STATE OF ARKANSAS

Arkansas Geological Commission
William V. Bush, State Geologist

INFORMATION CIRCULAR 35

A REGIONAL SURVEY OF THE DISTRIBUTION OF SILVER, ARSENIC, CHROMIUM, COPPER, NICKEL, LEAD, AND ZINC IN THE ROCKS OF THE OUACHITA MOUNTAINS OF ARKANSAS

by

John David McFarland, Charles G. Stone, and Joe F. Nix

Little Rock, Arkansas
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A REGIONAL SURVEY OF THE DISTRIBUTION OF SILVER, ARSENIC, CHROMIUM, COPPER, NICKEL, LEAD, AND ZINC IN THE ROCKS OF THE OUACHITA MOUNTAINS OF ARKANSAS

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Introduction and Background:

The geochemical survey of the rocks of the Ouachita Mountains of Arkansas to determine the natural distribution of mercury (Stone, Nix, and McFarland, 1995) presented the opportunity to analyze the same sample set for additional elements. Seven other elements were initially chosen for analysis: silver, chromium, cobalt, copper, nickel, lead, and zinc. The cobalt data was subsequently tossed out when quality controls indicated that the analytical data lacked sufficient accuracy. A few of the samples from a small, selected geographic region were also analyzed for arsenic. Originally, 728 lithic samples were collected throughout the highland drainage basins of the Little Missouri, Caddo, Ouachita and Saline Rivers (Figure 1). A small number of these samples were not analyzed for every element because of duplicate, spiked, insufficient, or lost samples.

The highland drainage basins of the Little Missouri, Caddo, Ouachita, and Saline Rivers lies within the Ouachita Mountain province of Arkansas. The Ouachita Mountains are made up of Paleozoic age sedimentary rocks that have been mildly to severely deformed by Late Paleozoic compressional forces (Stone and McFarland, 1981). Late Cretaceous intrusions (mostly alkalic) are found in scattered locations and Tertiary and Cretaceous sediments overlap the Paleozoic strata to the east and south respectively. The exposed rocks are of generally deep-marine origin and are dominated (in decreasing order of abundance) by shale, sandstone, siltstone, chert/novaculite, and limestone. They were deposited during the Late Cambrian through the Middle Pennsylvanian Periods. Metallic mineralization is sometimes associated with major faults in the area. Samples were collected with this in mind and an effort was made to avoid all known occurrences of metallic mineralization.

Procedures:

The samples were gathered directly from both natural and culturally produced bedrock outcrops. Two to five kilograms of lithic material was collected from each site. Each sample was obtained from a fresh rock surface cleaned by chipping away the surface rock prior to sampling. The hammer used in collecting the samples was washed in distilled water before each collecting event. The overall collection strategy was to collect a random sample set that fairly represented the general area without giving special consideration to stratigraphic interval, structural environment, or degree of chemical or thermal alteration. Approximately seven samples per township (36 square miles) were collected.

The chemical analyses were carried out at Ouachita Baptist University. A sub-sample of approximately one gram of ground rock was weighed into a Teflon beaker. The sample was treated with a 1:1 mixture of nitric and hydrofluoric acid. The mixture was heated until

dissolution was complete. It should be noted that some black carbon residue (<1% of original sample) remained after this acid treatment. After cooling, the acid solution was diluted to 100 ml. The concentration of metals was determined using atomic absorption spectroscopy (Perkin Elmer Model 4000 with HGA 400 Graphite furnace). Arsenic was determined using the graphite furnace method while the other metals were determined using direct flame aspiration. These methods are described in Methods for determination of metals in environmental samples (EPA, 1991). The method number and detection limits (three standard deviations of a set of blanks) are given below:

Element	EPA Method	Detection limits
Silver	7760a	1 µg/g
Arsenic	7060A	0.4 µg/g
Chromium	7190	4 µg/g
Copper	7210	1 µg/g
Nickel	7520	2 µg/g
Lead	7420	5 µg/g
Zinc	7950	1 µg/g

Results:

The results of various chemical analyses is presented in the following pages as a table, a map, and a graph set for each of the elements. The table lists the means, deviations, and ranges for all the samples, listed formations, principle lithologies, and ages. The map presents the concentration distribution via a triangle symbol scaled to the sample concentration at that point. The graph set displays a set of histograms of the distribution of the data for each data subset as well as the overall sample distribution. The entire dataset is listed in Appendix A.

The formation, geologic period, and principle lithology data subsets do not include all samples for that element. Some samples were collected where the stratigraphic horizon was questionable or unknown and some samples involved uncommon lithologies. No statistics were generated for sample subsets where too few samples would result in meaningless results.

Samples means are presented as arithmetic means and standard deviations in most cases. Geometric means and deviations are listed in a few cases. The mean of a sample set should represent a fair approximation of central tendency. Visual inspection of the distribution of all the data determined the method used herein. When the data displayed a distribution that appeared reasonably normal, an arithmetic mean was used. When the data exhibited a distinct positively skewed frequency distribution, a geometric mean was calculated.

In some cases an inspection of the distribution of the data showed that a few sample concentration values were well beyond the bulk of the sample concentrations (see the 'all samples' graph in each element's graph set). These anomalous samples were selectively

