

This file shows economic (or potentially economic) commodities as primary products or by-products; it also indicates Geochemical anomalies. These represent the elements present anywhere in the deposit, not solely in haloes distinct from ore. The listing covers only those deposits for which models are present elsewhere in this compilation. Figure 206 is a graphical presentation of some of the information in the following table. It provides an overview of the distribution of the elements among deposit types.

In an effort to represent the commonness or rarity of features, numbers are assigned. Universally present products/anomalies rate a +5 (shown simply as "5") grading down through 0 to -5 (shown as "(-5)") in a system similar to PROSPECTOR. The "0" value will seldom, if ever, be shown as it is the "don't know" (or "don't care") default. Note that negative numbers for "Primary" or "By-product" are not used, although they might be applied to indicate serious deleterious elements, such as phosphorus in iron ores. In almost all instances at present, these values will be guesses based on experience, not hard data; however, we do urge the compilation of data to make such assignments possible eventually. It is our intent to have the "1", "2", "3", "4" and "5" scores correspond respectively to the 0-10, 10-30, 30-70, 70-90, and 90-100 percent frequency relationship between the element and the deposit type. Obviously such statistical approaches are meaningless for deposit types having few representatives, such as emerald veins (31c), but the value can still be useful as an estimate of the compiler's opinion regarding the probable generality of the observation. The abbreviated suffixes "(prox.)" and "(dist.)" indicate respectively Proximal (or nearer source) and distal (or farther from the source). For more complex relations please refer back to the models.

Figure 206 shows only the presence of an element at some unspecified anomalous level, either proximally or distally with respect to the deposit. The elements are grouped in such a way that the distinction between those of granitic and mafic associations can be easily made. The elements of high mobility in hydrothermal environments form a distinct grouping on the right side of the matrix.

It should be obvious from examination of the table and figure below that the presence of a given element seldom, if ever, "proves" the existence of an ore deposit. Anomalous amounts of some elements such as copper, gold, iron, and zinc are so common in so many settings that their presence tells very little about the possible character of the host deposit. Their presence is encouraging, however, and indicates that additional studies may be warranted.

Element	Primary	By-product	Geochemical	Deposit type and model number
Ag			3	Sn skarn (14b)
		3	4(dist.)	porphyry Cu (17)
		3	5	porphyry Cu, skarn-related (18a)
		4	5	Cu skarn (18b)
		4	5	Zn-Pb skarn (18c)
		5(dist.)	4	polymetallic replacement (19a)
			4	replacement Mn (19b)
			4(dist.)	porphyry Sn (20a)
	3	3	5	Sn-polymetallic veins (20b)
		4	5(prox.)	porphyry Cu-Au (20c)
		4	5(dist.)	porphyry Cu-MO (21a)
			5(dist.)	porphyry MO, low-F (21b)
	3	5	5	volcanic-hosted Cu-As-Sb (22a)
	2	5	5	Au-Ag-Te veins (22b)
	4	2	5	polymetallic veins (22c)
		3	4	basaltic Cu (23)
		3	4	Cyprus massive sulfide (24a)
		3	5	Besshi massive sulfide (24b)
		2	3	Blackbird Co-Cu (24d)
	3	4	5(prox.)	hot-spring Au-Ag (25a)

