Geochemistry

Table 1 -- Univariate statistics for "old" stream sediment samples from Puerto Rico (based on arithmatic values). [All values in parts per million (ppm) unless otherwise noted. All analyses are by semiquantative spectrographic method except for zinc and gold (No.'s 22 and 23) which were done by atomic absorption method. L, detected but below lower limit of determination; N, not detected at lower limit of determination; G, greater than upper limit of determination]

No.	Element	Minimum	Maximum	Mean	Deviation	Valid No. of samples	Number of samples L	N	G	Percent valid
1	Fe%	1.0	20.0	5.6	1.88	2,493	0	0	0	100
2	Mg%	.05	10.0	1.3	.85	2,490	0	0	3	100
3	Ca%	.05	20.0	1.4	2.30	2,489	2	0	2	100
4	Ti%	.05	3.0	.5	.23	2,488	0	0	5	100
5	Mn%	70	5,000	1,031.5	493.58	2,491	0	0	2	100
6	Ag	.5	30	1.5	5.22	32	2	2,459	0	1
7	B	10	500	113.7	13.65	1,864	550	79	0	75
8	Ba	20	5,000	627.7	432.87	2,486	5	1	1	100
9	Co	5	1,500	31.4	49.75	2,461	0	32	0	99
10	Cr	0.0001	5,000	626.7	993.68	2,431	5	8	49	98
11	Cu	5	7,000	82.8	180.74	2,491	2	0	0	100
12	Mo	5	20	6.8	3.26	82	7	2,404	0	3
13	Ni	5	5,000	96.3	332.18	2,469	2	18	4	99
14	Pb	10	2,000	23.6	56.53	1,909	421	163	0	77
15	Sc	5	70	22.9	7.71	2,473	0	20	0	99
16	Sn	10	300	32.5	.03	96	1	2,396	0	4
17	Sr	100	5,000	241.2	225.78	1,022	27	1,444	0	41
18	V	0.0001	700	231.9	81.42	2,493	0	0	0	100
19	Y	0.0001	50	20.7	7.63	2,372	2	119	0	95
20	Zn	200	700	245.4	4.77	163	212	2,118	0	7
21	Zr	0.0001	1,000	74.3	8.80	2,482	0	8	3	100
22	Zn	0.0001	580	82.1	47.70	2,493	0	0	0	100
23	Au	0.0001	5.000	.08	.38	705	1,788	0	0	28

Table 2 -- Univariate statistics for "new" stream sediment samples from Puerto Rico (based on arithmatic values). [All values in parts per million (ppm) unless otherwise noted. S prefix, analysis by semiquantative spectrographic method; AA prefix, analysis by atomic absorption method. L, detected but below lower limit of determination; N, not detected at lower limit of determination; G, greater than upper limit of determination. Leaders (--), insufficient data to calculate statistic]

No.	Element	Minimum	Maximum	Mean	Deviation	Valid No. of samples	Number of samples L	N	G	Percent valid
1	S-Ca%	.07	20.0	2.07	2.52	291	0	0	1	100
2	S-Fe%	.7	15.0	5.35	1.96	292	0	0	0	100
3	S-Mg%	.2	3.0	.95	.43	292	0	0	0	100
4	S-Na%	.2	5.0	1.53	.69	284	8	0	0	97
5	S-P%	.2	.2	.20	--	1	118	173	0	0
6	S-Ti%	.07	1	.57	.21	284	0	0	0	97
7	S-Ag	.5	2	.99	.57	7	2	283	0	2
8	S-B	10	30	13.88	4.91	138	89	65	0	47
9	S-Ba	70	3,000	508.04	344.94	291	0	0	1	100
10	S-Be	1	1	1.00	--	18	211	63	0	6
11	S-Co	10	150	30.50	15.16	281	8	3	0	96
12	S-Cr	10	5,000	367.28	675.75	289	0	0	3	99
13	S-Cu	10	150	51.39	26.47	292	0	0	0	100
14	S-Ga	5	70	41.53	12.06	291	1	0	0	100
15	S-La	50	50	50.00	--	2	78	212	0	1
16	S-Mn	150	2,000	1,101.03	305.61	291	0	0	1	100
17	S-Nb	20	20	20.00	--	3	39	250	0	1
18	S-Ni	5	1,000	46.34	113.30	277	13	2	0	95
19	S-Pb	10	300	28.15	23.45	292	0	0	0	100
20	S-Sc	5	30	18.59	4.95	291	1	0	0	100
21	S-Sn	10	50	19.31	12.06	29	10	253	0	10
22	S-Sr	100	700	250.77	97.65	260	12	20	0	89
23	S-V	50	1,500	393.01	259.86	292	0	0	0	100
24	S-W	30	30	30.00	--	1	0	291	0	0
25	S-Y	10	70	21.83	9.57	290	2	0	0	99
\26	S-Zn	200	700	266.67	130.08	27	208	57	0	9
27	S-Zr	15	1,000	193.68	193.68	289	0	0	3	99
28	AA-Au	0.0001	1.0	.04	.14	112	74	106	0	38
29	AA-Ag	0.0001	1.4	.11	.18	58	0	234	0	20
30	AA-As	0.0001	22.0	2.70	2.76	213	0	79	0	73
31	AA-Au	0.0001	13.0	1.15	3.73	12	0	280	0	4
32	AA-Bi	0.0001	1.9	.21	.63	9	0	283	0	3
33	AA-Cd	0.0001	.95	.12	.10	267	0	25	0	91
34	AA-Cu	0.0001	170.0	51.63	27.25	290	0	2	0	99
35	AA-Mo	0.0001	3.7	.53	.42	288	0	4	0	99
36	AA-Pb	0.0001	51.0	11.37	8.22	288	0	4	0	99
37	AA-Sb	0.0001	4.1	1.00	.79	45	0	247	0	15
38	AA-Zn	0.0001	340.0	85.14	52.88	290	0	2	0	99

Table 3. Crustal abundances for elements shown on maps _-_. [Abundances derived from Govett (1983) and S.E. Church (written commun., 1993). ppm, parts per million. 90th percentile abundances derived from and cumulative frequency plots (figs. 1-22)]

Element	Crustal abundance (ppm)	90th percentile (ppm)
Cobalt (Co)	29	50
Copper (Cu)	65	100
Chromium (Cr)	120	2000
Gold (Au)	0.004	0.05
Lead (Pb)	13	70
Molybdenum (Mo)	1.2	1.0
Nickel	90	300
Silver (Ag)	0.08	0.1
Tin (Sn)	2.1	10
Tungsten (W)	1.2	30
Zinc (Zn)	75	130
Zirconium (Zr)	162	500

Table 4 -- Correlation coefficients for "old" stream sediment samples from Puerto Rico. [**.08**, significant positive correlation ratio of 1 to 3 at 99 percent confidence level; **.11**, significant positive correlation ratio of greater than 3; *-.10*, significant negative correlation ratio of -1 to -3; *-.13*, significant negative correlation ratio of greater than -3; *****, insufficient data to calculate correlation coefficient; 1.88, standard deviation of the variable; and +++++, standard deviation greater than 99.99. Numbers located in columns below the standard deviation are the number of samples that have valid data for the elements indicated and that were used in calculating the correlation coefficient. S prefix, analysis by semiquantitative spectrographic method; AA prefix, analysis by atomic absorption method]

	S-Fe%	S-Mg%	S-Ca%	S-Ti%	S-Mn	S-Ag	S-B	S-Ba	S-Co	S-Cr	S-Cu	S-Mo	S-Ni	S-Pb	S-Sc	S-Sn	S-Sr	S-V	S-Y	S-Zn	S-Zr	AA-Zn	AA-Au
S-Fe%	1.88	**.11**	*-.13*	**.19**	**.14**	-.19	.04	*-.10*	**.08**	*-.07*	**.23**	.11	-.02	.02	**.13**	.05	.02	**.46**	**.04**	.08	**.09**	**.17**	.06
S-Mg%	2490	.85	**.06**	*-.09*	**.22**	-.19	-.02	**.13**	**.29**	**.43**	.01	-.14	**.49**	.01	**.28**	-.03	-.02	**.18**	.01	.00	*-.18*	*-.10*	-.03
S-Ca%	2489	2486	2.30	*-.10*	-.02	-.12	*-.05*	*-.06*	-.03	**.23**	*-.05*	-.21	-.02	.03	*-.06*	-.05	**.28**	*-.08*	**.12**	-.18	-.02	*-.18*	-.05
S-Ti%	2488	2485	2484	.23	**.27**	-.02	-.02	**.10**	-.02	*-.09*	-.03	.07	*-.17*	-.02	**.40**	.13	.04	**.40**	**.42**	-.08	**.17**	**.07**	.01
S-Mn	2491	2488	2487	2486	+++++	.12	-.03	**.19**	**.14**	.02	**.08**	-.13	**.05**	**.08**	**.36**	.05	-.02	**.33**	**.24**	**.23**	-.02	**.17**	-.03
S-Ag	32	32	31	32	32	5.22	-.02	.21	.29	.08	**.86**	*****	**.78**	.21	-.07	*****	.36	-.05	-.02	-.25	.19	-.05	*****
S-B	1864	1861	1862	1860	1862	25	13.65	.00	-.02	-.03	.03	.24	-.03	.00	.00	-.06	-.03	.01	-.01	-.12	-.04	.03	-.01
S-Ba	2486	2483	2482	2481	2484	32	1863	+++++	-.02	**.15**	.00	-.09	*-.07*	**.05**	**.14**	.13	-.03	**.17**	**.12**	-.02	.03	*-.05*	.10
S-Co	2461	2458	2457	2456	2459	32	1851	2454	49.75	**.40**	.02	-.15	**.58**	.00	**.15**	-.04	-.08	**.11**	-.02	-.04	*-.08*	.01	-.02
S-Cr	2431	2428	2427	2426	2429	32	1824	2424	2402	+++++	-.02	-.13	**.60**	.03	**.16**	-.03	.08	**.06**	-.03	-.06	*-.07*	*-.14*	.04
S-Cu	2491	2488	2487	2486	2489	32	1863	2484	2459	2431	+++++	**.33**	-.02	.03	.01	-.02	-.07	**.08**	-.03	.05	-.03	**.17**	.06
S-Mo	82	82	80	81	82	16	59	82	82	82	82	3.26	-.11	.02	-.08	-.33	.18	-.12	.01	-.05	-.08	.00	.34
S-Ni	2469	2466	2465	2464	2467	32	1850	2462	2446	2411	2468	82	+++++	-.02	.01	-.01	-.07	*-.04*	*-.13*	.04	*-.11*	*-.09*	-.05
S-Pb	1909	1906	1906	1904	1907	31	1527	1904	1897	1891	1909	72	1901	56.53	-.01	.00	**.13**	.04	.02	**.34**	-.01	**.17**	.00
S-Sc	2473	2470	2470	2468	2471	32	1856	2466	2447	2412	2472	80	2451	1902	7.71	-.03	-.03	**.50**	**.37**	-.05	*-.06*	**.06**	-.05
S-Sn	96	96	96	96	95	2	71	96	96	96	96	4	95	89	965	0.03	.20	.14	-.07	.14	.07	.16	.12
S-Sr	1022	1019	1021	1020	1022	7	701	1017	1012	1001	1020	27	1015	783	1018	52	+++++	-.02	**.14**	-.15	.06	*-.15*	-.02
S-V	2493	2490	2489	2488	2491	32	1864	2486	2461	2431	2491	82	2469	1909	2473	96	1022	81.42	**.26**	.06	**.07**	**.06**	.03
S-Y	2372	2369	2370	2367	2370	29	1799	2366	2350	2330	2372	68	2352	1847	2367	91	979	2372	7.63	-.04	**.22**	.00	-.07
S-Zn	163	163	163	163	161	15	121	162	163	154	163	22	163	150	163	12	28	163	1538	4.77	.06	**.36**	.13
S-Zr	2482	2479	2478	2479	2480	32	1856	2475	2450	2425	2480	82	2458	1904	2462	96	1021	2482	2368	1594	8.80	*-.08*	.01
AA-Zn	2493	2490	2489	2488	2491	32	1864	2486	2461	2431	2491	82	2469	1909	2473	96	1022	2493	2372	163	2482	47.70	.02
AA-Au	705	705	703	703	705	11	513	704	698	684	705	24	696	516	699	19	273	705	68	43	697	705	.38

Table 5 -- Correlation coefficients for "new" stream sediment samples from Puerto Rico. [**.08**, significant positive correlation ratio of 1 to 3 at 99 percent confidence level; **.11**, significant positive correlation ratio of greater than 3; *-.10*, significant negative correlation ratio of -1 to -3; *-.13*, significant negative correlation ratio of greater than -3; *****, insufficient data to calculate correlation coefficient; 1.88, standard deviation of the variable; and +++++, standard deviation greater than 99.99. Numbers located in columns below the standard deviation are the number of samples that have valid data for the elements indicated and that were used in calculating the correlation coefficient. S prefix, analysis by semiquantitative spectrographic method; AA prefix, analysis by atomic absorption method]

	S-Ca%	S-Fe%	S-Mg%	S-Na%	S-Ti%	S-Ag	S-B	S-Ba	S-Co	S-Cr	S-Cu	S-Ga	S-Mn	S-Ni	S-Pb	S-Sc	S-Sn	S-Sr	S-V	S-Y	S-Zn	S-Zr
S-Ca%	2.52	*-.29*	**.25**	.00	*-.25*	-.28	.20	*-.16*	-.12	.07	*-.27*	*-.21*	*-.22*	-.07	.06	*-.18*	-.18	**.35**	*-.16*	-.01	.09	-.09
S-Fe%	291	1.96	.03	-.06	**.49**	.46	*-.28*	.03	**.30**	.06	.09	**.36**	**.28**	.07	-.12	**.39**	-.02	-.05	**.69**	**.39**	**.54**	**.42**
S-Mg%	291	292	.43	**.28**	-.13	-.14	-.11	.02	**.36**	**.29**	.13	.04	.08	**.34**	-.06	**.35**	.17	.10	-.09	.11	-.01	-.10
S-Na%	283	284	284	.69	-.13	-.28	-.20	**.18**	.07	-.05	.04	**.36**	.10	-.12	.08	.12	.01	**.25**	-.03	.11	-.07	.01
S-Ti%	283	284	284	279	.21	.28	-.11	.02	.07	.05	**.20**	.06	**.18**	-.11	-.02	**.23**	-.02	-.07	**.43**	**.21**	.49	.06
S-Ag	7	7	7	7	7	.57	.30	-.02	.26	-.25	.59	.58	-.19	.06	.80	.09	*****	.75	.57	.49	*****	.78
S-B	137	138	138	135	138	7	4.91	.11	-.20	-.07	.00	*-.22*	*-.28*	-.08	.08	*-.38*	.47	.11	*-.17*	-.12	-.24	-.15
S-Ba	290	291	291	283	283	6	137	*****	-.02	.12	**.19**	.11	.11	.06	.11	-.01	.00	**.20**	-.12	**.17**	-.12	**.20**
S-Co	281	281	281	274	273	7	128	280	15.16	**.44**	**.24**	-.06	.14	**.61**	.00	**.20**	.29	-.07	.13	-.10	.12	-.08
S-Cr	288	289	289	282	281	7	137	288	278	*****	.08	*-.23*	00	**.68**	.03	.08	-.04	-.05	-.12	*-.16*	.04	*-.16*
S-Cu	291	292	292	284	284	7	138	291	281	289	26.47	.06	.09	.01	.09	**.21**	.03	-.16	.00	-.14	-.14	*-.22*
S-Ga	290	291	291	284	283	7	137	290	281	288	291	12.06	**.30**	*-.28*	.02	**.33**	-.17	.10	**.29**	**.38**	.08	**.28**
S-Mn	290	291	291	283	283	7	137	290	280	288	291	290	*****	-.07	-.06	**.31**	.19	-.08	**.18**	**.15**	.16	.06
S-Ni	276	277	277	269	269	7	135	276	268	274	277	276	276	*****	-.01	-.04	-.11	-.09	*-.17*	-.13	-.11	.03
S-Pb	291	292	292	284	284	7	138	291	281	289	292	291	291	277	23.44	-.08	-.13	**.24**	*-.17*	-.08	-.35	.01
S-Sc	290	291	291	284	283	7	137	290	281	288	291	291	290	276	291	4.95	.00	-.01	**.28**	**.40**	-.05	.10
S-Sn	29	29	29	28	29	1	15	29	29	29	29	29	28	28	29	29	12.0	-.23	-.02	-.39	*****	-.16
S-Sr	259	260	260	256	255	7	123	259	252	259	260	260	259	246	260	260	28	97.65	-.04	.13	-.16	.12
S-V	291	292	292	284	284	7	138	291	281	289	292	291	291	277	292	291	29	260	*****	**.25**	**.59**	**.25**
S-Y	289	290	290	283	282	7	137	289	280	288	290	289	289	276	290	289	29	259	290	9.57	*-.21*	**.58**
S-Zn	27	27	27	26	25	0	7	27	27	27	27	27	27	25	27	27	2	22	27	27	*****	-.21
S-Zr	288	289	289	281	281	7	138	288	278	286	289	288	288	274	289	288	29	257	289	287	27	*****
AA-Au	112	112	112	110	111	3	51	111	111	111	112	112	112	110	112	112	17	97	112	112	11	112
AA-Ag	58	58	58	56	58	4	38	57	54	57	58	57	57	54	58	57	11	52	58	57	5	58
AA-AS	213	213	213	209	213	7	118	212	206	211	213	212	212	206	213	212	25	193	213	213	19	213
AA-Au	12	12	12	12	12	0	7	12	11	12	12	12	12	12	12	12	1	11	12	12	1	12
AA-Bi	9	9	9	9	9	0	5	9	8	9	9	9	9	9	9	9	0	8	9	9	0	9
AA-Cd	267	267	267	261	261	7	133	266	259	265	267	266	266	258	267	266	29	239	267	266	23	266
AA-Cu	289	290	290	282	282	7	136	289	280	287	290	289	289	275	290	289	29	258	290	288	27	287
AA-Mo	288	288	288	280	280	7	134	287	279	285	288	287	287	273	288	287	29	256	288	286	27	285
AA-Pb	288	288	288	280	280	7	134	287	279	285	288	287	287	273	288	287	29	256	288	286	27	285
AA-Sb	45	45	45	42	45	1	31	45	43	45	45	45	45	44	45	45	7	38	45	45	6	45
AA-Zn	289	290	290	282	282	7	136	289	279	287	290	289	289	275	290	289	29	258	290	288	27	287

	AA-Au	AA-Ag	AA-As	AA-Au	AA-Bi	AA-Cd	AA-Cu	AA-Mo	AA-Pb	AA-Sb	AA-Zn
S-Ca%	.08	-.06	.01	-.10	-.01	**.23**	*-.27*	-.08	.04	-.15	*-.21*
S-Fe%	.02	-.01	-.11	.07	.04	*-.22*	-.03	-.07	-.05	-.04	**.27**
S-Mg%	.06	-.16	-.14	-.30	.37	*-.17*	.07	*-.23*	*-.14*	.00	*-.17*
S-Na%	-.0 2	-.10	*-.24*	.09	.11	-.06	-.02	*-.16*	.04	.06	-.10
S-Ti%	-.16	-.02	.02	.02	-.01	-.11	**.16**	.10	.05	-.06	**.33**
S-Ag	.19	.55	-.22	*****	*****	**.94**	.66	.66	.63	*****	**.88**
S-B	-.14	**.43**	.13	-.47	-.53	**.26**	-.06	**.26**	-.02	.00	-.11
S-Ba	-.03	.02	-.01	.03	-.17	.01	.07	**.26**	-.03	.12	-.12
S-Co	-.03	.01	-.01	-.01	-.09	-.13	.13	-.07	.03	-.12	**.16**
S-Cr	-.05	-.07	.10	-.25	-.09	-.05	.08	.05	.06	.08	.08
S-Cu	.11	.09	.04	-.01	-.04	.07	**.65**	**.29**	.06	-.06	**.21**
S-Ga	.12	.04	*-.24*	.28	.29	-.06	-.10	-.12	-.07	-.01	.04
S-Mn	.09	.09	-.11	.28	.35	.00	.10	.11	-.01	-.13	**.20**
S-Ni	-.06	-.01	.16	-.22	-.17	-.06	-.02	.01	.00	**.47**	-.02
S-Pb	-.02	.08	.09	.05	-.36	**.26**	.04	.13	**.41**	.08	.10
S-Sc	-.02	.04	-.15	.16	.17	-.15	**.16**	-.14	-.12	-.05	.03
S-Sn	.12	.06	-.09	*****	*****	-.26	.09	-.15	-.34	-.18	-.12
S-Sr	-.03	-.05	-.16	-.07	.47	.09	*-.20*	-.02	.06	-.05	*-.14*
S-V	.04	.19	-.12	.32	-.03	*-.20*	-.03	-.10	-.05	-.08	**.40**
S-Y	-.03	-.07	-.16	-.02	.04	-.01	*-.25*	-.02	*-.19*	.12	*-.26*
S-Zn	.08	*****	-.13	*****	*****	-.26	-.11	.07	.26	-.67	**.56**
S-Zr	-.01	-.12	-.01	-.21	-.12	-.09	*-.33*	-.03	-.10	.28	*-.15*
AA-Au	.14	**.84**	-.04	.90	*****	-.09	.05	-.01	-.05	.15	-.09
AA-Ag	33	.18	.08	**.99**	**1.00**	.10	.26	.19	.07	.51	.23
AA-AS	96	54	2.76	**.75**	*****	**.30**	.17	**.34**	**.25**	**.44**	.13
AA-Au	5	12	11	3.73	**1.00**	.16	.69	.18	.18	*****	.44
AA-Bi	2	8	8	9	.63	**1.00**	**1.00**	**1.00**	**1.00**	*****	**1.00**
AA-Cd	108	55	204	12	9	.10	**.20**	**.37**	**.50**	**.41**	**.33**
AA-Cu	112	58	213	12	9	266	27.25	**.35**	**.22**	.33	**.35**
AA-Mo	112	58	213	12	9	265	288	.42	**.16**	.22	**.16**
AA-Pb	112	58	213	12	9	265	288	288	8.21	.37	**.42**
AA-Sb	20	17	43	8	8	43	45	45	45	.79	.29
AA-Zn	112	58	213	12	9	265	289	288	288	45	52.88

Table 6 -- Univariate statistics for "all" stream sediment samples from Puerto Rico (based on arithmetic values).

[All values in parts per million (ppm) unless otherwise noted. All analyses are by semiquantative spectrographic method except for zinc and gold (No.'s 22 and 23) which were done by atomic absorption method. L, detected but below lower limit of determination; N, not detected at lower limit of determination; G, greater than upper limit of determination]

No.	Element	Minimum	Maximum	Mean	Deviation	Valid No. of samples	Number of samples L	N	G	Percent valid
1	Fe%	.7	20.0	5.5	1.89	2,785	0	0	0	100
2	Mg%	.05	10.0	1.3	.83	2,782	0	0	3	100
3	Ca%	.05	20.0	1.5	2.33	2,780	2	0	3	100
4	Ti%	.05	3.0	.5	.23	2,772	0	0	13	100
5	Mn	70	5,000	1,038.8	477.84	2,782	0	0	3	100
6	Ag	.5	30	1.4	4.72	39	4	2,742	0	1
7	B	10	500	13.7	13.23	2,002	639	144	0	72
8	Ba	20	5,000	615.2	426.04	2,777	5	1	20	100
9	Co	5	1,500	31.3	47.38	2,742	8	35	0	99
10	Cr	0.0001	5,000	599.1	968.10	2,720	5	8	52	98
11	Cu	5	7,000	79.5	171.48	2,783	2	0	0	100
12	Mo	5	20	6.8	3.26	82	14	2,689	0	3
13	Ni	5	5,000	91.2	317.37	2,746	15	20	4	99
14	Pb	10	2,000	24.2	53.34	2,201	421	163	0	79
15	Sc	5	70	22.4	7.59	2,764	1	20	0	99
16	Sn	10	300	29.4	44.52	125	11	2,649	0	5
17	Sr	100	5,000	243.1	206.33	1,282	39	1,464	0	46
18	V	0.0001	1,500	248.8	124.22	2,785	0	0	0	100
19	Y	0.0001	70	20.8	7.88	2,662	4	119	0	96
20	Zn	200	700	248.4	92.43	190	420	2,175	0	7
21	Zr	0.0001	1,000	82.0	80.87	2,771	0	8	6	100
22	Zn	0.0001	580	82.4	48.27	2,783	0	2	0	100
23	Au	0.0001	5.000	.07	.36	817	1,862	106	0	29

Table 7 -- Correlation coefficients for "all" stream sediment samples from Puerto Rico. [**.09**, significant positive correlation ratio of 1 to 3 at 99 percent confidence level; **.21**, significant positive correlation ratio of greater than 3; -*.08*, significant negative correlation ratio of -1 to -3; *-.15*, significant negative correlation ratio of greater than -3; *****, insufficient data to calculate correlation coefficient; 1.89, standard deviation of the variable; and +++++, standard deviation greater than 99.99. Numbers located in columns below the standard deviation are the number of samples that have valid data for the elements indicated and that were used in calculating the correlation coefficient. S prefix, analysis by semiquantitative spectrographic method; AA prefix, analysis by atomic absorption method]

	S-Fe%	S-Mg%	S-Ca%	S-Ti%	S-Mn	S-Ag	S-B	S-Ba	S-Co	S-Cr	S-Cu	S-Mo	S-Ni	S-Pb	S-Sc	S-Sn	S-Sr	S-V	S-Y	S-Zn	S-Zr	AA-Zn	AA-Au
S-Fe%	1.89	**.10**	*-.15*	**.21**	**.14**	-.14	.03	*-.08*	**.09**	*-.05*	**.22**	.11	-.02	.01	**.16**	.07	.01	**.41**	**.09**	.14	**.14**	**.18**	.06
S-Mg%	2782	.82	**.06**	*-.11*	**.21**	-.17	-.02	**.13**	**.29**	**.43**	.02	-.14	**.49**	.00	**.30**	.00	-.02	**.04**	.01	-.01	*-.15*	*-.10*	-.02
S-Ca%	2780	2777	2.33	*-.10*	*-.03*	-.09	-.04	*-.08*	-.03	**.20**	*-.06*	-.21	-.02	.04	*-.08*	-.09	**.28**	*-.05*	**.10**	*-.11*	-.01	*-.18*	-.04
S-Ti%	2772	2769	2767	.23	**.27**	-.03	-.02	**.08**	-.02	*-.09*	*-.03*	.07	*-.17*	-.02	**.35**	.08	.04	**.39**	**.40**	.00	**.15**	**.09**	-.01
S-Mn	2782	2779	2777	2769	+++++	.12	-.04	**.18**	**.14**	.02	**.08**	-.13	**.04**	**.08**	**.35**	.05	-.02	**.24**	**.23**	**.20**	.01	**.17**	-.03
S-Ag	39	39	38	39	39	4.72	-.02	.17	.29	.07	**.85**	*****	**.76**	.09	-.06	-.50	.22	-.05	-.02	-.25	.13	-.03	-.39
S-B	2002	1999	1999	1998	1999	32	13.23	.00	-.02	-.03	.03	.24	-.03	.01	.00	-.04	-.02	.00	-.01	-.12	-.04	.03	-.01
S-Ba	2777	2774	2772	2764	2774	38	2000	+++++	-.02	**.16**	.01	-.09	*-.06*	**.05**	**.14**	.15	-.01	**.04**	**.12**	-.02	**.03**	*-.06*	**.09**
S-Co	2742	2739	2738	2729	2739	39	1979	2734	47.38	**.40**	.02	-.15	**.57**	.01	**.15**	-.03	*-.07*	**.08**	-.03	-.01	*-.05*	.02	-.02
S-Cr	2720	2717	2715	2707	2717	39	1961	2712	2680	+++++	-.01	-.13	**.60**	.02	**.17**	-.02	.06	-.01	*-.04*	.01	*-.09*	*-.12*	.05
S-Cu	2783	2780	2778	2770	2780	39	2001	2775	2740	2720	+++++	**.33**	-.02	.03	.02	-.01	*-.08*	.03	*-.03*	.03	*-.04*	**.16**	.06
S-Mo	82	82	80	81	82	16	59	82	82	82	82	3.26	-.11	.02	-.08	-.33	.18	-.12	.01	-.05	-.08	.00	.34
S-Ni	2746	2743	2741	2733	2743	39	1985	2738	2714	2685	2745	82	+++++	-.02	.02	-.02	*-.07*	*-.06*	*-.13*	.02	*-.08*	*-.09*	-.04
S-Pb	2201	2198	2197	2188	2198	38	1665	2195	2178	2180	2201	72	2178	53.36	-.02	.00	**.14**	.01	.01	**.26**	.00	**.16**	.00
S-Sc	2764	2761	2760	2751	2761	39	1993	2756	2728	2700	2763	80	2727	2193	7.59	-.02	-.03	**.27**	**.35**	-.05	*-.07*	**.06**	-.04
S-Sn	125	125	125	125	123	3	86	125	125	125	125	4	123	118	125	44.51	.14	.05	-.11	.18	-.02	.13	.06
S-Sr	1282	1279	1280	1275	1281	14	824	1276	1264	1260	1280	27	1261	1043	1278	80	+++++	-.01	**.13**	-.02	.05	*-.13*	-.02
S-V	2785	2782	2780	2772	2782	39	2002	2777	2742	2720	2783	82	2746	2201	2764	125	1282	+++++	**.23**	**.26**	**.26**	**.14**	.01
S-Y	2662	2659	2659	2649	2659	36	1936	2655	2630	2618	2662	68	2628	2137	2656	120	1238	2662	7.87	-.08	**.29**	*-.04*	.06
S-Zn	190	190	190	188	188	15	128	189	190	181	190	22	188	177	190	14	50	190	180	92.43	-.06	**.38**	.09
S-Zr	2771	2768	2766	2760	2768	39	1994	2763	2728	2711	2769	82	2732	2193	2750	125	1278	2771	2655	186	80.87	*-.08*	.00
AA-Zn	2783	2780	2778	2770	2780	39	2000	2775	2740	2718	2781	82	2744	2199	2762	125	1280	2783	2660	190	2769	48.27	.02
AA-Au	817	817	815	814	817	14	564	815	809	795	817	24	806	628	811	36	370	817	792	54	809	817	.36