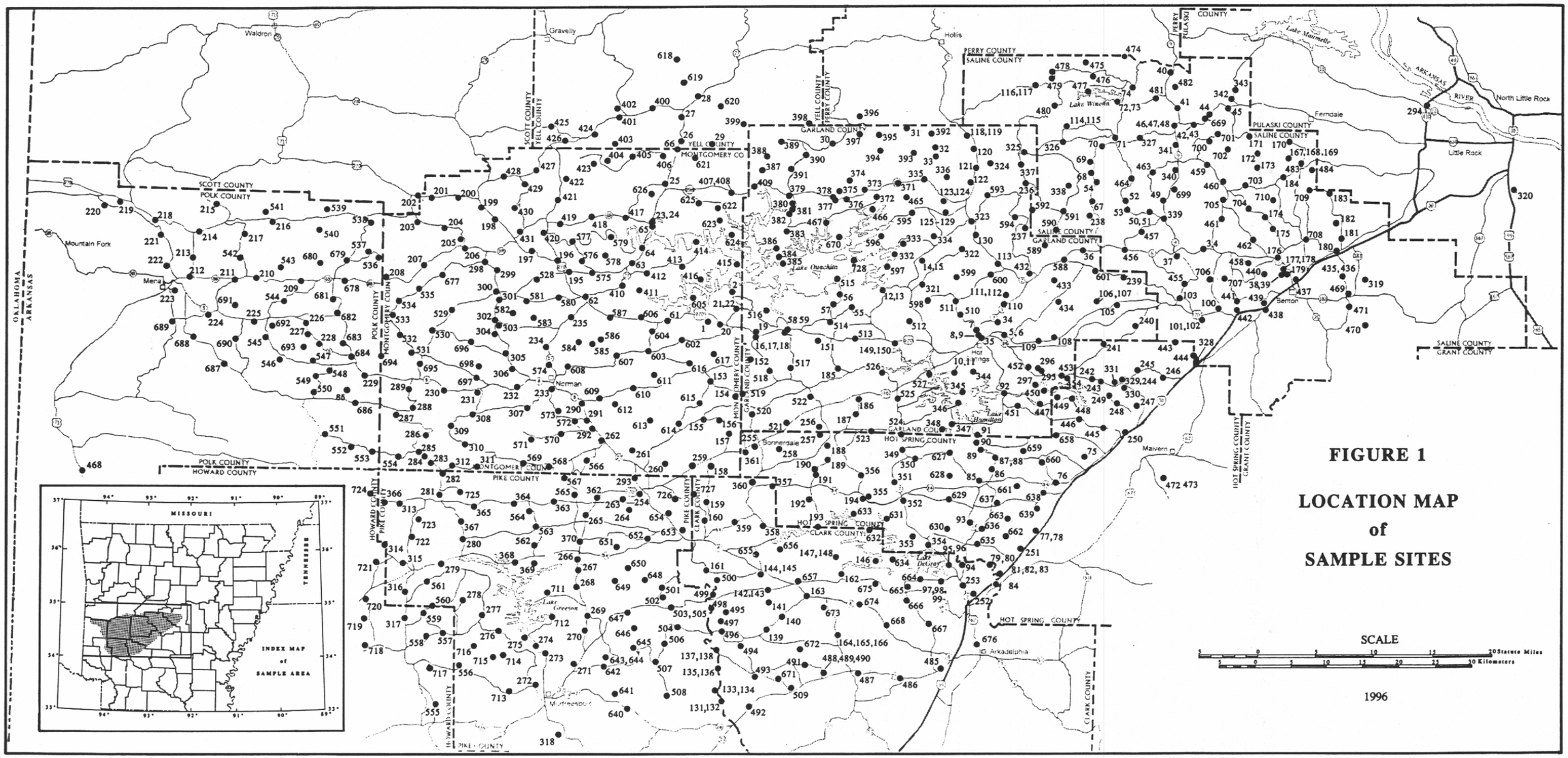


FIGURE 1

LOCATION MAP of SAMPLE SITES

1996

removed from the noted calculations. This procedure lowered the mean, significantly so in some cases, but had the greatest effect on the deviation values.

Tables 8 and 9 list the correlation coefficients calculated via the CORREL() function of Microsoft's Excel 5.0 for the six metals reported in this IC, plus the mercury values reported earlier in Arkansas Geological Commission's IC 32. Twenty-one coefficients were calculated for each of the different groupings, one for each possible combination of the seven metals. The arsenic data was not included in this correlation due to the limited number of samples available for comparison. The dataset was grouped by formation, principle lithology, and geologic time period. With the exception of the Tertiary Period data listed in Table 9, only categories with 10 or more values were used. The coefficients that are significant at the 95% confidence level are indicated by bold type. Most of the significant correlations are weak to moderate, but a few strong correlations do exist.

Other studies of element concentration in surface rocks and soils of the United States have yielded values not significantly different from the values determined herein (see below).

Source	Samples	Method	Ag	As	Cr	Cu	Ni	Pb	Zn
This report	700+	Arith	1.6	2.2*	74	33	37	32	66
T&W	shales	-	.07	13	90	45	68	20	95
T&W	sandstones	-	.0*x*	1	35	*x*.	2	7	16
T&W	carbonates	-	.0*x*	1	11	4	20	9	20
V,T,&K	30 AR/OK	Geo	-	-	110	42	45	19	-
V,T,&K	30 AR/OK	Arith	-	-	120	47	48	21	-
S,H,B&B	USA	Arith	-	-	53	25	20	20	54
S,H,B&B	USA	Geo	-	-	37	18	14	16	44
S,H,B&B	East USA	Geo	-	-	36	14	13	14	36
S&B	USA	Geo	-	5.2	37	17	13	16	48
S&B	USA	Arith(est.)	-	7.2	54	25	19	19	60
S&B	East USA	Geo	-	4.8	33	13	11	14	40
S&B	East USA	Arith(est.)	-	7.4	52	22	18	17	52

Average concentration values (in ppm) from other studies compared to the current effort. Samples indicates the number of samples the listed values are based on, the lithologies the samples came from, or the region that the samples came from. Method indicates the method used to calculate the mean: Arith - Arithmetic, Geo - Geometric. * - 24 samples; *x* - order of magnitude estimate; T&W - Turekian and Wedepohl, 1961; V,T,&K - Vine, Tourtelot, and Keith, 1969; S,H,B&B - Shacklette, Hamilton, Boerngen, and Bowles, 1971; S&B - Shacklette and Boerngen, 1984.

These other studies, however, are generally based on relatively few widely spaced samples often collected in a non-standardized manner. The Erickson, Chazin, and Haley (1986) study of drill core samples from Ordovician age rocks from Montgomery County is not included in the above list. They reported concentrations ranging from not detected to 5ppm for silver, not detected to 300ppm for arsenic, not detected to 100ppm for chromium, <5ppm to 300ppm for copper, <5ppm to 150ppm for nickel, not detected to 150ppm for lead, and not detected to >10,000ppm for zinc.