Model Number	Deposit Type	Li	Na	K	Rb	Cs	Be	B	REE	U	Th	Zr	Nb	Ta	Mg	Ca	Sr	Ba	Al	Ga	P	Ti	V	Cr	Mn	Fe
1	Saltwater Ni-Cu														*											
2a	Bushveld Cr														*									*		
2b	Merensky Reef PGE														*								*			
3	Bushveld Fe-Ti-V														*							*	*	*		
5a	Duluth Cu-Ni-PGE														*							*	*	*		*
5b	Noril'sk Cu-Ni-PGE														*							*	*	*		*
6a	Komatiite Ni-Cu														*											
6b	Dunitic Ni-Cu														*											
7a	Synorogenic-Synvolcanic Ni-Cu														*											
7b	Anorthositic Ti														*											
8a & 8b	Podiform chromite														*							*	*	*		*
8c	Limassol Forest Co-Ni														*									*		
8d	Serpentine-hosted asbestos														*									*		
9	Alaskan Cr-Pt														*							*	*	*		*
10	Carbonatite	*					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
12	Diamond pipes														*	*	*	*	*	*	*	*	*	*	*	*
14a	W skarn				*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
14b	Sn skarn	*			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
14c	Replacement Sn	*			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
15a	W veins	*			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
15b	Sn veins	*			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
15c	Sn greisen	*			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
16	Climax Mo			*	*	*				o			*	*												
17	Porphyry Cu			*	o			*																	o	
18a	Porphyry Cu, skarn-related			*	o			*																	o	
18b	Cu skarn							*																	o	
18c	Zn-Pb skarn						*																		o	*
18d	Fe skarn																								*	
18e	Carbonate-hosted asbestos														*										*	
19a	Polymetallic replacement																	*							o	
19b	Replacement Mn																	*							*	
20a	Porphyry Sn							*										*							o	
20b	Sn-polymetallic vein							*										o							o	
20c	Porphyry Cu-Au							*										*							o	
21a	Porphyry Cu-Mo			*	o			*																	o	
21b	Porphyry Mo, low-F			*	o			*																	o	
22a	Volcanic-hosted Cu-Au-Sb			*	o			*										*			*					
22b	Au-Ag-Te veins																*	*	*	*	*					
22c	Polymetallic veins																*	*	*	*	*					
23	Basaltic Cu																									
24a	Cyprus massive sulfide																								o	
24b	Besshi massive sulfide																								*	
24c	Volcanogenic Mn																	*							*	
24d	Blackbird Co-Cu							*																	*	*
25a	Hot-spring Au-Ag																									
25b	Creede epithermal vein																	*							*	
25c	Comstock epithermal vein																	*							*	
25d	Sado epithermal vein																	*							*	
25e	Epithermal quartz-alunite Au																	*							*	
25f	Volcanogenic U	o						*	*																	
25g	Epithermal Mn							*		*											*			*		
25h	Rhyolite-hosted Sn	*					*		*												*			*		
25i	Volcanic-hosted magnetite						*		*									*		*	*	*	*	*	*	*
26a	Carbonate-hosted Au-Ag																	*		*	*	*	*	*	*	*
27a	Hot-spring Hg																	*		*	*	*	*	*	*	*
27b	Almaden Hg																	*		*	*	*	*	*	*	*
27c	Silica-carbonate Hg																	*		*	*	*	*	*	*	*
27d	Sb veins																	*		*	*	*	*	*	*	*
28a	Kuroko massive sulfide														*			*		*	*	*	*	*	*	*
28b	Algoma Fe														*			*		*	*	*	*	*	*	*
29a	Quartz pebble conglomerate Au-U								*	*		*													*	*
29b	Olympic Dam Cu-U-Au							*	*	*		*						*		*	*	*	*	*	*	*
30a	Sandstone-hosted Pb-Zn								*	*		*						*		*	*	*	*	*	*	*
30b	Sediment-hosted Cu								*	*		*						*		*	*	*	*	*	*	*
30c	Sandstone U								*	*		*						*		*	*	*	*	*	*	*
31a	Sedimentary exhalative Zn-Pb								*	*		*						*		*	*	*	*	*	*	*
31b	Bedded barite								*	*		*						*		*	*	*	*	*	*	*
31c	Emerald vein	*	*				*		*			*			*			*		*	*	*	*	*	*	*
32a	Southeast Missouri Pb-Zn								*	*		*			*			o		*	*	*	*	*	*	*
32b	Appalachian Zn								*	*		*			*			*		*	*	*	*	*	*	*
32c	Kipushi Cu-Pb-Zn								*	*		*			*			*		*	*	*	*	*	*	*
34a	Superior Fe																							*	*	*
34b	Sedimentary manganese																							*	*	*
34c	Phosphate, upwelling type							*	*									*		*	*	*	*	*	*	*
34d	Phosphate, warm current type							*	*									*		*	*	*	*	*	*	*
36a	Low sulfide Au-quartz vein							*										*		*	*	*	*	*	*	*
36b	Homestake Au							*										*		*	*	*	*	*	*	*
37a	Unconformity U-Au			*				*	*	*					*			*		*	*	*	*	*	*	*
37b	Gold on flat faults														*			*		*	*	*	*	*	*	*
38a	Lateritic Ni																							*	*	*
38b	Bauxite, laterite type																	*	*	*	*	*	*	*	*	*
38c	Bauxite, karst type																	*	*	*	*	*	*	*	*	*
39a	Placer Au-PGE																	*	*	*	*	*	*	*	*	*
39b	Placer PGE-Au																	*	*	*	*	*	*	*	*	*
39c	Shoreline placer Ti								*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
39d	Diamond placer								*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
39e	Alluvial placer Sn	*					*	*							*			*		*	*	*	*	*	*	*

Figure 206. Matrix diagram showing deposit models and their geochemical signature. Closed and open circles indicate that the element is anomalous proximally or distally to the deposit respectively.