Table 8. Ten-factor model, varimax factor loadings (correlations) between the varimax scores and all the variables (elements) for the "all" stream sediment sample data set ("old" and "new" data), Puerto Rico. [**.6201**, factor loadings having a high positive correlation; .2586, factor loadings having a moderately positive correlation. S prefix, analysis by semiquantitative spectrographic method; AA prefix, analysis by atomic absorption method]

Variable	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8	Factor 9	Factor 10
S-FE	.2586	.0808	.2098	.0235	-.1064	.0277	**.3131**	**.6443**	-.0547	.0595
S-MG	.2577	**.6302**	-.1093	-.0292	.1470	.1108	-.2426	.2056	-.0841	.1366
S-CA	-.0646	.0362	-.0605	-.0161	**.8043**	-.0955	-.0484	-.0590	-.0066	-.1107
S-TI	**.6201**	-.1739	.0491	-.0366	-.1320	-.0575	**.3569**	.0056	-.0014	-.0965
S-MN	**.5921**	.1178	**.3131**	.0486	-.0015	.0640	-.1021	-.0981	-.1034	.1152
S-AG	-.0111	.0090	-.0027	**.9485**	.0020	-.0192	.0309	-.0720	-.0194	-.0038
S-B	.0242	.0065	-.0020	-.0088	-.0632	-.0149	-.0275	.0860	**.9339**	-.0157
S-BA	.2685	-.0008	-.1653	.0949	-.0493	**.5101**	-.0403	-.2796	.0504	**.3447**
S-CO	.0787	**.7202**	.0904	.0181	-.1227	-.1027	.0876	-.0294	.0002	-.0464
S-CR	-.0326	**.7931**	-.0870	-.0109	.1253	.0819	-.0695	-.0519	-.0136	-.0056
S-CU	.0249	.0019	.1318	**.9058**	-.0301	.0418	-.0483	.2882	.0242	.0150
S-MO	-.1512	-.0664	.0352	.1558	.0568	.0242	-.1255	**.7079**	.1343	.0132
S-NI	-.1197	**.8509**	.0123	.0061	-.0888	-.0805	.0336	-.0644	.0180	-.0118
S-PB	-.0113	-.0034	**.5036**	.0389	.2648	.2303	.0659	-.2544	.2420	.1925
S-SC	**.8058**	.1666	-.0896	-.0232	-.0311	-.0010	-.1230	.0743	.0288	.0027
S-SN	-.0516	-.0350	.0730	-.0415	-.0238	-.0834	.0344	.0503	.0025	**.8899**
S-SR	.0283	-.0252	-.0481	-.0341	**.7877**	.0551	.0917	.0185	-.0557	.0890
S-V	**.4483**	.0444	.1913	-.0447	.0136	.0068	**.5504**	.2378	-.1646	.0338
S-Y	**.6679**	-.1294	-.0692	.0087	.1950	-.0096	**.3176**	-.0772	.1315	-.0616
S-ZN	-.0288	.0271	**.7737**	.0486	.0019	-.0948	.0658	.2345	-.0928	-.0227
S-ZR	.0229	-.0571	-.0774	.0207	.0562	.0127	**.8490**	-.0320	-.0058	.0301
AA-ZN	.1519	-.1140	**.7695**	.0282	-.2218	-.0396	-.1229	.0675	-.0027	-.0087
AA-AU	-.1240	.0128	.0384	-.0399	-.0614	**.8266**	.0548	.1448	-.0641	-.1791
% Varience[1]	12	11	9	7	6	6	5	4	5	4

[1]Total Variance explained by model is 69%

Description of factors

Factor 1 - **Ti, Mn, Sc, V, Y,** Fe, Mg, Ba: Lithologic factor; basic volcanic, volcaniclastic, and metavolcanic rocks.
Factor 2 - **Mg, Co, Cr, Ni**: Lithologic factor; mafic to ultramafic rocks and laterite, includes ophiolite sequences.
Factor 3 - **Mn, Pb, Zn(S), Zn(AA),** Fe: Mineralization factor; base-metal veins and possible zonation around porphyry deposits.
Factor 4 - **Ag, Cu**: Mineralization factor; porphyry copper deposits.
Factor 5 - **Ca, Sr,** Pb: Lithologic factor; limestone and dolomite rocks and possible replacement lead-zinc veins.
Factor 6 - **Ba, Au,** Pb: Mineralization factor; gold placers and gold- and sulfide-bearing hydrothermal veins.
Factor 7 - **Fe, Ti, V, Y, Zr**: Lithologic factor; igneous and meta-igneous rocks, includes granodiorite to diorite.
Factor 8 - **Fe, Mo,** Mg, Cu, Pb, V, Zn(S): Mineralization factor; porphyry copper and skarn deposits; may be associated with precious metals.
Factor 9 - **B,** Pb: Mineralization factor; porphyry copper-molybdenum and possible skarns.
Factor 10 - **Ba, Sn**: Mineralization factor; base-metal veins, zonation around porphyry deposits, and skarns.

Table 9. Nine factor model, varimax factor loadings (correlations) between the varimax scores and the variables (elements) for selected variables (highly censored elements removed) for the "all" stream sediment sample data set ("old" and "new" data), Puerto Rico. [**.3315**, factor loadings having a high positive correlation; .2148, factor loadings having a moderately positive correlation; -*.3275*, factor loadings with a high negative correlation. S prefix, analysis by semiquantitative spectrographic method; AA prefix, analysis by atomic absorption method]

Variable	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8	Factor 9
S-Fe	**.3315**	.0644	-.0897	.2148	.0004	-.2148	**.6800**	-.0189	.0499
S-Mg	-.1922	**.6283**	.1784	.2023	-.1559	.1933	.2469	-.0458	-.0140
S-Ca	-.0814	.0222	**.8120**	-.0185	-.0072	-.1303	-.1252	.0199	.0054
S-Ti	**.3319**	-.1735	-.1372	**.6573**	.0130	-.1271	-.0338	.0106	.0277
S-MN	-.1246	.1114	-.0556	**.6022**	.2565	.1402	.1020	-.1349	-.0243
S-B	-.0405	-.0045	-.0515	.0084	.0367	-.0070	.0451	**.9717**	.0006
S-Ba	.0400	.0071	-.0798	.1482	.0629	**.8970**	-.0192	-.0077	.0380
S-Co	.0662	**.7220**	-.1274	.1057	.0994	-.1591	-.0039	-.0202	-.0231
S-Cr	-.0599	**.7920**	.1377	-.0284	-.0588	.0923	-.0535	-.0016	.0662
S-Cu	-.1206	-.0442	-.0182	-.0886	.0559	.1139	**.7942**	.0604	-.0231
S-Ni	.0292	**.8531**	-.0910	-.1003	.0192	-.0613	-.0675	.0094	-.0365
S-Pb	.0691	.0115	.1556	-.0297	**.8597**	.1273	-.0037	.0470	.0007
S-Sc	-.1171	.1697	-.0045	**.7916**	-.1067	.0576	.0882	.0592	-.0209
S-Sr	.1070	-.0311	**.7863**	.0179	.0883	.0728	.0239	-.0614	-.0195
S-V	**.5443**	.0300	.0074	**.4540**	.0490	-.1202	.2910	-.1320	.0302
S-Y	**.3101**	-.1344	.1832	**.6750**	-.0155	.1034	-.0826	.1378	-.0339
S-Zr	**.8573**	-.0660	.0441	.0102	-.0164	.0945	-.0161	-.0095	-.0319
AA-Zn	-.1789	-.1268	-*.3275*	.2105	**.5504**	-.2647	.2449	-.0673	.0138
AA-Au	-.0013	.0028	-.0147	-.0389	-.0035	.0361	.0392	-.0063	**.9928**
% Varience[1]	14	13	9	7	7	5	6	5	5

[1]Total Varience expalined by model is 71%

Description of factors

Factor 1 - **Fe, Ti, V, Y, Zr**: Lithologic Factor; igneous and meta-igneous rocks, includes granodiorites to diorites.

Factor 2 - **Mg, Co, Cr, Ni**: Lithologic factor; mafic to ultramafic rocks and laterite, includes ophiolite sequences.

Factor 3 - **Ca,Sr,** *Zn*: Lithologic factor; limestone and dolomite rocks.

Factor 4 - **Ti, Mn, Sc, V, Y,** (Fe, Mg, Zn(AA)): Lithologic factor; basic volcanic, volcanoclastic, and metavolcanic rocks.

Factor 5 - **Pb, Zn,** (Mn): Mineralization factor; base-metal veins and possible zonation around porphyry deposits.

Factor 6 - **Ba**: Lithologic and(or) alteration factor; sedimentary rocks, barite veins related to mineralization, and hydrothermal alteration.

Factor 7 - **Fe, Cu,** (Mg, V, Zn(AA)): Mineralization factor; porphyry copper, base-metal veins, and skarn deposits; may be associated with precious metals.

Factor 8 - **B**: Mineralization factor; porphyry copper-molybdenum and possible skarns.

Factor 9 - **Au**: Mineralization factor; native-gold placer and veins and gold related to porphyry copper deposits.

Table 10 -- Univariate statistics for soil samples from Isla de Vieques (based on arithmatic values). [All values in parts per million (ppm) unless otherwise noted. S prefix, analysis by semiquantative spectrographic method; AA prefix, analysis by atomic absorption method. L, detected but below lower limit of determination; N, not detected at lower limit of determination; G, greater than upper limit of determination]

No.	Element	Minimum	Maximum	Mean	Deviation	Valid No. of samples	Number of samples L	N	G	Percent valid
1	S-Fe	.5	15.0	4.7	2.12	421	0	0	0	100
2	S-Mg	.1	3.0	1.2	.58	421	0	0	0	100
3	S-Ca	.05	20.0	2.2	2.65	411	0	0	10	100
4	S-Ti	.02	1.5	.4	.19	420	0	0	0	100
5	S-Mn	30	5,000	1,258.4	553.84	421	0	0	0	100
6	S-Ag	.5	1.5	.8	.33	11	1	409	0	3
7	S-B	10	100	13.5	9.01	189	232	0	0	45
8	S-Ba	20	3,000	643.0	653.56	421	0	0	0	100
9	S-Co	5	30	12.6	6.21	399	2	20	0	95
10	S-Cr	10	700	61.5	80.08	357	3	61	0	85
11	S-Cu	5	1,500	75.3	119.74	419	2	0	0	99
12	S-Mo	5	7	5.5	1.00	4	6	411	0	1
13	S-Ni	5	150	23.5	25.16	297	122	2	0	71
14	S-Pb	10	1,000	31.0	97.08	160	259	2	0	38
15	S-Sc	5	30	16.2	6.34	412	0	9	0	98
16	S-Sn	10	30	17.5	5.98	8	6	407	0	2
17	S-Sr	100	700	253.6	109.22	359	0	62	0	85
18	S-V	15	500	168.4	85.47	421	0	0	0	100
19	S-Y	10	50	23.1	7.31	408	4	9	0	97
20	S-Zn	200	3,000	657.1	692.51	21	15	385	0	5
21	S-Zr	10	300	85.1	43.16	420	0	1	0	100
22	AA-Au	.02	.46	.08	.14	10	411	0	0	2
23	AA-Zn	2.00	2,500.00	64.5	145.14	421	0	0	0	100

Table 11 -- Correlation coefficients for soil samples from Isla de Vieques. [**.32**, significant positive correlation ratio of 1 to 3 at 99 percent confidence level; **.68**, significant positive correlation ratio of greater than 3; *-.13*, significant negative correlation ratio of -1 to -3; *****, insufficient data to calculate correlation coefficient; 2.12, standard deviation of the variable; and +++++, standard deviation greater than 99.99. Numbers located in columns below the standard deviation are the number of samples that have valid data for the elements indicated and that were used in calculating the correlation coefficient. S prefix, analysis by semiquantitative spectrographic method; AA prefix, analysis by atomic absorption method]

	S-Fe%	S-Mg%	S-Ca%	S-Ti%	S-Mn	S-Ag	S-B	S-Ba	S-Co	S-Cr	S-Cu	S-Mo	S-Ni	S-Pb	S-Sc	S-Sn	S-Sr	S-V	S-Y	S-Zn	S-Zr	AA-Zn	AA-Au
S-Fe%	2.12	**.68**	-.08	**.63**	**.44**	-.07	.04	*-.13*	**.65**	**.32**	**.30**	.83	**.35**	.15	**.72**	-.09	*-.15*	**.76**	**.46**	.40	-.01	**.16**	-.33
S-Mg%	421	.58	.00	**.61**	**.42**	.22	.04	*-.18*	**.67**	**.39**	**.24**	.90	**.43**	**.22**	**.66**	-.07	*-.14*	**.67**	**.47**	.39	-.03	**.26**	-.42
S-Ca%	411	411	2.65	-.07	-.11	.23	**.17**	-.03	.02	.04	-.02	.86	.01	-.04	-.03	-.09	.07	-.05	.02	-.28	*-.24*	-.10	-.22
S-Ti%	420	420	410	19	**.48**	.14	.06	-.06	**.52**	**.16**	**.23**	.98	**.17**	.19	**.52**	-.11	-.09	**.61**	**.51**	.39	.10	**.19**	-.56
S-Mn	421	421	411	420	+++++	.12	-.01	**.29**	**.29**	.04	**.14**	.58	.07	.02	**.28**	-.58	**.18**	**.35**	**.32**	.30	.07	**.28**	-.50
S-Ag	11	11	11	11	11	.33	-.12	.06	-.30	-.15	.02	*****	-.18	.18	-.05	*****	.40	-.14	.27	*****	.21	-.27	*****
S-B	189	189	181	189	189	6	9.01	-.07	.00	.09	-.08	*****	.06	.22	.08	-.07	-.13	.05	.06	.43	-.09	.04	.49
S-Ba	421	421	411	420	421	11	18	+++++	*-.26*	*-.20*	-.06	-.06	*-.26*	-.06	*-.22*	-.35	**.63**	*-.17*	-.12	-.04	.04	-.06	-.35
S-Co	399	399	398	399	399	10	176	399	6.21	**.47**	**.30**	.93	**.54**	.18	**.66**	-.43	*-.26*	**.67**	**.40**	**.65**	-.12	**.27**	-.06
S-Cr	357	357	347	356	357	10	181	357	342	80.08	.11	*****	**.84**	.03	**.47**	.11	*-.15*	**.39**	.10	**.66**	-.09	**.15**	-.16
S-Cu	419	419	410	418	419	11	187	419	399	355	+++++	**.98**	.06	.10	**.28**	-.60	-.09	**.36**	**.15**	-.14	-.01	.07	-.22
S-Mo	4	4	4	4	4	0	4	4	4	1	4	1.00	*****	*****	.52	*****	*****	.92	.56	*****	.33	.61	*****
S-Ni	297	297	296	297	297	11	155	297	296	281	297	1	25.15	.04	**.53**	-.18	*-.13*	**.38**	.08	**.74**	**-.14**	**.28**	.00
S-Pb	160	160	158	159	160	10	85	160	155	153	160	1	118	97.08	.12	-.28	-.07	.17	.12	.33	.02	**.31**	**1.00**
S-Sc	412	412	406	411	412	10	184	412	397	351	410	4	294	157	6.34	-.30	*-.14*	**.73**	**.50**	.27	.01	**.13**	**-.44**
S-Sn	8	8	8	8	8	0	6	8	8	7	8	1	7	7	8	5.98	-.18	-.21	.00	-.65	.54	-.29	*****
S-Sr	359	359	349	358	359	5	138	359	343	306	358	1	256	133	352	6	+++++	*-.16*	*-.15*	-.03	-.04	*-.16*	.40
S-V	421	421	411	420	421	11	189	421	399	357	419	4	297	160	412	8	359	85.47	**.42**	.24	-.06	**.15**	-.41
S-Y	408	408	404	407	408	10	183	408	396	347	407	4	295	159	404	8	349	408	7.31	.05	**.29**	.12	-.70
S-Zn	21	21	21	21	21	3	18	21	20	21	21	1	19	20	21	3	10	21	21	+++++	-.09	**.94**	*****
S-Zr	420	420	410	419	420	11	189	420	398	356	418	4	296	160	411	8	358	420	407	21	43.16	.04	-.67
AA-Zn	21	421	411	420	421	11	189	421	399	357	419	4	297	160	412	8	359	421	408	21	420	+++++	.12
AA-Au	10	10	10	10	10	1	8	10	10	9	10	0	10	5	10	1	8	10	10	2	10	.12	.14

Table 12. Six factor model, varimax factor loadings (correlations) between the varimax scores and all the variables (elements) for soil samples, Isla de Vieques. [**.8471**, factor loadings having a high positive correlation; .3479, factor loadings having a moderately positive correlation; -*.2446*, factor loadings having a high negative correlation. S prefix, analysis by semiquantitative spectrographic method; AA prefix, analysis by atomic absorption method]

Variable	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
S-Fe	**.8471**	.1236	.0027	.1233	.0205	.0451
S-Mg	**.8122**	.1300	.1139	-.0178	-.0714	-.0661
S-Ca	-.2772	.0890	-.0335	-*.5382*	.0075	-.1297
S-Ti	**.7030**	.0603	.0878	.3227	.0374	.0019
S-Mn	**.5364**	-*.2446*	.2198	**.4300**	-.0404	-.1830
S-Ag	.0320	.0161	.3688	-.0211	.1307	**.4233**
S-B	.1001	.2955	.1258	-.0357	.3171	-.1984
S-Ba	-.0898	-*.7425*	.0801	**.3013**	-.0281	-.0483
S-Be	-.0084	-.0095	-.0243	.0365	**.9117**	.0269
S-Bi	-.0636	.0574	-.0346	-.0278	.0001	.4034
S-Co	**.8374**	.1376	.1317	-.0689	-.0349	.0457
S-Cr	**.5958**	.0576	.0704	-*.5389*	.1809	-.0110
S-Cu	.3479	.0183	.0306	.0343	-.0695	**.6849**
S-La	.0154	-.0398	-.0400	.0635	**.8572**	.0277
S-Mo	-.0362	.1292	.0466	.1073	-.0183	**.6384**
S-Ni	**.6659**	.0882	.1593	-*.5147*	.1509	-.0373
S-Pb	.0455	.0223	**.6277**	.0748	.0533	.2342
S-Sc	**.8567**	.1579	-.0405	.0139	.0601	.0831
S-Sn	.0123	.1060	.0040	.0525	-.0247	.0823
S-Sr	.0137	-*.8234*	-.0840	.0285	-.1389	-.0701
S-V	**.8502**	.1280	-.0146	.0106	-.0521	.0902
S-Y	**.5833**	.2154	.0034	**.4670**	.1030	-.0997
S-Zn	.1211	.0968	**.9016**	.0003	-.0208	-.1025
S-Zr	-.0441	.1917	.0090	**.6171**	.2324	.0266
AA-Au	-.0407	-.0324	.1466	-.1150	-.0182	.1110
AA-Zn	.1823	.1363	**.8888**	.0123	-.0171	-.1021
% Varience[1]	23	13	7	6	6	5

[1]Total Varience expalined by model is 61%

Description of Factors

Factor 1 - **Fe, Mg, Ti, Mn, Co, Cr, Ni, Sc, V, Y,** (Cu): Lithologic factor; basic volcanic, metavolcanic, and volcanoclastic rocks

Factor 2 - (B), (Co), (Mo), (Sc), (Y), (Zr), (Zn), *Mn, Ba, Sr:* Lithologic and/or mineralization factor; igneous rocks (diorite and granodiorite)

Factor 3 - **Pb, Zn,** (Mn), (Ag), (Au): Mineralization factor; base- and precious-metal elemental suite, hydrothermal alteration

Factor 4 - **Mn, Ba, Y, Zr,** (Ti), *Ca, Cr, Ni:* Lithologic and/or alteration factor; igneous rocks (diorite and granodiorite and contact alteration

Factor 5 - **Be, La,** (B), (Zr): Lithologic factor; igneous rocks (diorite and ranodiorite)

Factor 6 - **Ag, Cu, Mo,** (Bi), (Pb), (Au): Mineralization factor; base- and precious-metal elemental suite, hydrothermal alteration

Table 13. Six factor model, varimax factor loadings (correlations) between the varimax scores and the variables (elements) for selected (highly censored elements removed) variables for soil samples, Isla de Vieques. [**.8613**, factor loadings having a high positive correlation; .2896, factor loadings having a moderately positive correlation; *-.6921*, factor loadings with a high negative correlation. S prefix, analysis by semiquantitative spectrographic method; AA prefix, analysis by atomic absorption method]

Variable	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
S-Fe	**.8613**	-.0025	0418	.0424	.1594	-.0340
S-Mg	**.7860**	-.0094	-.0525	.1392	.2646	.0567
S-Ca	-.2113	-.1534	*-.6921*	-.0499	-.0362	.2868
S-Ti	**.7854**	.0721	.1364	.1314	-.0458	.0909
S-Mn	**.5209**	**.5004**	.2582	.2291	.0202	.0534
S-B	.1936	-.2198	-.0848	.1350	-.0165	**.7771**
S-Ba	-.1345	**.8486**	.1017	.0357	-.1330	-.0050
S-Co	**.7569**	-.0569	.0070	.1441	.3773	-.0946
S-Cr	.2896	-.0846	-.0716	.0057	**.8602**	.0298
S-Cu	**.4376**	-.1808	-.1155	.1846	-.1523	*-.5584*
S-Ni	.3565	-.1009	-.0549	.0897	**.8767**	-.0111
S-Pb	.0896	-.0190	-.0695	**.7924**	-.1304	.0303
S-Sc	**.7952**	-.0953	.1227	-.0375	.3472	-.0344
S-Sr	-.0585	**.8355**	-.1842	-.1386	-.0425	-.1399
S-V	**.8497**	-.0512	-.0518	.0293	.2014	-.1020
S-Y	**.6533**	-.0563	**.4364**	.0191	-.0298	.2194
S-Zr	-.0226	-.1209	**.8226**	-.0029	-.1031	.1298
AA-Zn	.0725	-.0176	.1422	**.7915**	.2885	.0325
% Varience[1]	33	12	9	7	6	6

[1]Total varience explained by model is 73%

Description of Factors

Factor 1 - **Fe, Mg, Ti, Mn, Co, Cu, Sc, V, Y,** (Cr), (Ni): and — Lithologic factor; basic volcanic, metavolcanic, volcanoclastic rocks

Factor 2 - **Mn, Ba, Sr**: — Lithologic and/or alteration factor; limestone and

Factor 3 - **Y, Zr,** (Mn), *Ca*: — Lithologic and/or alteration factor; igneous rocks

Factor 4 - **Pb, Zn,** (Mn): — Mineralization factor; base metal and probable

Factor 5 - **Cr, Ni,** (Co), (Sc), (Zn): (hornblende — Lithologic factor; basic volcanic rocks andesite)

factor 6 - **B,** (Ca), (Y), *Cu*: — Lithologic factor; igneous rocks (diorite and

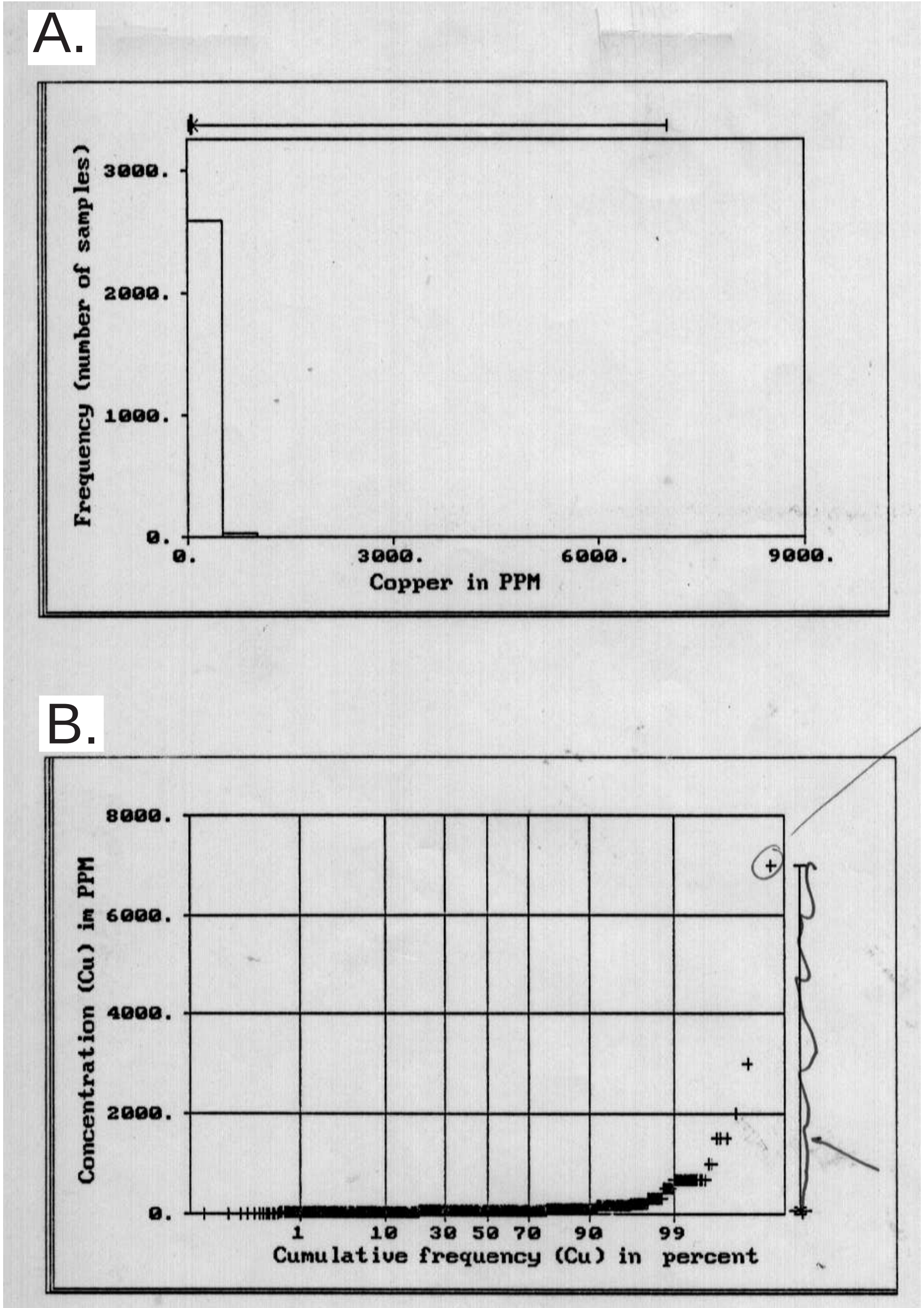


Figure 1 -- A. Histogram for copper in the "old" stream sediment data for Puerto Rico.
B. Cumulative frequency plot for copper in the "old" stream sediment data for Puerto Rico.

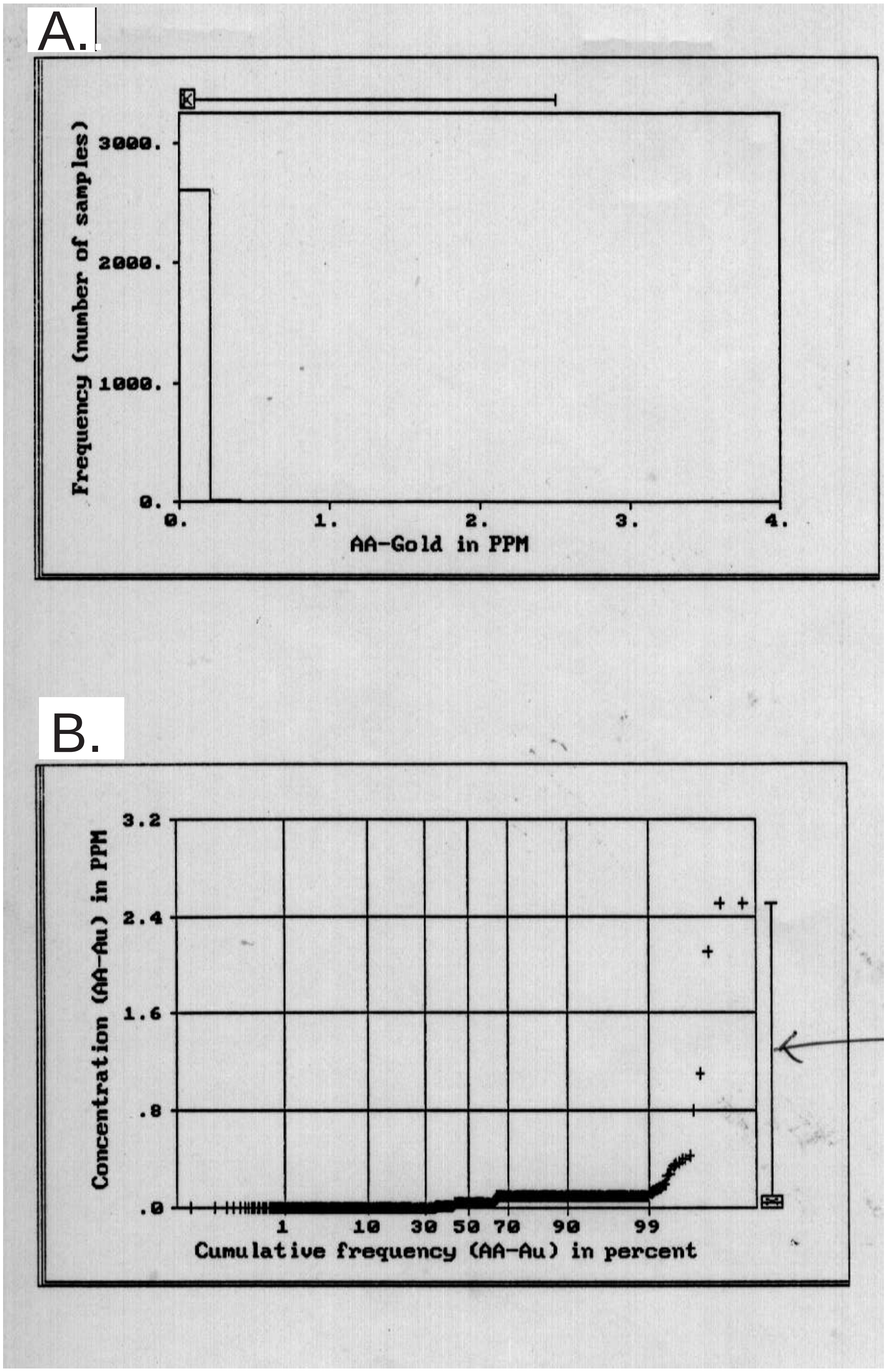


Figure 2 -- A. Histogram for gold in the "old" stream sediment data for Puerto Rico.
B. Cumulative frequency plot for gold in the "old" stream sediment data for Puerto Rico.