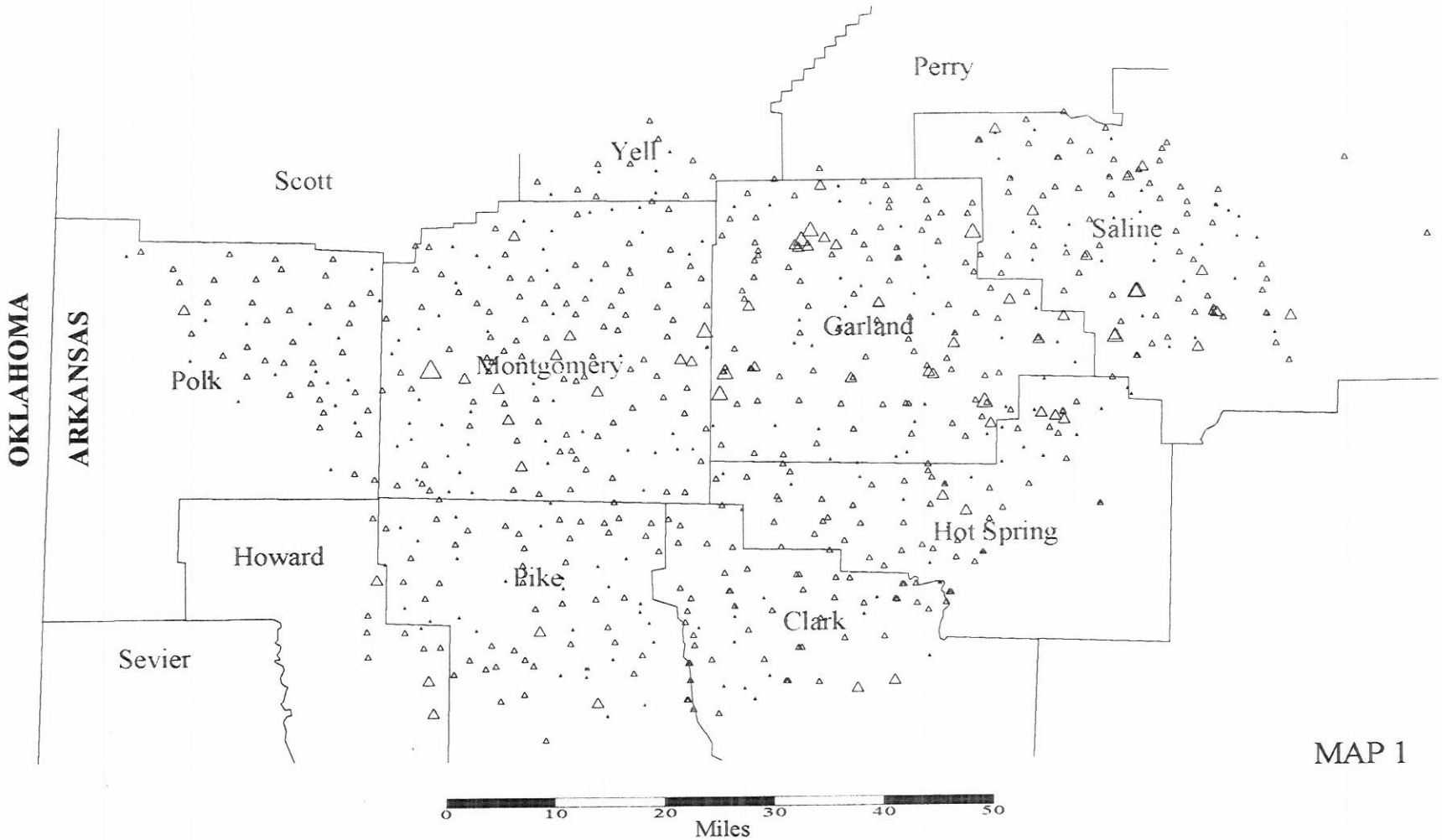
TABLE 1: SILVER

All values reported in parts per million (ppm). Arithmetic means and standard deviations used. Formations listed only when more than 10 samples were analyzed.

All Samples	Number of Samples	Mean	Deviation	Observed Range
All Samples	723	1.6	1.264	0 - 8
by Formation				
Atoka	19	1.6	0.815	0 - 2
Johns Valley	24	1.5	0.866	0 - 2
Jackfork	87	1.2	1.074	0 - 4
Stanley	229	1.6	1.013	0 - 6
Arkansas Novaculite	37	1.1	1.187	0 - 4
Polk Creek	16	1.5	1.323	0 - 4
Bigfork	39	1.0	1.687	0 - 8
Womble	46	2.2	1.397	0 - 6
Blakely	24	1.4	0.909	0 - 2
Mazarn	70	1.9	1.187	0 - 6
Crystal Mountain	13	0.8	1.250	0 - 4
Collier	12	3.2	1.518	2 - 6
by Period				
Tertiary	8	2.3	1.199	0 - 4
Cretaceous (sed rx only)	18	1.8	1.618	0 - 4
Pennsylvanian	135	1.3	1.013	0 - 4
Mississippian/Devonian	274	1.5	1.050	0 - 6
Silurian	11	1.4	0.923	0 - 2
Ordovician/Cambrian	241	1.7	1.415	0 - 8
by Principle Lithology				
Cretaceous Igneous	21	3.1	1.807	0 - 6
Limestone	24	3.6	1.412	0 - 6
Chert	65	1.3	1.470	0 - 8
Shale	514	1.6	1.054	0 - 6
Siltstone	17	1.5	1.091	0 - 4
Sandstone	38	1.0	1.000	0 - 2

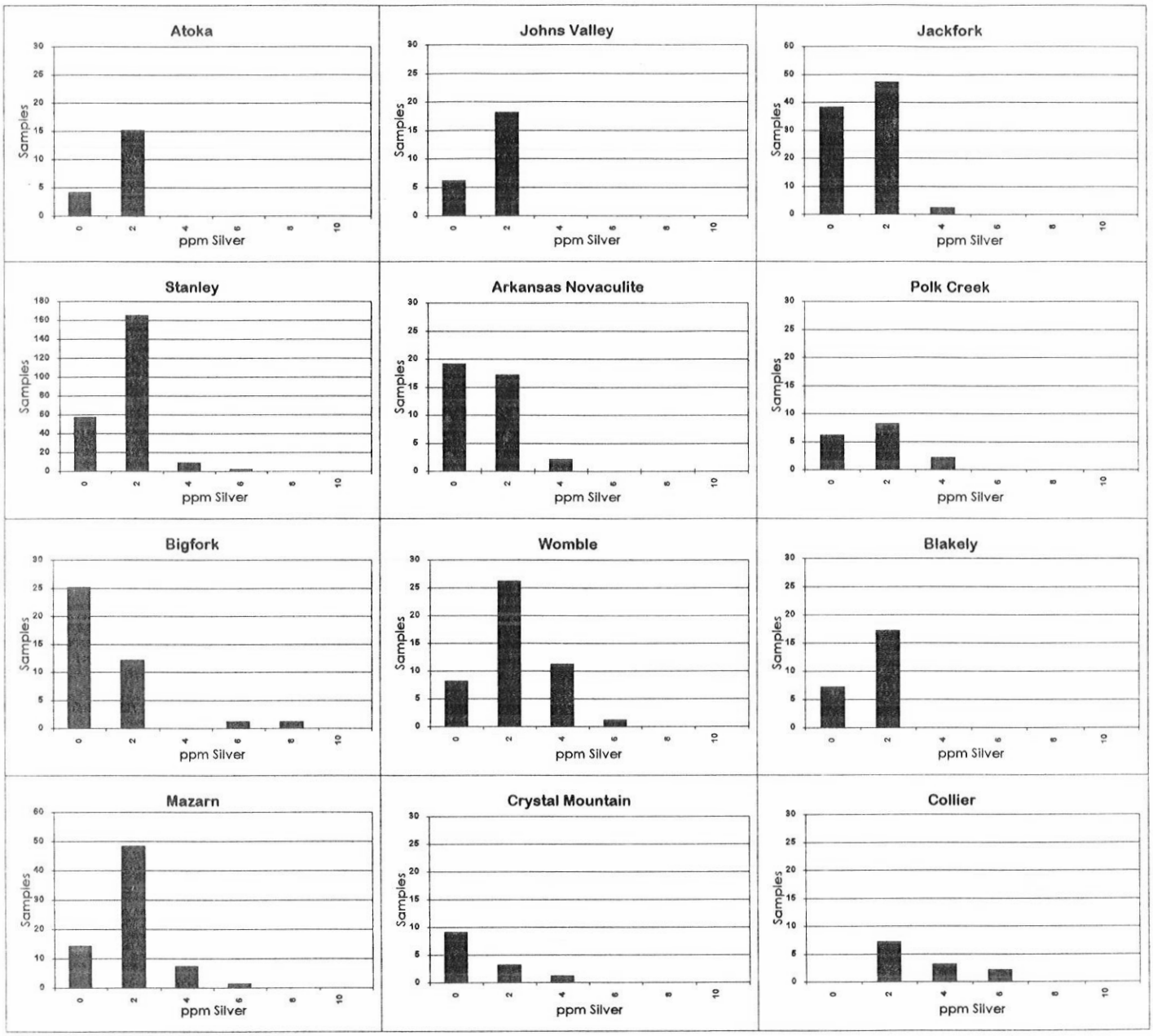
Silver Distribution

Symbol size denotes relative silver concentration ranging from 0 ppm to 8 ppm.