Model Number	Deposit Type	Co	Ni	Cu	Mo	W	Re	PGE	Ag	Au	Zn	Cd	Hg	Tl	Ge	Sn	Pb	As	Sb	Bi	Te	Se	S	F	Br	C	NH3
1	Siltwater Ni-Cu	*	*	*				*																			
2a	Bushveld Cr							*																			
2b	Merensky Reef PGE			*				*																			
3	Bushveld Fe-Ti-V			*				*																			
5a	Duluth Cu-Ni-PGE	*	*	*				*																			
5b	Noril'sk Cu-Ni-PGE	*	*	*				*		*																	
6a	Komatiitic Ni-Cu	*	*	*				*		*																	
6b	Dunitic Ni-Cu	*	*	*				*		*																	
7a	Synorogenic-Synvolcanic Ni-Cu	*	*	*				*		*																	
7b	Anorthositic Ti							*																			
8a & 8b	Podiform chromite							*																			
8c	Limassol Forest Co-Ni	*	*					*		*								*									
8d	Serpentine-hosted asbestos							*										*									
9	Alaskan Cr-Pt		*	*				*										*									
10	Carbonatite			*	*	*											*							*			
12	Diamond pipes	*	*					*																		*	
14a	W skarn			*	*	*					*						*	*	*		*			*			
14b	Sn skarn			*	*	*			*		*						*	*	*		*			*			
14c	Replacement Sn			*	*	*			*		*						*	*	*		*			*			
15a	W veins			*	*	*			*		*						*	*	*		*			*			
15b	Sn veins			*	*	*			*		*						*	*	*		*			*			
15c	Sn greisen			*	*	*			*		*						*	*	*		*			*			
16	Climax Mo			*	*	*	*				*						*	*			*			*			
17	Porphyry Cu		*	*	*	*			*	*	*						*	*	*	*	*	*	*	*			
18a	Porphyry Cu, skarn-related		*	*	*	*			*	*	*						*	*	*	*	*	*	*	*			
18b	Cu skarn	*	*	*	*	*			*	*	*						*	*	*	*	*	*	*	*			
18c	Zn-Pb skarn	*	*	*	*	*			*	*	*						*	*	*	*	*	*	*	*			
18d	Fe skarn	*	*	*	*	*			*	*	*						*	*	*	*	*	*	*	*			
18e	Carbonate-hosted asbestos			*	*	*			*	*	*						*	*	*	*	*	*	*	*			
19a	Polymetallic replacement			*	*	*			*	*	*						*	*	*	*	*	*	*	*			
19b	Replacement Mn			*	*	*			*	*	*						*	*	*	*	*	*	*	*			
20a	Porphyry Sn			*	*	*			*	*	*						*	*	*	*	*	*	*	*			
20b	Sn-polymetallic vein			*	*	*			*	*	*						*	*	*	*	*	*	*	*			
20c	Porphyry Cu-Au		*	*	*	*			*	*	*						*	*	*	*	*	*	*	*			
21a	Porphyry Cu-Mo		*	*	*	*	*		*	*	*						*	*	*	*	*	*	*	*			
21b	Porphyry Mo, low-F		*	*	*	*	*		*	*	*						*	*	*	*	*	*	*	*			
22a	Volcanic-hosted Cu-As-Sb		*	*	*	*			*	*	*						*	*	*	*	*	*	*	*			
22b	Au-Ag-Te veins		*	*	*	*		*	*	*	*			*			*	*	*	*	*	*	*	*			
22c	Polymetallic veins		*	*	*	*			*	*	*						*	*	*	*	*	*	*	*			
23	Basaltic Cu	*	*	*					*	*	*												*				
24a	Cyprus massive sulfide	*	*	*					*	*	*												*				
24b	Besshi massive sulfide	*	*	*					*	*	*												*				
24c	Volcanogenic Mn	*	*	*					*	*	*												*				
24d	Blackbird Co-Cu	*	*	*					*	*	*								*				*				
25a	Hot-spring Au-Ag			*					*	*	*			*	*			*	*	*	*	*	*	*			*
25b	Creede epithermal vein		*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
25c	Comstock epithermal vein		*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
25d	Sado epithermal vein		*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
25e	Epithermal quartz-alunite Au		*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
25f	Volcanogenic U		*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
25g	Epithermal Mn		*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
25h	Rhyolite-hosted Sn		*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
25i	Volcanic-hosted magnetite		*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
26a	Carbonate-hosted Au-Ag		*	*	*	*			*	*	*			*	*			*	*	*	*	*	*	*			
27a	Hot-spring Hg		*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
27b	Almaden Hg		*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
27c	Silica-carbonate Hg		*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
27d	Sb veins		*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
28a	Kuroko massive sulfide		*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
28b	Algoma Fe		*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
29a	Quartz pebble conglomerate Au-U		*	*		*		*	*	*				*	*			*	*	*	*	*	*	*			
29b	Olympic Dam Cu-U-Au	*	*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
30a	Sandstone-hosted Pb-Zn		*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
30b	Sediment-hosted Cu	*	*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
30c	Sandstone U		*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
31a	Sedimentary exhalative Zn-Pb		*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
31b	Bedded barite		*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
31c	Emerald vein		*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
32a	Southeast Missouri Pb-Zn	*	*	*	*	*			*	*	*			*	*			*	*	*	*	*	*	*			
32b	Appalachian Zn	*	*	*	*	*			*	*	*			*	*			*	*	*	*	*	*	*			
32c	Kipushi Cu-Pb-Zn	*	*	*	*	*			*	*	*			*	*			*	*	*	*	*	*	*			
34a	Superior Fe		*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
34b	Sedimentary manganese		*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
34c	Phosphate, upwelling type		*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
34d	Phosphate, warm current type		*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
36a	Low sulfide Au-quartz vein	*	*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
36b	Homestake Au	*	*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
37a	Unconformity U-Au	*	*	*		*		*	*	*	*			*	*			*	*	*	*	*	*	*			
37b	Gold on flat faults		*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
38a	Lateritic Ni	*	*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
38b	Bauxite, laterite type		*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
38c	Bauxite, karst type		*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
39a	Placer Au-PGE		*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
39b	Placer PGE-Au	*	*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
39c	Shoreline placer Ti		*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
39d	Diamond placer	*	*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			
39e	Alluvial placer Sn		*	*		*			*	*	*			*	*			*	*	*	*	*	*	*			

Figure 206. Continued.

Appendix C. Commodity/Geochemical Index--Continued

Element	Primary	By-product	Geochemical anomaly	Deposit type and model number
Ag (cont.)	4	2	5	Creede epithermal vein (25b)
	4	3	5	Comstock epithermal vein (25c)
	3	4	5	Sado epithermal vein (25d)
		2	3	epithermal quartz-alunite Au (25e)
			3	epithermal Mn (25g)
		2		carbonate-hosted Au-Ag (26a)
		1	3	simple Sb (27d)
	1	4	5	kuroko massive sulfide (28a)
		2	5	Olympic Dam Cu-U-Au (29b)
		3	4	sandstone-hosted Pb-Zn (30a)
	2	5	5	sediment-hosted Cu (30b)
		4	5	sedimentary exhalative Zn-Pb (31a)
		4	4	southeast Missouri Pb-Zn (32a)
		3	5	Kipushi Cu-Pb-Zn (32c)
		5	5	low-sulfide Au-quartz veins (36a)
		3	3	Homestake Au (36b)
		3	5	placer Au-PGE (39a)
		1	4	placer PGE-Au (39b)
			3	unconformity U-Au (37a)
			3	gold on flat faults (37b)
Al			5	volcanic-hosted Cu-As-Sb (22a)
			5	epithermal quartz-alunite Au (25e)
	5		5	bauxite, laterite type (38b)
	5		5	bauxite, karst type (38c)
As			4	unconformity U-Au (37a)
			5	Limassol Forest Co-Ni (8c)
			4	Alaskan PGE (9)
			4	W skarn (14a)
			5	replacement Sn (14c)
			3	W veins (15a)
			4	Sn veins (15b)
			4	Sn greisen (15c)
			3(dist.)	porphyry Cu (17)
			2(dist.)	Cu skarn (18b)
			4	Zn-Pb skarn (18c)
			3	polymetallic replacement (19a)
			4(dist.)	porphyry Sn (20a)
			4	Sn-polymetallic veins (20b)
			5(dist.)	porphyry Cu-Mo (21a)
	2		5	volcanic-hosted Cu-As-Sb (22a)
			4	polymetallic veins (22c)
			5	Blackbird Co-Cu (24d)
			4(dist.)	hot-spring Au-Ag (25a)
			4	Creede epithermal vein (25b)
			4	Comstock epithermal vein (25c)
			5	epithermal quartz-alunite Au (25e)
			4	Sado epithermal vein (25d)
			4(prox.)	volcanogenic U (25f)
			3	rhyolite-hosted Sn (25h)
			5	carbonate-hosted Au (26a)
			5	hot-spring Hg (27a)
			4	Almaden Hg (27b)
			5	simple Sb (27d)
			4	kuroko massive sulfide (28a)
			4	Homestake Au (28c)
			3	sedimentary exhalative Zn-Pb (31a)
			5	Kipushi Cu-Pb-Zn (32c)
			5	low-sulfide Au-quartz veins (36a)
			5	Homestake Au (36b)