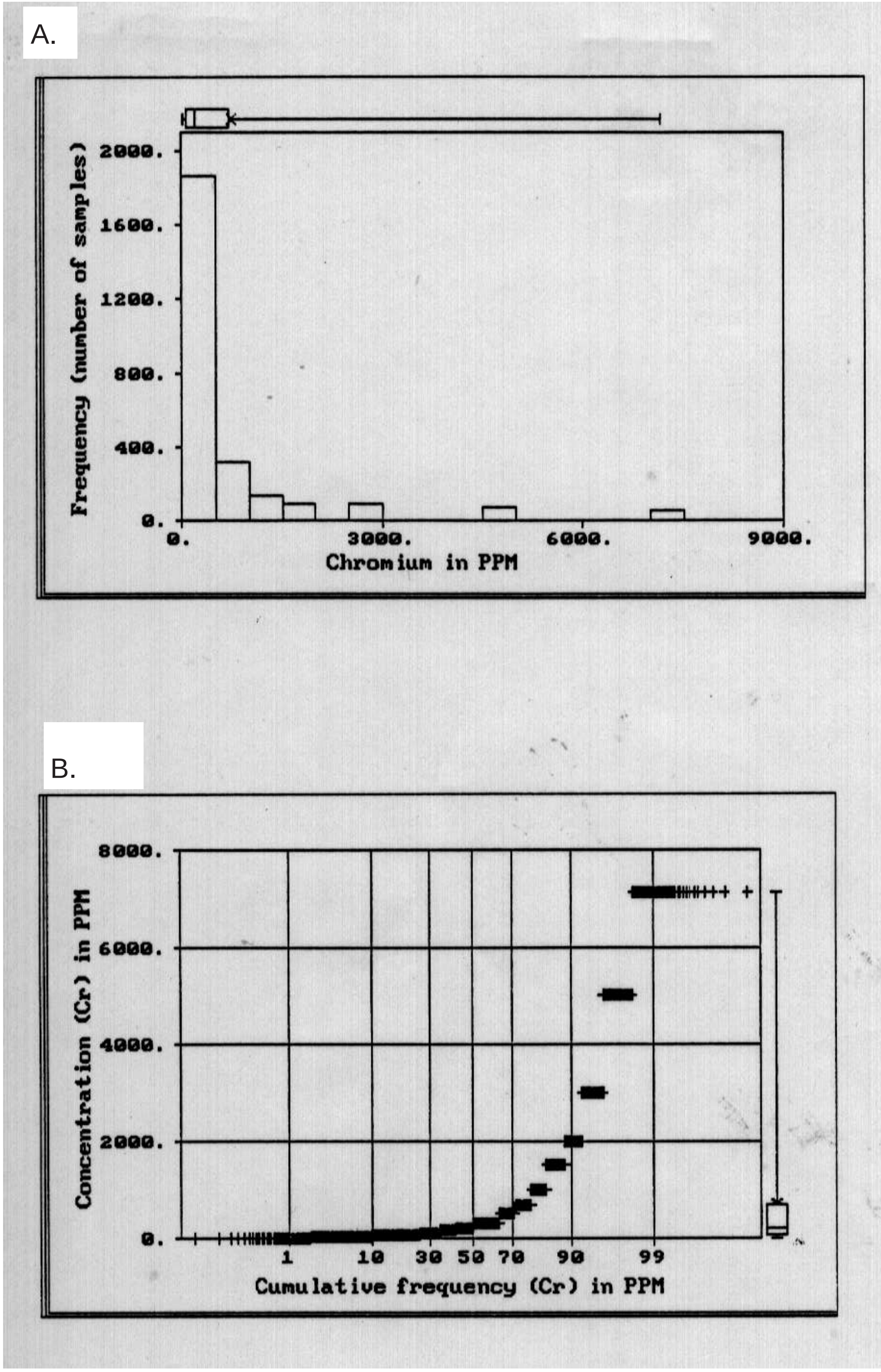
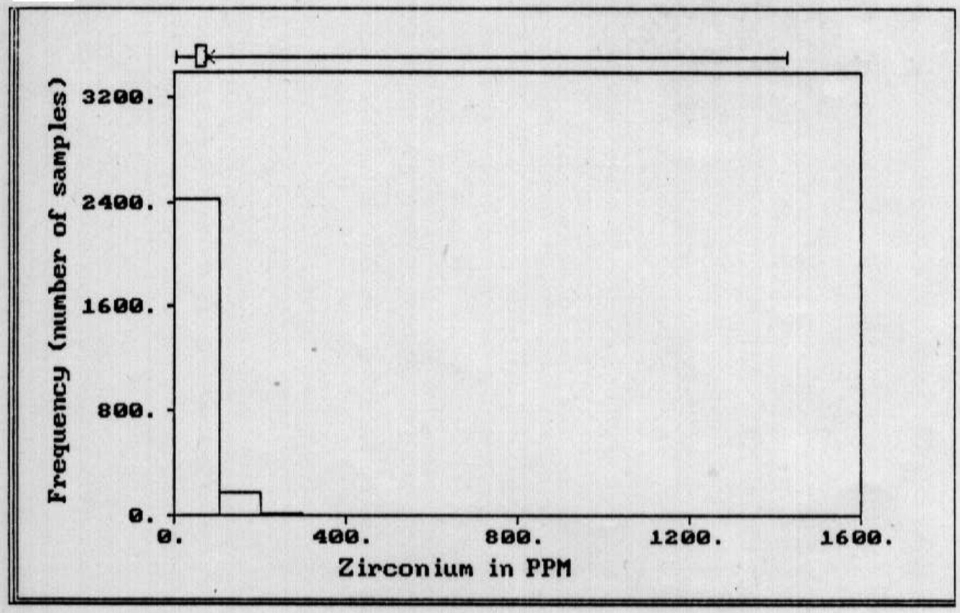


Figure 3 -- A. Histogram for chromium in the "old" stream sediment data for Puerto Rico. B. Cumulative frequency plot for chromium in the "old" stream sediment data for Puerto Rico.

A.



B.

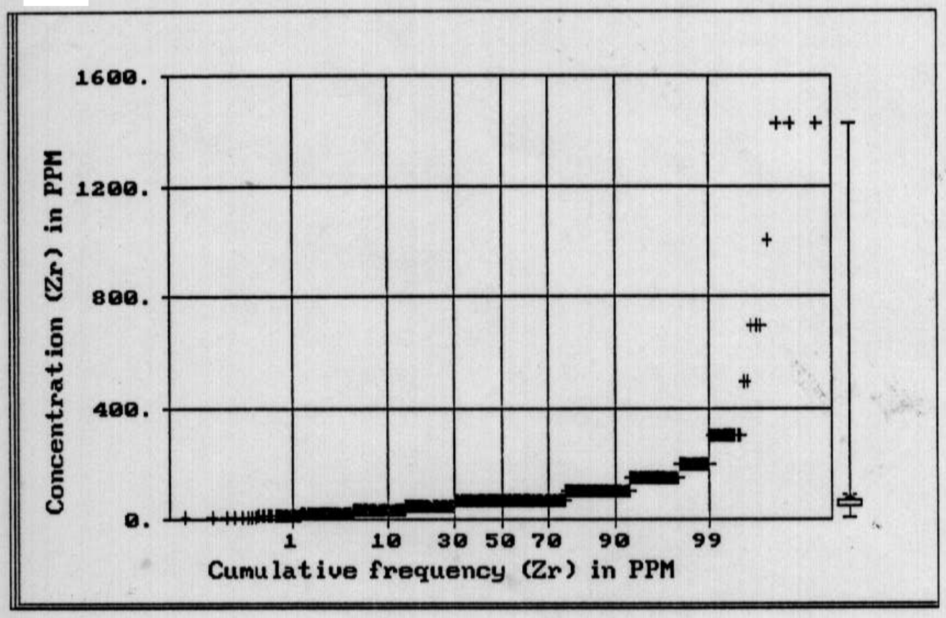
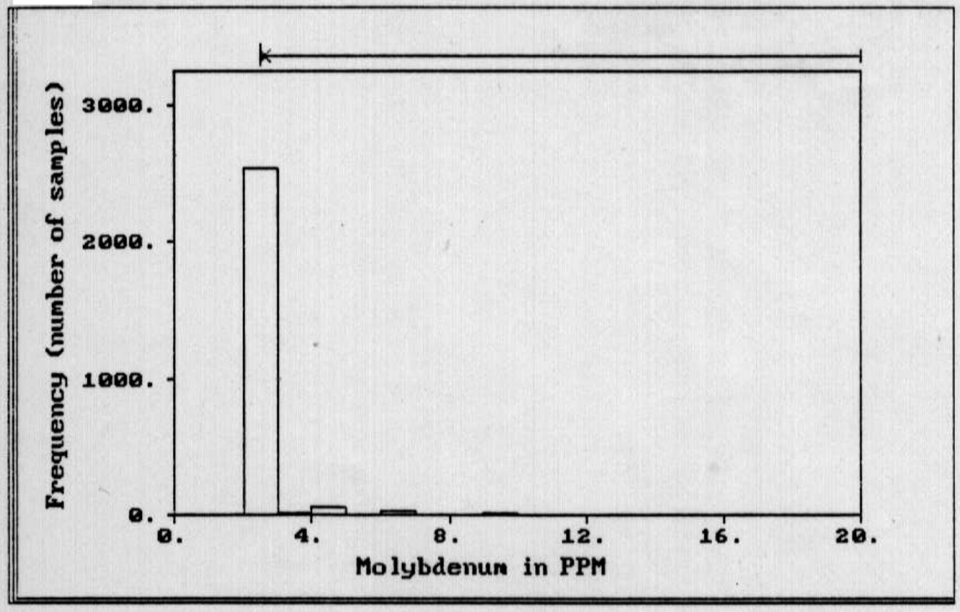


Figure 4 -- A. Histogram for zirconium in the "old" stream sediment data for Puerto Rico.
B. Cumulative frequency plot for zirconium in the "old" stream sediment data for Puerto Rico.

A.



B.

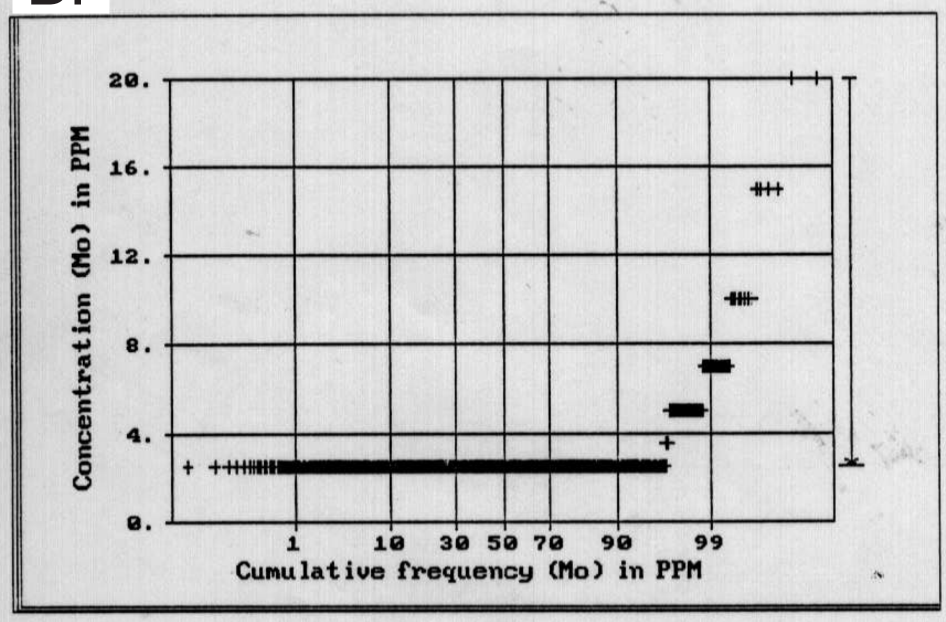


Figure 5 -- A. Histogram for molybdenum in the "old" stream sediment data for Puerto Rico.
B. Cumulative frequency plot for molybdenum in the "old" stream sediment data for Puerto Rico.

MISSING DATA

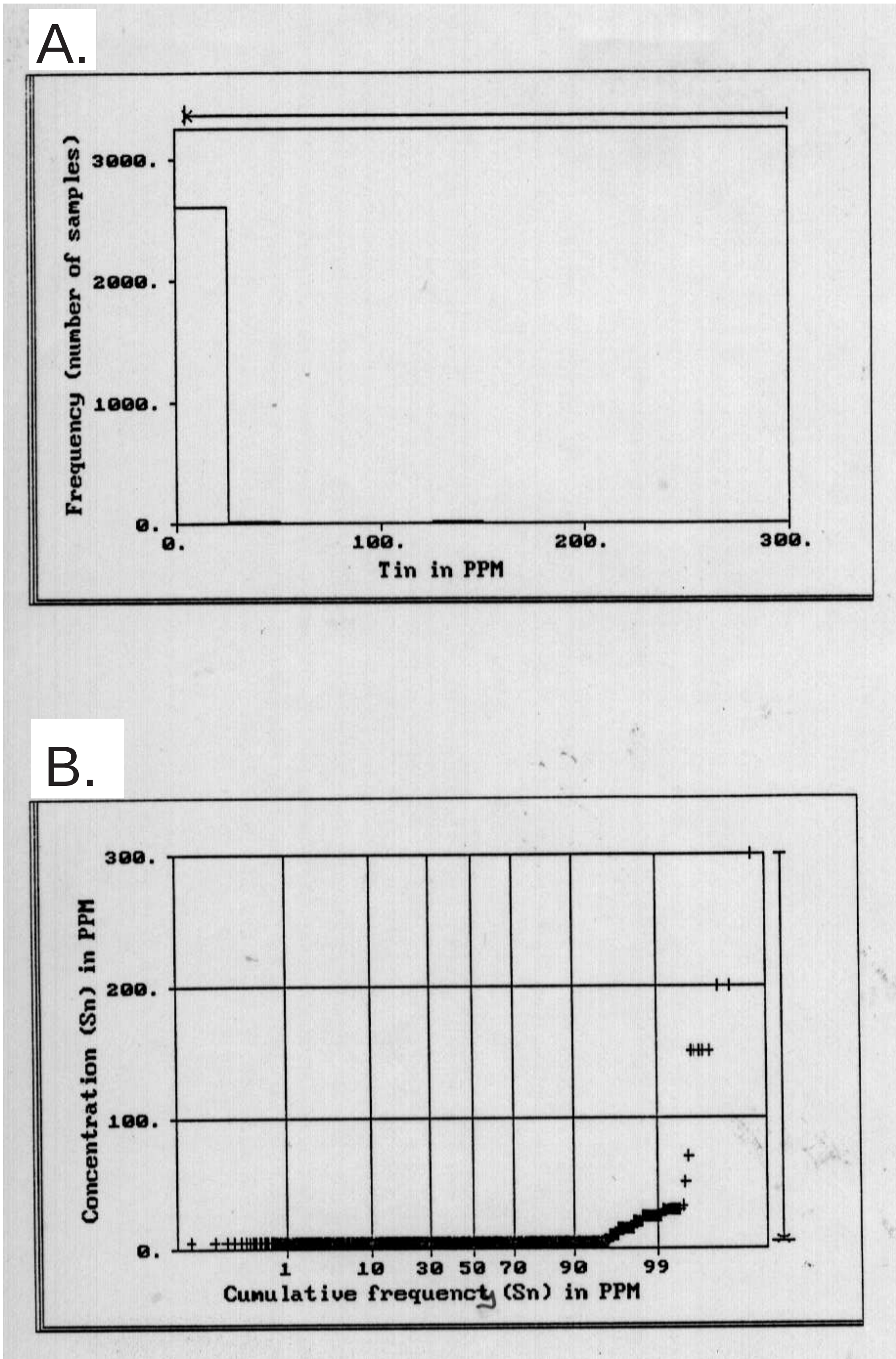


Figure 7 -- A. Histogram for tin in the "old" stream sediment data for Puerto Rico.
B. Cumulative frequency plot for tin in the "old" stream sediment data for Puerto Rico.

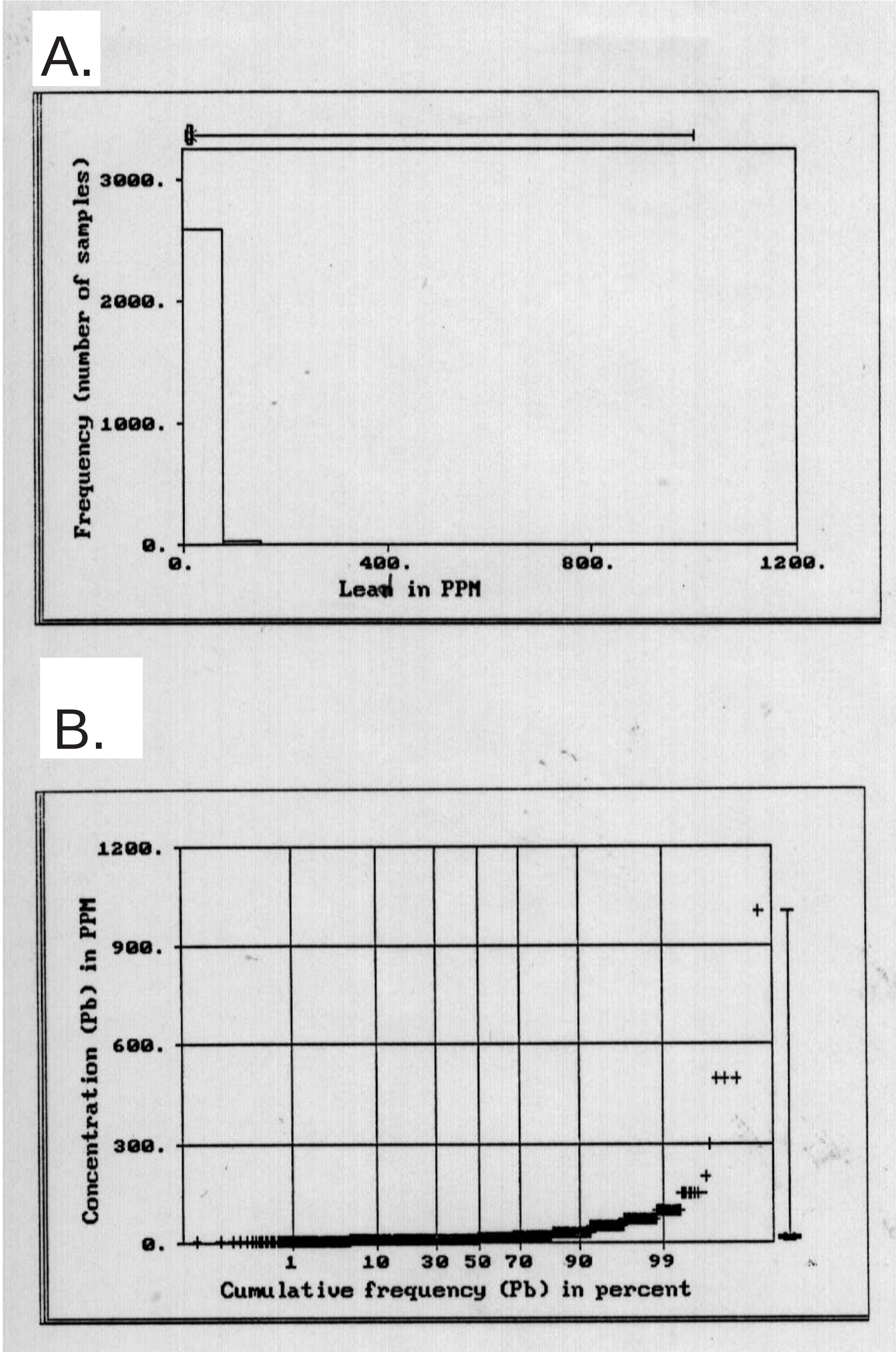


Figure 8 -- A. Histogram for lead in the "old" stream sediment data for Puerto Rico.
B. Cumulative frequency plot for lead in the "old" stream sediment data for Puerto Rico.

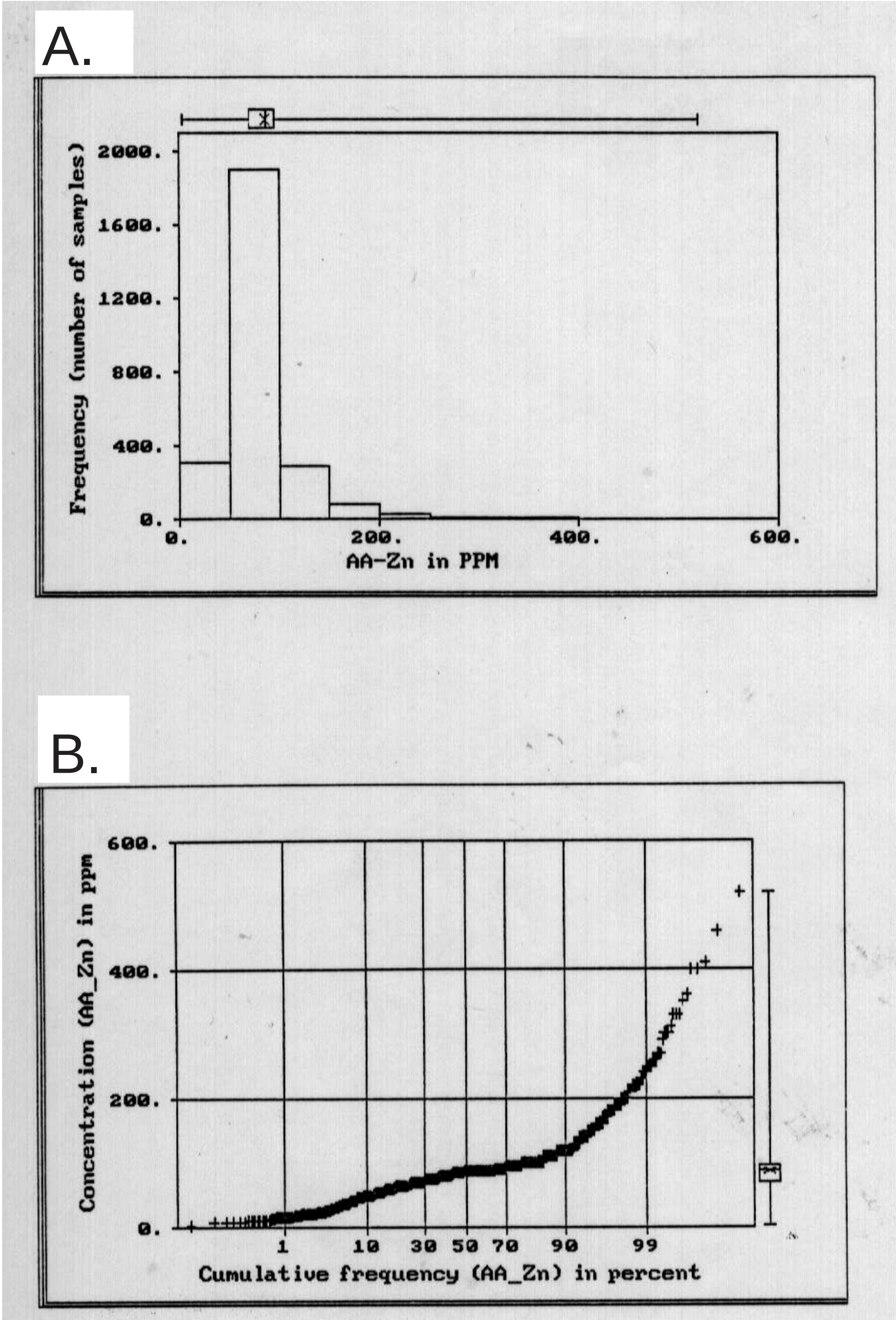


Figure 9 -- A. Histogram for zinc in the "old" stream sediment data for Puerto Rico.

B. Cumulative frequency plot for zinc in the "old" stream sediment data for Puerto Rico.

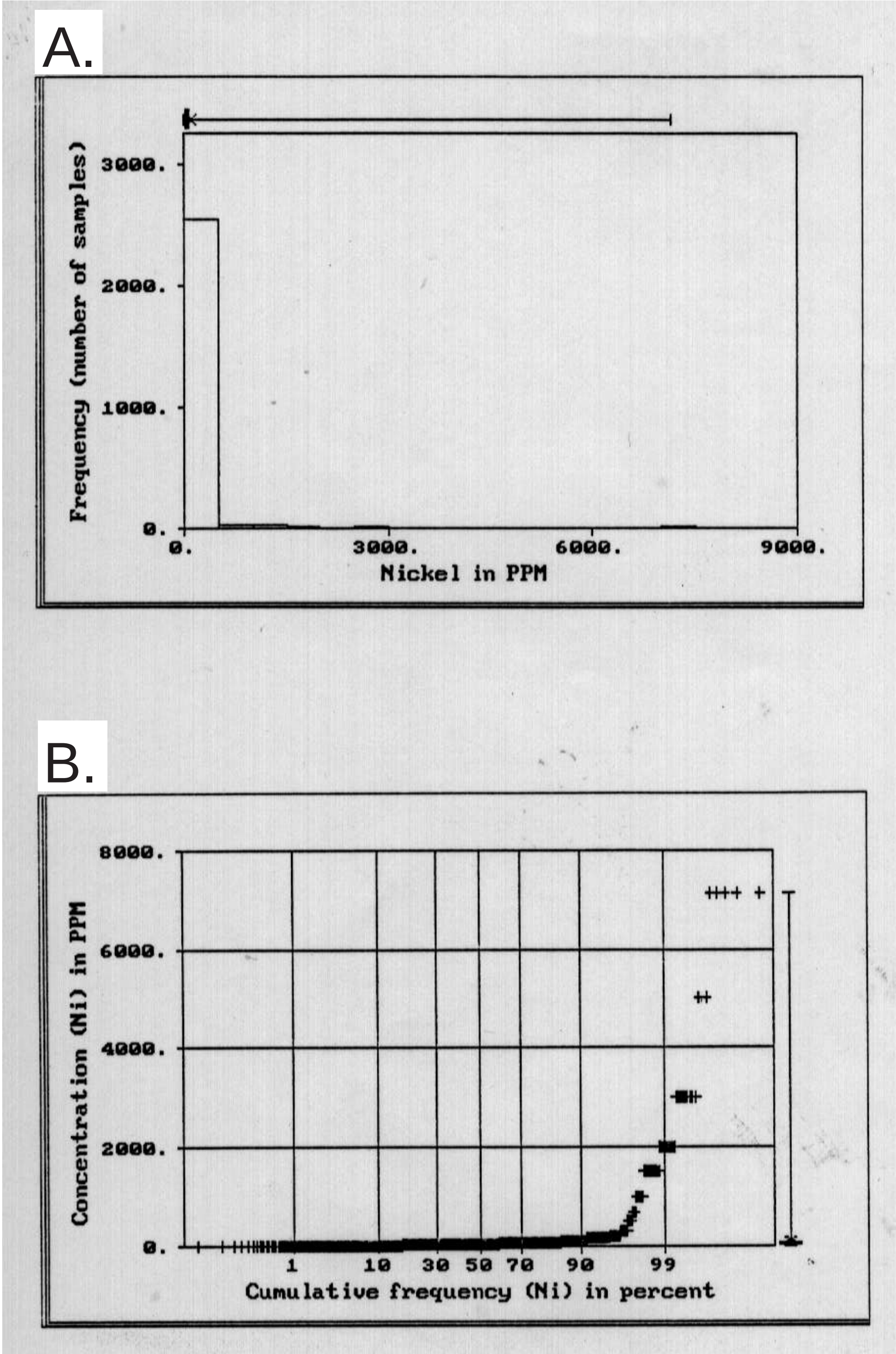
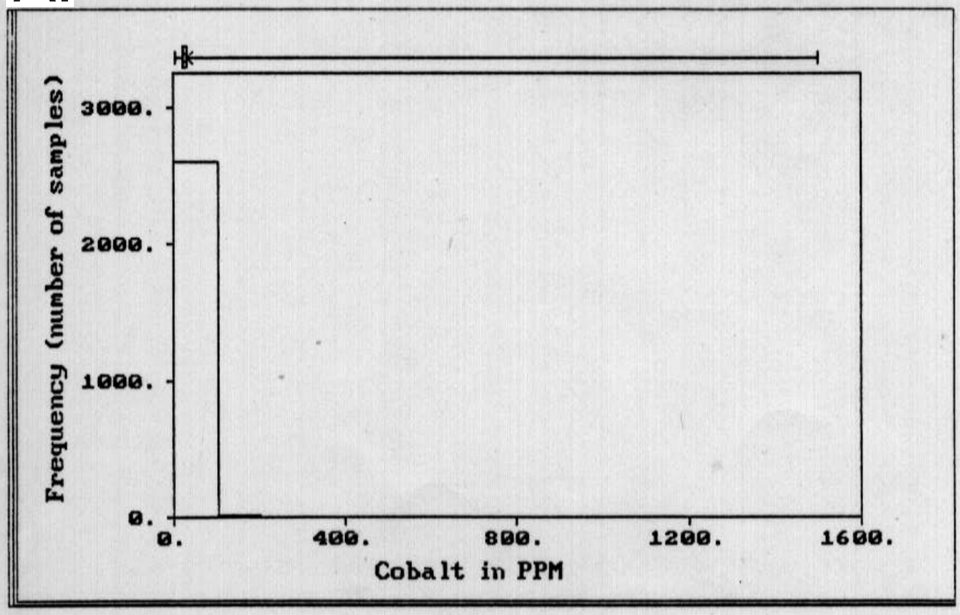


Figure 10 -- A. Histogram for nickel in the "old" stream sediment data for Puerto Rico.
B. Cumulative frequency plot for nickel in the "old" stream sediment data for Puerto Rico.