MAP 1

SILVER



GRAPH SET 1

These graphs show the distribution of sample silver concentrations in the rocks of the Ouachita Mountains of Arkansas. A separate sample concentration histogram is provided for each of the formations, periods, and lithologies listed in Table 1.

SILVER

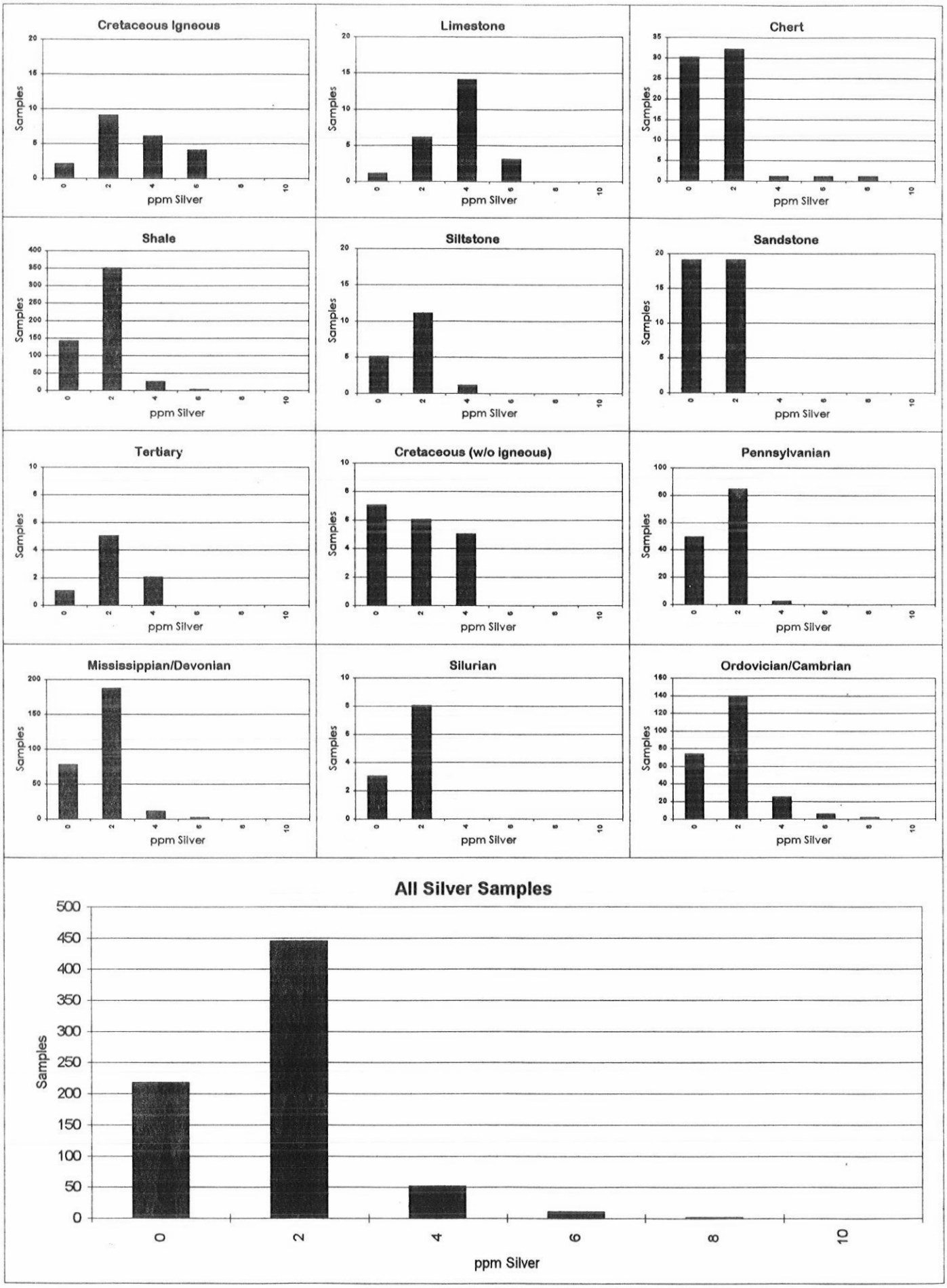
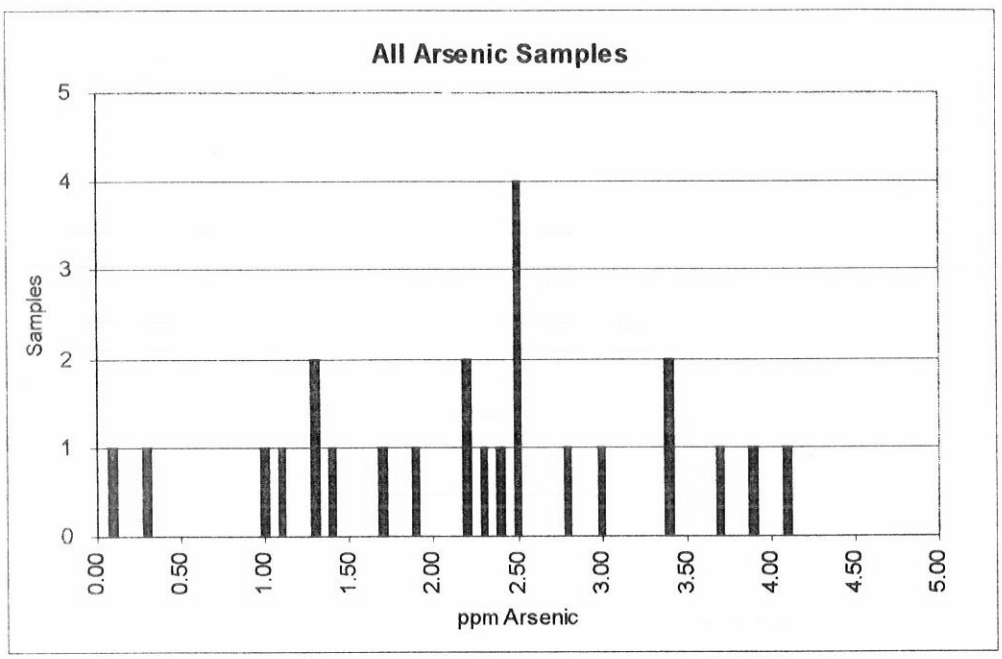

Cretaceous Igneous
Limestone
Chert
Shale
Siltstone
Sandstone
Tertiary
Cretaceous (w/o igneous)
Pennsylvanian
Mississippian/Devonian
Silurian
Ordovician/Cambrian
Samples
ppm Silver
All Silver Samples

TABLE 2: ARSENIC

All values reported in parts per million (ppm). Arithmetic mean and standard deviation used.