Appendix C. Commodity/Geochemical Index--Continued

Element	Primary	By-product	Geochemical anomaly	Deposit type and model number
As (cont.)			4	unconformity U-Au (37a)
			1	gold on flat faults (37b)
			4	placer Au-PGE (39a)
			4	placer PGE-Au (39b)
Au		2	3	komatiitic Ni-Cu (6a)
		4	5	porphyry Cu (17)
		3	4	porphyry Cu, skarn-related (18a)
		4	4	Cu skarn (18b)
		4	4	Zn-Pb skarn (18c)
	1	5	5(prox.)	porphyry Cu-Au (20c)
		3	5(dist.)	porphyry Cu-Mo (21a)
		3	4	Fe skarn (18d)
	1	3	4	polymetallic replacement (19a)
			4	replacement Mn (19b)
		3	4	Sn-polymetallic veins (20b)
			4(dist.)	porphyry Mo, low-F (21b)
		4	4	volcanic-hosted Cu-As-Sb (22a)
	5		5	Au-Ag-Te veins (22b)
	2	4	5(prox.)	polymetallic veins (22c)
			(-3)	basaltic Cu (23)
	2	4	5	Cyprus massive sulfide (24a)
	1	3	4	Besshi massive sulfide (24b)
		2	3	Blackbird Co-Cu (24d)
	4	2	5	hot-spring Au-Ag (25a)
	2	4	4	Creede epithermal vein (25b)
	4	3	5	Comstock epithermal vein (25c)
	4	3	5	Sado epithermal vein (25d)
	5		5	epithermal quartz-alunite Au (25e)
			3	epithermal Mn (25g)
	5		5	carbonate-hosted Au (26a)
		1	3	hot-spring Hg (27a)
		1	3	simple Sb (27d)
		3	5	kuroko massive sulfide (28a)
	5		5	Homestake Au (28c)
	4	2	5	quartz pebble conglomerate Au-U (29a)
		3	5	Olympic Dam Cu-U-Au (29b)
	5		5	low-sulfide Au-quartz veins (36a)
	5		5	Homestake Au (36b)
		3	5	unconformity U-Au (37a)
			5	gold on flat faults (37b)
	5	1	5	placer Au-PGE (39a)
		1	4	placer PGE-Au (39b)
B			1	carbonatite (10)
			5	Sn skarn (14b)
			4	replacement Sn (14c)
			2	W veins (15a)
			4	Sn veins (15b)
			4	Sn greisen (15c)
			3	porphyry copper (17)
			4(prox.)	porphyry Sn (20a)
			3	Blackbird Co-Cu (24d)
			3	kuroko massive sulfide (28a)
			3	sedimentary exhalative Zn-Pb (31a)
			4	Homestake Au (36b)
Ba	1		4	carbonatite (10)
			3	diamond pipes (12)
			3	polymetallic replacement (19a)
			4(dist.)	porphyry Sn (20a)

Appendix C. Commodity/Geochemical Index--Continued

Element	Primary	By-product	Geochemical anomaly	Deposit type and model number
Ba (cont.)			3	Au-Ag-Te veins (22b)
			4(dist.)	polymetallic veins (22c)
			3	volcanogenic Mn (24c)
			4	Creede epithermal vein (25b)
			3	volcanic-hosted magnetite (25i)
			3	carbonate-hosted Au (26a)-Ag
		1	3	kuroko massive sulfide (28a)
			3	Olympic Dam Cu-U-Au (29b)
			3	sandstone-hosted Pb-Zn (30a)
			4(dist.)	sedimentary exhalative Zn-Pb (31a)
	5		5	bedded barite (31b)
			3(dist.)	southeast Missouri Pb-Zn (32a)
			3	Appalachian Zn (32b)
			3	gold on flat faults (37b)
			3	diamond placers (39d)
Be			1	carbonatite (10)
			5	W skarn (14a)
		1	4	Sn skarn (14b)
			3	W veins (15a)
			3	Sn greisen (15c)
			2	Zn-Pb skarn (18c)
			4	rhyolite-hosted Sn (25h)
	5		5	emerald veins (31c)
Bi			4	W skarn (14a)
		1	5	W veins (15a)
			3	Sn greisen (15c)
			2	porphyry Cu (17)
			2	Cu skarn (18b)
			3	Zn-Pb skarn (18c)
			3	polymetallic replacement (19a)
		2	4	Sn-polymetallic veins (20b)
			2	Creede epithermal vein (25b)
			3	rhyolite-hosted Sn (25h)
			3	volcanic-hosted magnetite (25i)
			2	kuroko massive sulfide (28a)
			3	Kipushi Cu-Pb-Zn (32c)
			3	Homestake Au (36b)
			3	unconformity U-Au (37a)
Br		2	5	marine potash
			3	southeast Missouri Pb-Zn (32a)
C (diamond)				
	5			diamond pipes (12)
	5			diamond placers (39d)
C (organic)				
			5	carbonate-hosted Au (26a)
			5	sandstone U (30c)
			4	sedimentary exhalative Zn-Pb (31a)
			4	quartz pebble conglomerate Au-U (29a)
			3	southeast Missouri Pb-Zn (32a)
			4	phosphate, upwelling type (34c)
			3	phosphate, warm-current type (34d)
			3	unconformity U-Au (37a)
Ca			(-4)	kuroko massive sulfide (28a)
			(-4)	Cyprus massive sulfide (24a)
			(-5)	southeast Missouri Pb-Zn (32a)