A.



B.

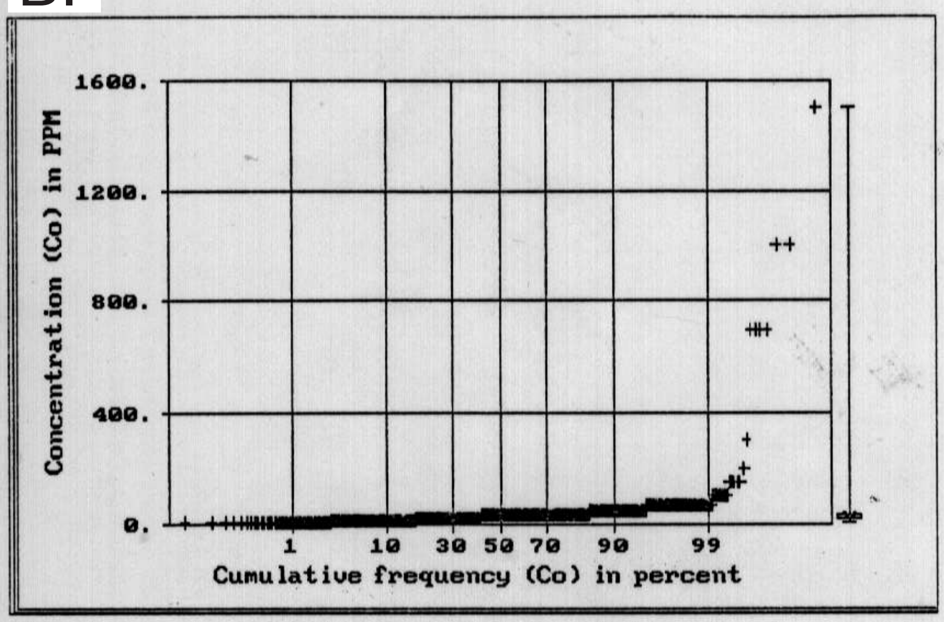


Figure 11 -- A. Histogram for cobalt in the "old" stream sediment data for Puerto Rico.
B. Cumulative frequency plot for cobalt in the "old" stream sediment data for Puerto Rico.

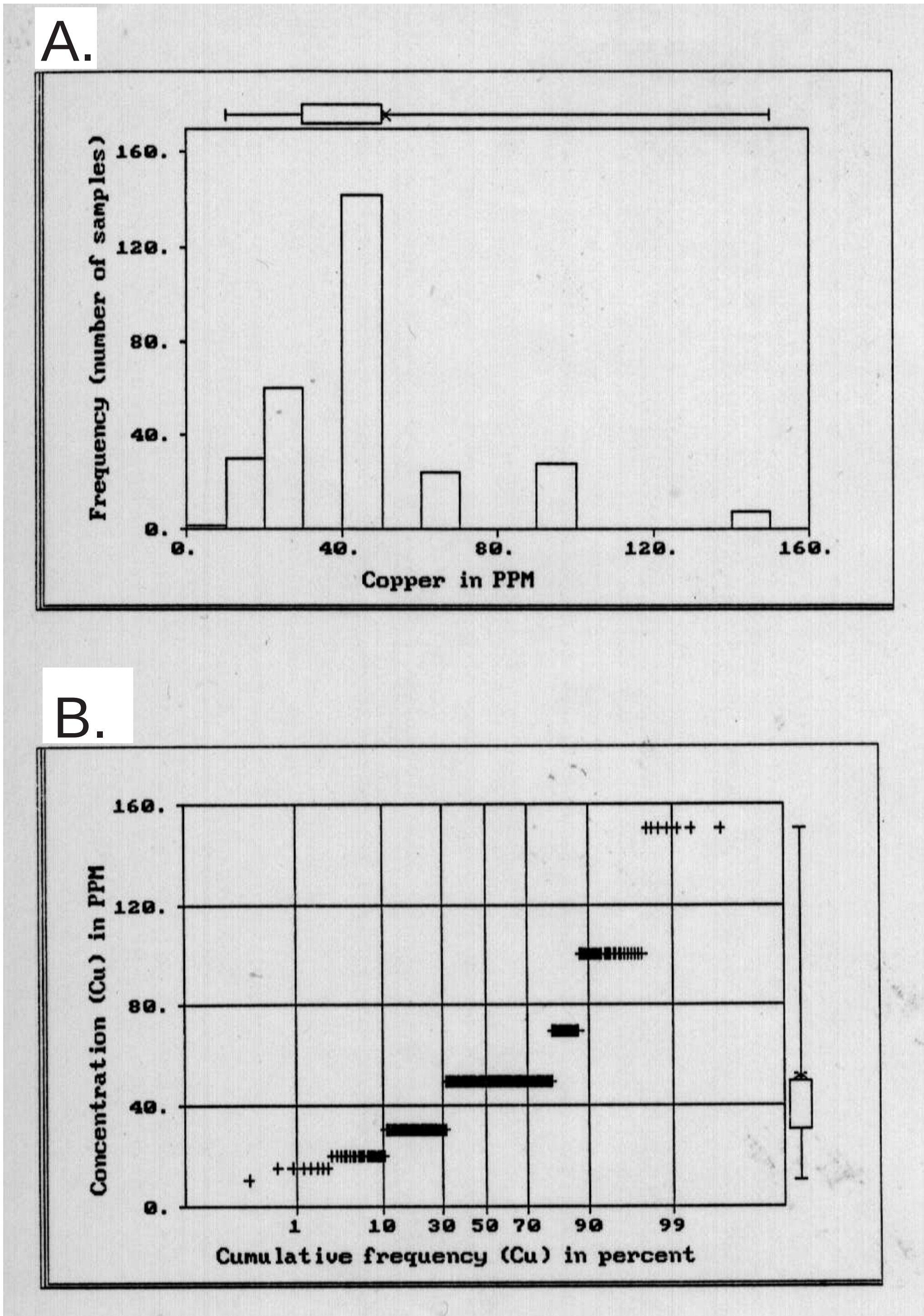


Figure 12 -- A. Histogram for copper in the "new" stream sediment data for Puerto Rico.
B. Cumulative frequency plot for copper in the "new" stream sediment data for Puerto Rico.

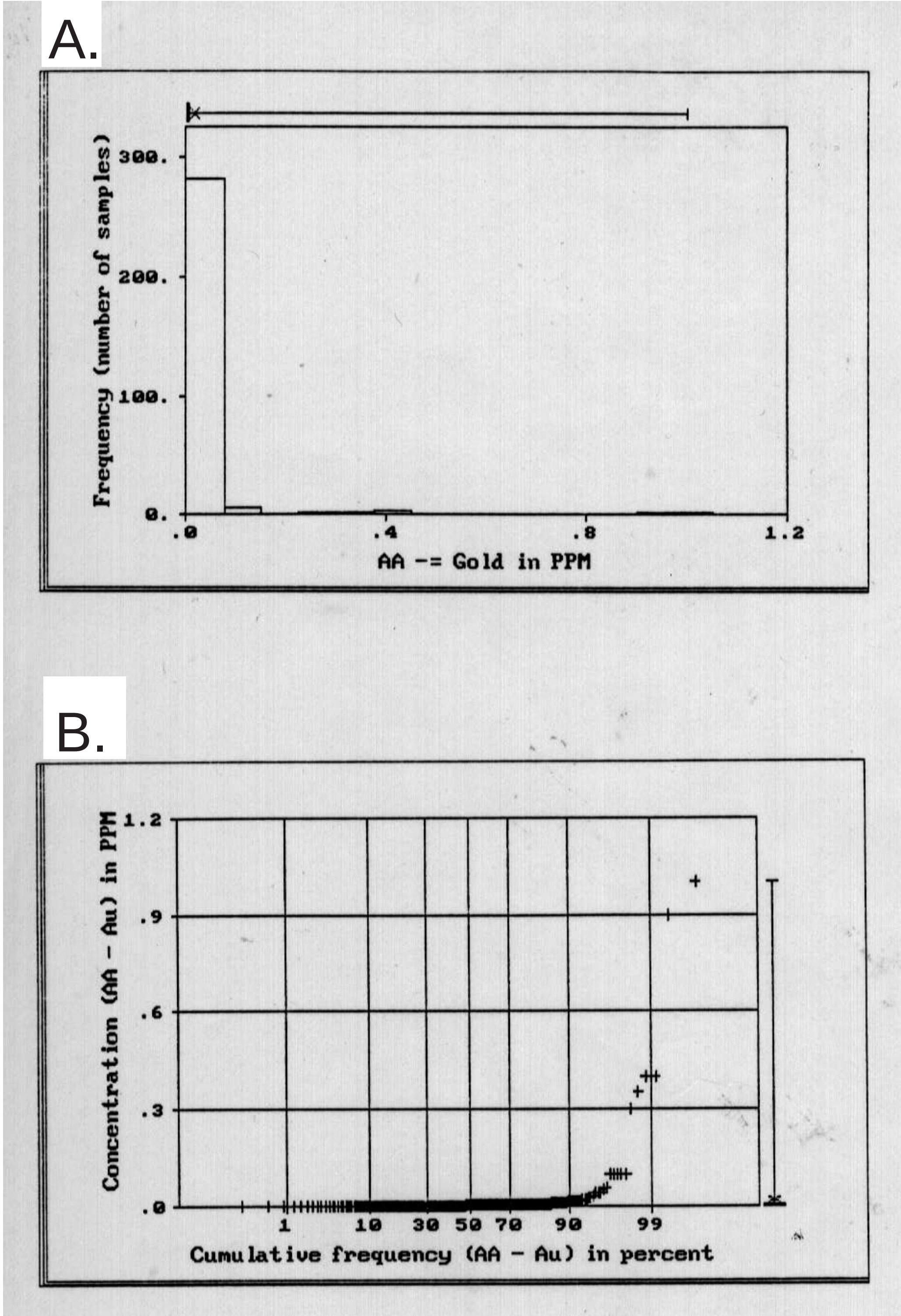
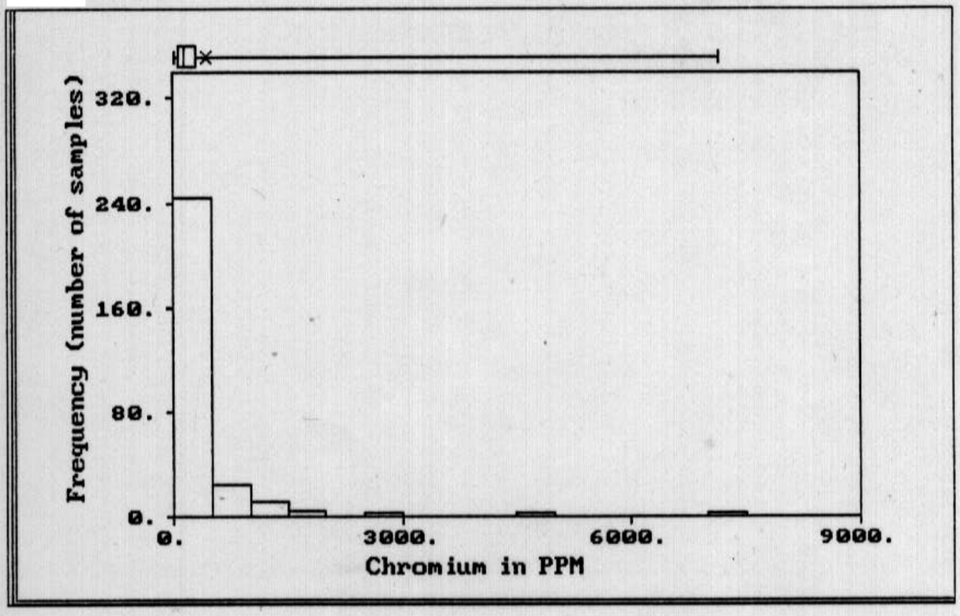


Figure 13 -- A. Histogram for gold in the "new" stream sediment data for Puerto Rico.
B. Cumulative frequency plot for gold in the "new" stream sediment data for Puerto Rico.

A.



B.

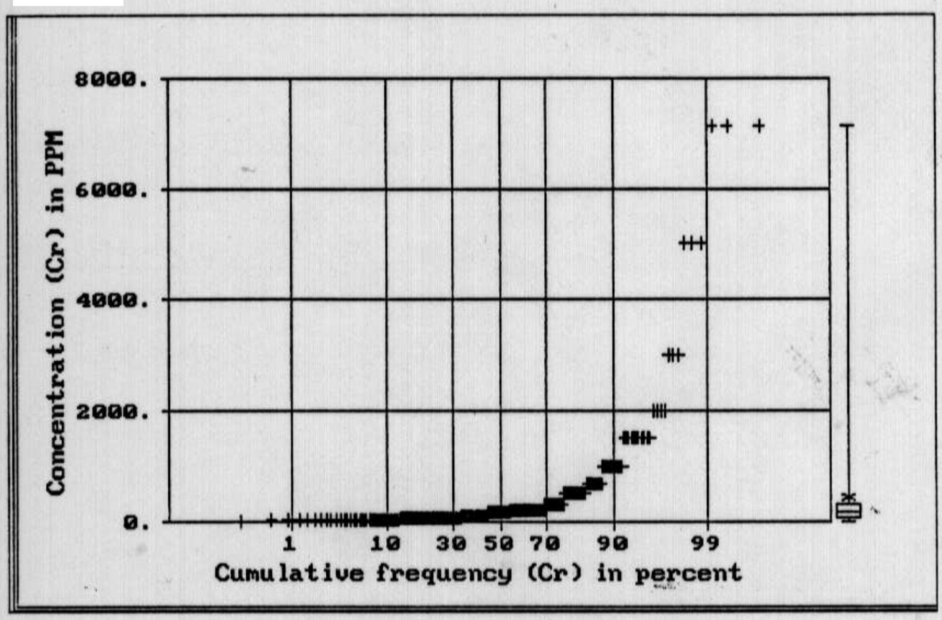
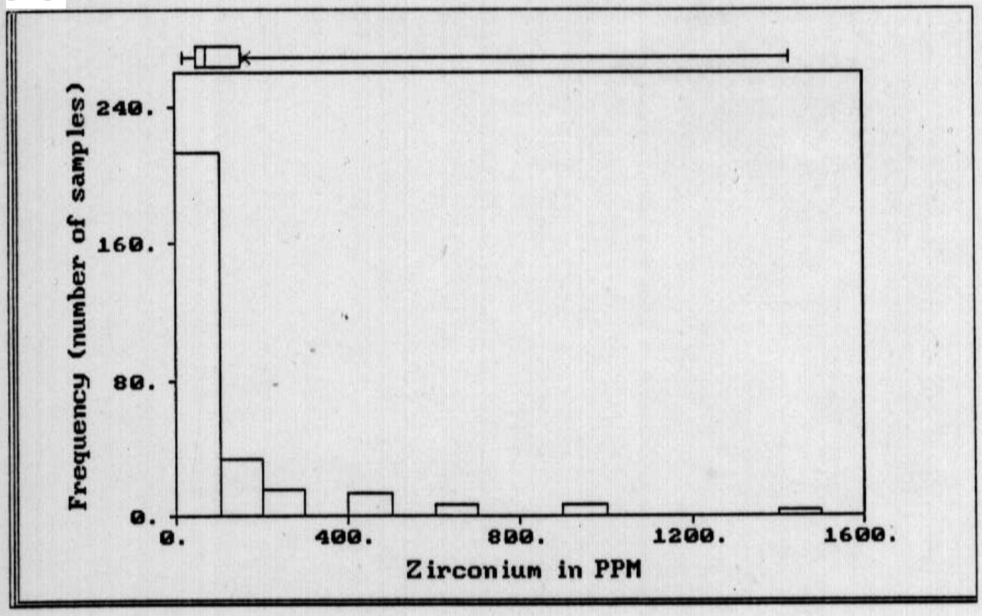


Figure 14 -- A. Histogram for chromium in the "new" stream sediment data for Puerto Rico.
B. Cumulative frequency plot for chromium in the "new" stream sediment data for Puerto Rico.

A.



B.

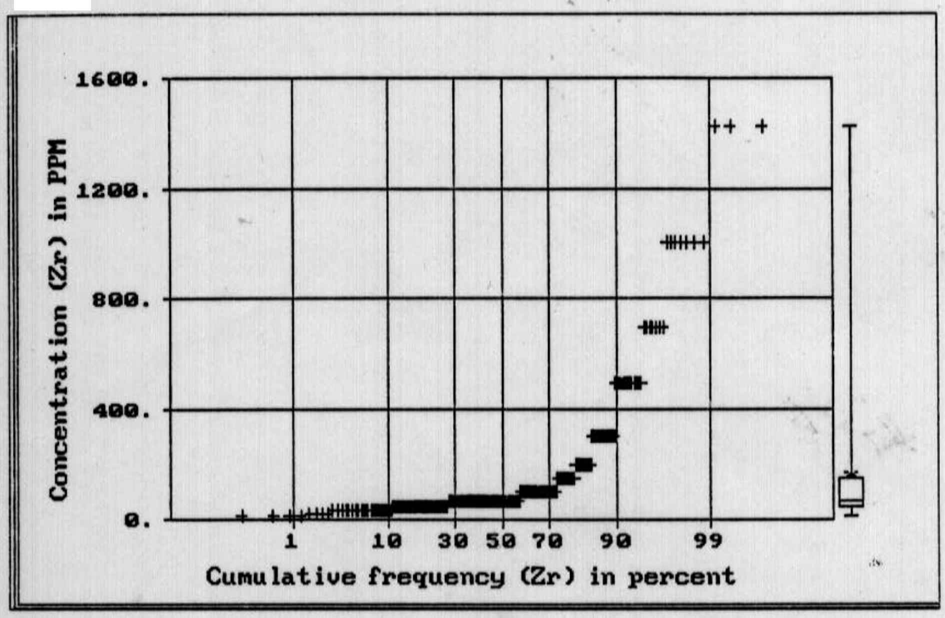


Figure 15 -- A. Histogram for zirconium in the "new" stream sediment data for Puerto Rico.
B. Cumulative frequency plot for zirconium in the "new" stream sediment data for Puerto Rico.

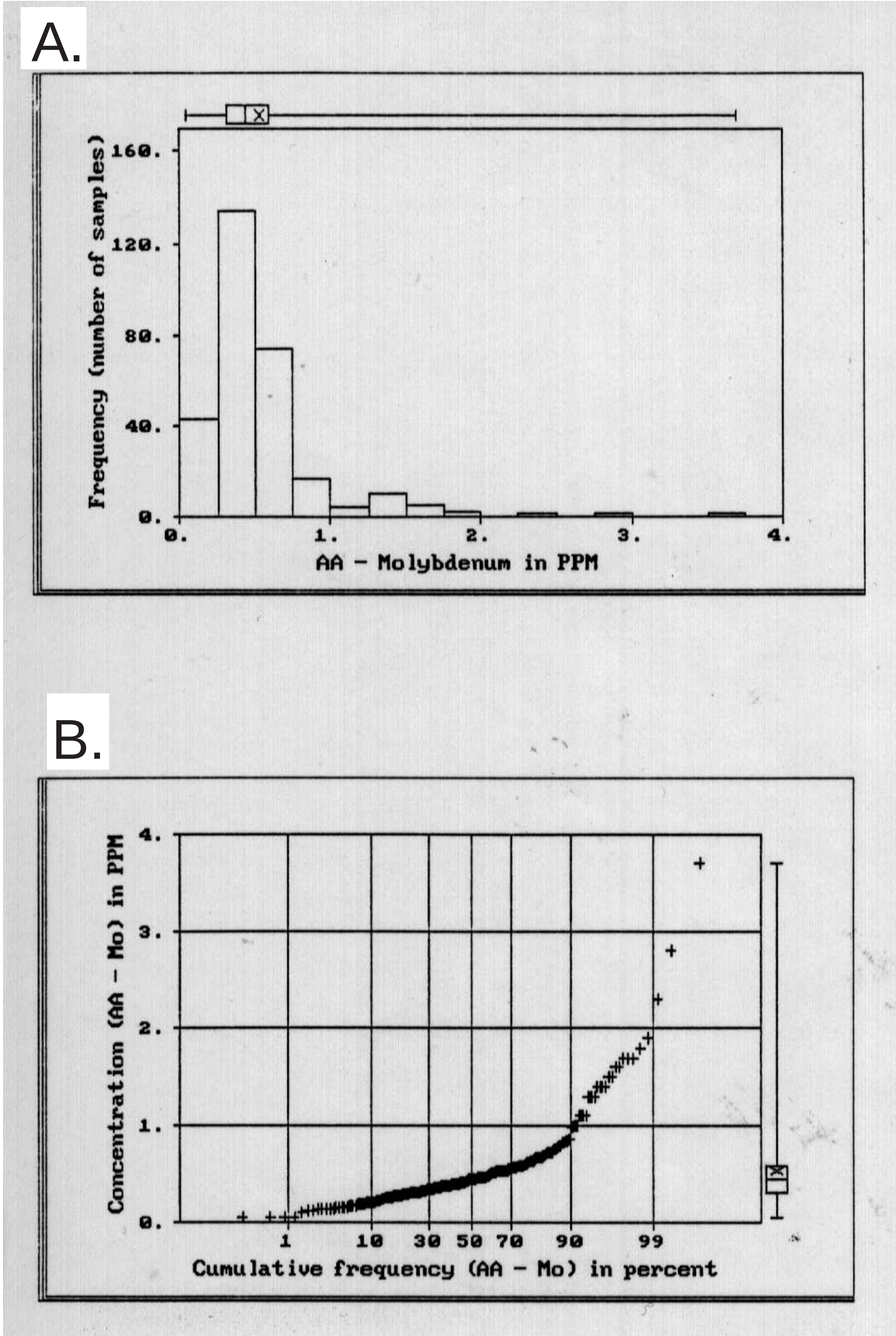
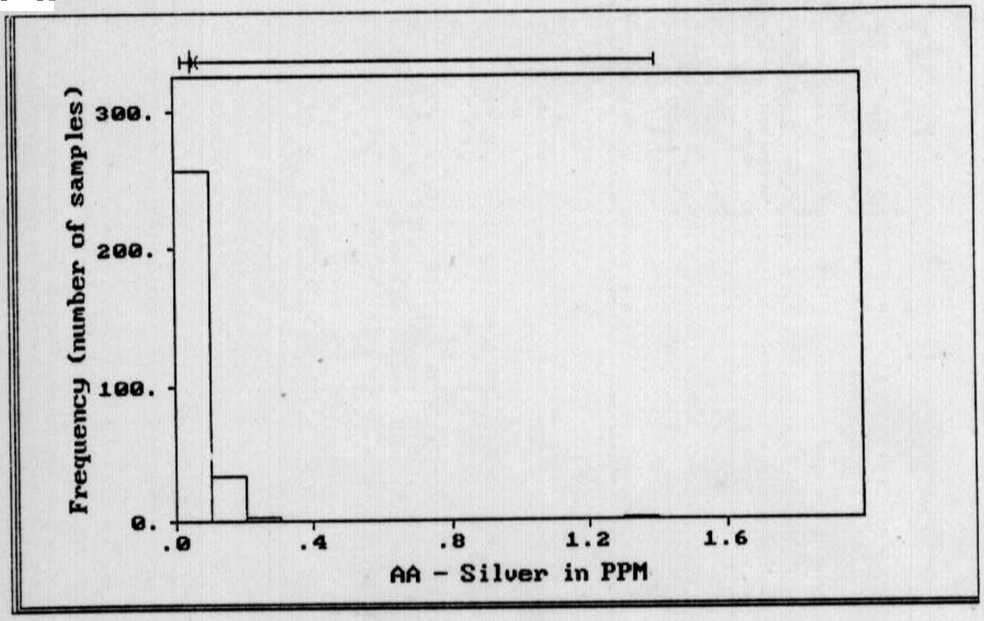


Figure 16 -- A. Histogram for molybdenum in the "new" stream sediment data for Puerto Rico.
B. Cumulative frequency plot for molybdenum in the "new" stream sediment data for Puerto Rico.

A.



B.

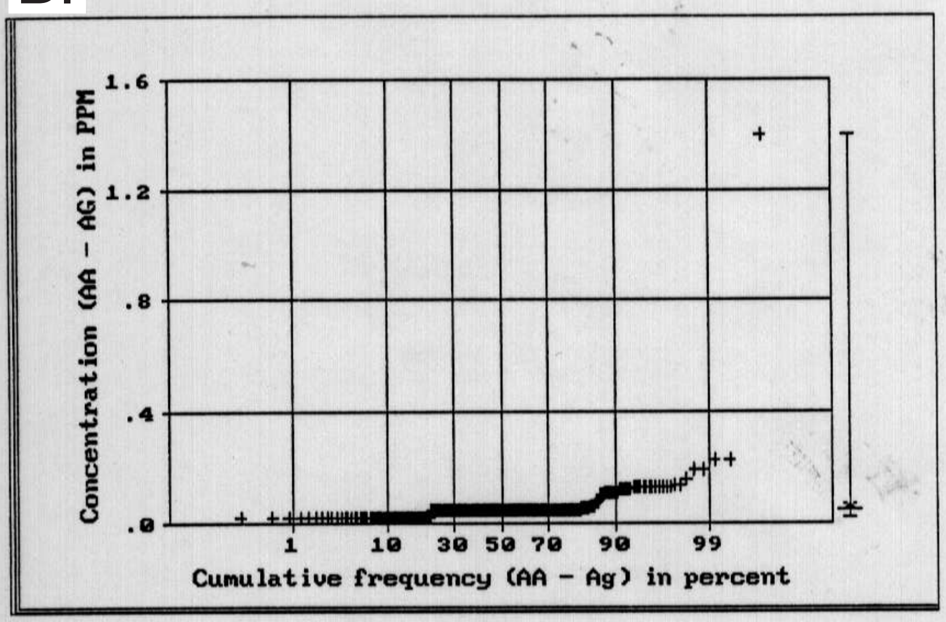


Figure 17 -- A. Histogram for silver in the "new" stream sediment data for Puerto Rico.
B. Cumulative frequency plot for silver in the "new" stream sediment data for Puerto Rico.

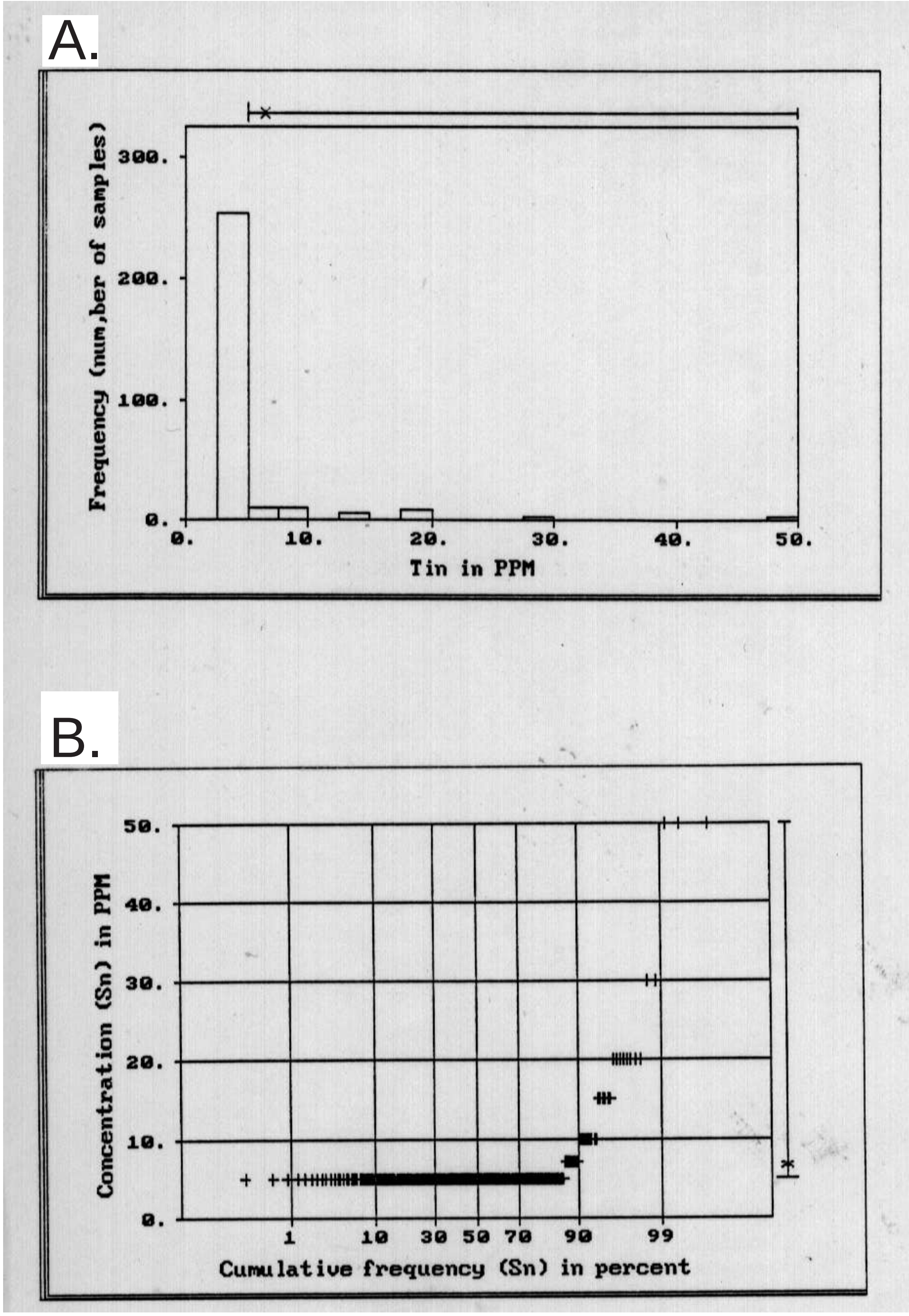
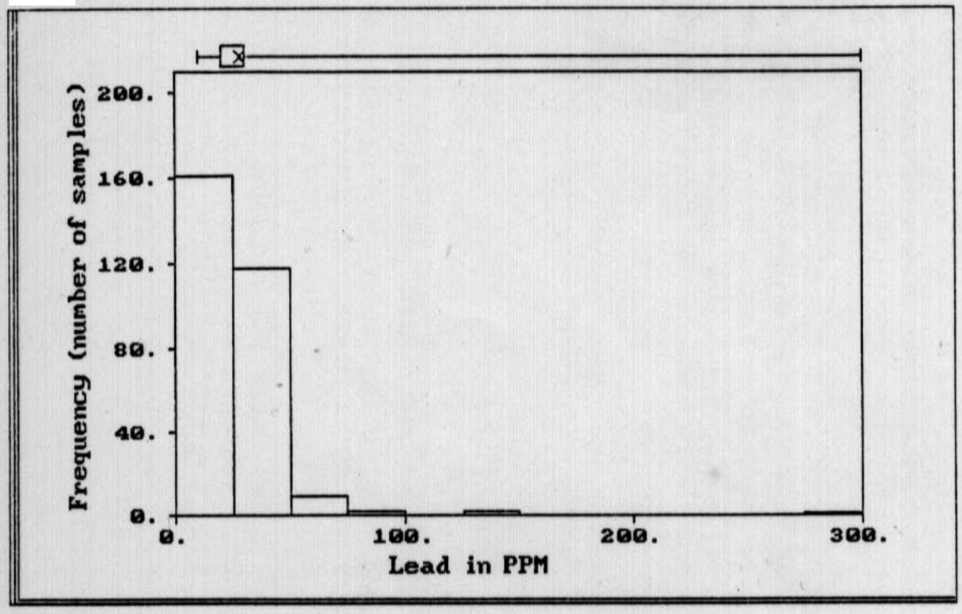


Figure 18 -- A. Histogram for tin in the "new" stream sediment data for Puerto Rico.
B. Cumulative frequency plot for tin in the "new" stream sediment data for Puerto Rico.