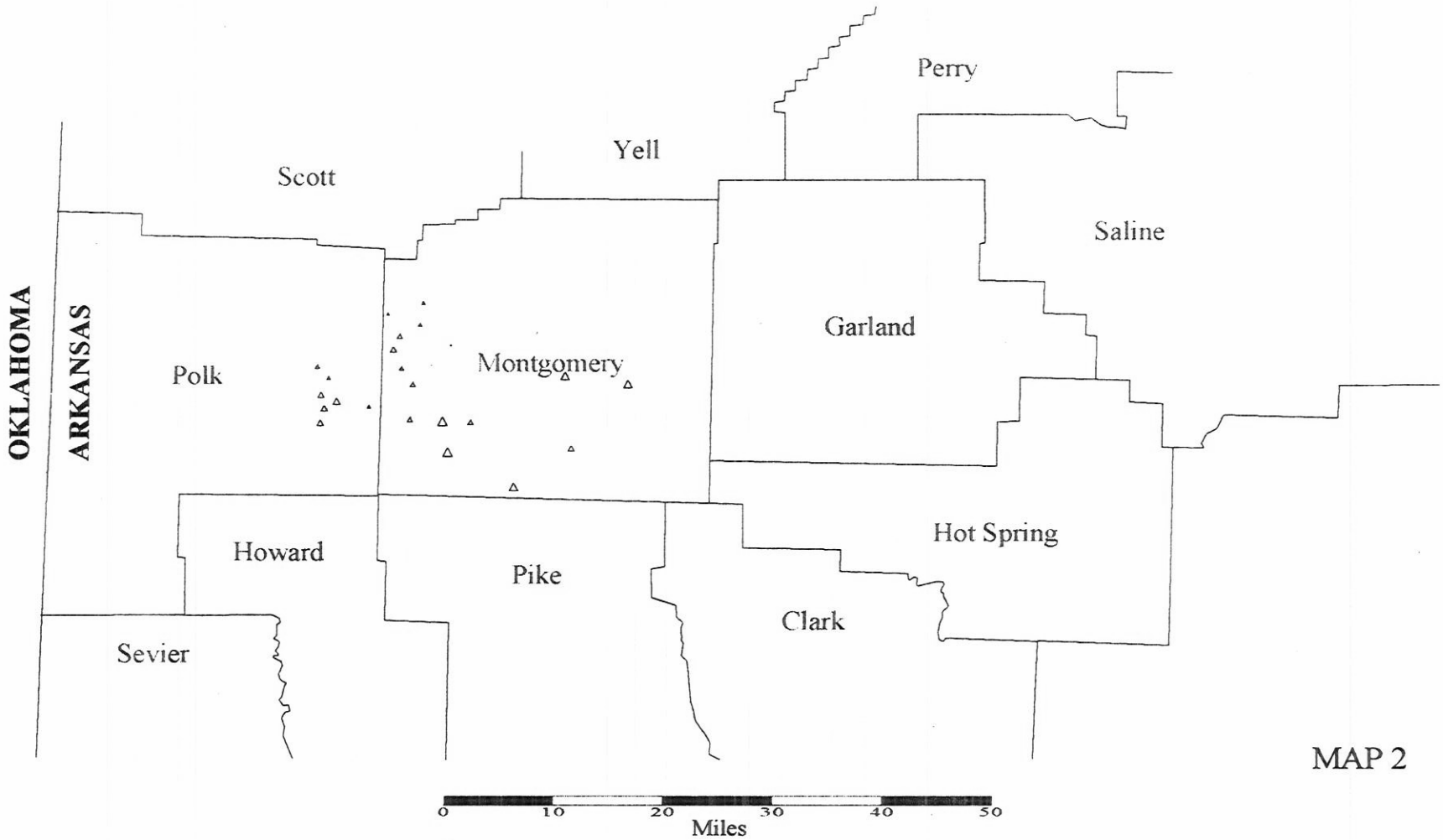
All Samples	Number of Samples	Mean	Deviation	Observed Range
All Samples	24	2.23	1.069	0.1 - 4.1



GRAPH SET 2: Graph showing the distribution of sample arsenic concentration.

Arsenic Distribution

Symbol size denotes relative arsenic concentration ranging from 0.1 ppm to 4.1 ppm.