Appendix C. Commodity/Geochemical Index--Continued

Element	Primary	By-product	Geochemical anomaly	Deposit type and model number
Ca (cont.)			(-5) (-3) 3	Appalachian Zn (32b) Blackbird Co-Cu (24d) unconformity U (37a)
Cd		4 4		southeast Missouri Pb-Zn (32a) Appalachian Zn (32b)
Co		3	5	Stillwater Ni-Cu (1)
			4	Duluth Cu-Ni-PGE (5a)
		3	5	Noril'sk Cu-Ni-PGE (5b)
		2	3	komatiitic Ni-Cu (6a)
		2	5	dunitic Ni (6b)
		1	5	synorogenic-synvolcanic Ni-Cu (7a)
	5		5	Limassol Forest Co-Ni (86)
			4	diamond pipes (12)
			2	Cu skarn (18b)
			3	Zn-Pb skarn (18c)
		1	2	Fe skarn (18d)
			1	basaltic Cu (23)
			3	Cyprus massive sulfide (24a)
			4	Besshi massive sulfide (24b)
	5		5	Blackbird Co-Cu (24d)
			3	Olympic Dam Cu-U-Au (29b)
	1	1	2	sediment-hosted Cu (30b)
			2	sedimentary exhalative Zn-Pb (31a)
		2	4	southeast Missouri Pb-Zn (32a)
		4	3	Kipushi Cu-Pb-Zn (32c)
		3	5	lateritic Ni (38a)
			3	Homestake Au (36b)
			4	unconformity U (37a)
			3	diamond placers (39d)
Cr	5		5	Bushveld Cr (2a)
			5	Merensky Reef PGE (2b)
			5	dunitic Ni (6b)
	5		5	podiform Cr (8a)
	2	1	5	Alaskan PGE (9)
			5	diamond pipes (12)
			3	Besshi massive sulfide (24b)
		1	5	lateritic Ni (38a)
			5	placer PGE-Au (39b)
			3	diamond placers (39d)
Cs			4	Sn skarn (14b)
			4	Climax Mo (16)
Cu		4	5	Stillwater Ni-Cu (1)
		1	5	Merensky Reef PGE (2b)
		3	5	Duluth Cu-Ni-PGE (5a)
		4	5	Noril'sk Cu-Ni-PGE (5b)
		3	5	komatiitic Ni-Cu (6a)
			4	dunitic Ni (6b)
		3	5	synorogenic-synvolcanic Ni-Cu (7a)
		1	5	Alaskan PGE (9)
			3	carbonatite (10)
		1	4	W skarn (14a)
		1	4	Sn skarn (14b)
		2	5	replacement Sn (14c)
			3	W veins (15a)
			4(prox.)	Climax Mo (16)
	5		5(prox.)	porphyry Cu (17)

Appendix C. Commodity/Geochemical Index--Continued

Element	Primary	By-product	Geochemical anomaly	Deposit type and model number
Cu (cont.)	5		5	porphyry Cu, skarn-related (18a)
	5		5(prox.)	Cu skarn (18b)
		4	5	Zn-Pb skarn (18c)
		1	4	Fe skarn (18d)
	3	4	5(prox.)	polymetallic replacement (19a)
			4	replacement Mn (19b)
			4(dist.)	porphyry Sn (20a)
	3	2	5	Sn-polymetallic veins (20b)
	5		5(prox.)	porphyry Cu-Au (20c)
	5		5(prox.)	porphyry Cu-Mo (21a)
			5(prox.)	porphyry Mo, low-F (21b)
	5		5	volcanic-hosted Cu-As-Sb (22a)
			4	Au-Ag-Te veins (22b)
	2	4	5(prox.)	polymetallic veins (22c)
	5		5	basaltic Cu (23)
	5		5	Cyprus massive sulfide (24a)
	5		5	Besshi massive sulfide (24b)
			3	volcanogenic Mn (24c)
		3	5	Blackbird Co-Cu (24d)
		3	5	Creede epithermal vein (25b)
		3	5	Comstock epithermal vein (25c)
		3	5	Sado epithermal vein (25d)
		3	5	epithermal quartz-alunite Au (25e)
			3	epithermal Mn (25g)
			3	volcanic-hosted magnetite (25i)
			3	silica-carbonate Hg (27c)
	5		5	kuroko massive sulfide (28a)
	5		5	Olympic Dam Cu-U-Au (29b)
	5		5	sediment-hosted Cu (30b)
		1	4	sandstone U (30c)
		1	5(prox.)	sedimentary exhalative Zn-Pb (31a)
		2	5	southeast Missouri Pb-Zn (32a)
	4	2	5	Kipushi Cu-Pb-Zn (32c)
			4	low-sulfide Au-quartz veins (36a)
			4	Homestake Au (36b)
			4	unconformity U (37a)
			5	gold on flat faults (37b)
			3	placer Au-PGE (39a)
			3	placer PGE-Au (39b)
F			2	carbonatite (10)
			2	W skarn (14a)
		1	4	Sn skarn (14b)
			5	replacement Sn (14c)
			4	W veins (15a)
			5	Sn greisen (15c)
			5	Climax Mo (16)
			3	Zn-Pb skarn (18c)
			3	porphyry Mo, low-F (21b)
			5	Au-Ag-Te veins (22b)
			5(prox.)	volcanogenic U (25f)
			4	rhyolite-hosted Sn (25h)
			3	volcanic-hosted magnetite (25i)
			2	carbonate-hosted Au (26a)
			3	Olympic Dam Cu-U-Au (29b)
			3	sandstone-hosted Pb-Zn (30a)
			2	southeast Missouri Pb-Zn (32a)
			3(dist.)	Appalachian Zn (32b)
		3	5	phosphate, upwelling type (34c)
		3	5	phosphate, warm current type (34d)
			4	gold on flat faults 37b

