24c)
		4m					Creede epithermal vein (25b)
		4					Comstock epithermal vein (25c)
		3			3		Sado epithermal vein (25d)
	5	4					epithermal Mn (25g)
			5				carbonate-hosted Au (26a)
					3		volcanic-hosted magnetite (25i)
			3m	3m			silica-carbonate Hg (27c)
					4		Olympic Dam Cu-U-Au (29b)
			5m				Kipushi Cu-Pb-Zn (32c)
ankerite							
		3					carbonatite (10)
		3					polymetallic veins (22c)
		3					low-sulfide Au-quartz veins (36a)
			3m	3m			Homestake Au (36b)
calcite							
		4m					carbonatite (10)
		3m					Sn greisen (15c)
					2		porphyry Cu (17)
		4	4				replacement Mn (19b)
		4					Au-Ag-Te veins (22b)
		3			3		polymetallic veins (22c)
		4			3		basaltic Cu (23)
					2		Cyprus massive sulfide (24a)
		3					Creede epithermal vein (25b)
		4					Comstock epithermal vein (25c)
		3			3		Sado epithermal vein (25d)
					2		epithermal quartz-alunite Au (25e)
		4					epithermal Mn (25g)
		4					Almaden Hg (27b)
		4					simple Sb (27d)

Mineral	Ore mineral	Gangue mineral	Host rock mineral	Associated rock mineral	Alteration mineral	Weathering mineral	Deposit type and model number
calcite		3					emerald veins (31c)
(cont.)		4					sandstone-hosted Pb-Zn (30a)
		4m					phosphate, upwelling type (34c)
		4					phosphate, warm-current type (34d)
		4					unconformity U (38d)
dolomite							
		4m					carbonatite (10)
		4	3		4m		polymetallic replacement (19a)
			3m				replacement Mn (19b)
		4			4		Au-Ag-Te veins (22b)
		2					polymetallic veins (22c)
					5		silica-carbonate Hg (27c)
					3		sedimentary exhalative Zn-Pb (31a)
		5			5		emerald veins (31c)
		5			5m		southeast Missouri Pb-Zn (32a)
		5m	5m		5m		Appalachian Zn (32b)
		4			4m		Kipushi Cu-Pb-Zn (32c)
				5			Superior Fe (34a)
		4m					phosphate, upwelling type (34c)
		4m					phosphate, warm-current type (34d)
		4			4		unconformity U (37b)
rhodochrosite							
		2					carbonatite (10)
		3			3		Climax Mo (16)
		3					Zn-Pb skarn (18c)
		3					polymetallic replacement (19a)
	5m						replacement Mn (19b)
		3					polymetallic veins (22c)
	4m						volcanogenic Mn (24c)
		4					Creede epithermal vein (25b)
		3					Comstock epithermal vein (25c)
		3					Sado epithermal vein (25d)
	5m						epithermal Mn (25g)
	3m						sedimentary Mn (34b)
siderite							
					4m		replacement Sn (14c)
					3		Sn-polymetallic veins (20b)
		3					carbonatite (10)
		3					polymetallic veins (22c)
		3					Creede epithermal vein (25b)
		2t					simple Sb (27d)
	3m						Algoma Fe (28b)
		3			3		Kipushi Cu-Pb-Zn (32c)
	3m						Superior Fe (34a)
		3					phosphate, upwelling type (34c)
		3					low-sulfide Au-quartz veins (36a)
			3m	3m			Homestake Au (36b)
		3					unconformity U (37a)
Carnotite							
						5	sandstone U (30c)
						3t	phosphate, upwelling type (34c)

Mineral	Ore mineral	Gangue mineral	Host rock mineral	Associated rock mineral	Alteration mineral	Weathering mineral	Deposit type and model number
Carrollite							
	3t						Limassol Forest Co-Ni (8c)
	3t						Olympic Dam Cu-U-Au (29b)
	3t						sediment-hosted Cu (30b)
	4t						Kipushi Cu-Pb-Zn (32c)
Cassiterite							
	3t						W skarn (14a)
	5						Sn skarn (14b)
	5						replacement Sn (14c)
	4t						W veins (15a)
	5						Sn veins (15b)
	5						Sn greisen (15c)
	3t						Climax Mo (16)
	1t						Fe skarn (18d)
	5						porphyry Sn (20a)
	5						Sn-polymetallic veins (20b)
	5						rhyolite-hosted Sn (25h)
	1t						sedimentary exhalative Zn-Pb (31a)
Celestite							
		3					Au-Ag-Te veins (22b)
Chalcedony (includes opal)							
		4					replacement Mn (19b)
		5			5		volcanic-hosted Cu-As-Sb (22a)
		3					polymetallic veins (22c)
		5					Cyprus massive sulfide (24a)
		5m					hot-spring Au-Ag (25a)
		5m					Creede epithermal vein (25b)
		4m					Comstock epithermal vein (25c)
		4m					Sado epithermal vein (25d)
		3					epithermal quartz-alunite Au (25e)
		4m					volcanogenic U (25f)
		5					epithermal Mn (25g)
		5					rhyolite-hosted Sn (25h)
		5					hot-spring Hg (27a)
					4		silica-carbonate Hg (27c)
		2					simple Sb (27d)
Chalcocite and related Cu_xS phases							
						5	Chalcocite and related Cu_xS minerals are extremely common as supergene alterations of copper-bearing sulfides and as supergene replacements of chalcopyrite and, to a lesser extent, other primary sulfides.
	3						volcanic-hosted Cu-As-Sb (22a)
	4						basaltic Cu (23)
	2t						volcanic-hosted magnetite (25i)
	1t						simple Sb (27d)
	5						Olympic Dam Cu-U-Au (29b)

Mineral	Ore mineral	Gangue mineral	Host rock mineral	Associated rock mineral	Alteration mineral	Weathering mineral	Deposit type and model number
Chalcocite and related Cu_xS phases (cont.)							
	2t						sandstone-hosted Pb-Zn (30a)
	4					4	sediment-hosted Cu (30b)
	2						southeast Missouri Pb-Zn (32a)
	4						Kipushi Cu-Pb-Zn (32c)
Chalcopyrite							
	5						Stillwater Ni-Cu (1)
	5t						Bushveld Cr (2a)
	5t						Merensky Reef PGE (2b)
	5						Duluth Cu-Ni-PGE (5a)
	5						Noril'sk Cu-Ni-PGE (5b)
	5						komatiitic Ni-Cu (6a)
	5t						dunitic Ni (6b)
	5						synorogenic-synvolcanic Ni-Cu (7a)
	4t						Limassol Forest Co-Ni (8c)
	3t						Alaskan PGE (9)
	5t						carbonatite (10)
	4t						W skarn (14a)
	3t						Sn skarn (14b)
	4t						replacement Sn (14c)
	5t						W veins (15a)
	4t						Sn veins (15b)
	4t						Sn greisen (15c)
	5						porphyry Cu (17)
	5						porphyry Cu, skarn-related (18a)
	5						Cu skarn (18b)
	4						Zn-Pb skarn (18c)
	4t						Fe skarn (18d)
	4t						polymetallic replacement (19a)
	3t						replacement Mn (19b)
	4t						porphyry Sn (20a)
	5						Sn-polymetallic veins (20b)
	5						porphyry Cu-Au (20c)
	5						porphyry Cu-Mo (21a)
	3t						porphyry Mo, low-F (21b)
	4						volcanic-hosted Cu-As-Sb (22a)
	4						polymetallic veins (22c)
	4						basaltic Cu (23)
	5						Cyprus massive sulfide (24a)
	5						Besshi massive sulfide (24b)
	5						Blackbird Co-Cu (24d)
	3t						hot-spring Au-Ag (25a)
	5						Creede epithermal vein (25b)
	4t						Comstock epithermal vein (25c)
	5t						Sado epithermal vein (25d)
	4						epithermal quartz-alunite Au (25e)
	3						volcanic-hosted magnetite (25i)
	4t						silica-carbonate Hg (27c)
	3t						simple Sb (27d)
	5						kuroko massive sulfide (28a)
	5						Olympic Dam Cu-U-Au (29b)
	4t						sandstone-hosted Pb-Zn (30a)
	4						sediment-hosted Cu (30b)
	3t						sandstone U (30c)

