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Menlo Park, California

# MAGNETIC SUSCEPTIBILITY MEASUREMENTS AND SAMPLE LOCATIONS OF GRANITIC ROCKS FROM ALONG A TRANSECT OF THE COAST MOUNTAINS NEAR JUNEAU, ALASKA

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## Abstract

The magnetic susceptibility of 194 granitic rock samples from along a transect of the Coast plutonic-metamorphic complex near Juneau, was measured using a Geoinstruments JH-8 model hand-held magnetic susceptibility meter. Variations in magnetic susceptibility are not only useful in differentiating individual plutons for mapping purposes, but may aid in (1) delineating hydrothermally altered and mineralized areas, (2) determining changes in metamorphic grade, (3) interpretation of aeromagnetic data, and (4) interpreting the tectonic and petrogenetic history of pluton emplacement. The variations in magnetic susceptibility define and delineate individual plutons and plutonic units that are part of three major plutonic belts of the region. Plutons range from quartz diorite to granite in modal composition. Variations in magnetic susceptibility are due to variable abundance of magnetite in the rocks, but granitic rocks with very low magnetic susceptibility lack magnetite, but may contain ilmenite, sulfides, and secondary opaque oxides. We also experimented with a Exploranium KT-5 model susceptibility meter and found the results compatible to the JH-8 meter. Both meters can accurately measure magnetic susceptibility on slabbed hand samples of sufficient size that will duplicate outcrop values.

## INTRODUCTION

Magnetic susceptibility is a useful and easily obtained measurement in various types of geologic investigations, particularly in the discrimination and mapping of plutons and plutonic suites (Ross, 1989; Drinkwater and others, 1992). Magnetic susceptibility also may be used in delineating mineralized areas (Grant, 1985; Ishihara and others, 1987; Puranen, 1989), rock alteration zones (Lapointe and others, 1986; Criss and Champion, 1984), grade of metamorphism (Subrahmauyam and Verma, 1981; Hageskov, 1984; Grant, 1985), and aid the interpretation of aeromagnetic data (Criss and Champion, 1984; Ford and others, 1988; Tulloch, 1989). Differences in magnetic susceptibility have been used to interpret tectonic settings of pluton emplacement (Ishihara, 1977; Takahashi and others, 1980), and when used in conjunction with chemical and isotopic data aids in petrogenetic interpretations (Ishihara and Sasaki,

1989; Bateman and others, 1991). The development of hand-held, battery operated susceptibility meters, such as the Geoinstruments JH-8 model, and Exploranium KT-5 model, makes differences in magnetic susceptibility easily measured during routine field and laboratory work.

Variations in magnetic susceptibility combined with chemical data were used by Drinkwater and others, (1992) to help define 18 plutons and plutonic units that form three major belts and 7 subbelts of the Coast plutonic-metamorphic complex in the vicinity of Taku Inlet, near Juneau (fig. 1). The plutons range from diorite, quartz monzodiorite, and quartz diorite to tonalite, granodiorite, and granite in average modal composition (table 1). This report provides sample locations and the magnetic susceptibility data summarized in the report of Drinkwater and others (1992), plus 49 additional measurements from the Taku Inlet transect area. Additionally, it compares results from two different models of magnetic susceptibility meters and makes general recommendations for use of these hand-held meters. The purpose of our investigation is to obtain representative values for various plutonic units and suites of the Juneau area to aid future detailed mapping and interpretation of aeromagnetic survey data of the region. The Taku Inlet transect area is within the Juneau and Taku River 1:250,000 quadrangles, mapped in reconnaissance by Brew and Ford (1985). Additional sources of geologic information for this area are found in Brew and Ford (1977), Ford and Brew (1973, 1977), Brew and Grybeck (1984), and Drinkwater and others (1989, 1990, 1992).

Magnetic susceptibility is the measurement of the ratio of intensity of magnetization of a substance, to the magnetizing field (Lindsley and others, 1966, Dobrin, 1976), and as used in this report is defined with respect to unit volume. The magnetic susceptibility of most rocks is proportional to the amount and type of ferromagnetic minerals present, principally magnetite. Pyrrhotite, ferrian ilmenite, chromite, franklinite, and a few other iron-rich spinels may be slightly ferromagnetic, but are uncommon and occur in such small amounts as to contribute very little to magnetic properties of rocks (Lindsley and others, 1966; Dobrin, 1976; Thompson and Oldfield, 1986), and ilmenite is usually antiferromagnetic. Magnetite-free rocks rich in mafic silicate minerals (high iron content), especially biotite, may yield slightly positive or paramagnetic susceptibility (Vernon, 1961; Tullock, 1989; Puranen, 1989). The relatively high specific magnetic susceptibility of the paramagnetic ferromagnesian silicates (biotite, hornblende, chlorite, and garnet), is due to the concentrations of magnetic ions  $Fe^{3+}$ ,  $Fe^{2+}$ , and  $Mn^{2+}$ , and to a lesser degree the magnetic ions of Co, Ni, and Ti (Vernon, 1961; Thompson and

Oldfield, 1986). Grain size and fabric of magnetite also influence the magnetic susceptibility of rocks (Lindsley and others, 1966; Tulloch, 1989) with coarser textures yielding higher magnetic susceptibility, and preferred orientation of magnetite or its magnetic domains generally giving anisotropic susceptibility. Weathering and hydrothermal alteration may decrease magnetic susceptibility (Lapointe and others, 1986; Puranen, 1989)