Appendix C. Commodity/Geochemical Index--Continued

Element	Primary	By-product	Geochemical anomaly	Deposit type and model number
Fe			5	many, including:
		3	5	Bushveld Fe-Ti-V (3)
			5	anorthosite Ti (7b)
			1	carbonatite (10)
	5		5	Fe skarn (18d)
		1	5	Cyprus massive sulfide (24a)
	5		5	volcanic-hosted magnetite (25i)
	1	1	5	kuroko massive sulfide (28a)
			5	Olympic Dam Cu-U-Au (29b)
	5		5	Algoma Fe (28b)
			3	sedimentary exhalative Zn-Pb (31a)
	5		5	Superior Fe (34a)
			4	gold on flat faults (37b)
			4	placer Au-PGE (39a)
			4	placer PGE-Au (39b)
Ga		3	3	shoreline placer Ti (39c)
		3	3	Kipushi Cu-Pb-Zn (32c)
		3	5	bauxite, laterite type (38b)
Ge		2	5	bauxite, karst type (38c)
		2	4	sediment-hosted Cu (30b)
Hg			3	Kipushi Cu-Pb-Zn (32c)
	1		5	carbonate-hosted Au-Ag (26a)
			4	Au-Ag-Te veins (22b)
	1		4(dist.)	hot-spring Au-Ag (25a)
			2	Creede epithermal vein (25b)
			3	Comstock epithermal vein (25c)
			4(dist.)	volcanogenic U (25f)
			4	carbonate-hosted Au (26a)
	5		5	hot-spring Hg (27a)
	5		5	Almaden Hg (27b)
	5		5	silica-carbonate Hg (27c)
			4	simple Sb (27d)
			3	Homestake Au (36b)
			3	placer Au-PGE (39a)
			3	placer PGE-Au (39b)
Ir (see PGE)				
K			(-4)	Stillwater Ni-Cu (1)
			(-5)	Bushveld Cr (2a)
			(-5)	Merensky Reef PGE (2b)
			4	diamond pipes (12)
			(-3)	emerald veins (31c)
			4	unconformity U (37a)
Li			2	carbonatite (10)
			4	Sn skarn (14b)
			5	replacement Sn (14c)
			4(dist.)	volcanogenic U (25f)
			4	rhyolite-hosted Sn (25h)
Mg			(-3)	emerald veins (31c)
			5	Stillwater Ni-Cu (1)
			5	Bushveld Cr (2a)
			5	Merensky Reef PGE (2b)
			5	komatiitic Ni-Cu-(6b)
			5	dunitic Ni (6b)
			3	kuroko massive sulfide (28a)

Appendix C. Commodity/Geochemical Index--Continued

Element	Primary	By-product	Geochemical anomaly	Deposit type and model number
Mg (cont.)			3	dolomitic Cu-Co
			5	southeast Missouri Pb-Zn (32a)
			5	Appalachian Zn (32b)
			4	emerald veins (31c)
Mn			3	carbonatite (10)
			4	diamond pipes (12)
			4(dist.)	porphyry Cu (17)
			5	Zn-Pb skarn (18c)
			4(dist.)	polymetallic replacement (19a)
	5		5	replacement Mn (19b)
			4(dist.)	porphyry Cu-Au (20c)
			4(dist.)	porphyry Cu-Mo (21a)
			5(dist.)	polymetallic veins (22c)
			4(dist.)	Cyprus massive sulfide (24a)
	5		5	volcanogenic Mn (24c)
			4	Blackbird Co-Cu (24d)
			3	Creede epithermal vein (25b)
	5		5	epithermal Mn (25g)
			4(dist.)	sedimentary exhalative Zn-Pb (31a)
	5		5	sedimentary Mn (34b)
			4	unconformity U (37a)
			4	diamond placers (39d)
Mo			4	carbonatite (10)
		2	5	W skarn (14a)
		2	5	W veins (15a)
		1	5	Sn greisen (15c)
		5	5(prox.)	Climax Mo (16)
		3	5(prox.)	porphyry Cu (17)
		2	5	porphyry Cu, skarn-related (18a)
		1	4	Cu skarn (18b)
		1	5(dist.)	porphyry Cu-Au (20c)
		4	5(prox.)	porphyry Cu-Mo (21a)
	5		5(prox.)	porphyry Mo, low-F (21b)
			5(prox.)	volcanogenic U (25f)
			2	carbonate-hosted Au (26a)
			3	sediment-hosted Cu (30b)
			4	sandstone U (30c)
			2	sedimentary exhalative Zn-Pb (31a)
			(-3)	emerald veins (31c)
			4	southeast Missouri Pb-Zn (32a)
			3	Kipushi Cu-Pb-Zn (32c)
			2	Homestake Au (36b)
			2	unconformity U-Au (37a)
N (as NH ₄ ⁺)			3	carbonate-hosted Au (26a)
			3	sedimentary exhalative Zn-Pb (31a)
			3	phosphate, upwelling type (34c)
			3	phosphate, warm-current type (34d)
Na			(-4)	Stillwater Ni-Cu (1)
			(-5)	Bushveld Cr (2a)
			(-5)	Merensky Reef PGE (2b)
			(-3)	Blackbird Co-Cu (24d)
Nb			(-4)	kuroko massive sulfide (28a)
			(-5)	Cyprus massive sulfide (24a)
			5	emerald veins (31c)
	4	1	4	carbonatite (10)
			4	diamond pipes (12)