Mineral	Ore mineral	Gangue mineral	Host rock mineral	Associated rock mineral	Alteration mineral	Weathering mineral	Deposit type and model number
Chalcopyrite (cont.)							
	4t						sedimentary exhalative Zn-Pb (31a)
	4t						southeast Missouri Pb-Zn (32a)
	4						Kipushi Cu-Pb-Zn (32c)
	4t						low-sulfide Au-quartz veins (36a)
	3t						Homestake Au (36b)
	4t						unconformity U (37a)
	4t						gold on flat faults (37b)
Chert							
				4m			Cyprus massive sulfide (24a)
				4m			volcanogenic Mn (24c)
			4m	1m			kuroko massive sulfide (28a)
		5m	5m	5m			Algoma Fe (28b)
		4m	4m	4m			sedimentary exhalative Zn-Pb (31a)
		5m	5m				Superior Fe (34a)
			5m	5m			Homestake Au (36b)
Chlorite							
		3			3		Sn skarn (14b)
					4m		W veins (15a)
					4m		Sn veins (15b)
					3m		Sn greisen (15c)
		2			4		porphyry Cu (17)
					3		porphyry Cu, skarn-related (18a)
				4			Cu skarn (18b)
					3		Zn-Pb skarn (18c)
		4			4		Fe skarn (18d)
					2		polymetallic replacement (19a)
					3		porphyry Sn (20a)
					4		Sn-polymetallic veins (20b)
					4		porphyry Cu-Mo (21a)
					4		porphyry Mo, low-F (21b)
		4			4		polymetallic veins (22c)
		3			5m		Cyprus massive sulfide (24a)
			5				Besshi massive sulfide (24b)
					5m		Blackbird Co-Cu (24d)
					3		hot-spring Au-Ag (25a)
		4			4		Creede epithermal vein (25b)
		3			4		Comstock epithermal vein (25c)
		3			4		Sado epithermal vein (25d)
					3		epithermal quartz-alunite Au (25e)
					4		hot-spring Hg (27a)
					3		simple Sb (27d)
				3	4		kuroko massive sulfide (28a)
		3			5		Olympic Dam Cu-U-Au (29b)
					5		sediment-hosted Cu (30b)
					4		sedimentary exhalative Zn-Pb (31a)
		3			3		low-sulfide Au-quartz veins (36a)
		4	4	4			Homestake Au (36b)
		5			5m		unconformity U (37a)
					5m		gold on flat faults (37b)
Chromite							
	5m			3t			Bushveld Cr (2a)
	3			3t			Merensky Reef PGE (2b)
		4		5			dunitic Ni (6b)
	5m			5			podiform Cr (8a)

Appendix D. Mineralogical Index--Continued

Mineral	Ore mineral	Gangue mineral	Host rock mineral	Associated rock mineral	Alteration mineral	Weathering mineral	Deposit type and model number
Chromite (cont.)			3	3			Limassol Forest Co-Ni (8c)
	5m			5			Alaskan PGE (9)
		4					diamond pipes (12)
		4					placer PGE-Au (39b)
Chrysotile							
	5						serpentine-hosted asbestos (8d)
	5						carbonate-hosted asbestos (18e)
Cinnabar							
	3t						carbonate-hosted Au (26a)
	5						hot-spring Hg (27a)
	5						Almaden Hg (27b)
	5						silica-carbonate Hg (27c)
Clays (see specific clays below)							Clays are very common minerals in soils and sedimentary rocks as well as in altered rocks associated with ores.
					4		porphyry Cu (17)
					3		porphyry Cu, skarn-related (18a)
					3		Cu skarn (18b)
					3		polymetallic replacement (19a)
					3		porphyry Sn (20a)
					5		porphyry Cu-Au (20c)
					4		porphyry Cu-Mo (21a)
					4		Mo porphyry, low-F (21b)
					5		volcanic-hosted Cu-As-Sb (22a)
					4		polymetallic veins (22c)
					5		Creede epithermal vein (25b)
		3			5		Comstock epithermal vein (25c)
		3			5		Sado epithermal vein (25d)
					5		epithermal quartz-alunite Au (25e)
					5		volcanogenic U (25f)
					3		rhyolite-hosted Sn (25h)
					5		carbonate-h03ted Au (26a)
					4		simple Sb (27d)
		5m					phosphate, upwelling type (34c)
		5m					phosphate, warm-current type (34d)
ammonium-bearing					3		epithermal quartz-alunite Au (25e)
					3		carbonate-hosted Au (26a)
					3		sedimentary exhalative Zn-Pb (31a)
illite							
					4		Cyprus massive sulfide (24a)
					4		Creede epithermal vein (25b)
					5		Comstock epithermal vein (25c)
					4		carbonate-hosted Au (26a)
kaolinite and dickite							
						5m	Kaolinite is commonly formed through the reaction of sulfuric acid derived from oxidizing sulfides with felsic rocks.

Mineral	Ore mineral	Gangue mineral	Host rock mineral	Associated rock mineral	Alteration mineral	Weathering mineral	Deposit type and model number
kaolinite and dickite (cont.)							
					4	4	porphyry Cu (17)
					5		porphyry Cu-Au (20c)
					5		porphyry Cu-Mo (21a)
					5		volcanic-hosted Cu-As-Sb (22a)
					3		Comstock epithermal vein (25c)
		3			4		Sado epithermal vein (25d)
					5		epithermal quartz-alunite Au (25e)
					5		volcanogenic U (25f)
					5		epithermal Mn (25g)
					3		rhyolite-hosted Sn (25h)
					2		volcanic-hosted magnetite (25i)
					4		carbonate-hosted Au (32a)
				5			hot-spring Hg (27a)
		4t					southeast Missouri Pb-Zn (32a)
					3		unconformity U (37a)
montmorillonite (smectite)							
					4		Creede epithermal vein (25b)
					4		Comstock epithermal vein (25c)
					4		Sado epithermal vein (25d)
					3		epithermal quartz-alunite Au (25e)
					4		volcanogenic U (25f)
					3		rhyolite-hosted Sn (25h)
					3		carbonate-hosted Au (26a)
					2		kuroko massive sulfide (28a)
sericite							
					4		porphyry Sn (20a)
					4		Sn-polymetallic veins (20b)
					4		porphyry Cu-Mo (21a)
					4		Au-Ag-Te veins (22b)
					5		polymetallic veins (22c)
					4		Besshi massive sulfide (24b)
					4		Creede epithermal vein (25b)
					4		Comstock epithermal vein (25c)
					4		Sado epithermal vein (25d)
					3		volcanic-hosted magnetite (25i)
					4		simple Sb (27d)
					3		kuroko massive sulfide (28a)
					5		Olympic Dam Cu-U-Au (29b)
					3t		sandstone-hosted Pb-Zn (30a)
					4		unconformity U (38d)
Co-bearing arsenides, sulfides and sulf-arsenides							
	3t						Stillwater Ni-Cu (1)
	2t						dunitic Ni (6b)
	4t						Limassol Forest Co-Ni (8c)
	2						Cu skarn (18b)
	2						Fe skarn (18d)
	2t						Besshi massive sulfide (24b)