## METHODS AND RESULTS

Magnetic susceptibility measurements were made with a Geoinstruments Model JH-8 hand-held volume susceptibility meter. The units of measurement in volume susceptibility are the commonly used dimensionless SI units (International Standard units), (Goldman and Bell, 1981). We report our measured values as  $10^{-5}$  SI units. The older CGS system may be converted to SI units by using  $4\pi$  CGS (Thompson and Oldfield, 1986). One percent magnetite in a rock produces a magnetic susceptibility of about  $4000 \times 10^{-5}$  SI units, which approximates  $3000 \times 10^{-6}$  emu/cm<sup>3</sup> (electromagnetic unit per cubic centimeter) of the CGS system (Ross, 1989). Magnetic susceptibility values were determined by taking several measurements from the surface of slabbed samples. We used the highest reading which, according to Tulloch (1989), reflects the closest approach to the actual value. The differences between high and low readings were generally less than 20 percent, and most were less than 10 percent. As suggested by the JH-8 manual, each measurement was multiplied by 2 to compensate for the use of hand samples rather than outcrops. The reading errors are  $\pm 1$  at 0-100,  $\pm 10$  at 100-1000, and  $\pm 100$  at 1000 to 10,000 scale. Samples yielding very heterogeneous readings were not used, and those giving anomalous high or low values were also discarded unless they represent a distinct part of a pluton such as a border or core zone. Samples with magnetite grains coarser than 1 mm were not used in averages or ranges. The size of magnetite in granitic rocks of the transect area, generally, are very uniform in size, most are less than .5 mm. The 194 measurements listed in table 2 are grouped according to pluton or unit, and for comparison, the mafic mineral content is also listed. Average magnetic susceptibility values and ranges for individual plutons and units are shown in table 3.

The distribution of magnetic susceptibility of all samples in the Taku Inlet transect area is shown in figure 2; and has a bi-modal pattern, one group with a very low susceptibility and a second group with a moderately high susceptibility ( $1000$  to  $4000 \times 10^{-5}$  SI units). The distribution has a

gap between 500 and 1000  $\times 10^{-5}$  SI units, and a steady decline in samples with magnetic susceptibility greater than 4000. A more thorough description and analysis of the distribution patterns of magnetic susceptibility in this area is provided by Drinkwater and others (1992). The two highest measured values of 7000 and 8000 ( table 1) are not included in figure 2 because they are unusual in containing abundant coarse-grained magnetite ( $> 2$  mm). Samples yielding very low values (less than 300) generally lack opaque minerals, but where present the opaques are chiefly sulfides, ilmenite, or secondary magnetite or opaque oxides (goethite or limonite). Ilmenite was identified by its elongated and 6-sided forms, and skeletal grains, as compared to the more equant (4 and 3 sided) forms of magnetite.

We also scanned 30 of the samples with an Exploranium KT-5 model magnetic susceptibility meter to provide a comparison to the JH-8 model. The KT-5 measures volume susceptibility in SI units similar to the JH-8 model. It has a digital display readout ( $SI \times 10^{-3}$ ), memory recall control that stores up to 12 measurements, and a scan mode that allows repeated measurements over a given outcrop area for rapid assessment of distribution of magnetic susceptibility. The KT-5 can accurately measure magnetic susceptibility on samples with surface diameters of as small as 100 mm and a minimum thickness of 50 mm. To compare the KT-5 and JH-8 models, we measured magnetic susceptibility of 30 samples previously measured by the JH-8 model, and the results are tabulated in table 4. The susceptibility values for 23 samples above  $100 \times 10^{-5}$  SI units from the JH-8 meter were consistently slightly higher than corresponding values measured by the KT-5 meter. For four samples below 100, the KT-5 meter recorded higher values. The differences and percent difference are shown in table 4 and graphically in figure 3. The majority of samples show a difference of less than 10 percent between susceptibility values measured by the two meters, and only two are greater than 16 percent difference. The large percent differences in these two samples, which have very low susceptibility values (less than 100), is probably not significant because the rocks in that range are basically non-magnetic.

## DISCUSSION

The differences in magnetic susceptibility allow us to divide intrusive rocks into magnetite-bearing granitoids, - those with values greater than approximately  $300 \times 10^{-5}$  SI units, - and magnetite-free granitoids (Ilmenite-bearing) with values less than 300. The two magmatic series of igneous rocks are considered to represent different

tectonic settings, source rock compositions, and crystallization and emplacement histories (Ishihara, 1977; Takahashi and others, 1980; Ishihara and others, 1987; Piccoli and Hyndman, 1985; Tulloch, 1989; and Bateman and others, 1991). The differences in susceptibility also helped differentiate 3 major plutonic belts and 7 subbelts in the Taku Inlet transect area (Drinkwater and others, 1992). We also found significant differences in magnetic signatures between magnetite-bearing plutons of similar modal composition. We found no correlation between magnetic susceptibility and mafic mineral content (fig. 4) within subbelts, or individual units or plutons, indicating that the variations in susceptibility are due to local variations in abundance of magnetite or ilmenite.

Grant (1985) determined, from chemical and experimental data, that intrusive rocks of intermediate composition (quartz diorite to tonalite) should exhibit the highest magnetite content and magnetic susceptibility values. In our study area, the highest susceptibility values are found in tonalites and granodiorites, whereas the lowest values occur in all rock types from diorite to granite. The Speel River, Taku Cabin, and Mendenhall Glacier plutons are tonalites which exhibit very high susceptibility values, whereas the Mount Juneau, Grand Island, Carlson Creek, and Lemon Creek Glacier plutons are also chiefly tonalites, but exhibit very low susceptibility.

Finally, we note that the use of the multiplication factor of 2 for hand specimens as suggested by the JH-8 manual may not be necessary. James G. Moore (personal communications, 1992) indicates that test results on outcrops and hand specimens do not warrant the use of the multiplication factor, and that hand specimens of a certain minimum size will yield susceptibility values approximating those of outcrops. We suggest that, in future studies of this kind, it may be better to compensate for size of hand specimens by devising correction factors based on experimental comparisons between outcrops and hand samples for the specific study.

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Table 1. Average rock types of units and plutons of the Taku Inlet transect area.