MAP 2

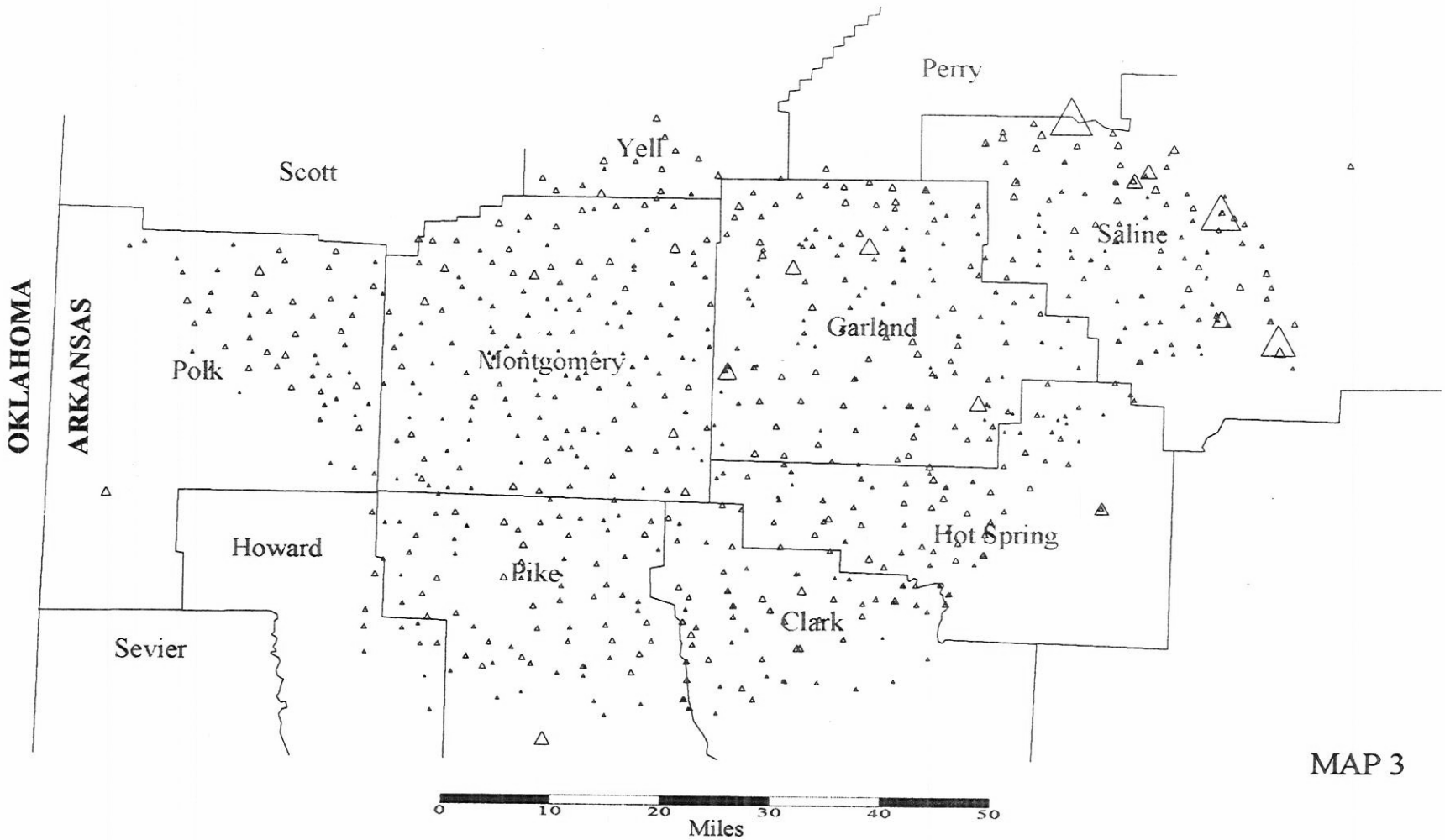
TABLE 3: CHROMIUM

All values reported in parts per million (ppm). Arithmetric means and standard deviations used. Some of the anomalously high chromium values were removed from consideration for the indicated calculations. Formations listed only when more than 10 samples were analyzed.

All Samples	Number of Samples	Mean	Deviation	Observed Range
All Samples	723	80.8	72.882	0 - 990
All w/o highest 12	711	73.9	39.047	0 - 216
by Formation				
Atoka	19	88.2	34.623	32 - 139
Johns Valley	24	95.3	23.841	32 - 129
Jackfork	87	99.2	104.977	12 - 990
Jackfork w/o highest 1	86	88.8	42.588	12 - 169
Stanley	229	89.6	40.592	0 - 378
Arkansas Novaculite	38	52.4	34.790	4 - 140
Polk Creek	16	73.1	33.722	18 - 144
Bigfork	39	32.1	29.335	4 - 140
Womble	46	58.5	28.526	8 - 116
Blakely	24	71.5	28.460	2 - 133
Mazarn	70	78.3	60.756	16 - 426
Mazarn w/o highest 2	68	69.4	31.328	16 - 143
Crystal Mountain	14	76.6	36.920	0 - 143
Collier	12	44.9	20.337	10 - 82
by Period				
Tertiary	8	127.1	78.050	16 - 290
Cretaceous (sed rx only)	18	47.1	21.691	20 - 76
Pennsylvanian	135	97.2	86.015	12 - 990
Pennsylvanian w/o highest 1	134	90.5	38.214	12 - 169
Mississippian/Devonian	273	83.9	41.660	0 - 378
Silurian	11	73.6	19.997	46 - 112
Ordovician/Cambrian	242	62.1	44.445	0 - 426
by Principle Lithology				
Cretaceous Ingeous	21	124.1	196.932	4 - 776
Cretaceous Ingeous w/o hi 5	16	24.5	14.659	4 - 63
Limestone	24	35.0	21.255	8 - 98
Chert	65	51.2	41.312	4 - 183
Shale	514	88.9	57.965	0 - 990
Shale w/o highest 5	509	84.9	33.929	0 - 216
Siltstone	17	58.5	34.662	8 - 122
Sandstone	38	41.2	28.933	0 - 142

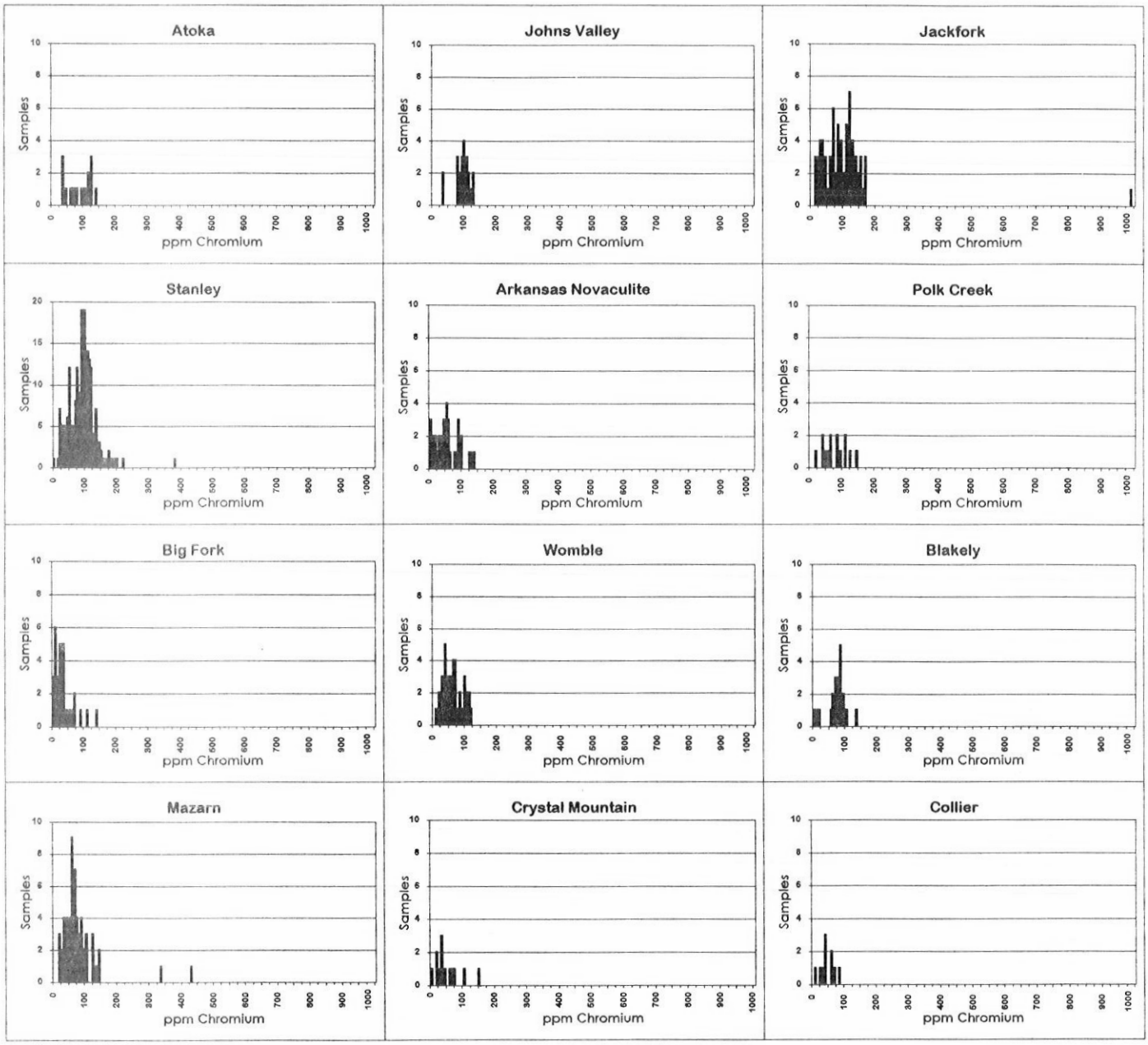
Chromium Distribution

Symbol size denotes relative chromium concentration ranging from 0 ppm to 990 ppm.