Mineral	Ore mineral	Gangue mineral	Host rock mineral	Associated rock mineral	Alteration mineral	Weathering mineral	Deposit type and model number
Co-bearing arsenides, sulfides and sulfarsenides (cont.)							
	5						Blackbird Co-Cu (24d)
	4t						Olympic Dam Cu-U-Au (29b)
	3						sediment-hosted Cu (30b)
	2t						sedimentary exhalative Zn-Pb (31a)
	2t						southeast Missouri Pb-Zn (32a)
	4t						Kipushi Cu-Pb-Zn (32c)
Coffinite							
	5t						volcanogenic U (25f)
	4t						Olympic Dam Cu-U-Au (29b)
	5t						sandstone U (30c)
	4t						unconformity U (38d)
Copper (native)							
						3	Native copper is a common mineral in oxidized copper ores; it also occurs as a trace deuteric mineral in some mafic rocks.
	4						basaltic Cu (23)
	3t						sediment-hosted Cu (30b)
Cordierite							
				2	2		kuroko massive sulfide (28a)
Corundum							
					1t		porphyry Cu (17)
					2t		epithermal quartz-alunite Au (25e)
Covellite							
							Covellite is a very common supergene mineral in oxidized copper ores.
	3						volcanic-hosted Cu-As-Sb (22a)
	4						epithermal quartz-alunite Au (25e)
	2						volcanic-hosted magnetite (25i)
	2t						southeast Missouri Pb-Zn (32a)
Cubanite							
	4						Duluth Cu-Ni-PGE (5a)
	4						Noril'sk Cu-Ni-PGE (5b)
							dunitic Ni (6b)
	3t						Cyprus massive sulfide (24a)
	3t						Besshi massive sulfide (24b)
Diamond							
	5tt						diamond pipes (12)
	5tt						diamond placers (39d)
Diaspore							
	2				2		porphyry Cu (17)
					3		volcanic-hosted Cu-As-Sb (22a)
					3		epithermal quartz-alunite Au (25e)
Diopside (see pyroxenes)							

Appendix D. Mineralogical Index--Continued

Mineral	Ore mineral	Gangue mineral	Host rock mineral	Associated rock mineral	Alteration mineral	Weathering mineral	Deposit type and model number
Dumortierite							
					3		volcanic-hosted Cu-As-Sb (22a)
Enargite							
luzonite							
	2t						W veins (15a)
	2t						Cu skarn (18b)
	3						polymetallic replacement (19a)
	5						volcanic-hosted Cu-As-Sb (22a)
	5						epithermal quartz-alunite Au (25e)
	1t						sedimentary exhalative Zn-Pb (31a)
	1t						southeast Missouri Pb-Zn (32a)
	2						Kipushi Cu-Pb-Zn (32c)
Epidote							
		3t			3		porphyry Cu (17)
					3		Cu skarn (18b)
		4			4		Fe skarn (18d)
		4					basaltic Cu (23)
					4		volcanic-hosted magnetite (25i)
Ferrimolybdite							
						4t	Ferrimolybdite is a common oxidation product in Mo-bearing ores.
Fletcherite (see sulfospinels)							
Fluorite							
		4					carbonatite (10)
		4t					W skarn (14a)
		4					Sn skarn (14b)
		5					replacement Sn (14c)
		4					W veins (15a)
		4			3		Sn greisen (15c)
		5			3		Climax Mo (16)
		2					Zn-Pb skarn (18c)
		3					replacement Mn (19b)
		3			3		Sn-polymetallic veins (20b)
		4					Au-Ag-Te veins (22b)
		4					polymetallic veins (22c)
		3					hot-spring Au-Ag (25a)
		3					Creede epithermal vein (25b)
		4					Comstock epithermal vein (25c)
		4					volcanogenic U (25f)
		3			3		rhyolite-hosted Sn (25h)
					2		volcanic-hosted magnetite (25i)
		3					carbonate-hosted Au (26a)
		2					simple Sb (27d)
		4t			4t		Olympic Dam Cu-U-Au (29b)
		3t					sandstone-hosted Pb-Zn (30a)
		5					emerald veins (31c)
		2t					Appalachian Zn (32b)
		3t					low-sulfide Au-quartz veins (36a)
		2t					Homestake Au (36b)
		3t					gold on flat faults (37b)

Appendix D. Mineralogical Index--Continued

Mineral	Ore mineral	Gangue mineral	Host rock mineral	Associated rock mineral	Alteration mineral	Weathering mineral	Deposit type and model number
Dumortierite							
					3		volcanic-hosted Cu-As-Sb (22a)
Enargite							
luzonite							
	2t						W veins (15a)
	2t						Cu skarn (18b)
	3						polymetallic replacement (19a)
	5						volcanic-hosted Cu-As-Sb (22a)
	5						epithermal quartz-alunite Au (25e)
	1t						sedimentary exhalative Zn-Pb (31a)
	1t						southeast Missouri Pb-Zn (32a)
	2						Kipushi Cu-Pb-Zn (32c)
Epidote							
		3t			3		porphyry Cu (17)
					3		Cu skarn (18b)
		4			4		Fe skarn (18d)
		4					basaltic Cu (23)
					4		volcanic-hosted magnetite (25i)
Ferrimolybdite							
						4t	Ferrimolybdite is a common oxidation product in Mo-bearing ores.
Fletcherite (see sulfospinels)							
Fluorite							
		4					carbonatite (10)
		4t					W skarn (14a)
		4					Sn skarn (14b)
		5					replacement Sn (14c)
		4					W veins (15a)
		4			3		Sn greisen (15c)
		5			3		Climax Mo (16)
		2					Zn-Pb skarn (18c)
		3					replacement Mn (19b)
		3			3		Sn-polymetallic veins (20b)
		4					Au-Ag-Te veins (22b)
		4					polymetallic veins (22c)
		3					hot-spring Au-Ag (25a)
		3					Creede epithermal vein (25b)
		4					Comstock epithermal vein (25c)
		4					volcanogenic U (25f)
		3			3		rhyolite-hosted Sn (25h)
					2		volcanic-hosted magnetite (25i)
		3					carbonate-hosted Au (26a)
		2					simple Sb (27d)
		4t			4t		Olympic Dam Cu-U-Au (29b)
		3t					sandstone-hosted Pb-Zn (30a)
		5					emerald veins (31c)
		2t					Appalachian Zn (32b)
		3t					low-sulfide Au-quartz veins (36a)
		2t					Homestake Au (36b)
		3t					gold on flat faults (37b)