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<u>Diorite</u>	<u>Quartz Diorite</u>	<u>Tonalite</u>
Irving Peak	Glass Peninsula	Speel River
		Taku Cabin
		Grand Island
		Mendenhall Glacier
		Mount Juneau
		Carlson Creek
		Lemon Creek Glacier
<u>Quartz Monzodiorite</u>	<u>Granodiorite</u>	<u>Granite</u>
Everett Peak	Annex Lakes	Turner Lake batholith
Arthur Peak	Butler Peak	eastern unit
	Wright Glacier 2	Wright Glacier 1
	Turner Lake batholith	
	northern unit	
	central unit	
	southern unit	

Table 2. MAGNETIC SUSCEPTIBILITIES OF INDIVIDUAL ROCK SAMPLES FROM PLUTONIC UNITS OF THE TAKU INLET TRANSECT AREA. MAGNETIC SUSCEPTIBILITY (MS) REPORTED IN SI UNITS  $\times 10^{-5}$

Sample no	Unit	Map no.	MS	% mafics	Mafic mins	Notes
<b>ADMIRALTY-REVILLAGIGEDO BELT</b>						
83DB041	Glass Pen.	1	32	13	hbl, bio, ga	epidote
83DB043	"	2	56	09	hbl, sp, ilm	epidote, sulfides
83DB044	"	3	64	12	hbl, bio, ga, sp	epidote, sulfides
83DB045	"	4	54	13	hbl, sp	epidote, ilmenite
83DB054	"	5	160	13	bio, hbl, ga	sulfides, epidote
83DB055	"	6	128	14	bio, hbl, ga, sp	epidote, ilmenite
83DB057	"	7	86	14	hbl, bio, sp	sulfides
83DB058	"	8	64	13	hbl, bio, ga	sulfides
83DB065	"	9	84	11	hbl, bio, sp	sulfides, epidote
83DB066	"	10	168	15	hbl, bio, sp	sulfides, ilmenite
83DB056	"	11	88	34	hbl, sp, bio	sulfides
83DB047	Grand Is.	12	70	15	hbl, sp	epidote
83DB059	"	13	300	16	hbl, bio, sp, ep, ilm	sulfides, secondary ma
83DB060	"	14	240	35	hbl, bio, sp, ep, ilm	sulfides, secondary ma
87SK040	Irving Pk.	15	74	44	hbl, bio, sp	sulfides, epidote
87SK042	"	16	190	39	hbl, bio, sp,	sulfides, ilmenite
82SK411	"	17	237	>25	hbl, bio, sp	sulfides, secondary ma
82SK414	"	18	70	>25	hbl, ox	sulfides, ilmenite
87DB016	Butler Pk.	19	20	10	bio, ga	epidote
87DB012	"	20	300	7	bio, sp	sulfides, epidote
87DB023	"	21	30	11	bio, ga, ilm	epidote
83EL106	Everett Pk.	26	1740	15	hbl, bio, sp, ma	epidote
83RK138	"	27	1600	18	hbl, sp, ma	sulfides
87RK141	"	28	2400	16	hbl, ma, sp	sulfides
87RK127	"	29	1180	22	hbl, ma	epidote
87RK143	"	30	4200*	22	hbl, sp, ma	epidote
87RK140	"	31	2200	19	hbl, sp, ma	
87RK137	"	32	3000	23	hbl, sp, ma	sulfides
87RK139	"	33	1000	20	hbl, sp, ma	sulfides
87RK135	"	34	3000	19	hbl, sp, ma	epidote
87SK030	"	35	4000*	18	hbl, sp, ma	epidote
87AF046	Arthur Pk.	22	480	17	hbl, sp, ma	
82PB173	"	23	2000	8	hbl, ma	sulfides
85EL105	"	24	1670	14	hbl, ep, ma	sulfides
87JS004	"	25	3400*	12	hbl, ma	

Sample no	Unit	Map no.	MS	% mafics	Mafic mins	Notes
<b>GREAT TONALITE SILL</b>						
87DB028	Speel R.	36	4400	23	hbl, bio, ma	
87SK045	"	37	2200		hbl, bio	
87DB033	"	38	4900	22	hbl, bio, ma	
87DB035	"	39	3000	21	hbl, bio, sp, ma	
87DB027	"	40	3800	27	hbl, bio, ma, sp	
82RK956	"	41	2000	13	hbl, bio, ma	
87SK052	"	42	2200	23	hbl, bio, ma	
82RK165	"	43	1200*	31	hbl, bio, ma	near border zone
82RK957	"	44	3200	16	bio, hbl, ma	
87RK148	"	45	4800	19	hbl, bio, ma	
87SK043	"	46	1060*	18	bio, hbl, sp, ma	near border zone
87SK044	"	47	3200	28	hbl, bio, ma, sp	
87AF048	"	48	1600	28	hbl, bio, sp, ma	
87AF058	"	49	1700	27	hbl, bio, ma	
87DB029	"	50	3000	21	bio, hbl, ma	
87RK128	"	51	4000	29	hbl, bio, ma	
87AF059	"	52	4000	30	hbl, bio, ma	
87DB038	border zone	53	140	30	hbl, bio, sp	ilmenite
82RK164	"	54	300	23	bio, hbl, sp	ilmenite
87RK147	"	55	68	32	hbl, bio, sp	no opaques
85EL065	Taku Cabin	56	3000	17	hbl, bio, sp, ma	
85EL069	"	57	4000	23	hbl, bio, sp, ma	
85SD108	"	58	2000	22	hbl, bio, sp, ma	
85SD067	"	59	3000	11	bio, sp, ma	
86RK085	"	60	4000	21	hbl, bio, sp, ma	
86SK363	Annex Lakes	115	3800	18	hbl, bio, ox	
88DB031	"	116	3200	17	bio, hbl, ox	
88SK142	"	117	5200	8	hbl, sp, ox	
88DB034	"	118	3200	14	bio, ox	
88SK143	"	119	3000	6	hbl, bio, ox	
88SK144	"	120	4000	6	hbl, bio, ox	
88SK146	"	121	3600	27	hbl, bio, sp	opaque oxides trace
86AF099	"	122	2800	9	hbl, bio, ox	
88DB032	"	123	600*	26	hbl, bio	trace of magnetite
88DB033	"	124	4000	14	bio, sp, ox	
88DB035	"	125	7000*	13	bio, hbl, ox	c-gr magnetite (>2mm)
87DB011	"	126	3800	12	bio hbl, ox	
88DB030	"	127	8000*	20	bio, hbl, ox	abundant c-gr magnetite
86SK374	"	128	5200	12	hbl, bio, ox	
88SK141	"	129	3200	3	bio, ox	