A.



B.

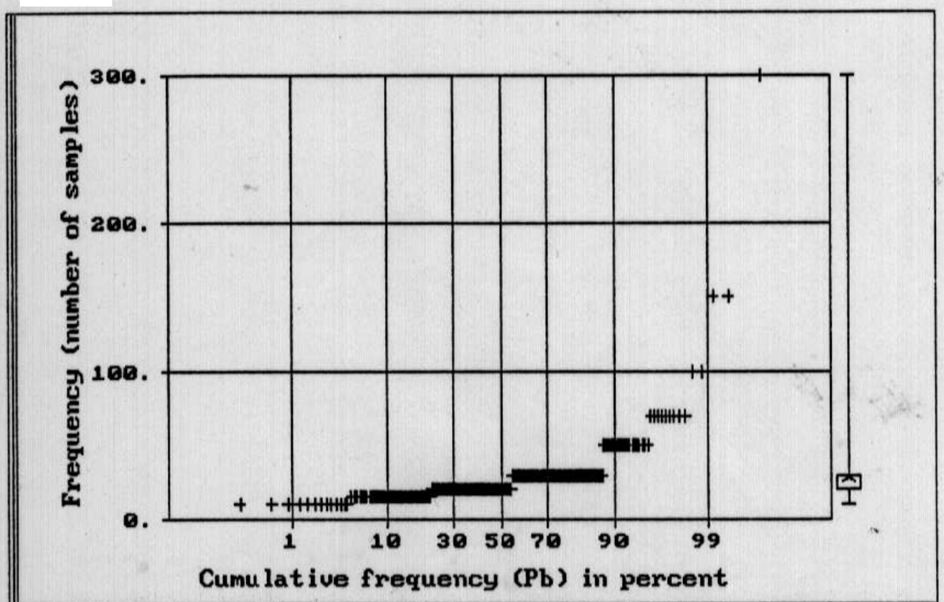
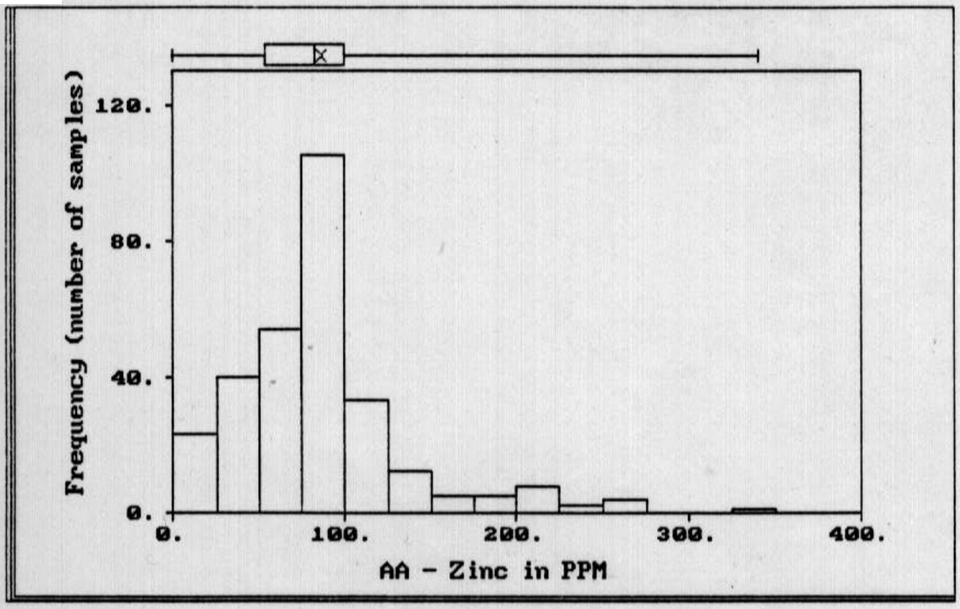


Figure 19 -- A. Histogram for lead in the "new" stream sediment data for Puerto Rico.
B. Cumulative frequency plot for lead in the "new" stream sediment data for Puerto Rico.

A.



B.

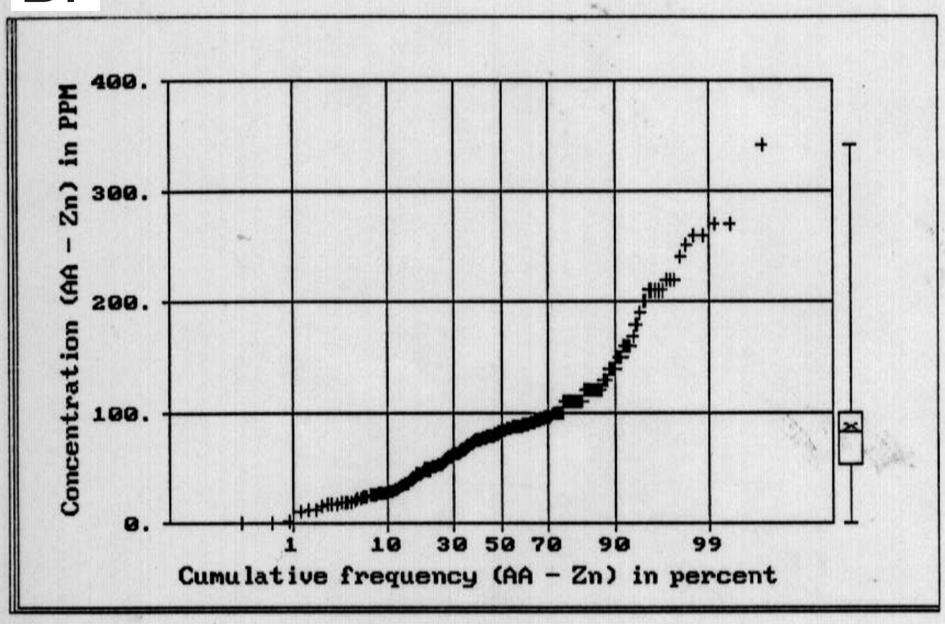
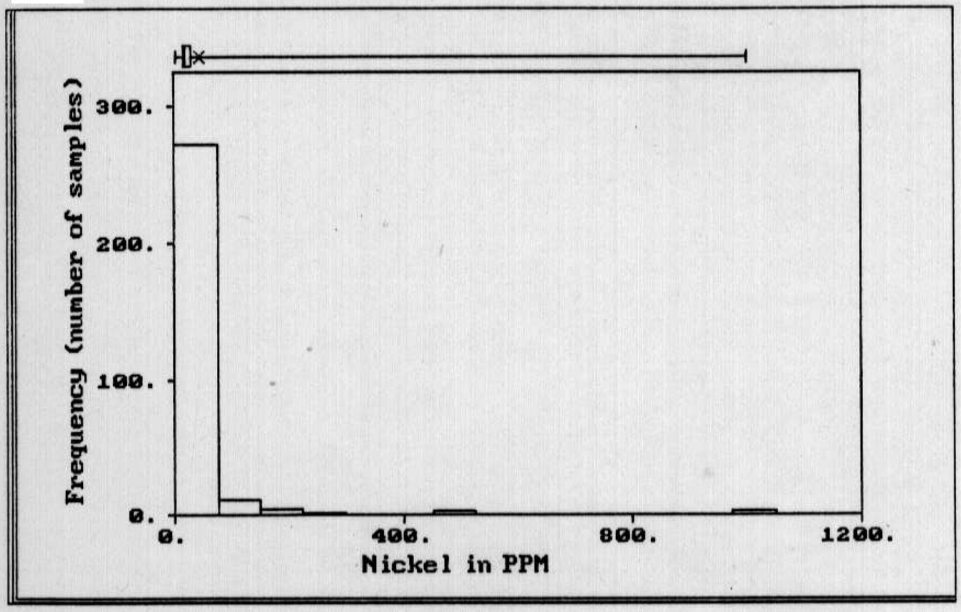


Figure 20 -- A. Histogram for zinc in the "new" stream sediment data for Puerto Rico.
B. Cumulative frequency plot for zinc in the "new" stream sediment data for Puerto Rico.

A.



B.

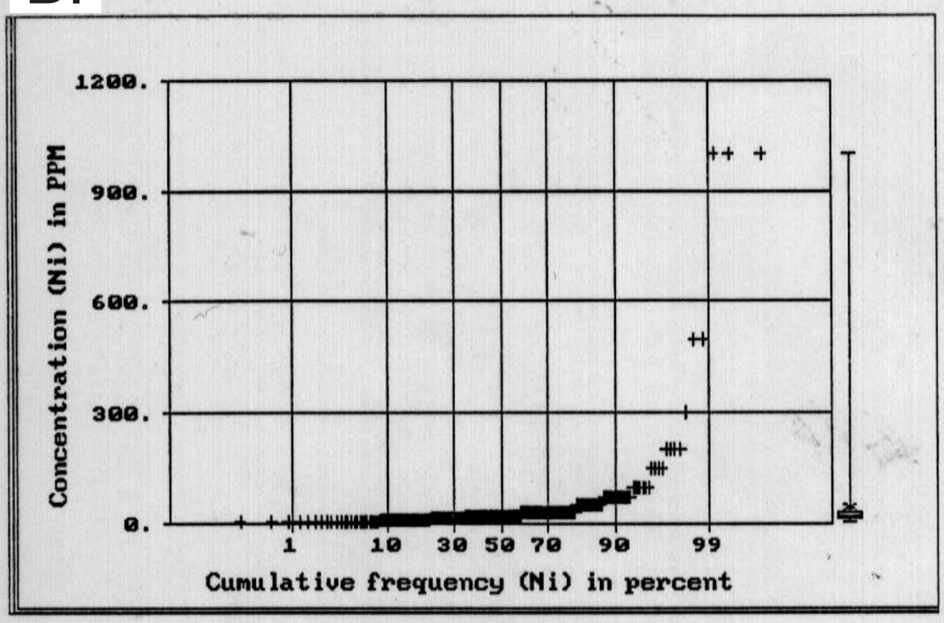
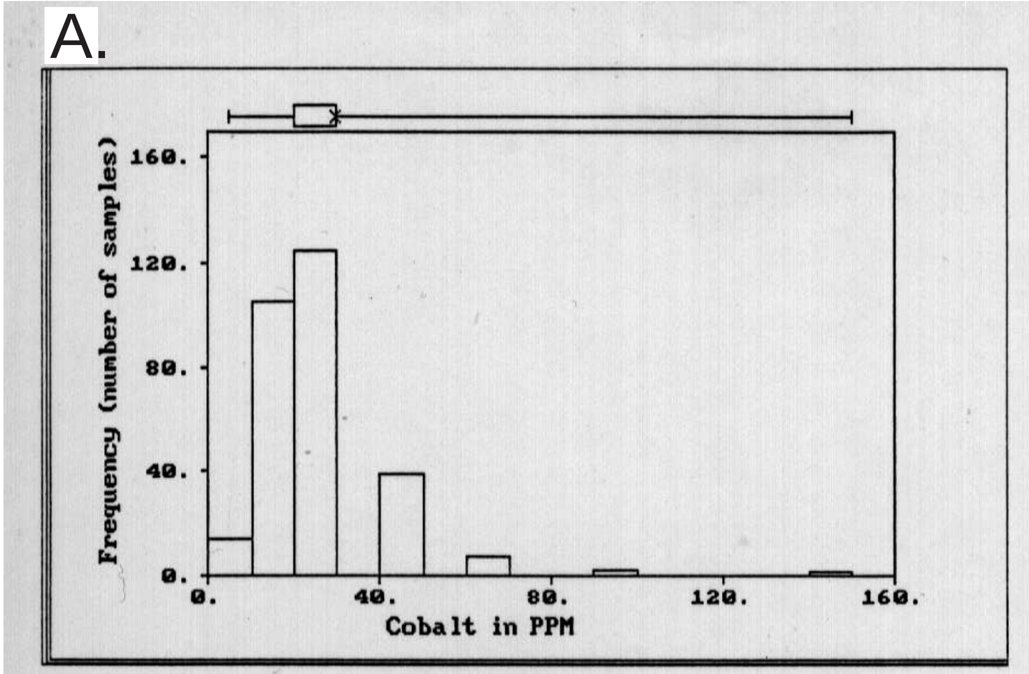


Figure 21 -- A. Histogram for nickel in the "new" stream sediment data for Puerto Rico.
B. Cumulative frequency plot for nickel in the "new" stream sediment data for Puerto Rico.



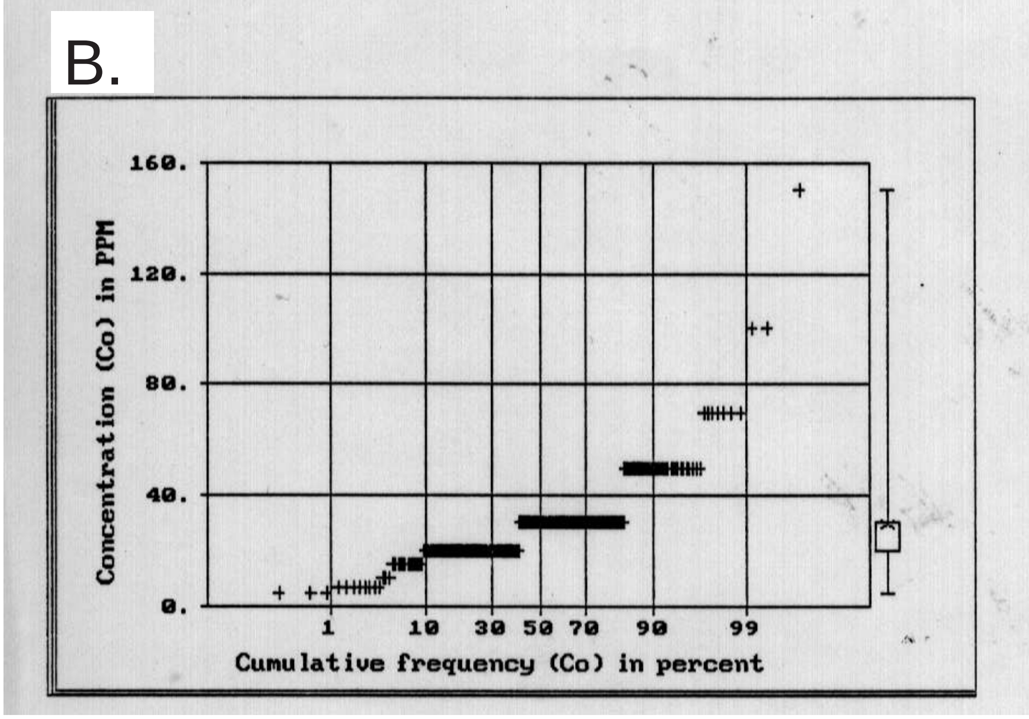


Figure 22 -- A. Histogram for cobalt in the "new" stream sediment data for Puerto Rico.
B. Cumulative frequency plot for cobalt in the "new" stream sediment data for Puerto Rico.

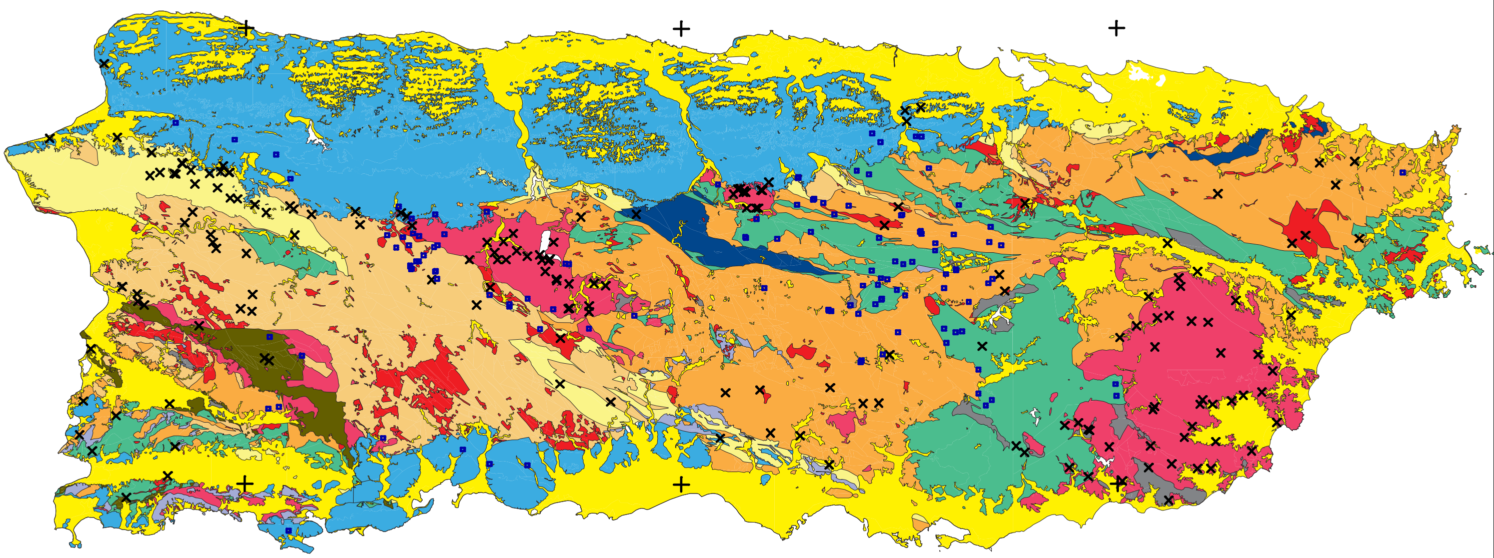


Figure 23 -- Factor score plot for samples anomalous in factor 1 (Fe, Ti, V, Y, and Zr) from the "all" geochemical data with censored data removed. Base is a generalized geologic map of igneous rocks (red) in Puerto Rico. Positive factor loadings greater than 1 = X; negative loadings less than -1 = squares.

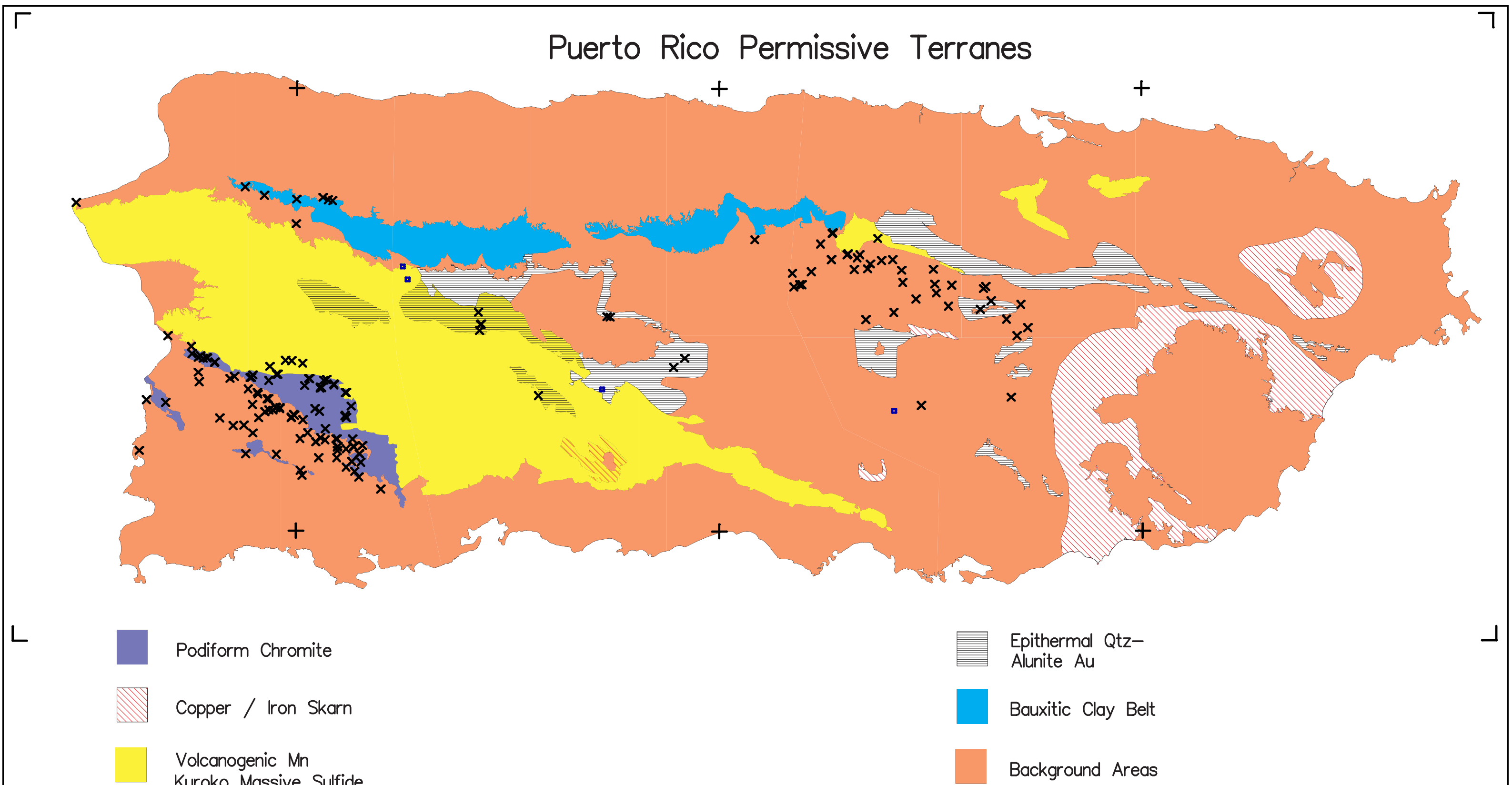


Figure 24 -- Factor score plot for samples anomalous in factor 2 (Mg, Co, Cr, and Ni) from the "all" geochemical data with censored data removed. Base is a map showing permissive terranes for mineral deposit types. Positive loadings greater than 1 = X; negative loadings less than -1 = squares.

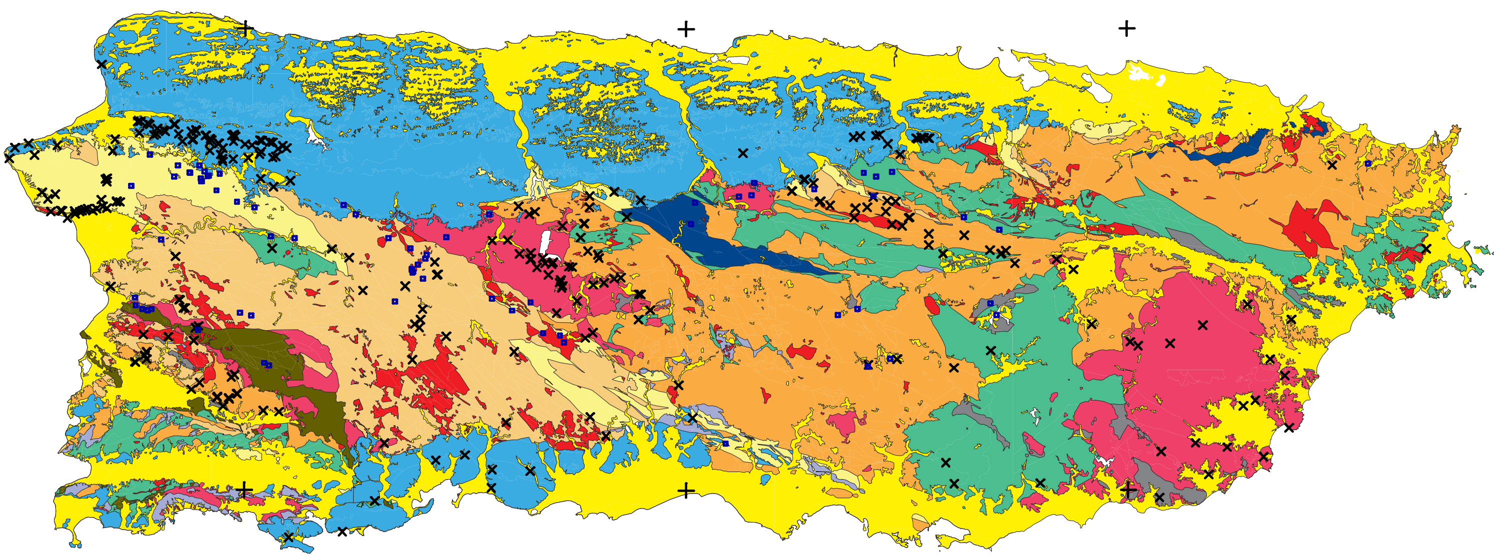


Figure 25 -- Factor score plot for samples anomalous in factor 3 (Ca, and Sr) from the "all" geochemical data with censored data removed. Base is a generalized geologic map of Quaternary sediments (blue and yellow) in Puerto Rico. Positive factor loadings greater than 1 = X; negative loadings less than -1 = squares.

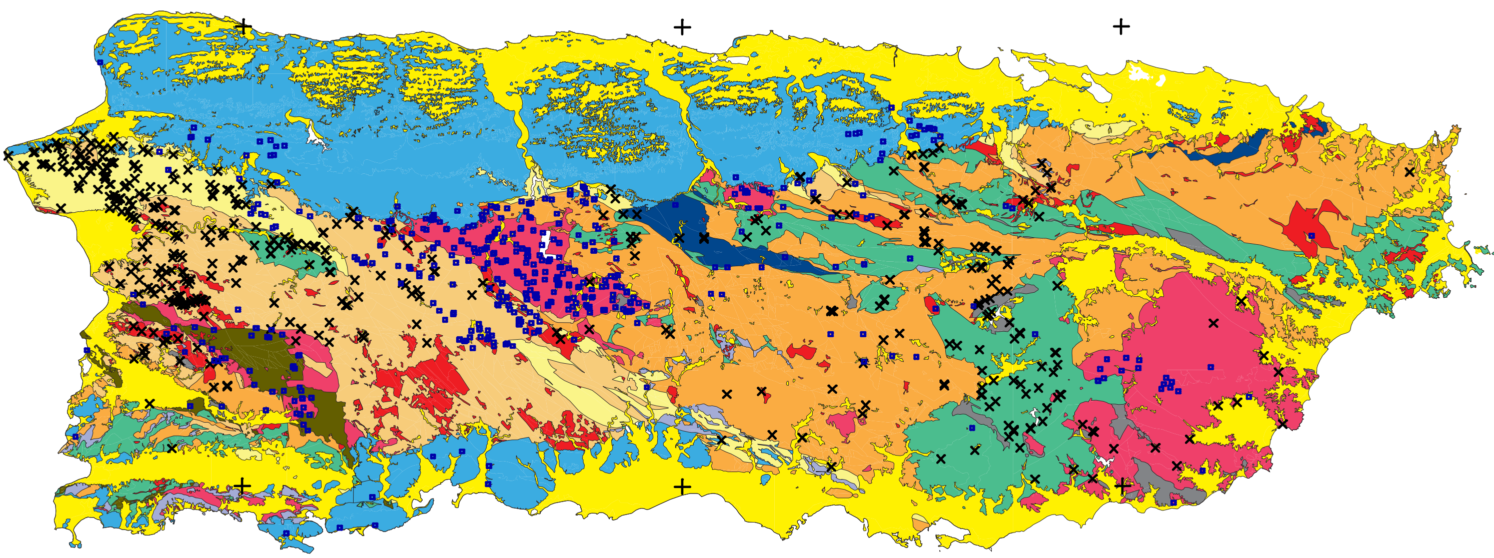


Figure 26 -- Factor score plot for samples anomalous in factor 4 (Ti, Mn, Sc, V, Y, Fe, Mg, and Zn) from the "all" geochemical data with censored data removed. Base is a generalized geologic map of Puerto Rico: blue and yellow = Quaternary sediments; tan and orange = volcanoclastic rocks, green = submarine basalts and cherts, red = intrusives, brown = mafic rocks, grey = alteration. Positive factor loadings greater than 1 = X; negative loadings less than -1 = squares.