Appendix D. Mineralogical Index--Continued

Mineral	Ore mineral	Gangue mineral	Host rock mineral	Associated rock mineral	Alteration mineral	Weathering mineral	Deposit type and model number
Ga minerals							
	2t						Kipushi Cu-Pb-Zn (32c)
Gahnite							
					3		kuroko massive sulfide'(28a)
Galena							
	3t						carbonatite (10)
	2						replacement Sn (14c)
	2t						W veins (15a)
	3t						Sn veins (15b)
	3t						Sn greisen (15c)
	2t						porphyry Cu, skarn-related (18a)
	3t						Cu skarn (18b)
	5						Zn-Pb skarn (18c)
	4						polymetallic replacement (19a)
	2t						replacement Mn (19b)
	4t						Sn-polymetallic veins (20b)
	2						porphyry Cu-Mo (21a)
	4						Au-Ag-Te veins (22b)
	4						polymetallic veins (22c)
	3t						Besshi massive sulfide (24b)
	5						Creede epithermal vein (25b)
	4						Comstock epithermal vein (25c)
	4t						Sado epithermal vein (25d)
	4t						epithermal quartz-alunite Au (25e)
	4t						silica-carbonate Hg (27c)
	2t						simple Sb (27d)
	4						kuroko massive sulfide (28a)
	5						sandstone-hosted Pb-Zn (30a)
	2t						sediment-hosted Cu (30b)
	2t						sandstone U (30c)
	5						sedimentary exhalative Zn-Pb (31a)
	3t						bedded barite (31b)
	5						southeast Missouri Pb-Zn (32a)
	2t						Appalachian Zn (32b)
	3						Kipushi Cu-Pb-Zn (32c)
	4t						low-sulfide Au-quartz veins (36a)
	4t						unconformity U-Au (37a)
Garnet							
							Garnet is a common mineral in most, skarns, in some regionally metamorphosed rocks, and in some igneous rocks.
almandine							
		3			3		W skarn (14a)
andradite							
		3m			4m		W skarn (14a)
					4m		Cu skarn (18b)
					4		volcanic-hosted magnetite (25i)
(Sn-bearing)							
					3		Sn skarn (14b)
and.-gros.-spess.					4		Zn-Pb skarn (18c)

Appendix D. Mineralogical Index--Continued

Mineral	Ore mineral	Gangue mineral	Host rock mineral	Associated rock mineral	Alteration mineral	Weathering mineral	Deposit type and model number
Garnet (cont.)							
grossular-andradite		3m			5m		W skarn (14a)
					3		porphyry Cu, skarn-related (18a)
					4		Zn-Pb skarn (18c)
					5		Fe skarn (18d)
pyrope							
			5				diamond pipes (12)
			4				diamond placers (39d)
spessartine							
					3		Climax Mo (16)
					4		Zn-Pb skarn (18c)
					3		W skarn (14a)
		3					volcanogenic Mn (24c)
uvarovite							
			3				podiform Cr (8a)
Garnierite							
	5					5	lateritic Ni (38a)
Ge minerals							
	2t						sediment-hosted Cu (30b)
	5t						Kipushi Cu-Pb-Zn (32c)
Gold							
	3t						Alaskan PGE (9)
	4t						porphyry Cu (17)
	2t						polymetallic replacement (19a)
	4t						Sn-polymetallic veins (20b)
	5t						porphyry Cu-Au (20c)
	4t						porphyry Cu-Mo (21a)
	4t						volcanic-hosted Cu-As-Sb (22a)
	5t						polymetallic veins (22c)
	4t						Cyprus massive sulfide (24a)
	5t						hot-spring Au-Ag (25a)
	4t						Creede epithermal vein (25b)
	5t						Comstock epithermal vein (25c)
	5t						Sado epithermal vein (25d)
	5t						epithermal quartz-alunite Au (25e)
	3t						volcanogenic U (25f)
	5t						carbonate-hosted Au (26a)
	3t						simple Sb (27d)
	4t						kuroko massive sulfide (28a)
	5t						quartz pebble conglomerate Au-U (29a)
	4t						Olympic Dam Cu-U-Au (29b)
	5t						low-sulfide Au-quartz veins (36a)
	5t						Homestake Au (36b)
	3t						unconformity U-Au (37a)
	5t						gold on flat faults (37b)
	5t						placer Au-PGE (39a)
	4t						placer PGE-Au (39b)
Graphite							
	3t			3t			Merensky reef PGE (2b)
	3			3			Duluth Cu-Ni-PGE (5a)

Appendix D. Mineralogical Index--Continued

Mineral	Ore mineral	Gangue mineral	Host rock mineral	Associated rock mineral	Alteration mineral	Weathering mineral	Deposit type and model number
Graphite (cont.)							
	3			3			synorogenic-synvolcanic Ni-Cu (7a)
	2						simple Sb (27d)
				4			kuroko massive sulfide (28a)
Greenockite							
						4t	Greenockite is a common trace mineral developed in the early stages of oxidation of cadmium-bearing sphalerite. Greenockite is rare as a primary mineral.
	2t						sediment-hosted Cu (30b)
Gypsum							
	2t						Appalachian Zn (32b)
	3						phosphate, upwelling type (34c)
			2	2			kuroko massive sulfide (28a)
Halite							
	3						Halite occurs as a daughter mineral in fluid inclusions from many porphyry copper and molybdenum deposits and from a few other deposits.
Hematite							
						5	Hematite is a common weathering product of iron minerals.
		3					Carbonatite (10)
		4			3		Sn veins (15b)
		3					porphyry Cu, skarn-related (18a)
		3					Cu skarn (18b)
		3					polymetallic veins (22c)
					3		basaltic Cu (23)
					3		volcanogenic Mn (24c)
		3					Creede epithermal vein (25b)
		4			2		Comstock epithermal vein (25c)
		5					rhyolite-hosted Sn (25h)
		1t		3			kuroko massive sulfide (28a)
	4m					5m	Algoma Fe (28b)
		5			5		Olympic Dam Cu-U-Au (29b)
				4			sediment-hosted Cu (30b)
				4			sandstone U (30c)
	5m					5m	Superior Fe (34a)
		3			3		unconformity U (37a)
		5					gold on flat faults (37b)
Hematite/Goethite							
						4	Hematite and goethite are common weathering products of iron-bearing sulfides. They are often grouped under the blanket term "limonite."
		4					carbonate-hosted Au (26a)
				5			hot-spring Hg (27a)
		4					phosphate, upwelling type (34c)
	in ochre		4		4		Cyprus massive sulfide (24a)