MAP 3

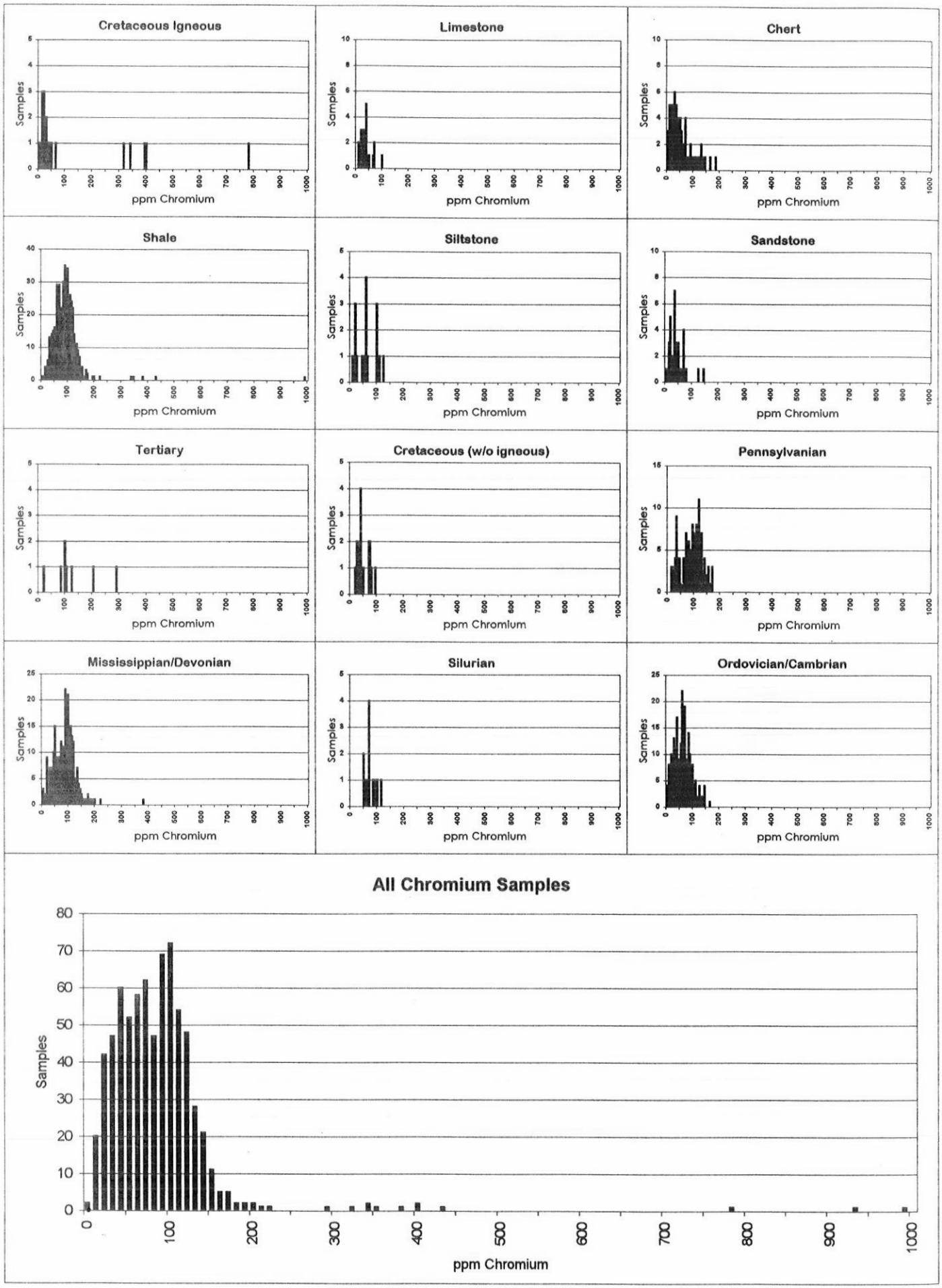
CHROMIUM



GRAPH SET 3

These graphs show the distribution of sample chromium concentrations in the rocks of the Ouachita Mountains of Arkansas. A separate sample concentration histogram is provided for each of the formations, periods, and lithologies listed in Table 3.

CHROMIUM


Cretaceous Igneous
Limestone
Chert
Shale
Siltstone
Sandstone
Tertiary
Cretaceous (w/o igneous)
Pennsylvanian
Mississippian/Devonian
Silurian
Ordovician/Cambrian
Samples
ppm Chromium