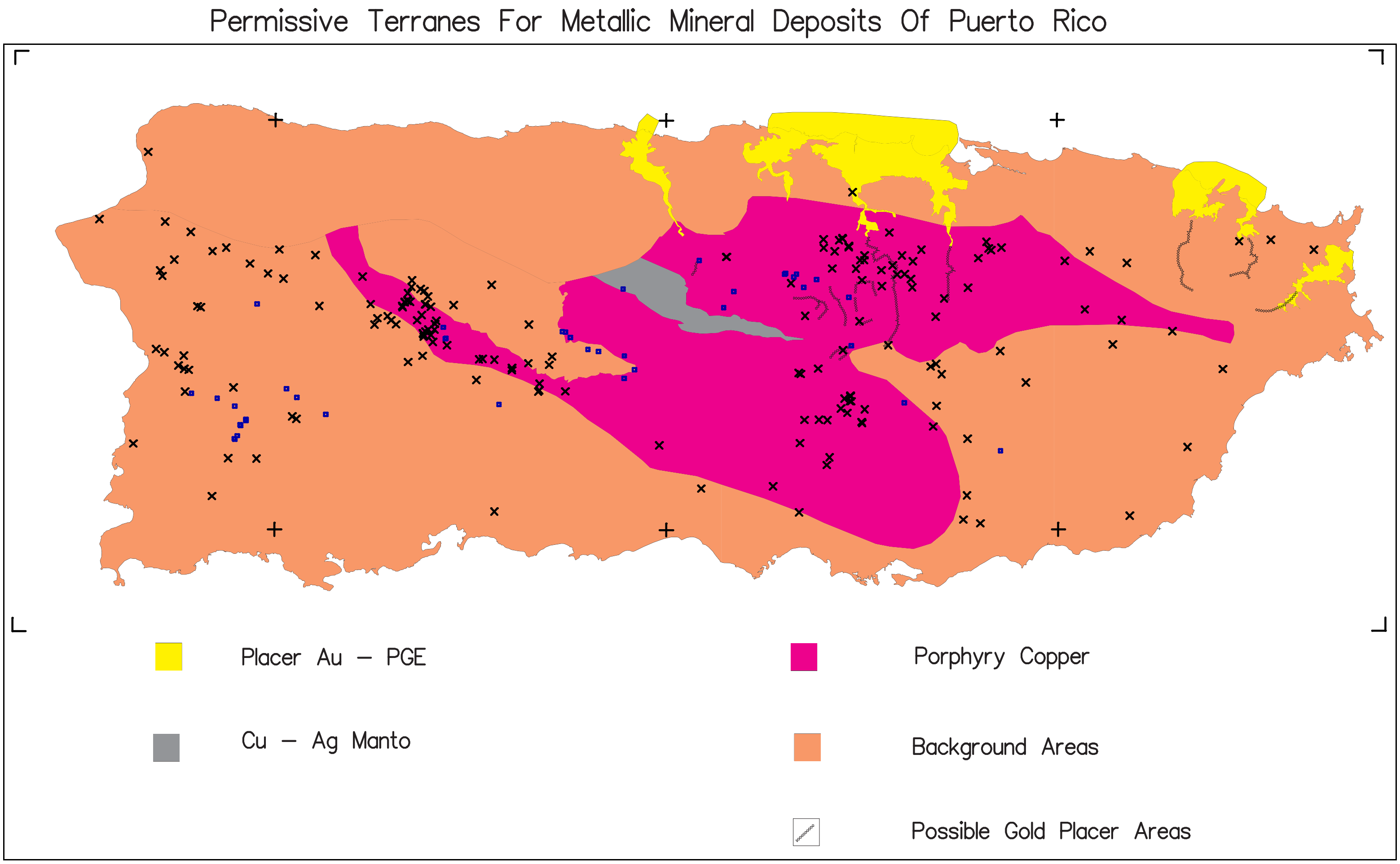


Figure 27 -- Factor score plot for samples anomalous in factor 5 (Pb, Zn, and Mn) from the "all" geochemical data with censored data removed. Base is a map showing permissive terranes for mineral deposit types. Positive loadings greater than 1 = X; negative loadings less than -1 = squares.

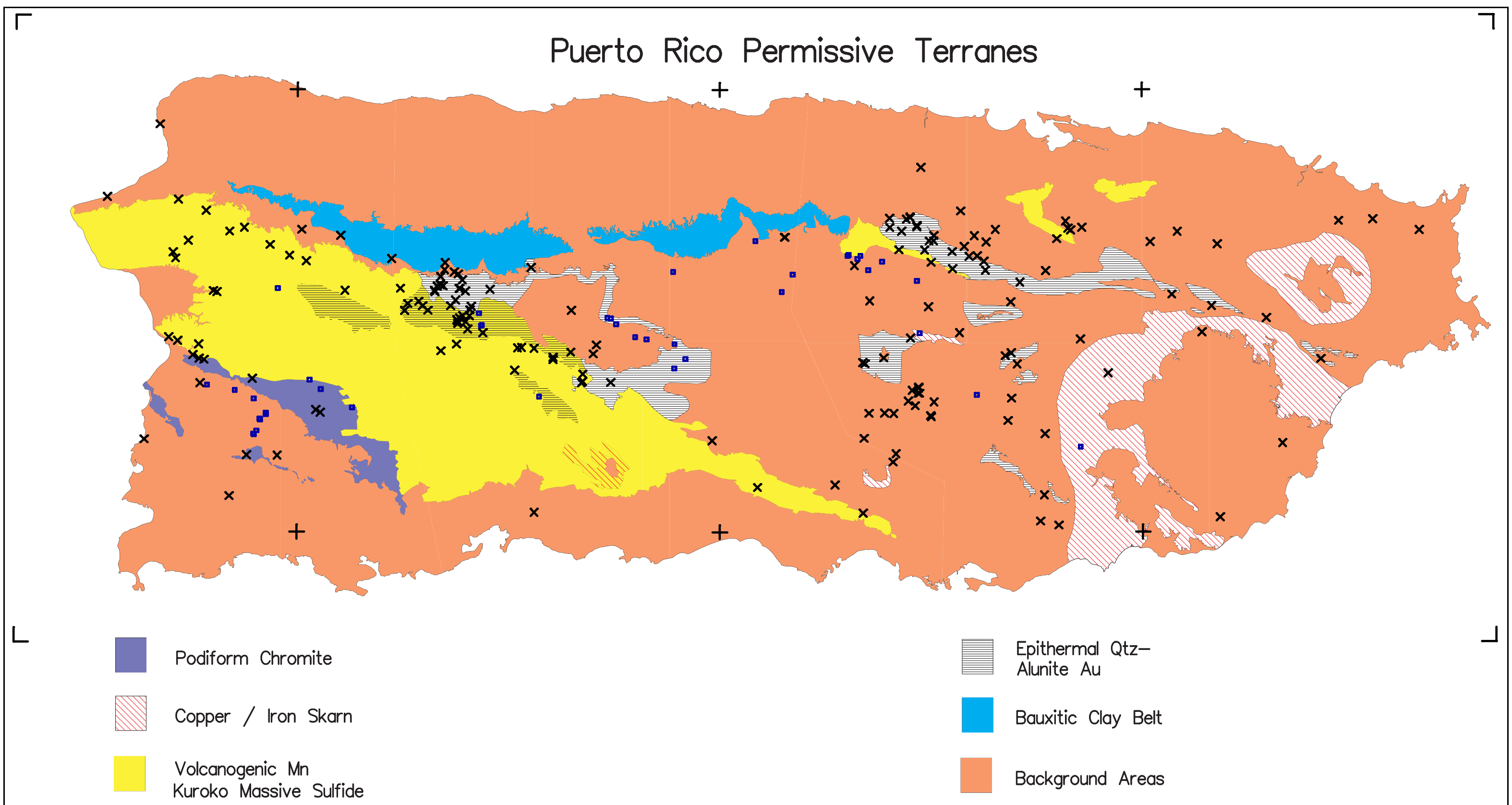


Figure 28 -- Factor score plot for samples anomalous in factor 5 (Pb, Zn, and Mn) from the "all" geochemical data with censored data removed. Base is a map showing permissive terranes for mineral deposit types. Positive loadings greater than 1= X; negative loadings less than -1 = squares.

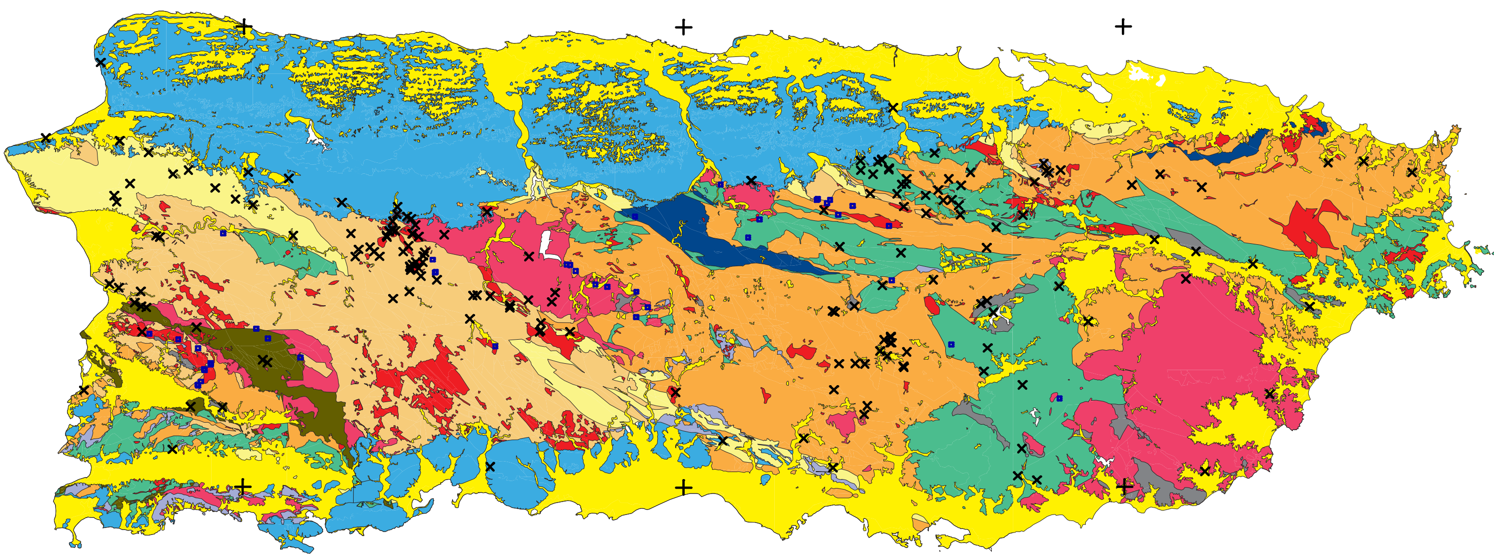


Figure 29 -- Factor score plot for samples anomalous in factor 5 (Pb, Zn, and Mn) from the "all" geochemical data with censored data removed. Base is a generalized geologic map of rocks in Puerto Rico. Positive loadings greater than 1 = X; negative loadings less than -1 = squares.

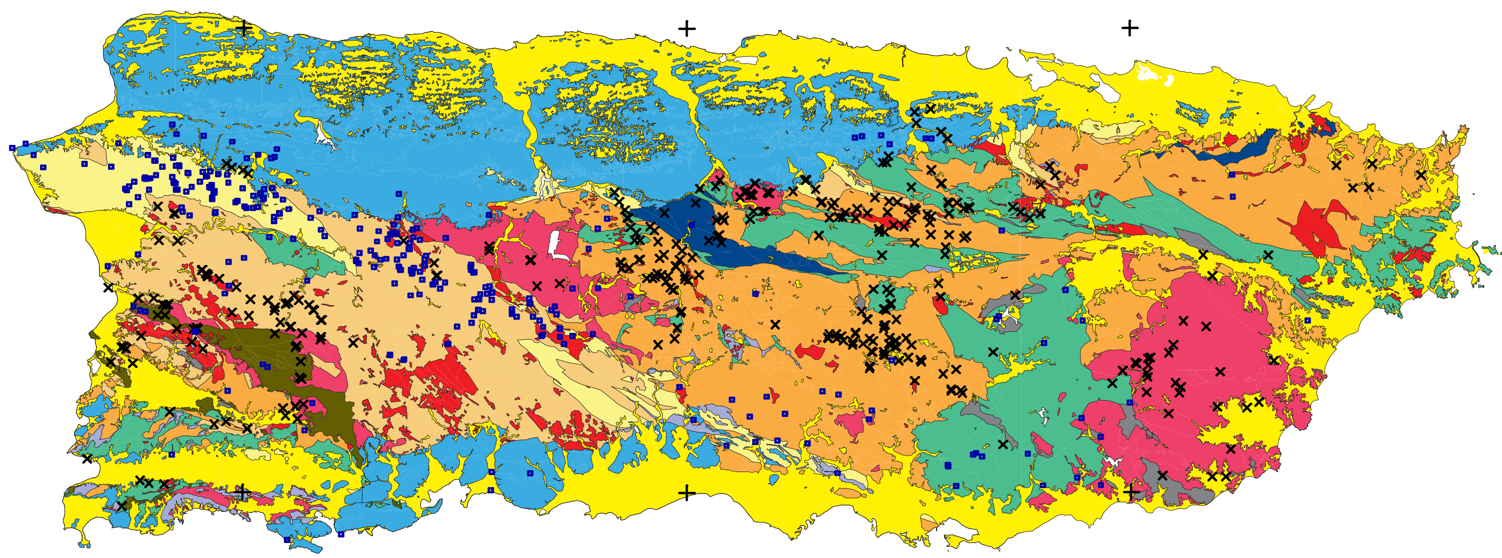


Figure 30 -- Factor score plot for samples anomalous in factor 6 (Ba) from the "all" geochemical data with censored data removed. Base is a generalized geologic map. Positive factor loadings greater than 1 = X; negative loadings less than -1 = squares.

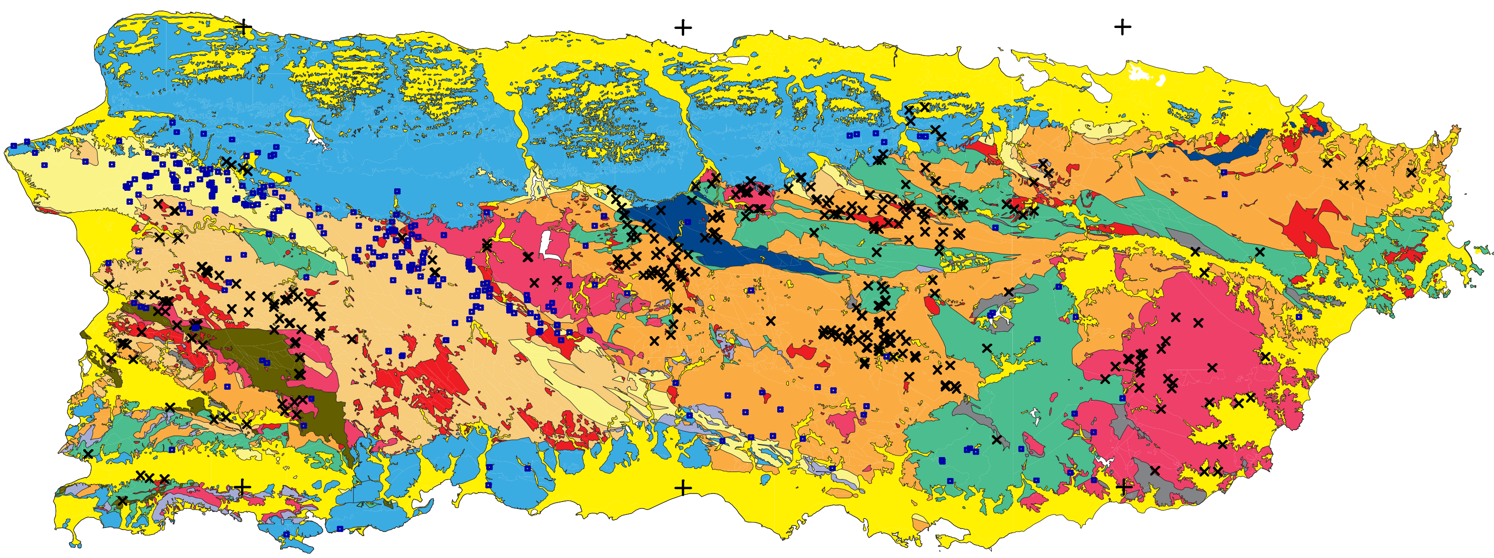


Figure 31 -- Factor score plot for samples anomalous in factor 6 (Ba) from the "all" geochemical data with censored data removed. Base is a generalized geologic map of rocks in Puerto Rico. Positive factor loadings greater than 1 = X; negative loadings less than -1 = squares.

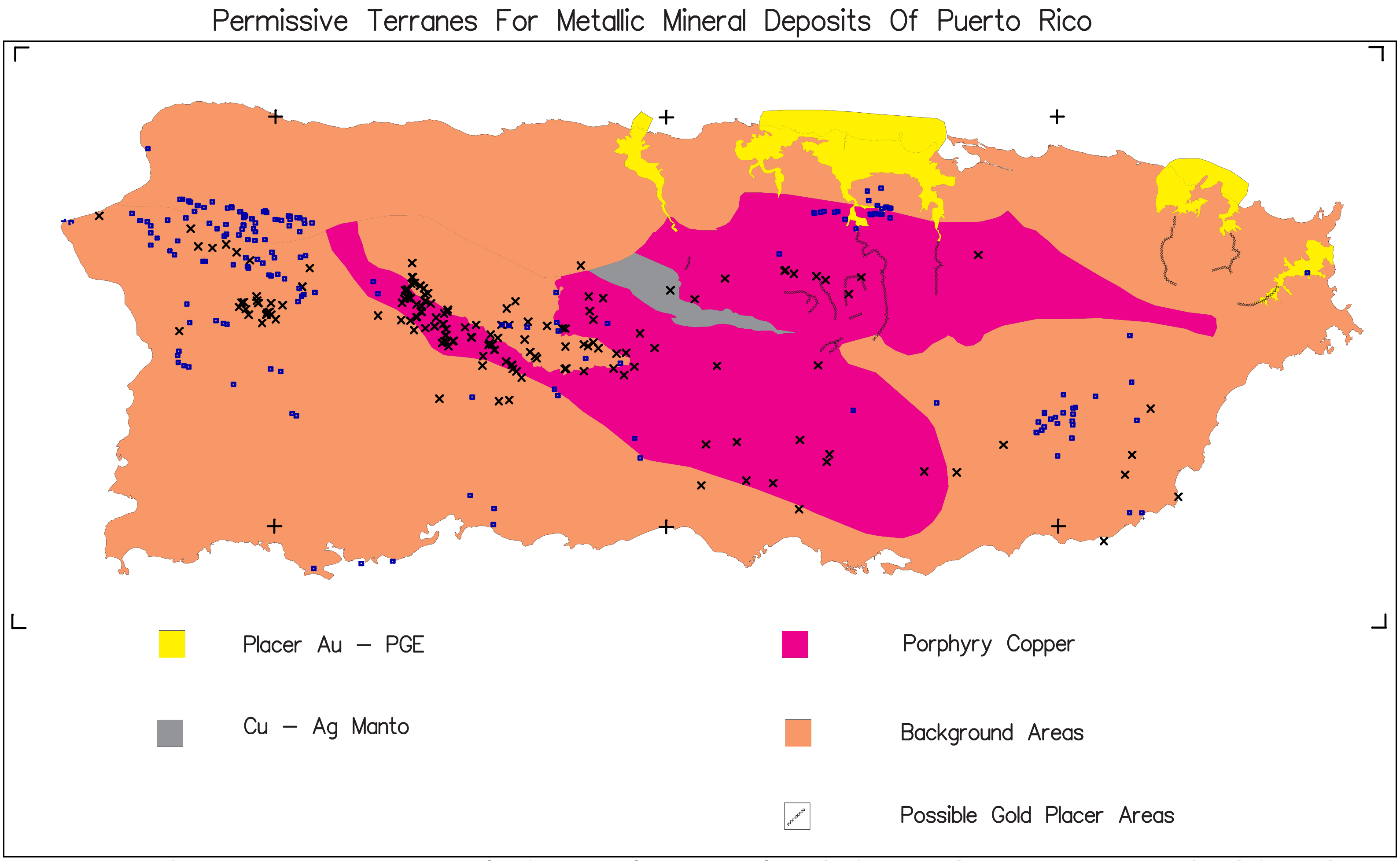


Figure 32 -- Factor score plot for samples anomalous in factor 7 (Fe, Cu, Mg, V, and Zn) from the "all" geochemical data with censored data removed. Base is a map showing permissive terranes for mineral deposit types. Positive factor loadings greaterthan 1 = X; negative loadings less than -1 = square.

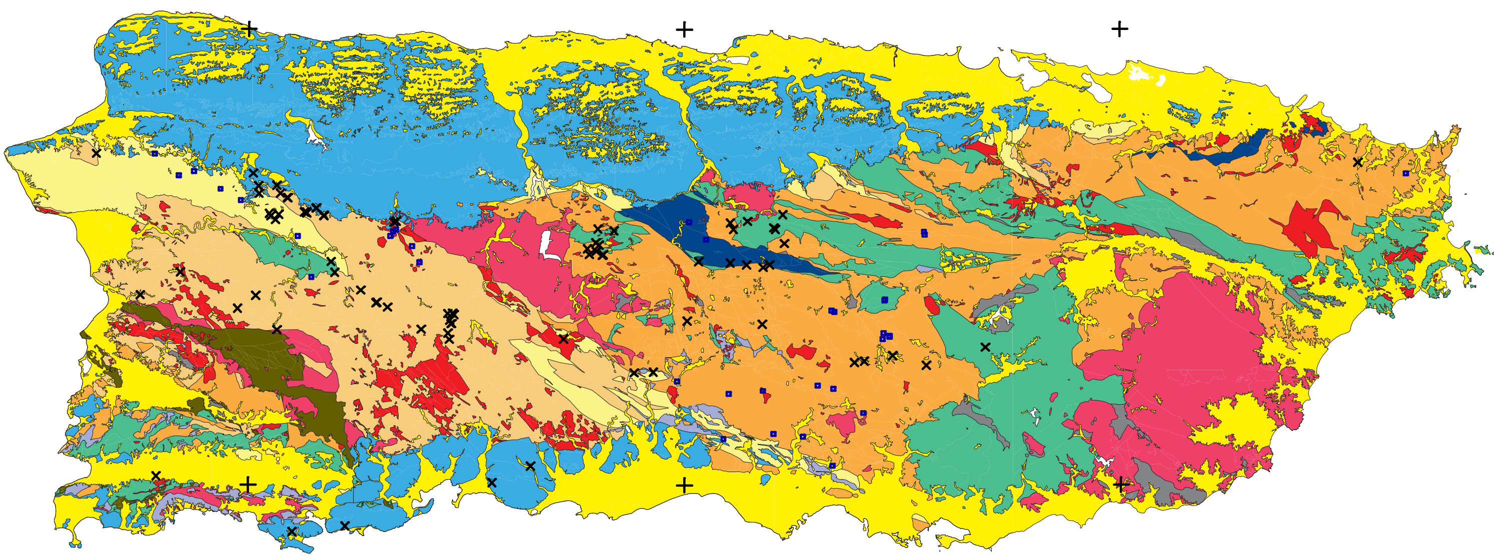


Figure 33 -- Factor score plot for samples anomalous in factor 8 (B) from the "all" geochemical data with censored data removed. Base is a generalized geologic map of rocks in Puerto Rico. Positive factor loadings greater than 1 = X; negative loadings less than -1 = square.

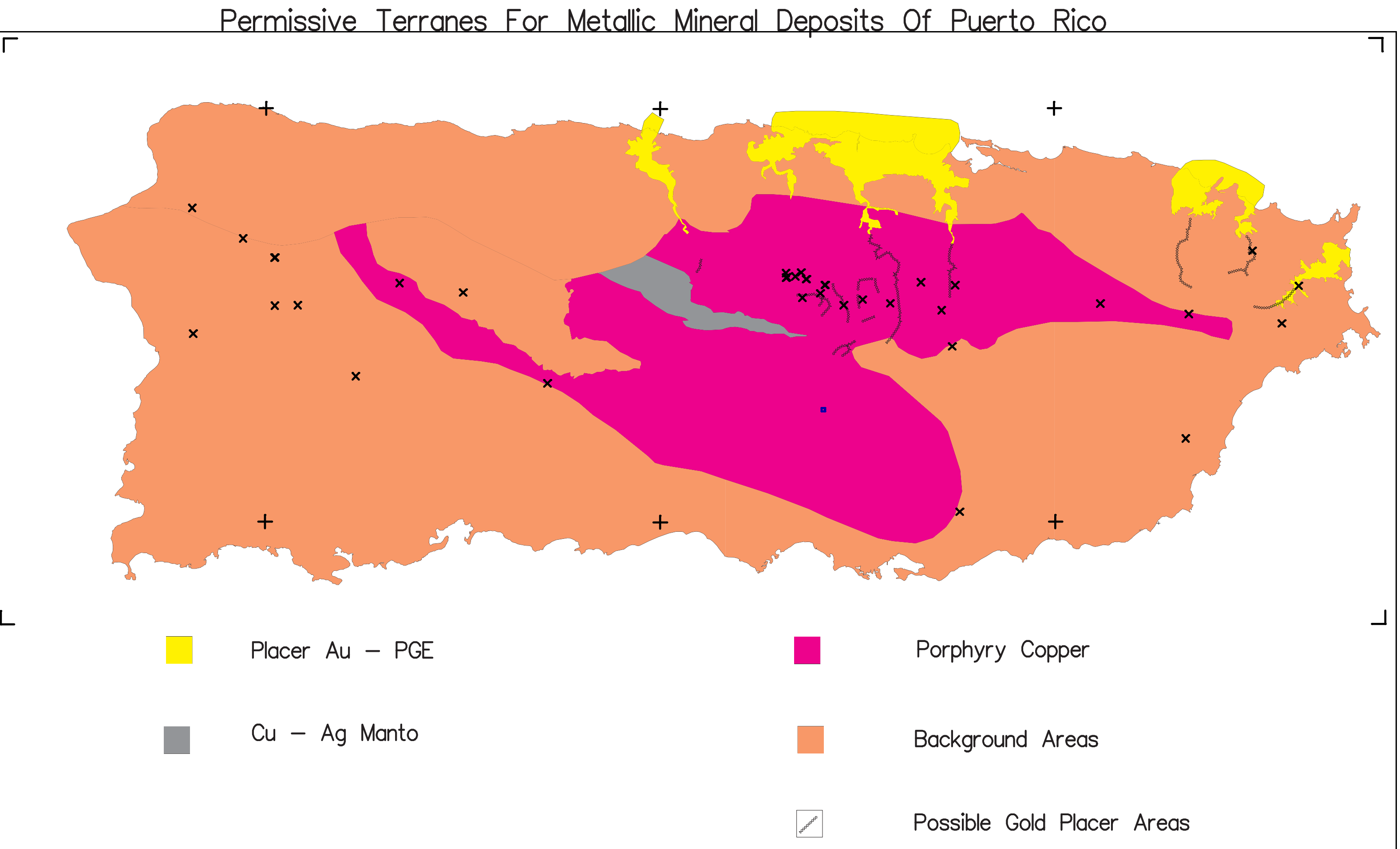


Figure 34 -- Factor score plot for samples anomalous in factor 9 (Au) from the "all" geochemical data with censored data removed. Base is a map showing permissive terranes for mineral deposit types. Positive factor loadings greater than 1 = X; negative loadings less than -1 = square.

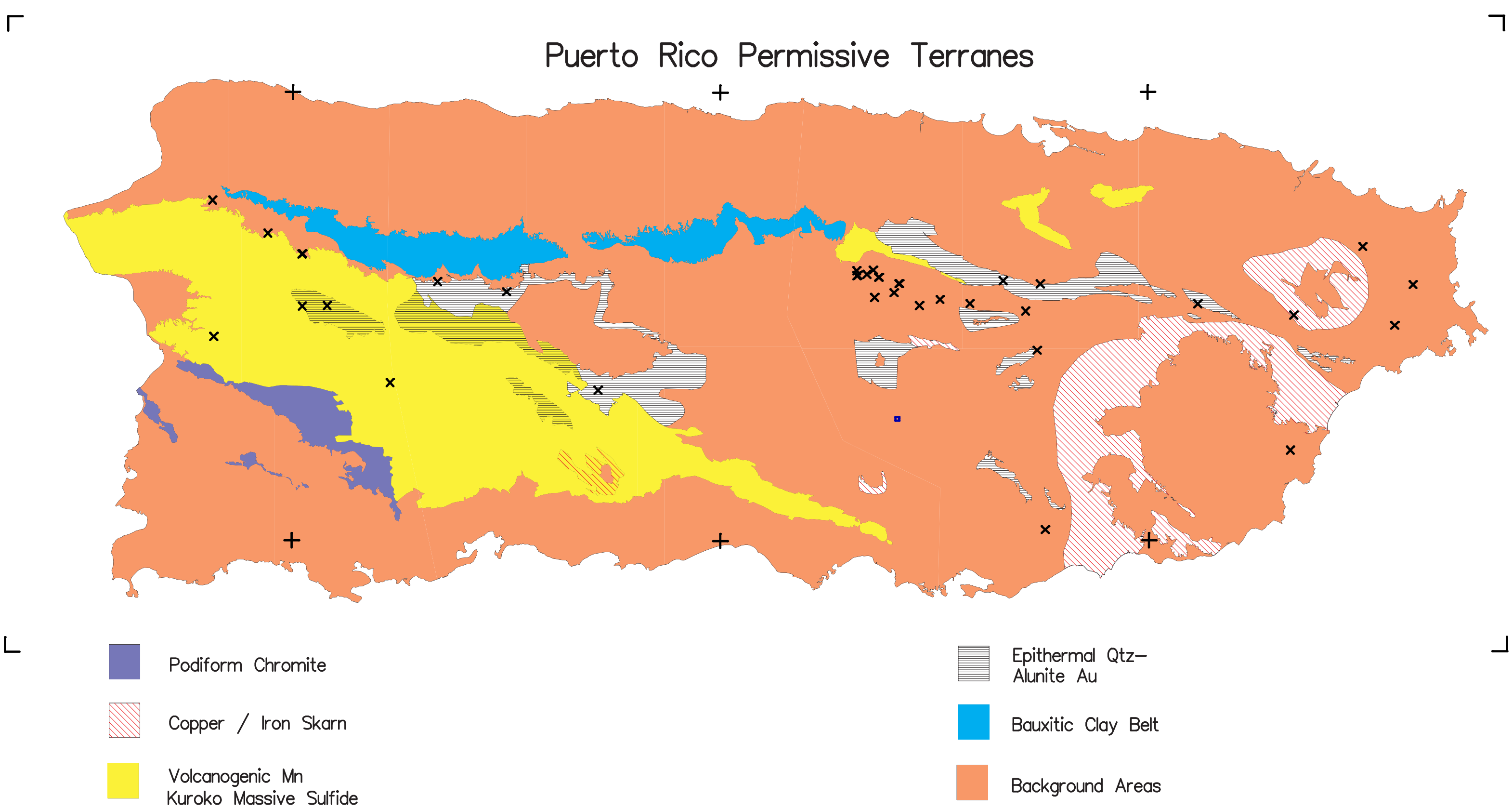
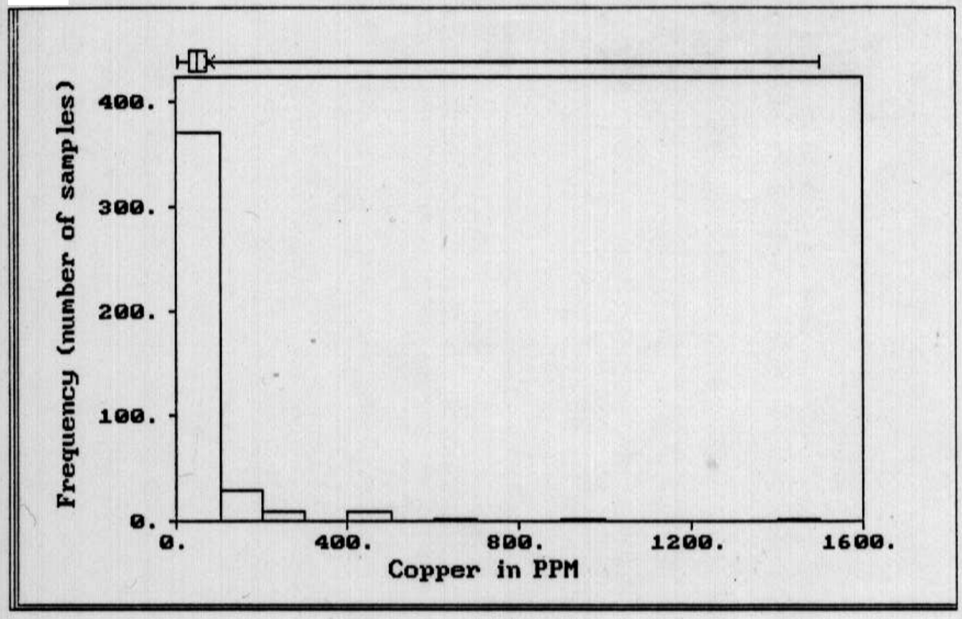


Figure 35 -- Factor score plot for samples anomalous in factor 9 (Au) from the "all" geochemical data with censored data removed. Base is a map showing permissive terranes for mineral deposit types. Positive factor loadings greater than 1 = X; negative loadings less than -1 = square.