Sample no	Unit	Map no.	MS	% mafics	Mafic mins	Notes
<b>TURNER LAKE BATHOLITH</b>						
85DB132	Northern Gd	61	1820	13	bio, hbl, ma	
85DB136	"	62	1740	10	bio, hbl, ma	
85WN093	"	63	1480	7	bio, hbl, ma	
85WN069	"	64	1960	10	bio, hbl, ma	
85SD078	"	65	1600	11	bio, hbl, ma	
85WN089	"	66	1820	5	bio, ma	
85DB134	"	67	1320	9	bio, hbl, ma	near sulfide zone
85DB133	"	68	2200	9	bio, hbl, ma	
85DB096	"	69	1800	11	bio, hbl, ma	
85EL078	"	70	1700	10	bio, hbl, ma	
88SK148	"	71	2400	6	bio, hbl, ma	
85DB097	"	72	1840	14	bio, hbl, ma	
85WN074	"	73	1520	13	bio, hbl, ma	sulfides
86RK086	"	74	2400	8	bio, hbl, ma	
85WN091	"	75	1600	6	bio, hbl, ma	
85WN067	"	76	1620	7	bio, hbl, ma	
85DB098	"	77	2000	9	bio, hbl, ma	
85DB128	"	78	2400	9	bio, hbl, ma	
85SD080	"	79	2400	12	bio, hbl, ma	
85DB120	Central Gd	80	4200	10	hbl, bio, ma	
85SD072	"	81	3000	6	hbl, bio, ma	
85DB127	"	82	3820	14	hbl, bio, ma	
85DB118	"	83	4200	11	hbl, bio, ma	
85DB121	"	84	4000	11	hbl, bio, ma	
85DB122	"	85	3000	11	hbl, bio, ma	
85DB119	"	86	3000	8	bio, hbl, ma	
85DB115	"	87	2800	11	bio, hbl, ma	
85EL067	"	88	4400	12	bio, hbl, ma	
85WN064	"	89	4600	19	hbl, bio, ma	
75DB080	"	90	4000	14	bio, hbl, ma	
75AF123	"	91	3000	16	hbl, bio, ma	
75BJ015	"	92	4800	11	hbl, bio, ma	
87DB031	"	93	3000	16	bio, hbl, ma	
75DG106	"	182	3660	11	hbl, bio, ma	
75DB088	"	183	3480	14	hbl, bio, ma	
75DB090	"	184	4620	11	hbl, bio, ma	
75AF103	"	185	3000	16	hbl, bio, ma	
75CC033	"	186	4740	16	hbl, bio, ma	
75DB046	Southern Gd	94	2000	15	bio, hbl, ma	
75AF019	"	95	1480	15	hbl, bio, ma	
75CN013	"	96	1300	11	bio, hbl, ma	
75CN035	"	97	1800	17	hbl, bio, ma	
75CN061	"	98	440*	20	bio, hbl, ma	border phase
87RK149	"	99	840	10	bio, ma	
75BJ008	"	181	1760	17	bio, hbl, ma	
75DB104	"	187	1830	16	hbl, bio, ma	
75CN241	"	193	1740	21	hbl, bio, ma	

Sample no	Unit	Map no.	MS	% mafics	Mafic mins	Notes
75CN074	Eastern Gr	100	1060	9	bio, hbl, ma	
75DB069	"	101	1360	7	bio, hbl, ma	
75DG069	"	102	1780	9	bio, hbl, ma	
75AF099	"	103	1340	9	bio, ma	
75CC036	"	104	1120	8	bio, ma	
75AF062	"	105	1200	8	bio, hbl, ma	
75AF087	"	106	1620	8	bio, hbl, ma	
75CN037	"	107	1720	9	bio, hbl, ma	
75DB087	"	108	1460	1	bio, ma	
85WN104	Wright Glacier 1	109	66	8	bio, hbl	
85DB154	"	110	114	10	bio, hbl	
85WN105	"	111	172	10	bio	
85WN102	Wright Glacier 2	112	2400	36	hbl, bio, ma	
85EL096	"	113	2600	14	hbl, bio, ma	
85EL094	"	114	840	20	bio, hbl, ma	
86SU008	Undivided	156	3620	7	bio, hbl, sp, ma	
86SK370	"	157	3800	14	bio, hbl, sp, ma	
86SK373	"	158	3980	8	bio, hbl, sp, ma	
86SK367	"	159	2840	8	bio, hbl, sp, ma	
86RK089	"	160	4040	15	bio, hbl, sp, ma	
86SK368	"	161	3160	7	bio, hbl, sp, ma	
86SV009	"	162	2220	6	hbl, bio, ma	
85SD102	"	163	2600	9	bio, hbl, ma	
86SK369	"	164	5000	8	hbl, bio, ma	
86SU007	"	165	4420	13	bio, hbl, sp, ma	
86AF098	"	166	4860	17	bio, hbl, ma	
86SU006	"	167	4000	15	bio, hbl, sp, ma	
85WN066	"	168	2380	10	bio, hbl, ma	
87AF097	"	169	4100	17	bio, hbl, ma	
80DB020	"	170	4880	11	bio, sp, ma	
80SK127	"	171	2870	6	bio, hbl, ma	
86RK092	"	172	3070	8	bio, sp, ma	
87DB050	"	173	2000	3	bio, ma	
80DB024	"	174	2640	18	bio, hbl, sp, ma	
87AF101	"	175	5880	15	bio, hbl, sp, ma	
86AF103	"	176	4500	12	bio, hbl, ma	
86AF104	"	177	3120	8	bio, hbl, sp, ma	
86RK090	"	178	2690	3	bio, ma	
87RK166	"	179	3580	13	hbl, bio, sp, ma	
85SK081	"	180	3400	15	bio, hbl, ma	
74DB436	Southeast part	188	2360	8	bio, ma	
74CN239	"	189	1880	9	bio, ma	
74CN237	"	190	1460	10	bio, ma	
74DB351	"	191	2140	6	bio, ma	
74CC199	"	192	1560	12	bio, hbl, ma	
74DB352	"	194	2080	4	bio, ma	