Mineral	Ore mineral	Gangue mineral	Host rock mineral	Associated rock mineral	Alteration mineral	Weathering mineral	Deposit type and model number
Idocrase					3		Sn skarn (14b)
					2		porphyry Cu, skarn-related (18a)
Illite (see clays)							
Ilmenite							
							Ilmenite is a common accessory mineral in igneous and metamorphic rocks.
		3		4			Bushveld Cr (2a)
	1	4		5			Bushveld Fe-Ti-V (3)
	5m						anorthosite-Ti (7b)
			5				diamond pipes (12)
		3					replacement Sn (14c)
		4					placer Au-PGE (39a)
		4					placer PGE-Au (39b)
	5						shoreline placer Ti (39c)
		4					diamond placers (39d)
Ilvaite					3		Zn-Pb skarn (18c)
					3		Fe skarn (18d)
Jarosite						4	Jarosite is a common product of the supergene oxidation of iron sulfides.
					4		carbonate-hosted Au (26a)
Jasperoid (includes silicification in carbonate rocks)							Jasperoid here refers to massive silica replacement of pre-existing (usually carbonate) rock.
					5		polymetallic replacement (19a)
					3		polymetallic veins (22c)
					5m		hot-spring Au-Ag (25a)
					5m		silica-carbonate Hg (27c)
					5m		carbonate-hosted Au (26a)
					3m		sedimentary exhalative Zn-Pb (31a)
					3m		southeast Missouri Pb-Zn (32a)
					4m		Appalachian Zn (32b)
					3m		Kipushi Cu-Pb-Zn (32c)
Kaolinite (see clays)							
K-feldspar (also see adularia)							Potassium feldspar is a common mineral in most types of felsic igneous, metamorphic and sedimentary rocks. Several lower temperature hydrothermal deposits contain the adularia variety (separate listing).
		3			4m		W veins (15a)
		4m			5m		Climax Mo (16)
		3			4		porphyry Cu (17)
		2			3		porphyry Cu, skarn-related (18a)
		3			4		porphyry Cu-Au (20c)
		4			4		porphyry Cu-Mo (21a)
		4			4		porphyry Mo, low-F (21b)
		3					basaltic Cu (23)
					4		volcanic-hosted magnetite (25i)

Appendix D. Mineralogical Index--Continued

Mineral	Ore mineral	Gangue mineral	Host rock mineral	Associated rock mineral	Alteration mineral	Weathering mineral	Deposit type and model number
Leucoxene		3					volcanogenic U (25f)
Linneaite							
(also see sulfospinels)							
	2t						dunitic Ni (6b)
	3t						sandstone-hosted Pb-Zn (30a)
	3t						Kipushi Cu-Pb-Zn (32c)
Luzonite (see enargite-luzonite)							
Magnetite							
							Magnetite is a common accessory mineral in many types of rocks.
		4		4			Bushveld Cr (2a)
	5m			5			Bushveld Fe-Ti-V (3)
		4		5			dunitic Ni (6b)
		3		4			synorogenic-synvolcanic Ni-Cu (7a)
	5						anorthosite-Ti (7b)
		3		3			podiform Cr (8a)
		3		4			Limassol Forest Co-Ni (8c)
		4					serpentine-hosted asbestos (8d)
	3m		3	4			Alaskan PGE (9)
	4m						carbonatite (10)
		3		3			W skarn (14a)
		3					Sn skarn (14b)
		3					replacement Sn (14c)
		3			2		porphyry Cu (17)
		3			3		porphyry Cu, skarn-related (18a)
		4					Cu skarn (18b)
		3					Zn-Pb skarn (18c)
	5m						Fe skarn (18d)
		3					Sn-polymetallic veins (20b)
		4			4		porphyry Cu-Au (20c)
		4					Besshi massive sulfide (24b)
		5					Blackbird Co-Cu (24d)
	5m						volcanic-hosted magnetite (25i)
		3		2			kuroko massive sulfide (28a)
	5m						Algoma Fe (28b)
					2		Olympic Dam Cu-U-Au (29b)
		2t					southeast Missouri Pb-Zn (32a)
	5m						Superior Fe (34a)
		4	4	4			Homestake Au (36b)
		5					placer Au-PGE (39a)
		5					placer PGE-Au (39b)
Ti-rich							
	5m						Bushveld Fe-Ti-V (3)
	5m						anorthosite Ti (7b)
	4m						Alaskan PGE (9)
V-rich							
	5m						Bushveld Fe-Ti-V (3)
	4m						Alaskan PGE (9)
Malayaite							
	2t				2		Sn skarn (14b)

Appendix D. Mineralogical Index--Continued

Mineral	Ore mineral	Gangue mineral	Host rock mineral	Associated rock mineral	Alteration mineral	Weathering mineral	Deposit type and model number
Marcasite							
						4	Marcasite is common as an incipient stage in the oxidation of pyrrhotite.
		4					polymetallic replacement (19a)
		2					Cyprus massive sulfide (24a)
		5					hot-spring Hg (27a)
		2t					simple Sb (27d)
		3t					sandstone-hosted Pb-Zn (30a)
		3					sandstone U (30c)
		4t					sedimentary exhalative Zn-Pb (31a)
		4					southeast Missouri Pb-Zn (32a)
		4t					Appalachian Zn (32b)
		2					Kipushi Cu-Pb-Zn (32c)
Melnikovite							
		2t					sedimentary exhalative Zn-Pb (31a)
Mercury (native)							
	4t						hot-spring Hg (27a)
	4t						Almaden Hg (27b)
	4t						silica-carbonate Hg (27c)
Millerite							
	3t						Noril'sk Cu-Ni-PGE (5b)
	2t						sandstone-hosted Pb-Zn (30a)
	2t						sedimentary exhalative Zn-Pb (31a)
	2t						southeast Missouri Pb-Zn (32a)
Mn oxides and silicates							
							These are common oxidation products of manganese-bearing ores.
						5m	replacement Mn (19b)
				3			Cyprus massive sulfide (24a)
	5m						volcanogenic Mn (24c)
	4m					5m	sedimentary Mn (34b)
Molybdenite							
	4t						carbonatite (10)
	4t						W skarn (14a)
	5t						W veins (15a)
	4t						Sn veins (15b)
	5t						Sn greisen (15c)
	5						Climax Mo (16)
	4						porphyry Cu (17)
	3t						porphyry Cu, skarn-related (18a)
	3t						Cu skarn (18b)
	3t						Sn-polymetallic veins (20b)
	5t						porphyry Cu-Mo (21a)
	5t						porphyry Mo, low-F (21b)
	4t						volcanogenic U (25f)
	2t						sandstone U (30c)
	2t						sedimentary exhalative Zn-Pb (31a)
	2t						Kipushi Cu-Pb-Zn (32c)
	2t						low-sulfide Au-quartz veins (36a)
	3t						Homestake Au (36b)

Appendix D. Mineralogical Index--Continued

Mineral	Ore mineral	Gangue mineral	Host rock mineral	Associated rock min-	Alteration mineral	Weathering mineral	Deposit type and model number
Muscovite							
							Muscovite is a common mineral in igneous and metamorphic rocks. It also occurs as in some felsic skarns, in veins, and as the fine-grained, wallrock alteration known as sericite (see clays).
		4m		5	5m		Sn skarn (14b)
		4		4	4		replacement Sn (14c)
		3			5m		W veins (15a)
		4m			5m		Sn veins (15b)
		2			5m		Sn greisen (15c)
					4m		Climax Mo (16)
		2m			3m		porphyry Cu (17)
					4		porphyry Cu, skarn-related (18a)
					3		southeast Missouri Pb-Zn (32a)
Cr-rich							
					3		low-sulfide Au-quartz veins (36a)
					3		Homestake Au (36b)
V-rich							
		3					Au-Ag-Te veins (22b)
					4		sandstone U (30c)
Ni silicates							
	5					5	lateritic Ni (38a)
Ni sulfides, arsenides, and sulfarsenides (see also pentlandite)							
	5						dunitic Ni (6b)
	5						Limassol Forest Co-Ni (80
	3t						sandstone-hosted Pb-Zn (30a)
	4t						southeast Missouri Pb-Zn (32a)
	3t						unconformity U (37a)
Niobium minerals							
	4						carbonatite (10)
Olivine							
			4m				Olivine is a common mineral in mafic igneous rocks (including those associated with models 1 through 12).
Organic matter							
							Organic matter is found in many sedimentary and a few metamorphic rocks. The ore types noted here are those for which some relationship is probable.
		5			5		carbonate-hosted Au (26a)
		5					silica-carbonate Hg (27c)
				3			kuroko massive sulfide (28a)
			4				quartz pebble conglomerate Au-U (29a)