A.



B.

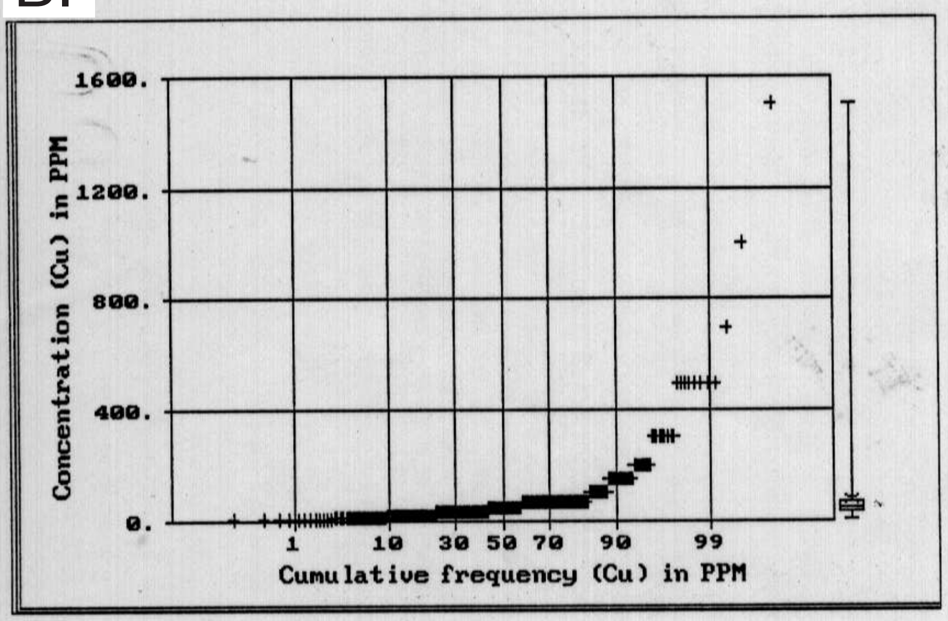


Figure 36 -- A. Histogram for copper in soil data for Isla de Vieques.
B. Cumulative frequency plot for copper in soil data for Isla de Vieques.

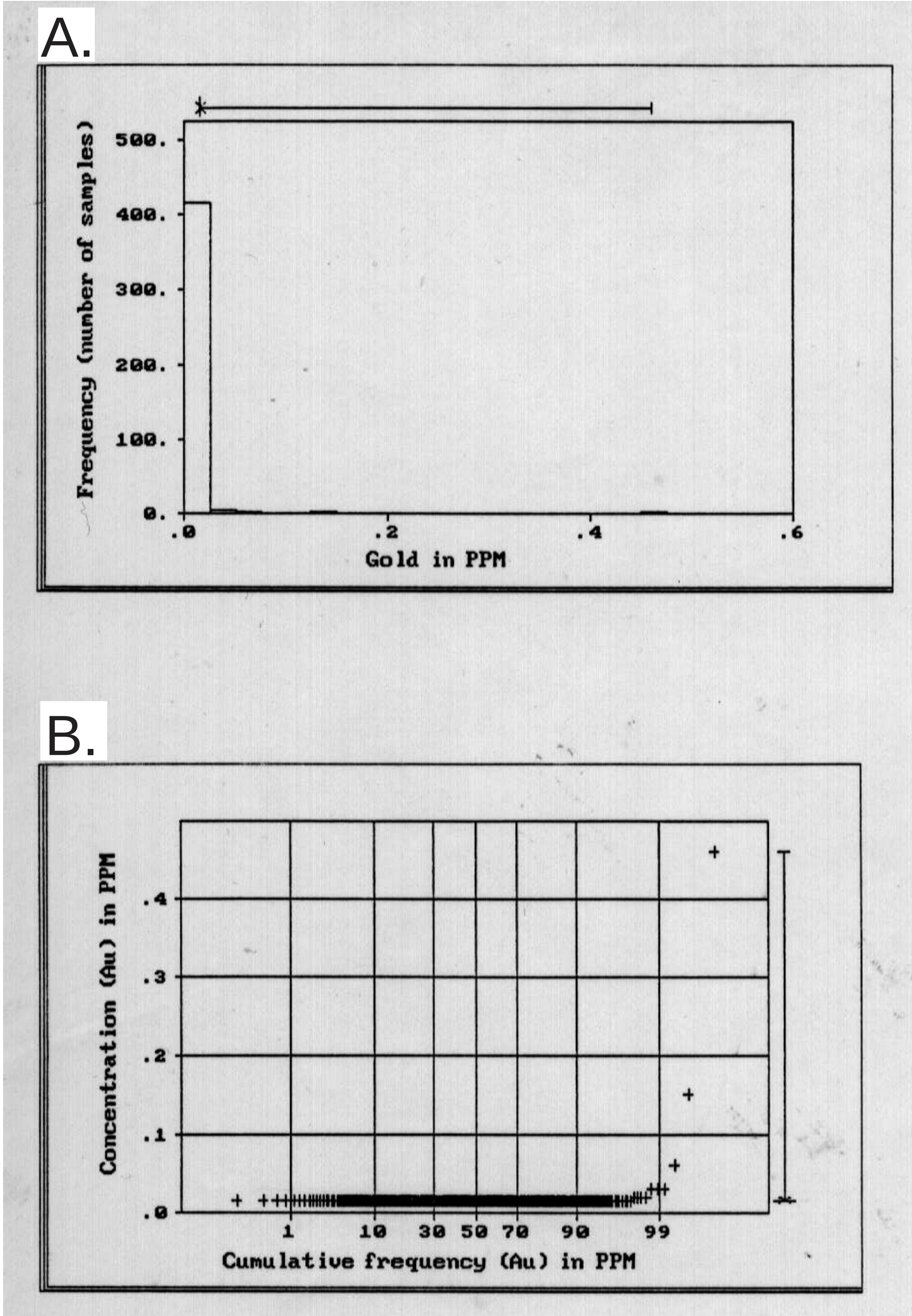


Figure 37 -- A. Histogram for gold in soil data for Isla de Vieques.
B. Cumulative frequency plot for gold in soil data for Isla de Vieques.

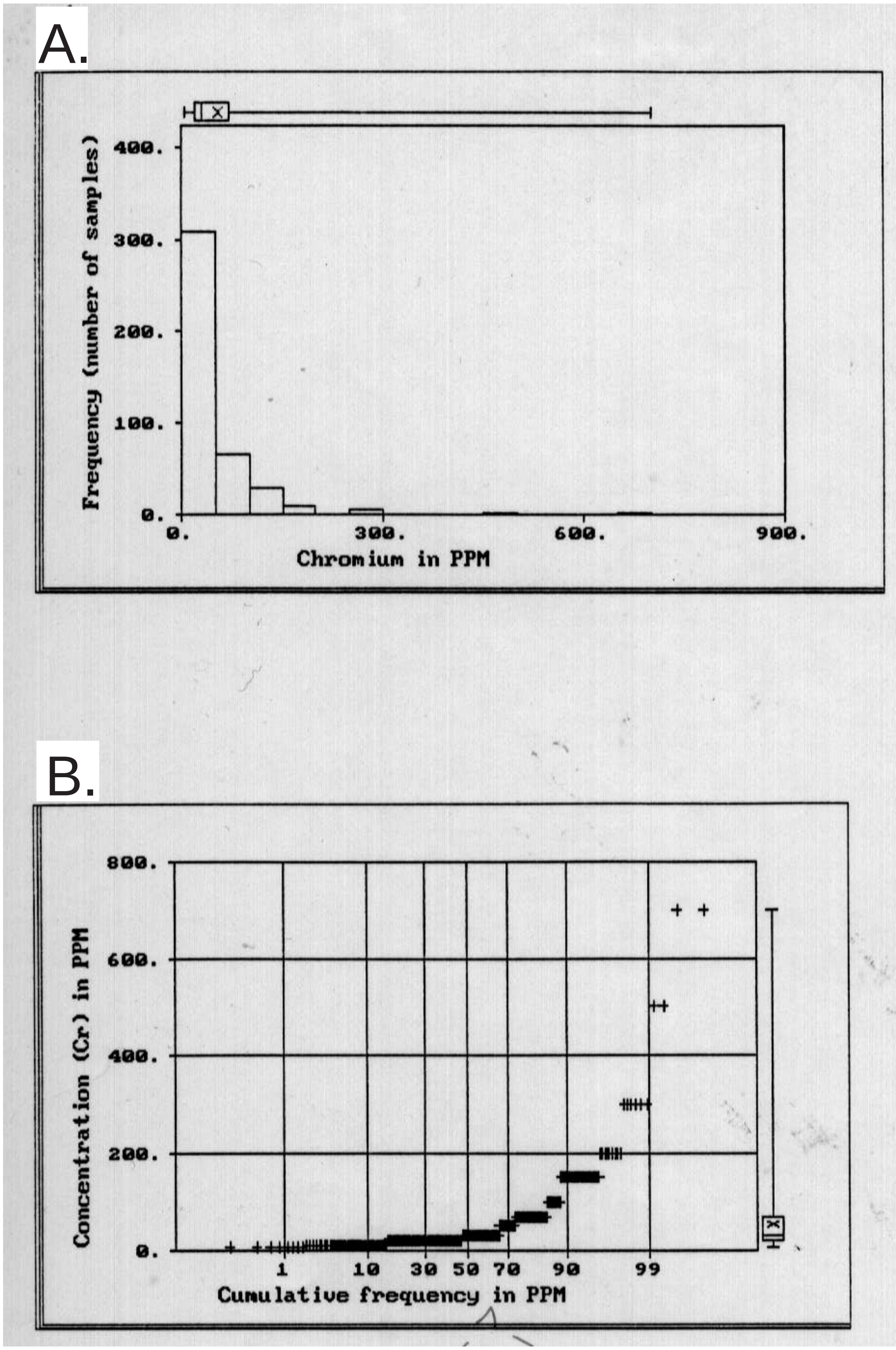
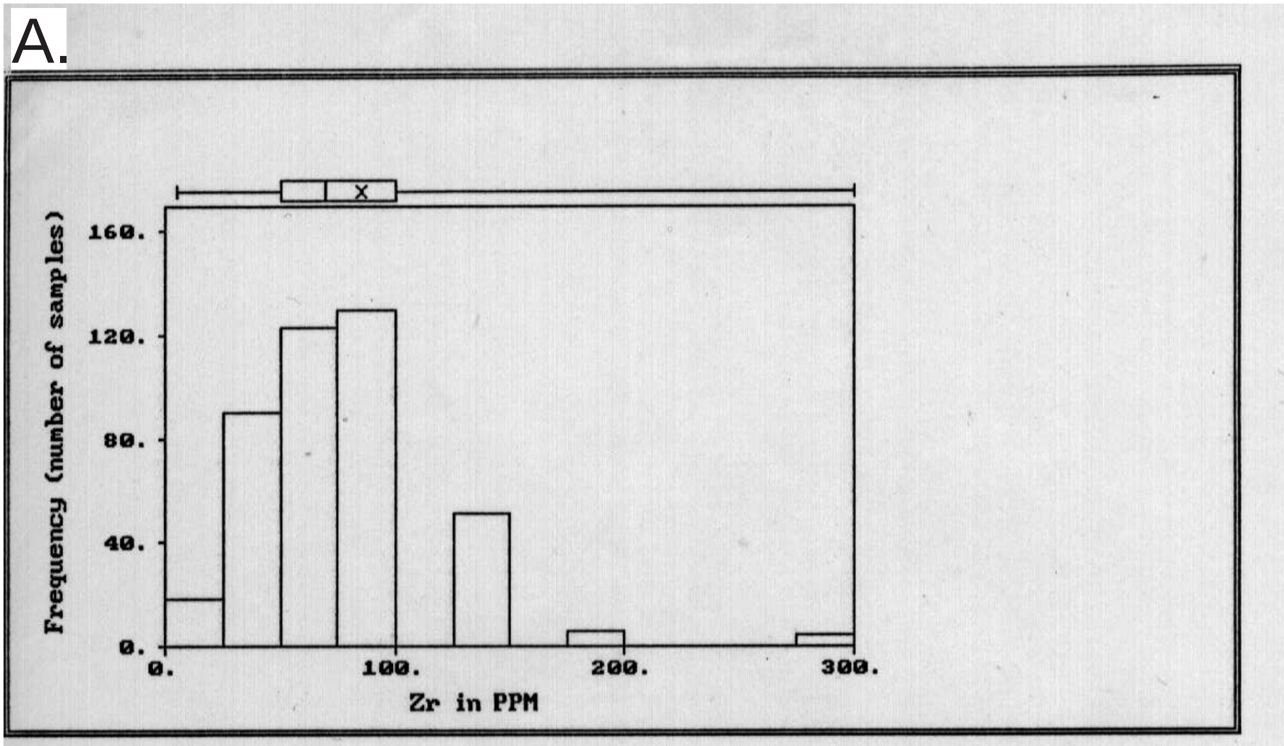


Figure 38 -- A. Histogram for chromium in soil data for Isla de Vieques.
B. Cumulative frequency plot for chromium in soil data for Isla de Vieques.



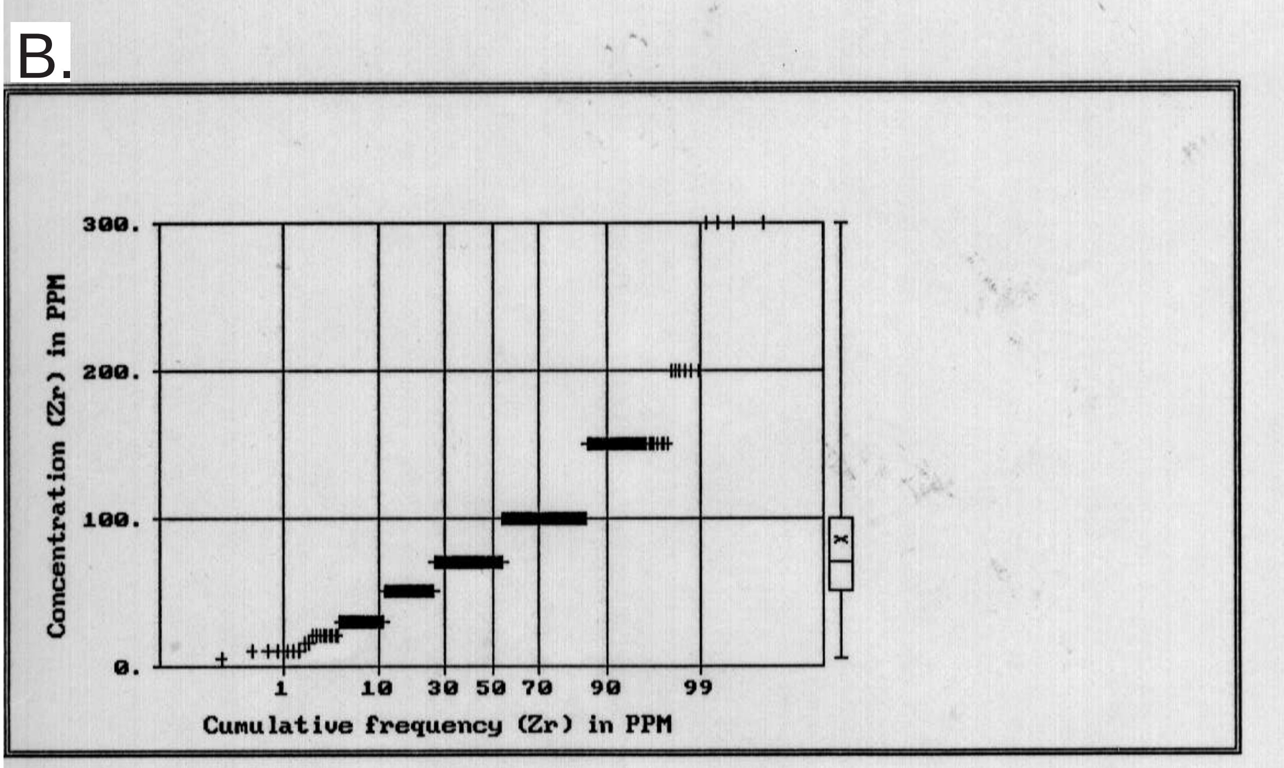


Figure 39 -- A. Histogram for zirconium in soil data for Isla de Vieques.
B. Cumulative frequency plot for zirconium in soil data for Isla de Vieques.

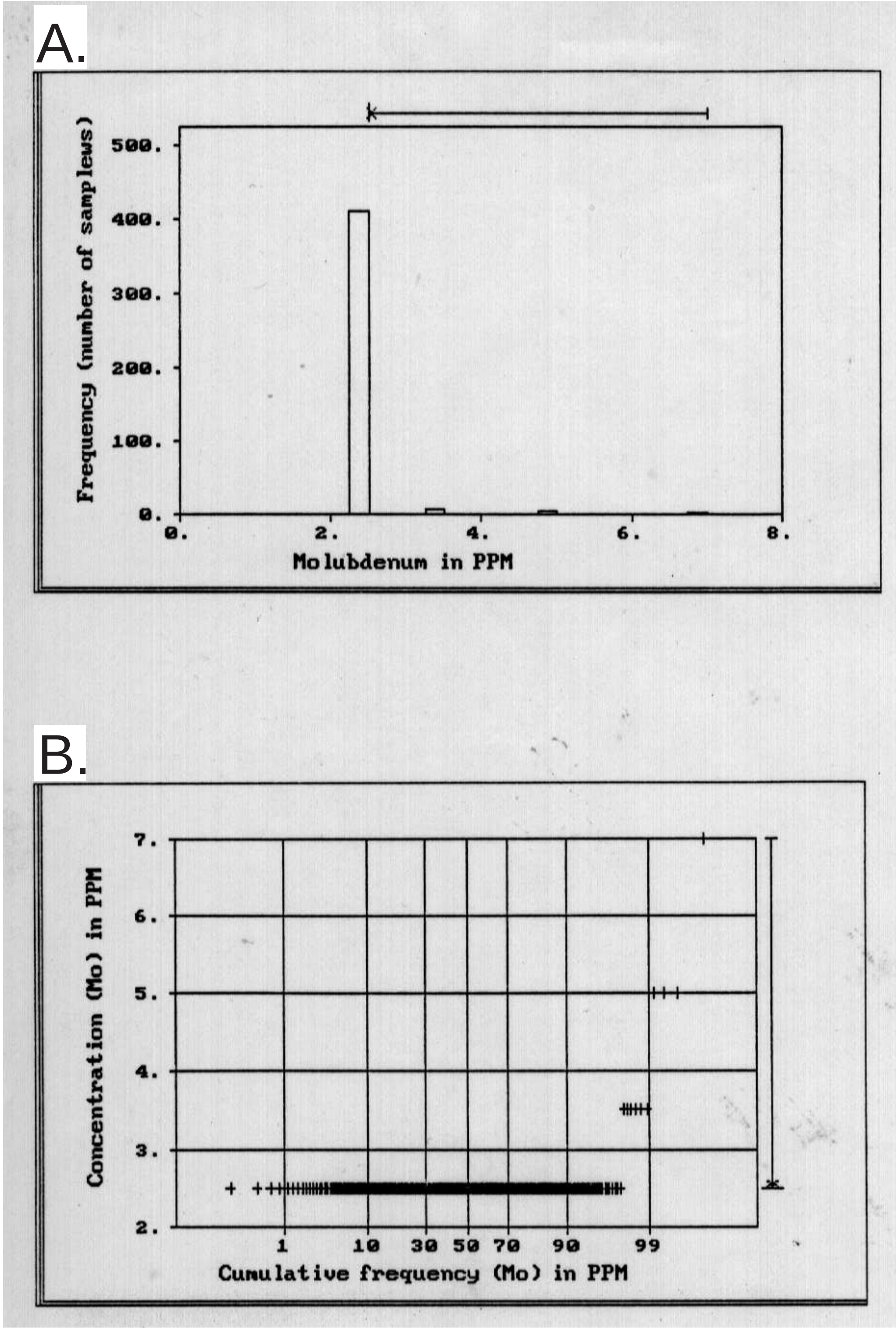
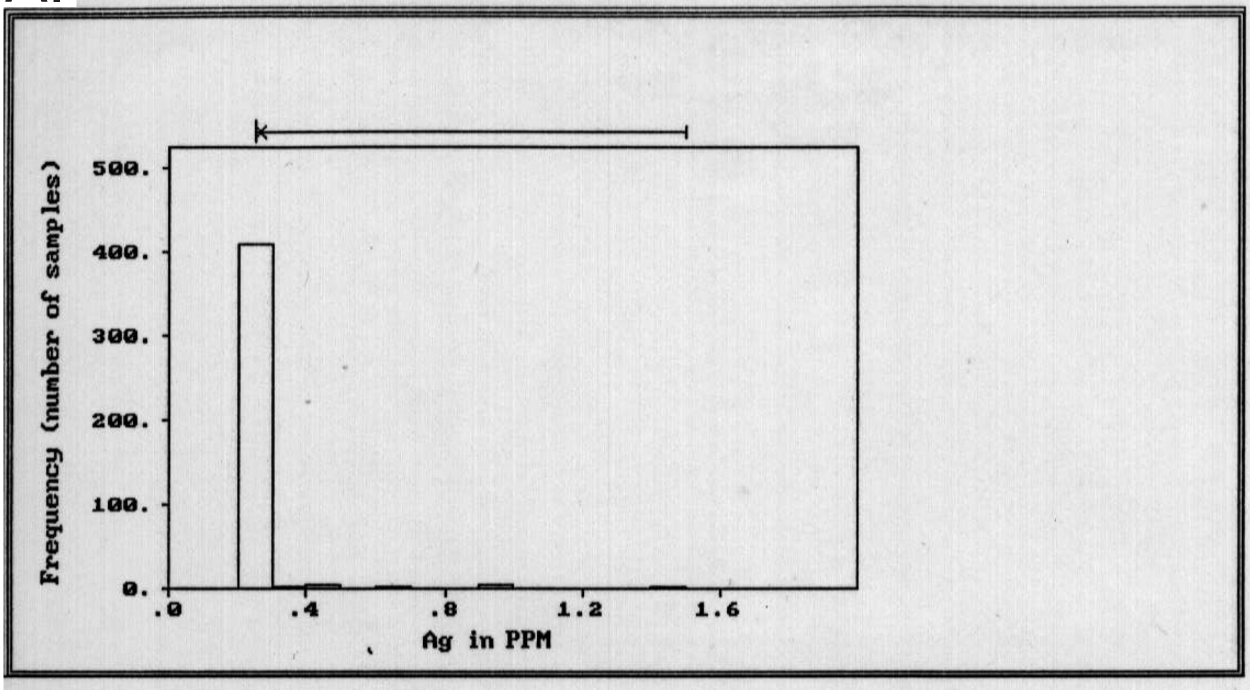


Figure 40 -- A. Histogram for molybdenum in soil data for Isla de Vieques.
B. Cumulative frequency plot for molybdenum in soil data for Isla de Vieques.

A.



B.

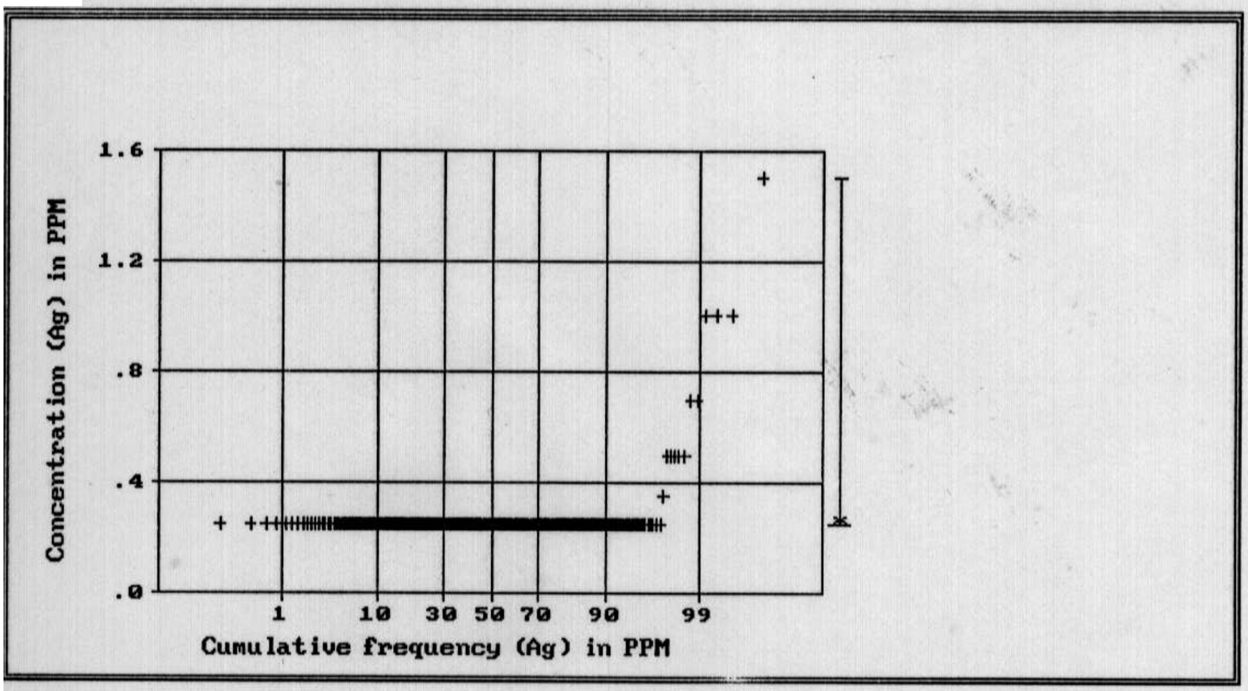


Figure 41 -- A. Histogram for silver in soil data for Isla de Vieques.
B. Cumulative frequency plot for silver in soil data for Isla de Vieques.