Sample no	Unit	Map no.	MS	% mafics	Mafic mine	Notes
<b>JUNEAU SILLS</b>						
85WN070	Mount Juneau	130	60	16	hbl, bio, sp	sulfides
87SK066	"	131	100		bio, ga, sp	sulfides & altered
85SD119	"	132	100	20	bio, hbl	sulfides
80DB022		133	110	21	bio, ep, ga	sulfides, ilmenite
80DB023		134	356	16	hbl, bio, ep	sulfides, alt. magnetite
85EL113	Carlson Creek	135	40	19	bio, hbl	secondary magnetite
85SD118	"	136	60	33	hbl, bio	sulfides
86DB053	"	137	60	36	hbl, bio, ox	ilmenite
86DB054	"	138	50	17	hbl, bio, ga	sulfides
86DB055	"	139	60	22	hbl, bio	secondary magnetite
87RK164	"	140	140	32	hbl, bio, ox	sulfides & ilmenite
87SK089	"	141	50	30	hbl, bio	no opaques
87DB010	"	142	70	32	hbl, bio, ox	sulfides & ilmenite
85SD116	"	143	50	23	hbl, bio	no opaques
80SK126	"	144	80	>25		
86DB049	Lemon Creek Gl.	145	800	11	hbl, sp, ox	border phase rock
82DB305	"	146	230	10	hbl, bio, ox	sulfides & alt. magnetite
82DB298	"	147	90	36	hbl, bio	ilmenite
82DB299	"	148	56	38	hbl, bio	ilmenite
82DB307	"	149	110	31	hbl, bio	ilmenite ?
87AF102	Mendenhall Gl.	150	680	32	hbl, bio	border phase rock
87RK173	"	151	530	28	hbl, bio, sp	border phase rock
87RK172	"	152	3500	23	hbl, bio, ma	
87SK096	"	153	4560	23	hbl, bio, ma	
87SK097	"	154	3400	24	hbl, bio, sp, ma	
80DB104	"	155	5860	25	bio, hbl, ma	

Abbreviations: hbl, hornblende; bio, biotite; ga, garnet; sp, sphene; ilm, ilmenite; ep, epidote, ma, magnetite;  
ox, opaque oxides

\* sample measurement not used in averages

Table 3. Magnetic susceptibility averages and ranges for plutons and granitic units from the Taku Inlet transect. Magnetic susceptibility reported in SI units (International standard units),  $\times 10^{-5}$

Unit or pluton	No. of samples	Average	Range	Comments
Glass Peninsula	11	89	32-168	
Grand Island	3	203	70-300	
Butler Peak	3	117	20-300	
Irving Peak	4	143	70-237	
Everett Peak	10	2015	1000-4000	only two greater than 3000
Arthur Peak	4	1330	500-3400	
Speel River	17	3200	1100-4900	only two less than 1500
<i>border zone</i>	3	170	68-300	
Taku Cabin	5	3200	2000-4000	
Annex Lakes	15	3750	2800-5200	
Mount Juneau	5	145	60-356	
Carlson Creek	10	70	40-140	only one greater than 100
Lemon Creek Glacier	5	122	56-800	
Mendenhall Glacier	6	3090	530-5860	border phase < 1000
<u>Turner Lake batholith</u>				
northern granodiorite	19	1810	1320-2400	only 5 greater than 2000
central granodiorite	19	3750	2800-4800	only one less than 3000
southern granodiorite	9	1595	840-2000	
eastern granite	9	1407	1060-1780	
Wright Glacier stock 1	3	117	66-172	
Wright Glacier stock 2	3	1950	840-2600	
Southeast part	6	1913	1500-2400	
Undivided	25	3590	2200-5800	16 greater than 3000
<i>sum</i>	<b>194</b>			

Table 4. Magnetic Susceptibility comparisons between the Helsinki meter (JH-8 model) and Exploranium meter (KT-5 model) in SI units x 10<sup>-5</sup>

Sample	JH-8	KT-5	difference	% + or -	KT-5/JH-8
85SD058	1700	1700	0	0.00	1.00
85DB121	2000	1940	60	3.00	0.97
85DB132	910	824	86	9.50	0.91
85DB136	870	832	38	4.37	0.96
85DB127	1800	1620	180	10.00	0.90
87DB028	2200	2030	170	7.73	0.92
87DB033	2450	2230	220	8.98	0.91
87RK141	1200	1130	70	5.83	0.94
87RK143	2100	1910	190	9.05	0.91
85EL106	820	836	-16	-1.95	1.02
82PB173	1000	1040	-40	-4.00	1.04
87AF046	240	214	26	10.83	0.89
88SK143	1500	1360	140	9.33	0.91
88DB031	1600	1480	120	7.50	0.93
86SK363	1850	1600	250	13.51	0.86
75DB056	960	930	30	3.13	0.97
88DB030	4000	3420	580	14.50	0.86
87AF058	850	832	18	2.12	0.98
75CN061	220	212	8	3.64	0.96
75AF099	670	621	49	7.31	0.93
75AF087	810	743	67	8.27	0.92
87SK066	50	53	-3	-6.00	1.06
86DB049	400	336	64	16.00	0.84
87RK164	70	78	-8	-11.43	1.11
85SD118	30	38	-8	-26.67	1.27
87DB010	35	44	-9	-25.71	1.26
88SK142	2600	2320	280	10.77	0.89
88DB035	3500	3410	90	2.57	0.97
85WN105	86	95	-9	-10.47	1.10
85EL090	1300	1180	120	9.23	0.91