Appendix D. Mineralogical Index--Continued

Mineral	Ore mineral	Gangue mineral	Host rock mineral	Associated rock mineral	Alteration mineral	Weathering mineral	Deposit type and model number
Organic matter							
		4t	4t				sandstone-hosted Pb-Zn (30a)
			4				sediment-hosted Cu (30b)
			5				sandstone U (30c)
			4	4			sedimentary exhalative Zn-Pb (31a)
		3	2				southeast Missouri Pb-Zn (32a)
		4t	4				Kipushi Cu-Pb-Zn (32c)
		2t					unconformity U-Au (37a)
Orpiment							
		3					volcanogenic U (25f)
		5					carbonate-hosted Au (26a)
Pentlandite							
	5						Stillwater Ni-Cu (1)
	4t						Bushveld Cr (2a)
	5t						Merensky Reef PGE (2b)
	5						Duluth Cu-Ni-PGE (5a)
	5						Norillsk Cu-Ni-PGE (5b)
	5						komatiitic Ni-Cu (6a)
	5						dunitic Ni (6b)
	5						synorogenic-synvolcanic Ni-Cu (7a)
	3						Limassol Forest Co-Ni (8c)
	2t						Alaskan PGE (9)
PGE minerals							
	5t						Stillwater Ni-Cu (1)
	4t						Bushveld Cr (2a)
	5t						Merensky Reef PGE (2b)
	5t						Duluth Cu-Ni-PGE (5a)
	5t						Norillsk Cu-Ni-PGE (5b)
	4t						komatiitic Ni-Cu (6a)
	3t						podiform Cr (8a)
	5t						Alaskan PGE (9)
	4t						quartz pebble conglomerate Au-U (29a)
	2t						placer Au-PGE (39a)
	5t						placer PGE-Au (39b)
Phlogopite							
			4				carbonatite (10)
			5				diamond pipes (12)
		4					diamond placers (39d)
Phosphates							
	1m	5					carbonatite (10)
	5m					5m	phosphate, upwelling type (34c)
	5m					5m	phosphate, warm-current type (34d)
Plagioclase (also see albite)							
			4m		1		Plagioclase feldspar is a common mineral in igneous and metamorphic rocks associated with deposit types 1 through 10.
		5			5		emerald veins (31c)

Mineral	Ore mineral	Gangue mineral	Host rock mineral	Associated rock mineral	Alteration mineral	Weathering mineral	Deposit type and model number
Pyrite							
							Pyrite is a very common and abundant mineral in many ore deposits and as the product of sulfidic alteration of Fe-bearing wallrocks.
				4			Duluth Cu-Ni-PGE (5a)
		3		4			Norillsk Cu-Ni-PGE (5b)
		4					komatiitic Ni-Cu (6a)
		4					dunitic Ni (6b)
		3					synorogenic-synvolcanic Ni-Cu (7a)
		4					Limassol Forest Co-Ni (8c)
		4					carbonatite (10)
		3			4		W skarn (14a)
		4			3		Sn skarn (14b)
		3					replacement Sn (14c)
		4			4		W veins (15a)
		5					Sn veins (15b)
		4					Sn greisen (15c)
		4					Climax Mo (16)
		5			4		porphyry Cu (17)
		4			2		porphyry Cu, skarn-related (18a)
		5					Cu skarn (18b)
		4					Zn-Pb skarn (18c)
		4					Fe skarn (18d)
		5			3		polymetallic replacement (19a)
		4					replacement Mn (19b)
		5					porphyry Sn (20a)
		5					Sn-polymetallic veins (20b)
					3		porphyry Cu-Au (20c)
		5			5		porphyry Cu-Mo (21a)
		5			5		porphyry Mo, low-F (21b)
		5			5		volcanic-hosted Cu-As-Sb (22a)
		5			5		Au-Ag-Te veins (22b)
		5			5		polymetallic veins (22c)
			3				basaltic Cu (23)
	1m	5m					Cyprus massive sulfide (24a)
		5m					Besshi massive sulfide (24b)
		5					Blackbird Co-Cu (24d)
		5					hot-spring Au-Ag (25a)
		5			5		Creede epithermal vein (25b)
		5			5		Comstock epithermal vein (25c)
		4					Sado epithermal vein (25d)
		5			5		epithermal quartz-alunite Au (25e)
		5					volcanogenic U (25f)
		2					volcanic-hosted magnetite (25i)
		5					carbonate-h03ted Au (26a)
		5					hot-spring Hg (27a)
		5					silica-carbonate Hg (27c)
		4					simple Sb (27d)
		5m			5		kuroko massive sulfide (28a)
			4				quartz pebble conglomerate Au-U (29a)
		4t					sandstone-hosted Pb-Zn (30a)
		4					sediment-hosted Cu (30b)
		5					sandstone U (30c)
		4m					sedimentary exhalative Zn-Pb (31a)
		3t					bedded barite (31b)
		5					emerald veins (31c)
		5					southeast Missouri Pb-Zn (32a)

Mineral	Ore mineral	Gangue mineral	Host rock mineral	Associated rock mineral	Alteration mineral	Weathering mineral	Deposit type and model number
Pyrite (cont.)							
		4					Appalachian Zn (32b)
		5					Kipushi Cu-Pb-Zn (32c)
		4t					phosphate, upwelling type (34c)
		5					low-sulfide Au-quartz veins (36a)
		5					Homestake Au (36b)
		3					unconformity U (37a)
Pyrophyllite							
					2		porphyry Cu (17)
					2		porphyry Cu-Mo (21a)
					3		volcanic-hosted Cu-As-Sb (22a)
					2		hot-spring Au-Ag (25a)
					4		epithermal quartz-alunite Au (25e)
Pyroxene							
							Pyroxene is a common rock-forming mineral in mafic igneous rocks and in metamorphic rocks associated with some deposit types 1 through 10.
		4					carbonatite (10)
					5		Cu skarn (18b)
					5		Zn-Pb skarn (18c)
					5m		Fe skarn (18d)
		2					shoreline placer Ti (39c)
diopside							
			4				diamond pipes (12)
		4m			5m		W skarn (14a)
					3		porphyry Cu, skarn-related (18a)
					4m		Cu skarn (18b)
					5m		Fe skarn (18d)
					4		volcanic-hosted magnetite (25i)
hedenbergite							
		4m			5m		W skarn (14a)
					5m		Fe skarn (18d)
					5		Zn-Pb skarn (18c)
Mn-rich							
		2			4		Zn-Pb skarn (18c)
Pyrrhotite							
		5m					Stillwater Ni-Cu (1)
		5t					Bushveld Cr (2a)
		5					Merensky Reef PGE (2b)
		3t					Bushveld Fe-Ti-V (3)
		5m		3			Duluth Cu-Ni-PGE (5a)
		5m		3			Noril'sk Cu-Ni-PGE (5b)
		5m					komatiitic Ni-Cu (6a)
		5m					dunitic Ni (6b)
		5					synorogenic-synvolcanic Ni-Cu (7a)
		5					Limassol Forest Co-Ni (8c)
		3					Alaskan PGE (9)
		4					carbonatite (10)
		4					W skarn (14a)
		4					Sn skarn (14b)
		4m					replacement Sn (14c)