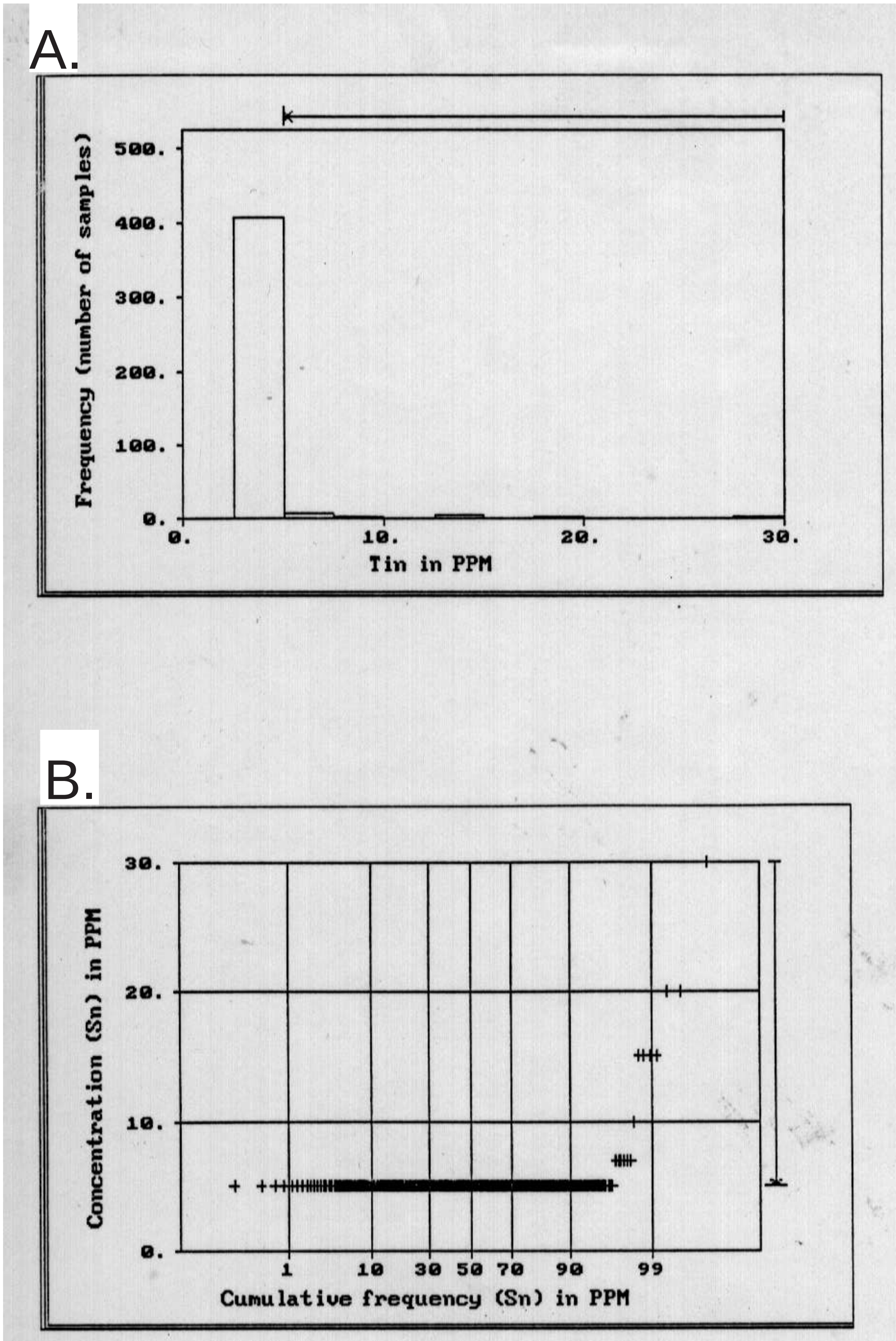
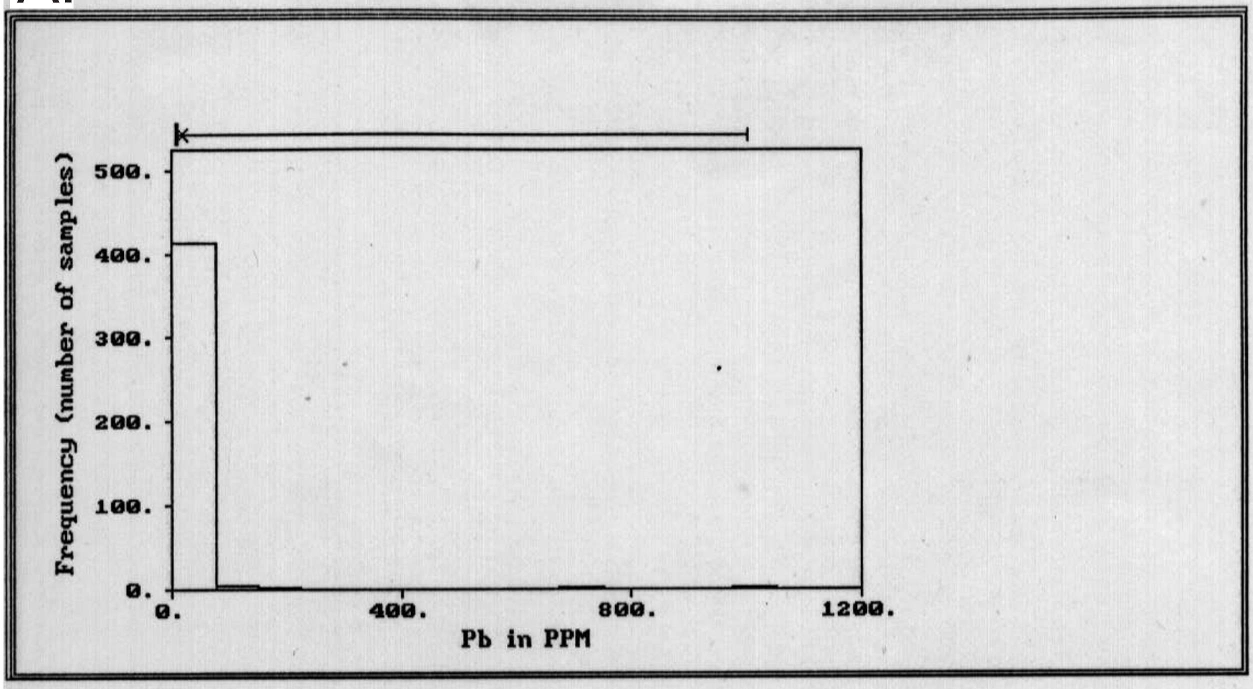


Figure 42 -- A. Histogram for tin in soil data for Isla de Vieques.
B. Cumulative frequency plot for tin in soil data for Isla de Vieques.

A.



B.

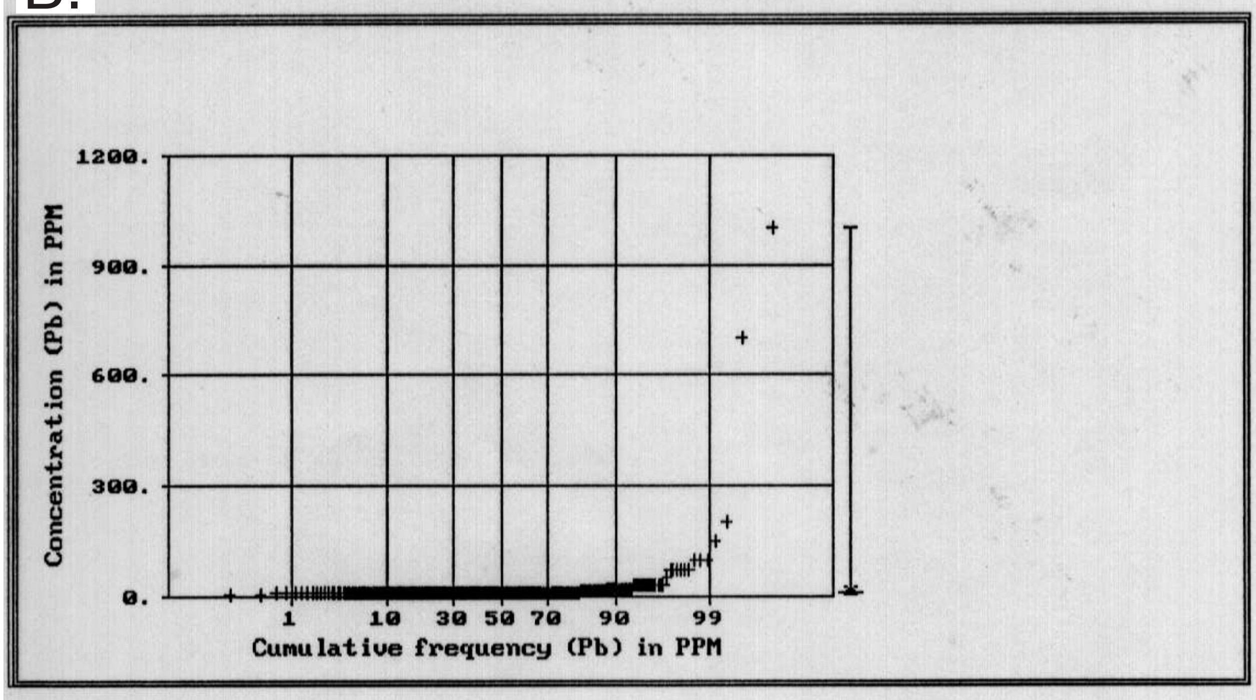
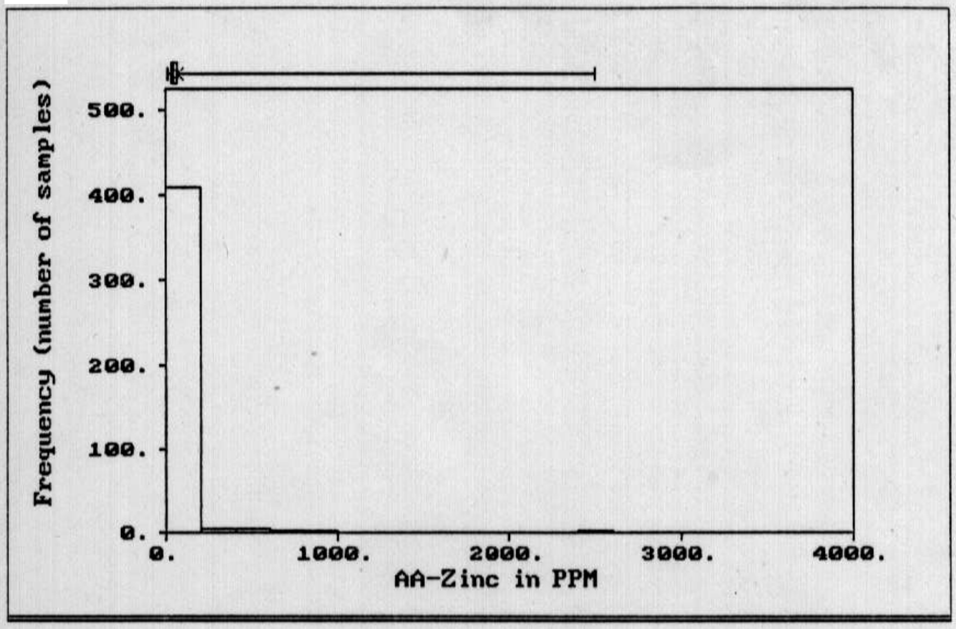


Figure 43 -- A. Histogram for lead in soil data for Isla de Vieques.
B. Cumulative frequency plot for lead in soil data for Isla de Vieques.

A.



B.

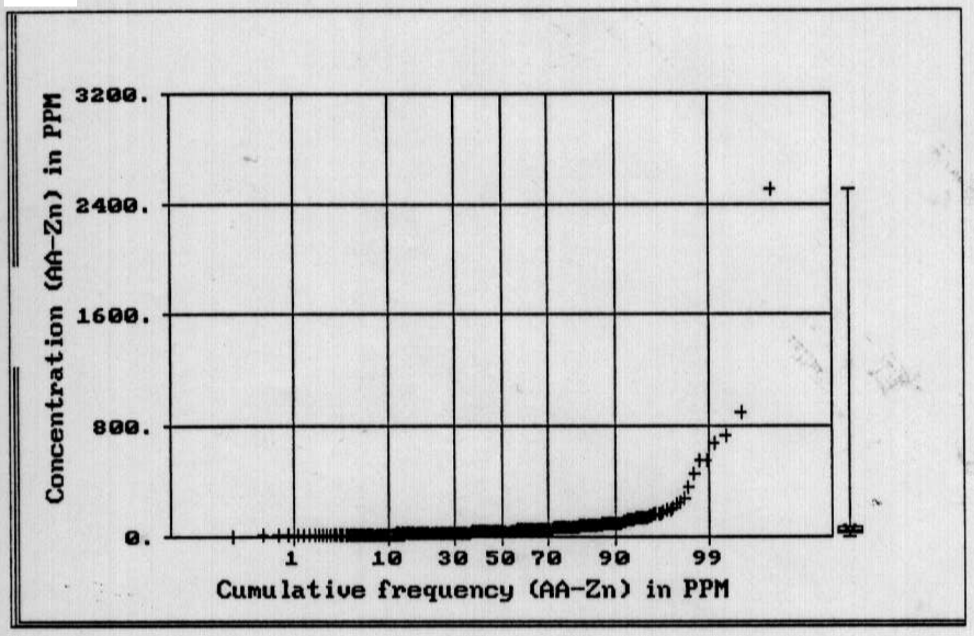
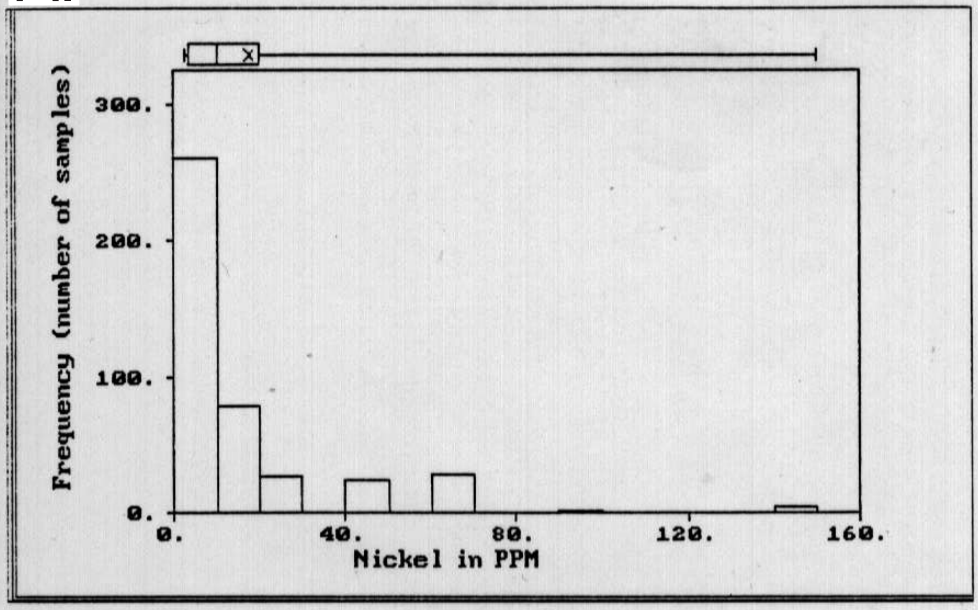


Figure 44 -- A. Histogram for zinc in soil data for Isla de Vieques.
B. Cumulative frequency plot for zinc in soil data for Isla de Vieques.

A.



B.

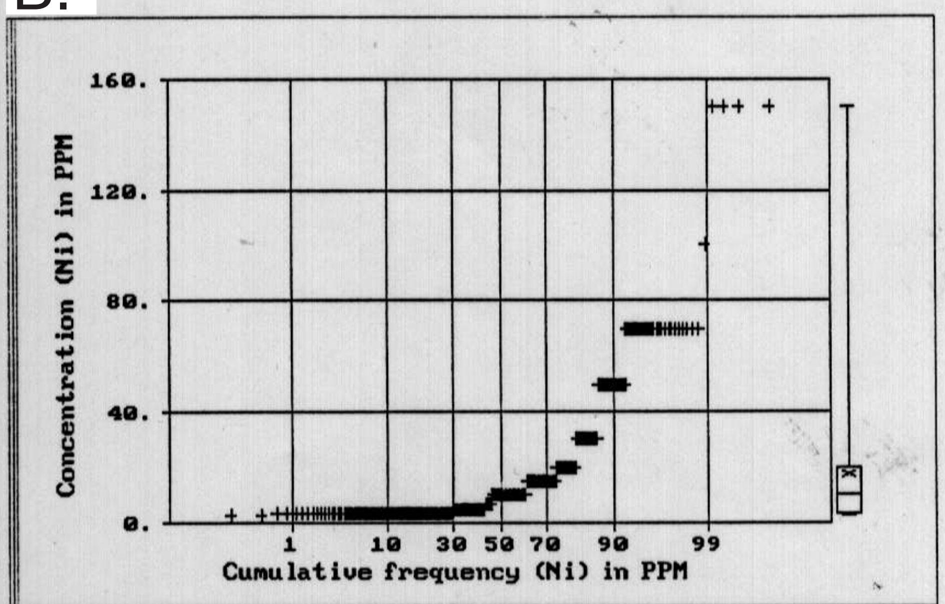
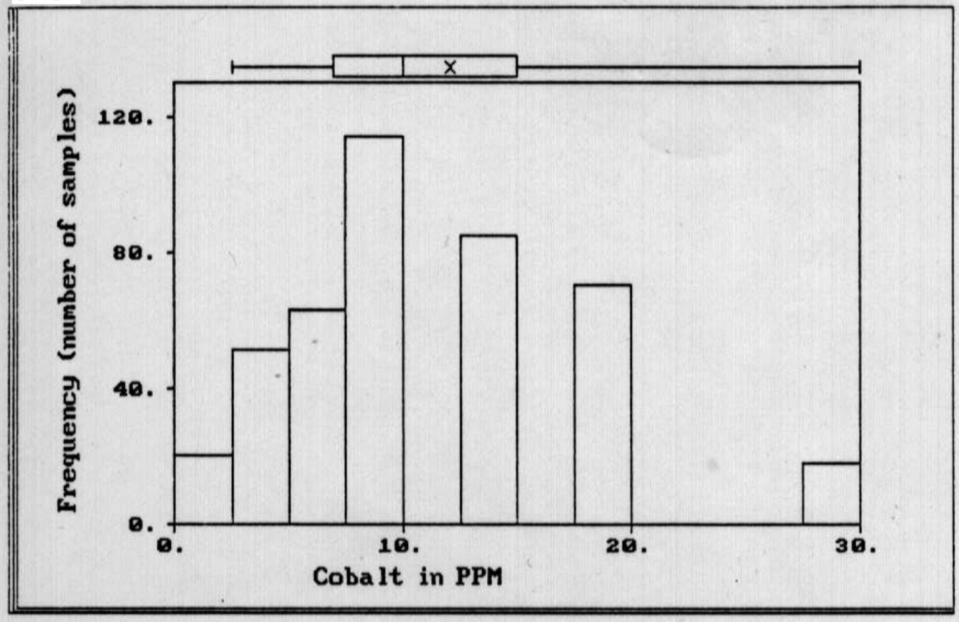


Figure 45 -- A. Histogram for nickel in soil data for Isla de Vieques.
B. Cumulative frequency plot for nickel in soil data for Isla de Vieques.

A.



B.

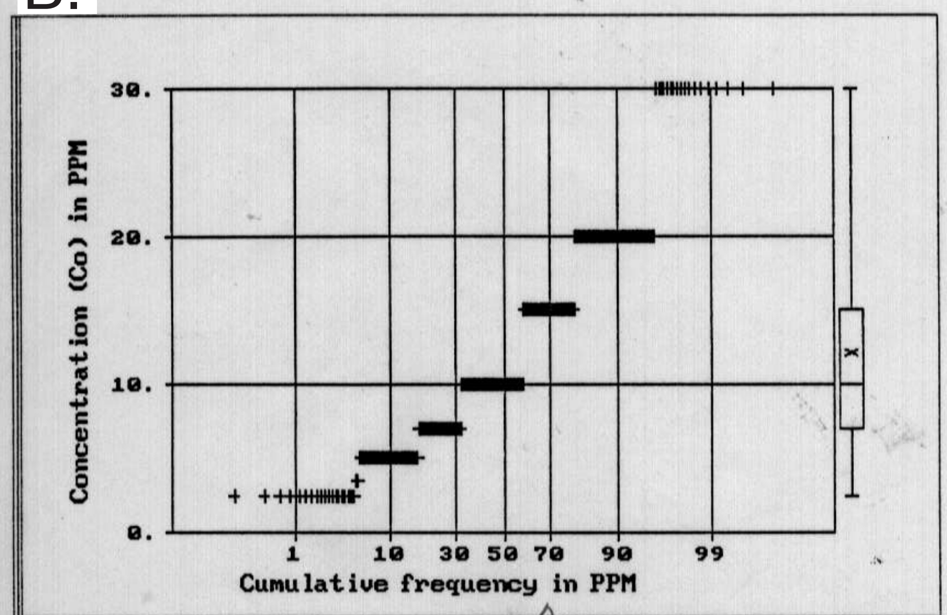


Figure 46 -- A. Histogram for cobalt in soil data for Isla de Vieques.
B. Cumulative frequency plot for cobalt in soil data for Isla de Vieques.

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Analytical results for stream sediment and soil samples from the Commonwealth of Puerto Rico, Isla de Culebra, and Isla de Vieques

By
Sherman P. Marsh

Open-File Report 92-353A

U.S. Geological Survey, DFC, Box 25046, MS 973, Denver, CO 80225

1992

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ILLUSTRATIONS

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INTRODUCTION

This report presents the results of a geochemical survey of the Commonwealth of

Puerto Rico, Isla de Culebra, and Isla de Vieques as digital data files on a 1.2 megabyte floppy disk. A regional stream-sediment geochemical survey of Puerto Rico began in the early 1970's as an outgrowth of the cooperative exploration geochemical studies by the Department of Natural Resources of Puerto Rico (DNR) and the U.S. Geological Survey (USGS) on the Rio Tanama and Rio Vivi copper projects. From the early 1970's through the mid-1980's stream sediment sampling continued over a large part of the island. In 1980 a cooperative project between DNR and the USGS was started to continue the regional stream sediment sampling program and continued for several years. A total of 2560 stream sediment samples were collected during this phase of the project. In 1990 a systematic search of USGS computer records yielded a geochemical data set for the stream sediments which indicated that the geochemical sample net for the island was incomplete. In 1991 two field trips were made to Puerto Rico and an additional 292 stream sediment samples were collected and analyzed in order to complete the regional geochemical survey. The analytical results of a total of 2852 stream sediment samples are included on the floppy disk. In addition to the main island of Puerto Rico, the islands of Culebra and Vieques were sampled.

GEOLOGY (from Schellekens, 1991)

Puerto Rico, the eastern-most island of the Greater Antilles, is a translational island-arc terrane with a geologic record of 140 million years. The island lies within the seismically active Caribbean-North American Plate boundary zone. The relative motion between the two plates is on the order of 2 cm per year and is mainly taken up by strong oblique underthrusting and left-lateral faulting in the Puerto Rico trench. A well defined southward dipping Benioff zone occurs under the eastern half of the island but is missing under the west side (McCann and Sykes, 1984; Schell and Tarr, 1978). Some plate motion and underthrusting also occurs south of Puerto Rico in the Muertos Trough.

Puerto Rico and the Virgin Islands appear to be a separate tectonic block within the plate boundary zone. Puerto Rico is separated from Hispaniola on the west by a zone of active extension, which runs from the Mona canyon through the southwestern quarter of the island. On land extensional faulting has produced the distinctive ridge and valley topography and generally low elevations of southwestern Puerto Rico. Eastern Puerto Rico and the northern Virgin Islands are separated from St. Croix and the Lesser Antilles by another active zone of extension which formed the Whiting Basin (south of Puerto Rico, the Virgin Islands basin, and the Anegada Passage.

Puerto Rico consists of volcanic, volcaniclastic, and sedimentary rocks of Late Jurassic to Early Tertiary age, which were intruded by felsic plutonic rocks during the Late Cretaceous and Early Tertiary, and are overlain by slightly tilted Oligocene and younger sedimentary rocks and sediments (Briggs and Akers, 1965).

Island-wide lithostratigraphic correlation within the basement rocks is difficult because individual units appear to have limited original lateral extent and the rocks have been subsequently strongly deformed and faulted. To overcome these correlation problems earlier workers divided the island into structural blocks (Cox and Briggs, 1973) or subprovinces (Barabas, 1977).

Figure 1. The Commonwealth of Puerto Rico, Isla de Culebra, and Isla de Vieques

METHODS OF STUDY

Sample Media and Collection

During the cooperative project between the USGS and DNR sediment samples were collected from first order streams that drained basins from less than 1 square kilometer to as much as 3 square kilometers. The sediment samples were collected from the main channel of mostly active streams. The sediment samples collected in 1991 were from first and second order streams and represented drainage basins as large as 10 square kilometers. These samples were also collected from the main channel of active streams. The island of Vieques was geochemically sampled for soils in 1972 and a report describing the results are discussed in Learned and Boissen (1972). A soil sample survey for Isla de Vieques was conducted, rather than a stream sediment survey, because stream drainages were poorly developed and commonly filled with colluvium and, when near populated areas, highly contaminated. A total of 421 soil samples were taken of the C horizon (weathered bedrock) on 0.5 kilometer centers on northwest trending traverses spaced approximately 1 kilometer apart. The small island of Culebra was sampled geoochemically in late 1970 as part of a study to determine the islands natural resources, development potential, and socio-economic aspects (Commonwealth of Puerto Rico, 1970). Because of the lack of active streams on the island geochemical samples of dry stream bed material were collected. This material included pebbles and cobbles showing the most intense iron staining and any material showing traces of mineralization. A total of 46 samples were collected.

Sample Preparation

All samples were sieved to minus 80 mesh (0.18 mm) and then pulverized to approximately minus-100 mesh (minus-0.15 mm) with a grinder using ceramic plates.

Sample Analysis

All samples were analyzed for 35 elements using a semiquantitative, direct-current arc emission spectrographic method (Grimes and Marranzino, 1968). The elements analyzed and their limits of determination are listed in table 2. Values determined for the major elements (iron, magnesium, calcium, phosphorus, sodium, sulfur and titanium) are given in weight percent; all others are given in parts per million (micrograms/gram).

Spectrographic results were obtained by visual comparison of spectra derived from the sample against spectra obtained from standards made from pure oxides and carbonates. Standard concentrations are geometrically spaced over any given order of magnitude of concentration as follows: 100, 50, 20, 10, and so forth. Samples whose concentrations are estimated to fall between those values are assigned values of 70, 30, 15, and so forth. The precision of the analytical method is approximately plus or minus one reporting interval at the 83 percent confidence level and plus or minus two reporting intervals at the 96 percent confidence level (Motooka and Grimes, 1976).

Atomic absorption results for gold were obtained after preparing the samples for analysis using the method of Thompson and others (1968) for samples collected between 1970 and 1985 and by the method of O'Leary and Meier (1986) for samples collected in 1991. Atomic absorption results for zinc were obtained by using a nitric acid digestion method described by Ward and others, (1969) for the samples collected between 1970 and 1985. for samples collected in 1991 zinc, and 9 other elements, were analyzed using ICP-AES by the method of Motooka (1988) (Table 2).

DATA STORAGE SYSTEM

Upon completion of the analytical work, the results were entered into a U.S. Geological Survey computer data base called RASS. This data base contains both descriptive geological information and analytical data. Any or all of this information may be retrieved and converted to a binary form (STATPAC) for computerized statistical analysis or publication (VanTrump and Miesch, 1977).

COMPUTER DISKETTE

The following text is included on the 1.2 megabyte diskette as a readme file titled "README.DOC". In addition to this file there are data files and a file containing the complete text of this report.

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Analytical results of stream sediment samples from the Commonwealth of Puerto Rico

By

Sherman P. Marsh

Open-File Report 92-353A

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards. Any use of trade, product or firm names is for descriptive purposes only and does not imply endorsement by the USGS.

U.S. Geological Survey, DFC, Box 25046, MS 973, Denver, CO 80225
1992

FILES ON THIS DISK

CULEBRA.STP is a binary file of chemical data for Isla de Culebra
VIEQUES.STP is a binary file of chemical data for Isla de Vieques
PRNEW.STP is a binary file of 1991 chemical data for Puerto Rico
PROLD.STP is a binary file of 1975-1985 chemical data for Puerto Rico
STP2DAT.EXE is a conversion program from "STP" data file to other commonly used data files (DBF, CMN, PST, DIF, and others).
PROFR.ASC is an ASCI text file of the U.S. Geological Survey Open-File Report 92-
README.DOC is an ASCI text file explaining the files on this diskette

The data tables (*.STP) can be converted into several formats, including DBF, DIF, and ASCII by using the program STP2DAT, authored by W.D. Grundy of the USGS. This program is included on this disk.

This disk contains geochemical data from 2560 stream sediment samples collected in Puerto Rico, 421 soil samples collected on Isla de Vieques, and 35 soiL samples were collected on Isla de Culebra. Each rock sample was analyzed for 35 elements by a semiquantitative spectrographic method and for gold and zinc by other chemical methods. Requirements: IBM PC or compatible, 1.2 megabyte disk drive, and a minimum 512K RAM. To order a paper or microfiche copy of this report, order OF92-353A, p. and to order an executable diskette, order OF92-353B.

Disclaimer:
Although the program STP2DAT.EXE has been used by the U.S. Geological Survey, no warranty, expressed or implied is made by the USGS as to the accuracy and functioning of the program and related material, nor shall the fact of distribution constitute any such warranty, and no responsibility is assumed by the USGS in connection therewith.

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TABLE 1. Limits of determination for spectrographic analysis of stream sediment and soil samples

Elements	Lower determination limits	upper determination limits
	Percent	
Iron (Fe)	0.05	20
Magnesium (Mg)	0.02	10
Calcium (Ca)	0.05	20
Titanium (Ti)	0.002	1
	Parts per million (ppm)	
Manganese (Mn)	10	5,000
Silver (Ag)	0.5	5,000
Arsenic (As)	200	10,000
Gold (Au	10	500
Boron (B)	10	20,000
Barium (Ba)	20	5,000
Beryllium (Be)	1	1,000
Bismuth (Bi)	10	1,000
Cadmium (Cd)	20	500
Cobalt (Co)	5	2,000
Chromium (Cr)	10	5,000
Copper (Cu)	5	20,000
Lanthanum (La)	20	1,000
Molybdenum (Mo)		2,000
Niobium (Nb)	20	2,000
Nickel (Ni)	5	5,000
Lead (Pb)	10	20,000
Antimony (Sb)	100	10,000
Scandium (Sc)	5	100
Tin (Sn)	10	1,000
Strontium (Sr)	100	5,000
Vanadium (V)	10	10,000
Tungsten (W)	50	10,000
Yttrium (Y)	10	2,000
Zinc (Zn)	200	10,000
Zirconium (Zr)	10	1,000

Thorium (Th)	100	2,000

Table 2. Limits of determination for atomic absorption (aa) and inductively coupled plasma-atomic emission spectroscopic analysis of stream sediment and soil samples

Element determined	Method	Lower Limit of Determination (ppm)	References
Gold (Au)	aa	0.05	Thompson and others, 1968
Gold (Au)	aa	0.002	O'Leary and Viets, 1986
Zinc (Zn)	aa	5	Ward and others, 1969
Zinc (Zn)	ICP	0.05	Motooka, 1988
Copper (Cu)	"	0.05	" "
Lead (Pb)	"	0.60	" "
Silver (Ag)	"	0.10	" "
Gold (Au)	"	0.15	" "
Bismuth (Bi)	"	1.0	" "
Cadmium (Cd)	"	0.05	" "
Molybdinum (Mo)	"	0.09	" "
Antimony (Sb)	"	1.0	" "
Arsenic (As)	"	1.0	" "