## FIGURE CAPTIONS

- Figure 1.** - Geologic sketch map and sample location map of the Taku Inlet Transect area.
- A.** Generalized geologic map showing individual plutons and plutonic units and their average magnetic susceptibility (modified from Drinkwater and others, 1992).
- B.** Sample locality map of expanded area of figure 1A. Refer to figure 1-A for unit and geographic names. Additional area is labeled. Some contacts have been modified from figure 1-A. Abbreviations: GR, granite; GD, granodiorite; TO, tonalite; and DI, diorite.
- Figure 2.** - Distribution of magnetic susceptibility values of plutonic rocks from the Taku Inlet transect area.
- Figure 3** - Differences in magnetic susceptibility values from samples measured by the JH-8 (series 1) and KT-5 (series 2) meters. Magnetic susceptibility in SI units  $\times 10^{-5}$ .
- Figure 4.**- Magnetic susceptibility versus modal percent mafic minerals for granitic rocks from five major subbelts (Drinkwater and others, 1992) of the Taku Inlet transect area.

Figure 1A

- Map Unit Abbreviations**
- WGs - Wright Glacier stocks
  - TLbg - Turner Lake batholith eastern unit
  - TLbn - Turner Lake batholith northern unit
  - TLbc - Turner Lake batholith central unit
  - TLBs - Turner Lake batholith southern unit
  - TLb - Turner Lake batholith undivided
  - TLs - Tease Lakes stocks
  - SR - Spcel River pluton
  - TC - Taku Cabin pluton
  - AL - Annex Lakes pluton
  - CC - Carlson Creek pluton
  - LCC - Lemon Creek Glacier pluton
  - MJ - Mount Juncou pluton
  - EP - Everett Peak pluton
  - AP - Arthur Peak pluton
  - BP - Butler Peak pluton
  - IP - Irving Peak pluton
  - GI - Grand Island pluton
  - GP - Glass Peninsula stocks
  - TKmg - Migmatitic gneiss (Tertiary and Cretaceous)
  - TKs - Schist (Tertiary and Cretaceous)
  - Kjs - Mesascidimentary and metavolcanic rocks (Cretaceous and Jurassic)
  - DI - Diorite

**EXPLANATION**

Average magnetic susceptibility values of units —

- High (>3,000 SI units) [diagonal hatching]
- Medium (1,000-3,000 SI units) [horizontal hatching]
- Low (<1,000 SI units) [dotted pattern]