Appendix C. Commodity/Geochemical Index--Continued

Element	Primary	By-product	Geochemical anomaly	Deposit type and model number
Nb (cont.)			3	Climax Mo (16)
			4	diamond placers (39d)
Ni	4	1	5	Stillwater Ni-Cu (1)
		2	5	Merensky Reef PGE (2b)
	4	1	5	Duluth Cu-Ni-PGE (5a)
	4	1	5	Noril'sk Cu-Ni-PGE (5b)
	5		5	komatiitic Ni-Cu-(6a)
	5		5	dunitic Ni (6b)
	5		5	synorogenic-synvolcanic Ni-Cu (7a)
	1	3	5	Limassol Forest Co-Ni (8c)
	1	3	5	Alaskan PGE (9)
			5	diamond pipes (12)
			3	Besshi massive sulfide (24b)
		1	4	southeast Missouri Pb-Zn (32a)
			5	unconformity U (37a)
	5		5	lateritic Ni (38a)
			4	diamond placers (39d)
Os (see PGE)				
P	1	1	5	carbonatite (10)
			(-4)	Stillwater Ni-Cu (1)
			(-5)	Bushveld Cr (2a)
			(-5)	Merensky Reef PGE (2b)
			5	anorthosite-Ti (7b)
			4	replacement Mn (19b)
			4	epithermal Mn (25g)
		2	5	volcanic-hosted magnetite (25i)
	5		5	phosphate, upwelling type (34c)
	5		5	phosphate, warm-current type (34d)
Pb			3	carbonatite (10)
			3	Sn skarn (14b)
			4	replacement Sn (14c)
			3	W veins (15a)
			4(dist.)	Climax Mo (16)
			4(dist.)	porphyry Cu (17)
			3	porphyry Cu, skarn-related (18a)
		1	4(dist.)	Cu skarn (18b)
	2	4	5	Zn-Pb skarn (18c)
	4	2	5(dist.)	polymetallic replacement (19a)
			4	replacement Mn (19b)
			4(dist.)	porphyry Sn (20a)
		2	4	Sn-polymetallic veins (20b)
			4(dist.)	porphyry Cu-Au (20c)
			4(dist.)	porphyry Cu-Mo (21a)
			4(dist.)	porphyry Mo, low-F (21b)
			4	Au-Ag-Te veins (22b)
			5	polymetallic veins (22c)
		2	5	Creede epithermal vein (25b)
		4	5	Comstock epithermal vein (25c)
		3	5	epithermal quartz-alunite Au (25e)
			4	epithermal Mn (25g)
			3	rhyolite-hosted Sn (25h)
			3	simple Sb (27d)
	1	3	5	kuroko massive sulfide (28a)
	5		5	sandstone-hosted Pb-Zn (30a)
			3	sediment-hosted Cu (30b)
	4		5	sedimentary exhalative Zn-Pb (31a)
			(-3)	emerald veins (31c)

Appendix C. Commodity/Geochemical Index--Continued

Element	Primary	By-product	Geochemical anomaly	Deposit type and model number
Pb (cont.)	5		5	southeast Missouri Pb-Zn (32a)
		2	3	Appalachian Zn (32b)
	3	3	5	Kipushi Cu-Pb-Zn (32c)
			4	low-sulfide Au-quartz veins (36a)
			4	Homestake Au (36b)
			4	unconformity U-Au (37a)
Pd (see PGE)				
Pt (incl. all PGE)		4	5	Stillwater Ni-Cu (1)
		4	5	Bushveld Cr (2a)
		5	5	Merensky Reef PGE (2b)
		4	5	Duluth Cu-Ni-PGE (5a)
		4	5	Noril'sk Cu-Ni-PGE (5b)
		3	5	komatiitic Ni-Cu(6a)
		2	5	dunitic Ni (6b)
		1	4	synorogenic-synvolcanic Ni-Cu (7a)
			5	podiform Cr (8a)
	1	3	5	Alaskan PGE (9)
			5	diamond pipes (12)
		1	2	Au-Ag-Te veins (22b)
			2	Homestake Au (28c)
		2	4	quartz pebble conglomerate Au-U (29a)
	1	1	3	placer Au-PGE (39a)
	5		5	placer PGE-Au (39b)
			4	diamond placers (39d)
Rare Earths				
	2	2	5	carbonatite (10)
		1	3	W veins (15a)
			3	volcanogenic U (25f)
			2	rhyolite-hosted Sn (25h)
			3	Olympic Dam Cu-U-Au (29b)
			5	emerald veins (31c)
		1	4	phosphate, upwelling type (34c)
		1	4	phosphate, warm-current type (34d)
			3	unconformity U-Au (37a)
		2	5	shoreline placer Ti (39c)
Rb			5	Sn skarn (14b)
			5	replacement Sn (14c)
			4	Climax Mo (16)
			3(dist.)	porphyry Cu (17)
			4(dist.)	porphyry Cu-Mo (21a)
			3	unconformity U-Au (37a)
Re			4	Sn skarn (14b)
			5	Climax Mo (16)
			5	Porphyry Mo, low-F (21b)
			3	Unconformity U-Au (37a)
Rh (see PGE)				
Ru (see PGE)				
S	1	2	5	kuroko massive sulfide (28a)
	1	2	5	Cyprus massive sulfide (24a)
Sb			3(dist.)	porphyry Cu (17)
			3	polymetallic replacement (19a)

Appendix C. Commodity/Geochemical Index--Continued

Element	Primary	By-product	Geochemical anomaly	Deposit type and model number
Sb (cont.)			4(dist.)	porphyry Sn (20a)
			4(dist.)	porphyry Cu-Mo (21a)
		3	3	volcanic-hosted Cu-As-Sb (22a)
			4	Au-Ag-Te veins (22b)
			4(dist.)	hot-spring Au-Ag (25a)
			4	Creede epithermal vein (25b)
			4	Comstock epithermal vein (25c)
			4	volcanogenic U (25f)
			3	rhyolite-hosted Sn (25h)
			4	carbonate-hosted Au (26a)
		1	5	hot spring Hg (27a)
			4	Almaden Hg (27b)
			4	silica-carbonate Hg (27c)
	5		5	simple Sb (27d)
			4	kuroko massive sulfide (28a)
			2	sedimentary exhalative Zn-Pb (31a)
			4	Homestake Au (36a)
			2	placer Au-PGE (39a)
			2	placer PGE-Au (39b)
Se			3	porphyry Cu (17)
			2	kuroko massive sulfide (28a)
			5	sandstone U (30c)
Si			5	almost all epigenetic deposits
Sn			1	carbonatite (10)
			5	W skarn (14a)
	3	3	5	Sn skarn (14b)
	5		5	replacement Sn (14c)
		2	5	W veins (15a)
	5		5	Sn veins (15b)
	5		5	Sn greisen (15c)
		2	5(prox.)	Climax Mo (16)
			3(dist.)	porphyry Cu (17)
			3	Zn-Pb skarn (18c)
			1	Fe skarn (18d)
	5		5	porphyry Sn (20a)
	5		5	Sn-polymetallic veins (20b)
			2	volcanic-hosted Cu-As-Sb (22a)
	5		5	rhyolite-hosted Sn (25h)
			4	kuroko massive sulfide (28a)
		1	2	sedimentary exhalative Zn-Pb (31a)
			3	Kipushi Cu-Pb-Zn (32c)
Sr			3	carbonatite (10)
			3	Au-Ag-Te veins (22b)
Ta			1	carbonatite (10)
			3	climax Mo (16)
Te			4(dist.)	porphyry Cu (17)
			4(dist.)	porphyry Cu-Mo (21a)
			3	polymetallic replacement (19a)
			5	Au-Ag-Te veins (22b)
			3	Comstock epithermal vein (25c)
Te (cont.)			3	Sado epithermal vein (25d)
			3	epithermal quartz-alunite Au (25e)
			3	unconformity U-Au (37a)
Th			5	carbonatite (10)