Mineral	Ore mineral	Gangue mineral	Host rock mineral	Associated rock mineral	Alteration mineral	Weathering mineral	Deposit type and model number
Pyrrhotite (cont.)							
		3					W veins (15a)
		3					porphyry Cu, skarn-related (18a)
		3					Cu skarn (18b)
		4					Zn-Pb skarn (18c)
		4					Fe skarn (18d)
		1					polymetallic replacement (19a)
		3					porphyry Sn (20a)
		5					Sn-polymetallic veins (20b)
		3m					Cyprus massive sulfide (24a)
	1m	4m					Besshi massive sulfide (24b)
		5					Blackbird Co-Cu (24d)
		3m					kuroko massive sulfide (28a)
		2t					sandstone-hosted Pb-Zn (30a)
		3m					sedimentary exhalative Zn-Pb (31a)
		1t					southeast Missouri Pb-Zn (32a)
		3					low-sulfide Au-quartz veins (36a)
		4					Homestake Au (36b)
Quartz							
		4m	4m	4m	3m	3m	Quartz is almost universal in hydrothermal ores and a common and abundant constituent of most rocks.
Rare earth bearing minerals							
	4						carbonatite (10)
					3t		W veins (15a)
		2t					volcanogenic U (25f)
	5t						Olympic Dam Cu-U-Au (29b)
		5t					emerald veins (31c)
	3						shoreline placer Ti (39c)
Realgar							
		4					hot-spring Au-Ag (25a)
		3t					volcanogenic U (25f)
		5					carbonate-hosted Au (26a)
		1t					Homestake Au (36b)
Rhodonite							
					3		Climax Mo (16)
	3						replacement Mn (19b)
					3		Zn-Pb skarn (18c)
	4						volcanogenic Mn (24c)
Rutile							
	2						anorthosite Ti (7b)
		2					carbonatite (10)
					4t		porphyry Cu (17)
					4t		porphyry Cu-Mo (21a)
					4t		Olympic Dam Cu-U-Au (29b)
		5t					emerald veins (31c)
	4						shoreline placer Ti (39c)
Scapolite							
					3		volcanic-hosted magnetite (25i)

Mineral	Ore mineral	Gangue mineral	Host rock mineral	Associated rock mineral	Alteration mineral	Weathering mineral	Deposit type and model number
Scheelite							
	5						W skarn (14a)
	4t						Sn skarn (14b)
	4t						W veins (15a)
	3t						Sn veins (15b)
	2t						porphyry Cu, skarn-related (18a)
	2t						Zn-Pb skarn (18c)
	3t						Sn-polymetallic veins (20b)
	4t						porphyry Mo, low-F (21b)
	3t						simple Sb (27d)
	3t						low-sulfide Au-quartz veins (36a)
	3t						Homestake Au (36b)
Selenides							
	2t						hot-spring Au-Ag (25a)
	3t						Comstock epithermal vein (25c)
	2t						sandstone U (30c)
Serpentine							
			4m	4m			Serpentine minerals are the common products of the low-temperature metamorphism of ultramafic and mafic rocks.
					5m		serpentine-hosted asbestos (8d)
		3					carbonatite (10)
			5m				diamond pipes (12)
					5m		carbonate-hosted asbestos (18e)
			5m				silica-carbonate Hg (27c)
					2		simple Sb (27d)
Silver (native)							
							Native silver is a common weathering product of silver-bearing sulfide ores.
	4t						basaltic Cu (23)
	2t					3t	Creede epithermal vein (25b)
	4t						Olympic Dam Cu-U-Au (29b)
	4t						sediment-hosted Cu (30b)
Silver sulfides and sulfosalts							
	4t					4t	Argentite and a wide variety of silver sulfosalts are common products of the oxidation and supergene enrichment of silver-bearing sulfide ores.
	1t						porphyry Cu-Mo (21a)
	4t						porphyry Mo, low-F (21b)
	4t						polymetallic veins (22c)
	5t						Creede epithermal vein (25b)
	4t						Comstock epithermal vein (25c)
	5t						Sado epithermal vein (25d)
	5t						epithermal quartz-alunite Au (25e)
	2t						simple Sb (27d)
	4t						kuroko massive sulfide (28a)
	2t						sandstone-hosted Pb-Zn (30a)
	3t						sedimentary exhalative Zn-Pb (31a)

Mineral	Ore mineral	Gangue mineral	Host rock mineral	Associated rock mineral	Alteration mineral	Weathering mineral	Deposit type and model number
Spessartite							
see Garnet							
Sphalerite							
	4t						carbonatite (10)
	4t						W skarn (14a)
	4t						Sn skarn (14b)
	3t						replacement Sn (14c)
	4t						W veins (15a)
	3t						Sn veins (15b)
	3t						Sn greisen (15c)
	3						porphyry Cu, skarn-related (18a)
	4						Cu skarn (18b)
	5						Zn-Pb skarn (18c)
	5						polymetallic replacement (19a)
	3t						replacement Mn (19b)
	4						porphyry Sn (20a)
	5						Sn-polymetallic veins (20b)
	3						porphyry Cu-Mo (21a)
	3						volcanic-hosted Cu-As-Sb (22a)
	3						Au-Ag-Te veins (22b)
	5						polymetallic veins (22c)
	3t						basaltic Cu (23)
	4						Cyprus massive sulfide (24a)
	5						Besshi massive sulfide (24b)
	4t						hot-spring Au-Ag (25a)
	5						Creede epithermal vein (25b)
	4						Comstock epithermal vein (25c)
	4t						Sado epithermal vein (25d)
	4t						epithermal quartz-alunite Au (25e)
	4t						silica-carbonate Hg (27c)
	3t						simple Sb (27d)
	5						kuroko massive sulfide (28a)
	5						sandstone-hosted Pb-Zn (30a)
	3t						sediment-hosted Cu (30b)
	2t						sandstone U (30c)
	5m						sedimentary exhalative Zn-Pb (31a)
	3t						bedded barite (31b)
	5						southeast Missouri Pb-Zn (32a)
	5						Appalachian Zn (32b)
	4						Kipushi Cu-Pb-Zn (32c)
	3						Homestake Au (36b)
	3t						unconformity U-Au (37a)
Sphene							
		3					carbonatite (10)
					2t		porphyry Cu (17)
		5t					volcanic-hosted magnetite (25i)
Spinel							
		4					carbonatite (10)
Stannite							
	3t						replacement Sn (14c)
	4t						Sn veins (15b)
	2t						Zn-Pb skarn (18c)
	4t						porphyry Sn (20a)
	4t						Sn polymetallic veins (20b)