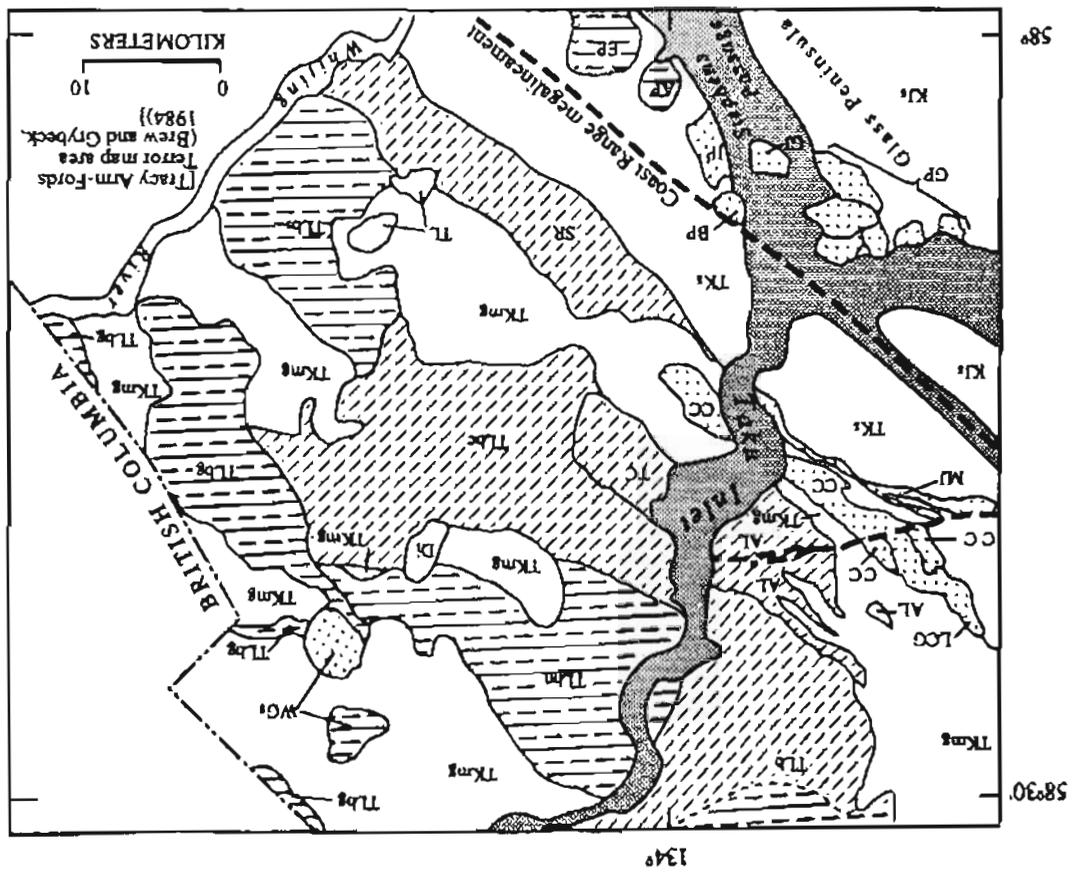
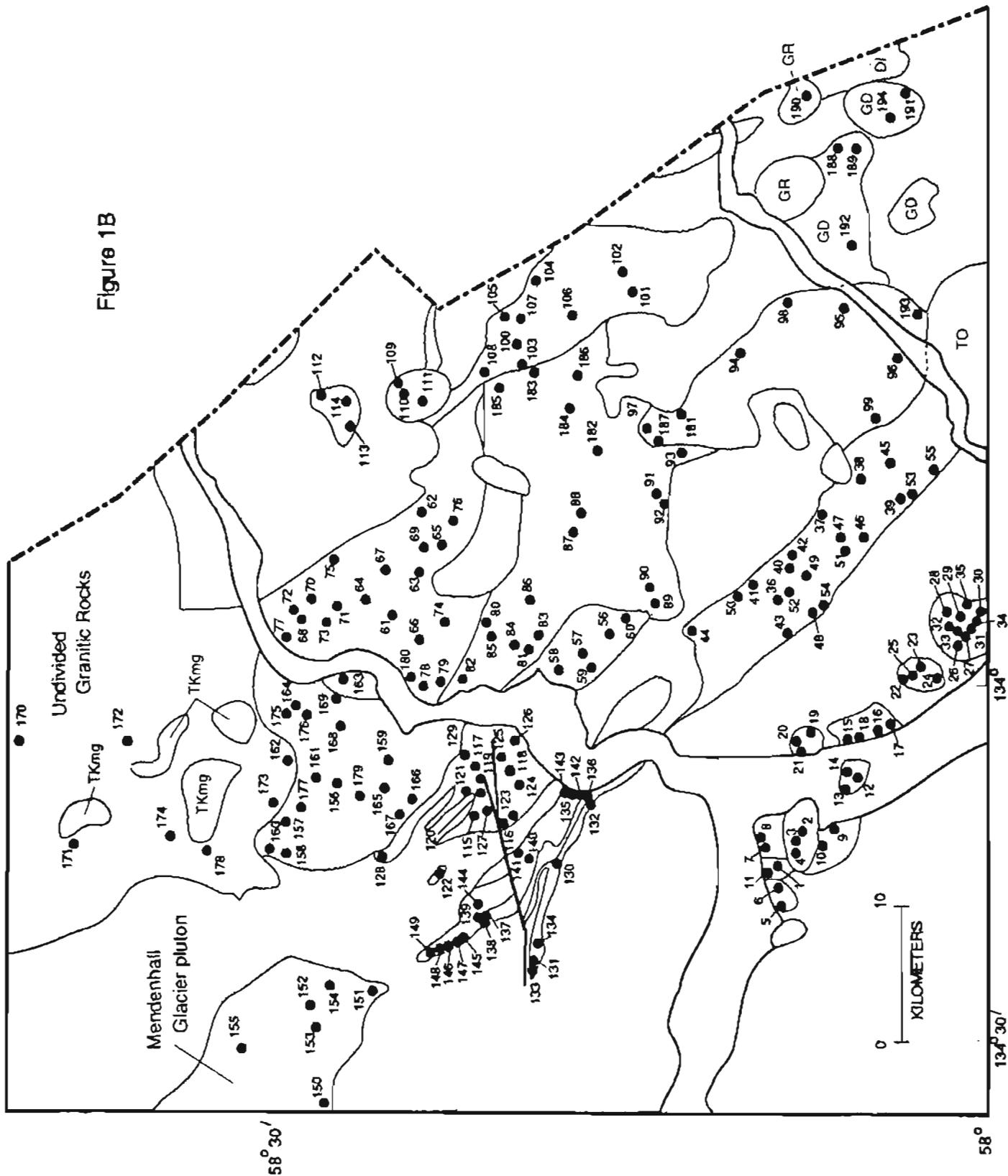