Appendix C. Commodity/Geochemical Index--Continued

Element	Primary	By-product	Geochemical anomaly	Deposit type and model number
Th (cont.)		2	5	shoreline placer Ti (39c)
Ti			4	Merensky Reef PGE (2b)
			5	Bushveld Fe-Ti-V (3)
			4	Duluth Cu-Ni-PGE (5a)
	5		5	anorthosite-Ti (7b)
			4	Alaskan PGE (9)
			4	carbonatite (10)
			5	diamond pipes (12)
	5		5	shoreline placer Ti (39c)
			5	diamond placers (39d)
T1			4(dist.)	hot-spring Au-Ag (25a)
			4	carbonate-hosted Au (26a)
U		1	5	carbonatite (10)
			3(dist.)	Climax Mo (16)
	1	4	4	quartz pebble conglomerate Au-U (29a)
		3	4	Olympic Dam Cu-U-Au (29b)
			2	sediment-hosted Cu (30b)
	5		5	sandstone U (30c)
			2	Kipushi Cu-Pb-Zn (32c)
		2	5	phosphate, upwelling type (34c)
		2	5	phosphate, warm-current type (34d)
	5		5	unconformity U (37a)
		1	5	shoreline placer Ti (39c)
V	3		5	Bushveld Fe-Ti-V (3)
		1	5	anorthosite-Ti (7b)
			4	Alaskan PGE (9)
		1	4	volcanic-hosted magnetite (25i)
			2	sediment-hosted Cu (30b)
	1	4	5	sandstone U (30c)
			3	Kipushi Cu-Pb-Zn (32c)
W			1	carbonatite (10)
	5		5	W skarn (14a)
	5		5	Sn skarn (14b)
		1	4	replacement Sn (14c)
	5		5	W veins (15a)
		2	5	Sn veins (15b)
		1	5(prox.)	Climax Mo (16)
			3(prox.)	porphyry Cu (17)
			2	porphyry Cu, skarn-related (18a)
		1	3	Zn-Pb skarn (18c)
		2	4	Sn-polymetallic veins (20b)
			4(prox.)	porphyry Cu-Mo (21a)
		1	5(prox.)	porphyry Mo, low-F (21b)
			2	Creede epithermal vein (25b)
			2	Comstock epithermal vein (25c)
			1	epithermal quartz-alunite Au (25e)
			2	volcanogenic U (25f)
		1	3	epithermal Mn (25g)
			4	carbonate-hosted Au (26a)
			4	simple Sb (27d)
			3	Kipushi Cu-Pb-Zn (32c)
Zn		1	4	W skarn (14a)
		1	4	Sn skarn (14b)
			4	replacement Sn (14c)
		1	3	W veins (15a)

Appendix C. Commodity/Geochemical Index--Continued

Element	Primary	By-product	Geochemical anomaly	Deposit type and model number
Zn (cont.)			3(dist.)	Climax Mo (16)
			4(dist.)	porphyry Cu (17)
			3	porphyry Cu, skarn-related (18a)
		2	4(dist.)	Cu skarn (18b)
	5		5	Zn-Pb skarn (18c)
	4	1	5(dist.)	polymetallic replacement (19a)
			4	replacement Mn (19b)
			4(dist.)	porphyry Sn (20a)
	2	3	5	Sn-polymetallic veins (20b)
			4(dist.)	porphyry Cu-Au (20c)
			4(dist.)	porphyry Cu-Mo (21a)
			3(dist.)	porphyry Mo, low-F (21b)
			4	volcanic-hosted Cu-As-Sb (22a)
			3	Au-Ag-Te veins (22b)
	2	2	4(dist.)	polymetallic veins (22c)
			3	basaltic Cu (23)
		3	5	Cyprus massive sulfide (24a)
		2	5	Besshi massive sulfide (24b)
			3	volcanogenic Mn (24c)
		3	5	Creede epithermal vein (25b)
		2	4(prox.)	epithermal quartz-alunite Au (25e)
			3	rhyolite-hosted Sn (25h)
			3	silica-carbonate Hg (27c)
			3	simple Sb (27d)
	5		5	kuroko massive sulfide (28a)
	1	3	5	sandstone-hosted Pb-Zn (30a)
			3	sediment-hosted Cu (30b)
	5		5	sedimentary exhalative Zn-Pb (31a)
	5		5	southeast Missouri Pb-Zn (32a)
	5		5	Appalachian Zn (32b)
	4	1	5	Kipushi Cu-Pb-Zn (32c)
			3	low-sulfide Au-quartz veins (36a)
			4	Homestake Au (36b)
			3	unconformity U (37a)
Zr			4	anorthosite-Ti (7b)
	1	1	4	carbonatite (10)
		3	5	shoreline placer Ti (39c)