Mineral	Ore mineral	Gangue mineral	Host rock mineral	Associated rock mineral	Alteration mineral	Weathering mineral	Deposit type and model number
Stibnite							
	3						Au-Ag-Te veins (22b)
	3t						hot-spring Au-Ag (25a)
	2t						Creede epithermal vein (25b)
	3t						carbonate-hosted Au (26a)
	4t						silica-carbonate Hg (27c)
	5						simple Sb (27d)
	2t						Homestake Au (36b)
Strontianite							
	3						carbonatite (10)
Sulfosalts							
							The term "sulfosalts" is here used to represent all of the minerals that combine silver or base metal sulfides with As- Sb- or Bi-sulfides; enargite-luzonite and tetrahedrite tennantite fall within this broad usage, but the Fe, Co and Ni sulfarsenides and sulfantimonides do not.
	4t						replacement Sn (14c)
	4t						W veins (15a)
	3t						Sn greisen (15c)
	3t						porphyry Cu, skarn-related (18a)
	4t						Cu skarn (18b)
	5t						polymetallic replacement (19a)
	4t						Sn-polymetallic veins (20b)
	3t						porphyry Cu-Mo (21a)
	3t						porphyry Mo, low-F (21b)
	5						volcanic-hosted Cu-As-Sb (22a)
	4t						Au-Ag-Te veins (22b)
	4t						polymetallic veins (22c)
	3t						Besshi massive sulfide (24b)
	5t						Creede epithermal vein (25b)
	5t						Comstock epithermal vein (25c)
	5t						Sado epithermal vein (25d)
	5t						epithermal quartz-alunite Au (25e)
	4t						simple Sb (27d)
	5t						kuroko massive sulfide (28a)
	4t						sandstone-hosted Pb-Zn (30a)
	4t						sedimentary exhalative Zn-Pb (31a)
	1t						southeast Missouri Pb-Zn (32a)
	5						Kipushi Cu-Pb-Zn (32c)
	3t						Homestake Au (36b)
	3t						unconformity U (37a)
Sulfospinels (also see carrollite, linneaite)							
	2t						dunitic Ni (6b)
	3t						Olympic Dam Cu-U-Au (29b)
	3t						sandstone-hosted Pb-Zn (30a)
	3t						sediment-hosted Cu (30b)
	2t						southeast Missouri Pb-Zn (32a)
	3t						Kipushi Cu-Pb-Zn (32c)

Mineral	Ore mineral	Gangue mineral	Host rock mineral	Associated rock mineral	Alteration mineral	Weathering mineral	Deposit type and model number
Sulfur (native)							
						2t	Native sulfur is sometimes found as an intermediate stage in the oxidation of sulfide ores.
	2	3			2		epithermal quartz-alunite Au (25e)
		4					hot-spring Hg (27a)
Sylvanite (see tellurides)							
Talc							
		3					serpentine-hosted asbestos (8d)
Tantalum minerals							
	3t						carbonatite (10)
Tellurides							
	5t						Au-Ag-Te veins (22b)
	3t						hot-spring Au-Ag (25a)
	3t						Creede epithermal vein (25b)
	3t						Comstock epithermal vein (25c)
	4t						Sado epithermal vein (25d)
	2t						simple Sb (27d)
	3t						low-sulfide Au-quartz veins (36a)
	2t						unconformity U-Au (37a)
	2t						polymetallic replacement (19a)
	2t						porphyry Cu-Au (20c)
	5t						Au-Ag-Te veins (22b)
	4t						hot-spring Au-Ag (25a)
	3t						Comstock epithermal vein (25c)
	4t						Sado epithermal vein (25d)
	3t						epithermal quartz-alunite Au (25e)
	2t						simple Sb (27d)
Tennantite-tetrahedrite							
	3t						replacement Sn (14c)
	3t						W veins (15a)
	3t						porphyry Cu, skarn-related (18a)
	4t						Cu skarn (18b)
	4						polymetallic replacement (19a)
	3t						porphyry Cu-Mo (21a)
	4t						porphyry Mo, low-F (21b)
	4						volcanic-hosted Cu-As-Sb (22a)
	4						Au-Ag-Te veins (22b)
	4						polymetallic veins (22c)
	3t						Besshi massive sulfide (24b)
	5t						Creede epithermal vein (25b)
	4t						Sado epithermal vein (25d)
	3t						simple Sb (27d)
	4t						kuroko massive sulfide (28a)
	3t						sandstone-hosted Pb-Zn (30a)
	3t						sedimentary exhalative Zn-Pb (31a)
	2t						southeast Missouri Pb-Zn (32a)
	5						Kipushi Cu-Pb-Zn (32c)
	3t						Homestake Au (36b)

Mineral	Ore mineral	Gangue mineral	Host rock mineral	Associated rock mineral	Alteration mineral	Weathering mineral	Deposit type and model number
Topaz							
	4						Sn skarn (14b)
	3			3			replacement Sn (14c)
	2				3		Sn veins (15b)
					4		Sn greisen (15c)
	3						Climax Mo (16)
Tourmaline							
		4					Sn skarn (14b)
		3		3			replacement Sn (14c)
		3			3		W veins (15a)
		4			4		Sn veins (15b)
		4m			4m		Sn greisen (15c)
		2			2		porphyry Cu (17)
		4			3		porphyry Sn (20a)
		4					Sn-polymetallic veins (20b)
		3			3		volcanic-hosted Cu-As-Sb (22a)
			3				Besshi massive sulfide (24b)
		5					Blackbird Co-Cu (24d)
					3		volcanic-hosted magnetite (25i)
				3			kuroko massive sulfide (28a)
					2		Olympic Dam Cu-U-Au (29b)
				3			sedimentary exhalative Zn-Pb (31a)
		3	3	3			Homestake Au (36b)
Tungstenite							
	2t						Kipushi Cu-Pb-Zn (32c)
Ulvospinel							
	3						anorthosite-Ti (7b)
Uraninite							
crystalline							
	4t						quartz pebble conglomerate Au-U (29a)
	5t						unconformity U (37a)
pitchblende							
	5t						volcanogenic U (25f)
	5t						sandstone U (30c)
	5t						unconformity U (37a)
V-oxides							
	4t					4t	sandstone U (30c)
Valleriite							
	3t						Norillsk Cu-Ni-PGE (5b)
	2t						Besshi massive sulfide (24b)
	2t						sedimentary exhalative Zn-Pb (31a)
Vanadates							
						4	sandstone U (30c)
Witherite							
		3t					bedded barite (31b)

Appendix D. Mineralogical Index--Continued

Mineral	Ore mineral	Gangue mineral	Host rock mineral	Associated rock mineral	Alteration mineral	Weathering mineral	Deposit type and model number
Wolframite							
	3t						W skarn (14a)
	5						W veins (15a)
	4						Sn veins (15b)
	3						Sn greisen (15c)
	3t						Climax Mo (16)
	4						Sn-polymetallic veins (20b)
	3t						epithermal quartz-alunite Au (25e)
	2t						simple Sb (27d)
	2t						Homestake Au (36b)
Wollastonite							
					4m		W skarn (14a)
					4		porphyry Cu, skarn-related (18a)
					4		Cu skarn (18b)
Zeolites							
		4			4		basaltic Cu (23)
		5					epithermal Mn (25g)
		4					rhyolite-hosted Sn (25h)
					4		hot-spring Hg (27a)
				2			kuroko massive sulfide (28a)
		3					phosphate, warm-current type (34d)
Zinnwaldite							
		2t			2		W veins (15a)
Zircon							
		3t					anorthosite Ti (7b)
		3t					carbonatite (10)
	4t						shoreline placer-Ti (39c)
Zunyite							
					3		epithermal quartz-alunite Au (25e)