Figure 1B



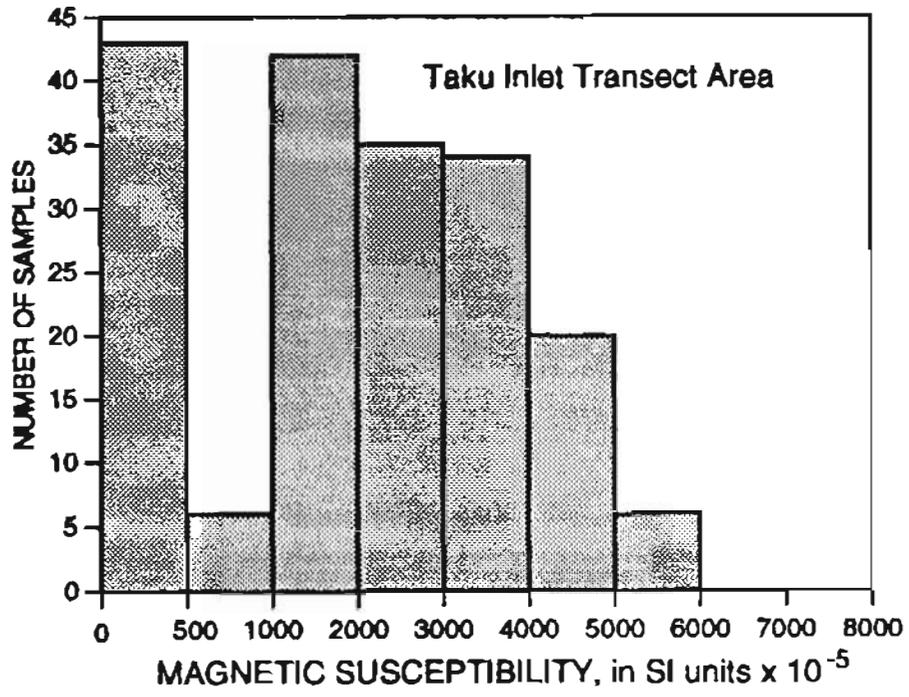
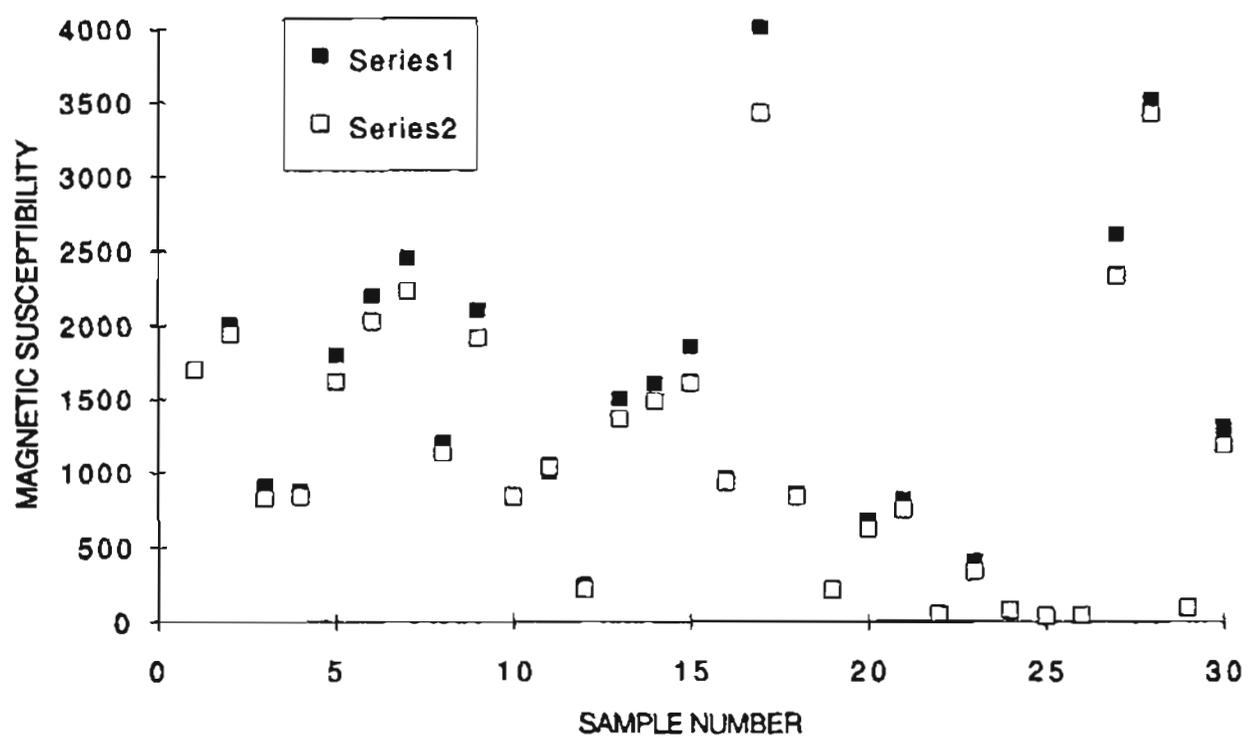


Figure 2.

Figure 3



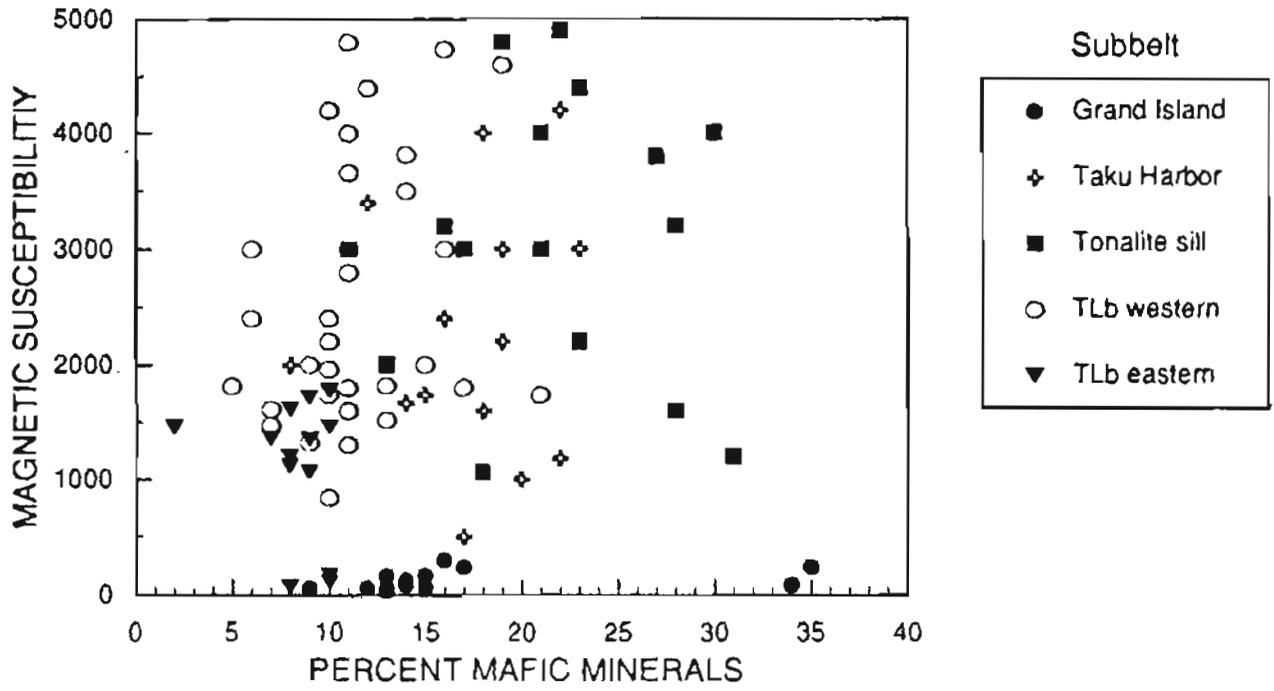


Figure 4.