All Chromium Samples
Samples
ppm Chromium

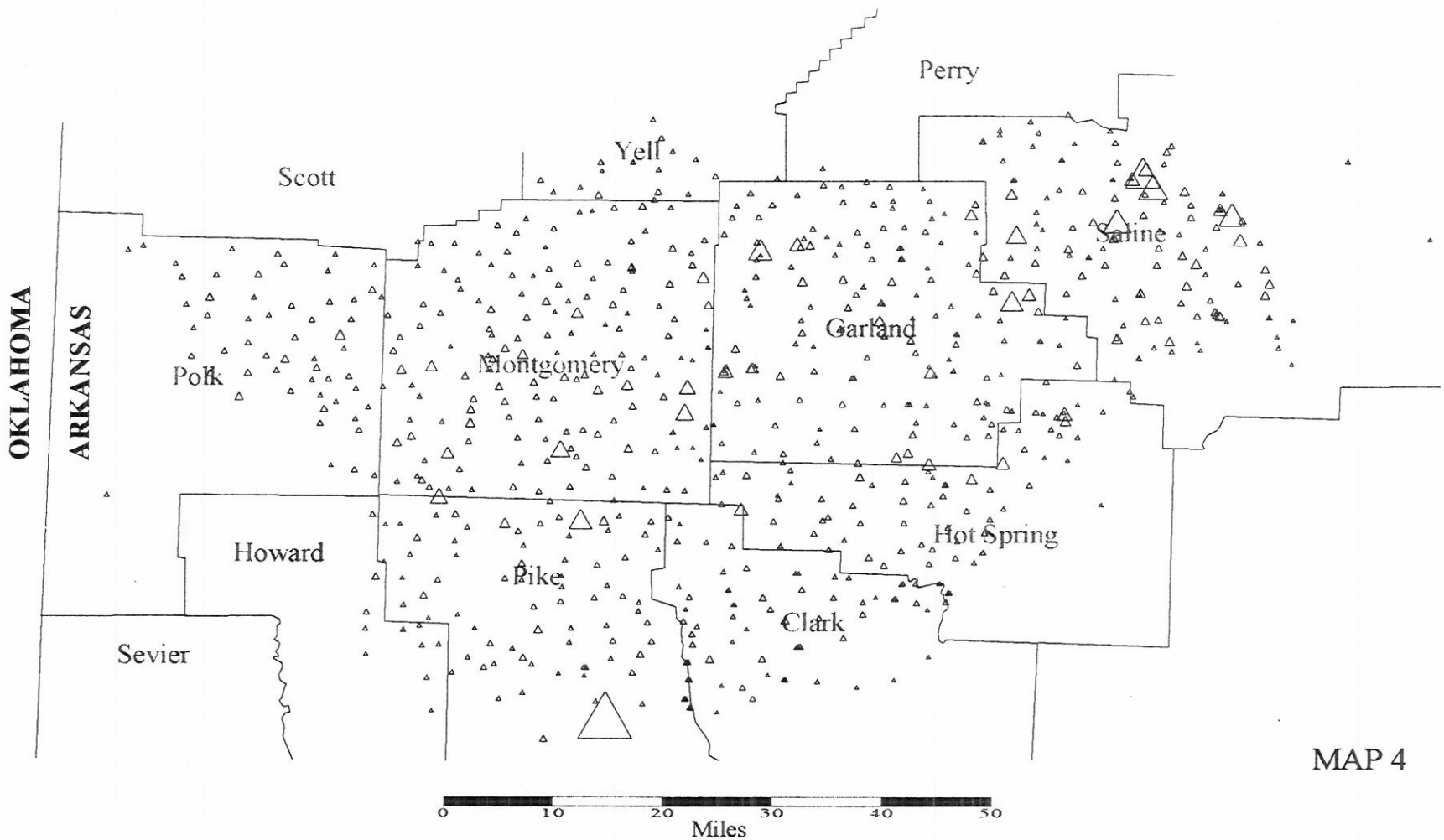
TABLE 4: COPPER

All values reported in parts per million (ppm). Geometric means and standard deviations used unless otherwise indicated. Six samples yielded zero values, i.e. below the detection limits of the analysis procedure. These values were not used for geometric statistics but were included in the arithmetic statistics. Formations listed only when more than 10 samples were analyzed.

All Samples	Number of Samples	Mean	Deviation	Observed Range
All Samples	716	23	2.341	2 - 614.5
All Samples (Arithmetic)	722	33	41.313	0 - 614.5
by Formation				
Atoka	19	22	1.823	5.9 - 52.2
Johns Valley	24	26	1.568	6 - 58
Jackfork	85	14	2.091	2 - 36.1
Stanley	228	24	1.780	2 - 366
Arkansas Novaculite	38	34	3.011	2 - 236
Polk Creek	16	20	1.958	6 - 82
Bigfork	38	21	2.886	2 - 266
Womble	44	26	2.888	2 - 230
Blakely	24	26	1.981	6 - 72
Mazarn	70	31	2.061	6 - 114
Crystal Mountain	14	16	3.536	2 - 94
Collier	12	20	2.641	4 - 107.6
by Period				
Tertiary	8	9	1.705	4 - 20.1
Cretaceous (sed rx only)	17	13	3.311	2 - 614.5
Pennsylvanian	133	17	2.032	2 - 58
Mississippian/Devonian	273	26	2.006	2 - 366
Silurian	11	30	1.925	10 - 116.5
Ordovician/Cambrian	239	26	2.555	2 - 309.2
by Principle Lithology				
Cretaceous Igneous	21	19	3.320	4 - 134.4
Limestone	22	11	2.301	2 - 65.7
Chert	64	32	2.615	2 - 366
Shale	512	27	1.964	2 - 309.2
Siltstone	17	19	2.344	3.9 - 66.9
Sandstone	37	8	2.168	2 - 32

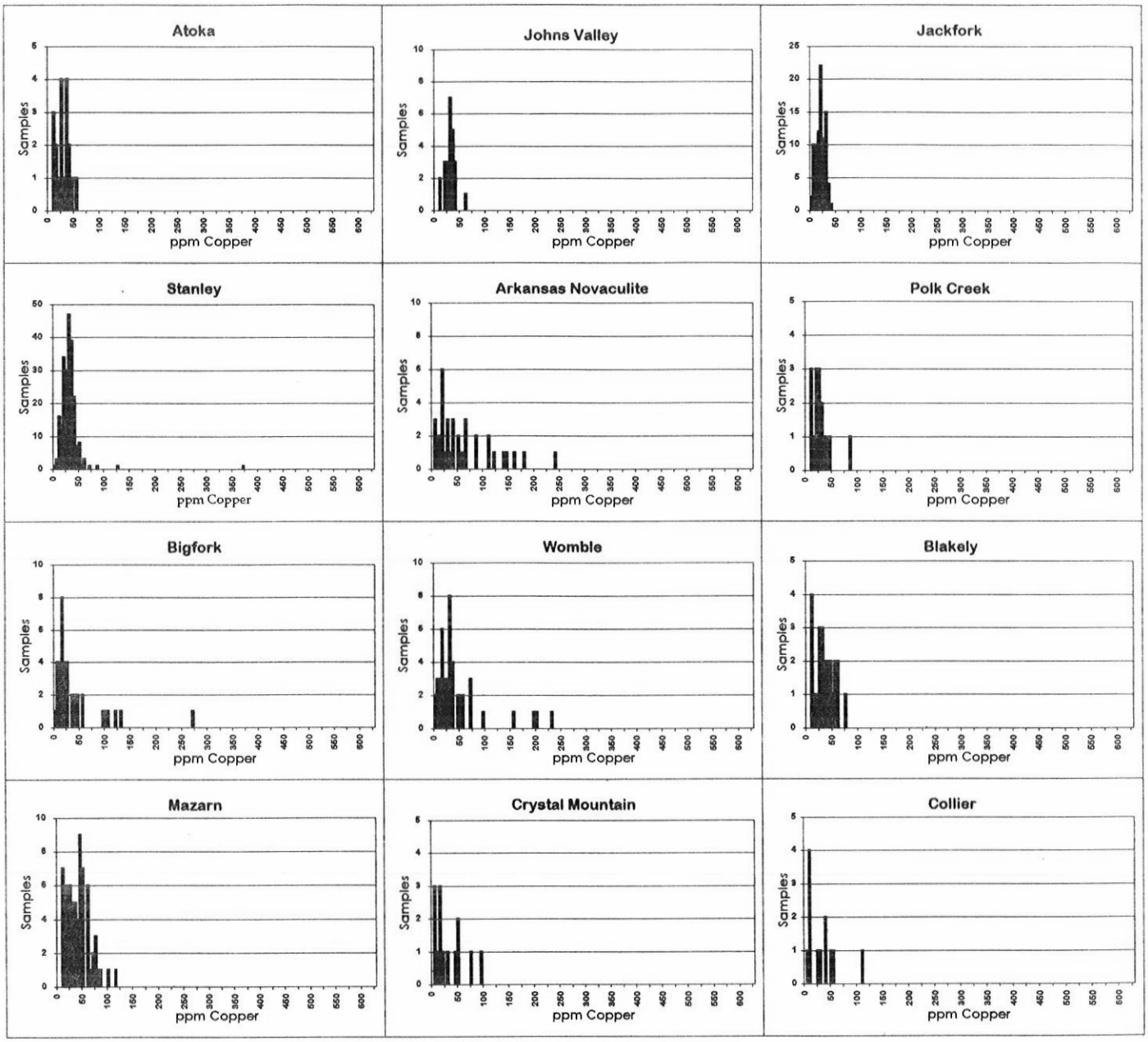
Copper Distribution

Symbol size denotes relative copper concentration ranging from 2 ppm to 614.5 ppm.



MAP 4

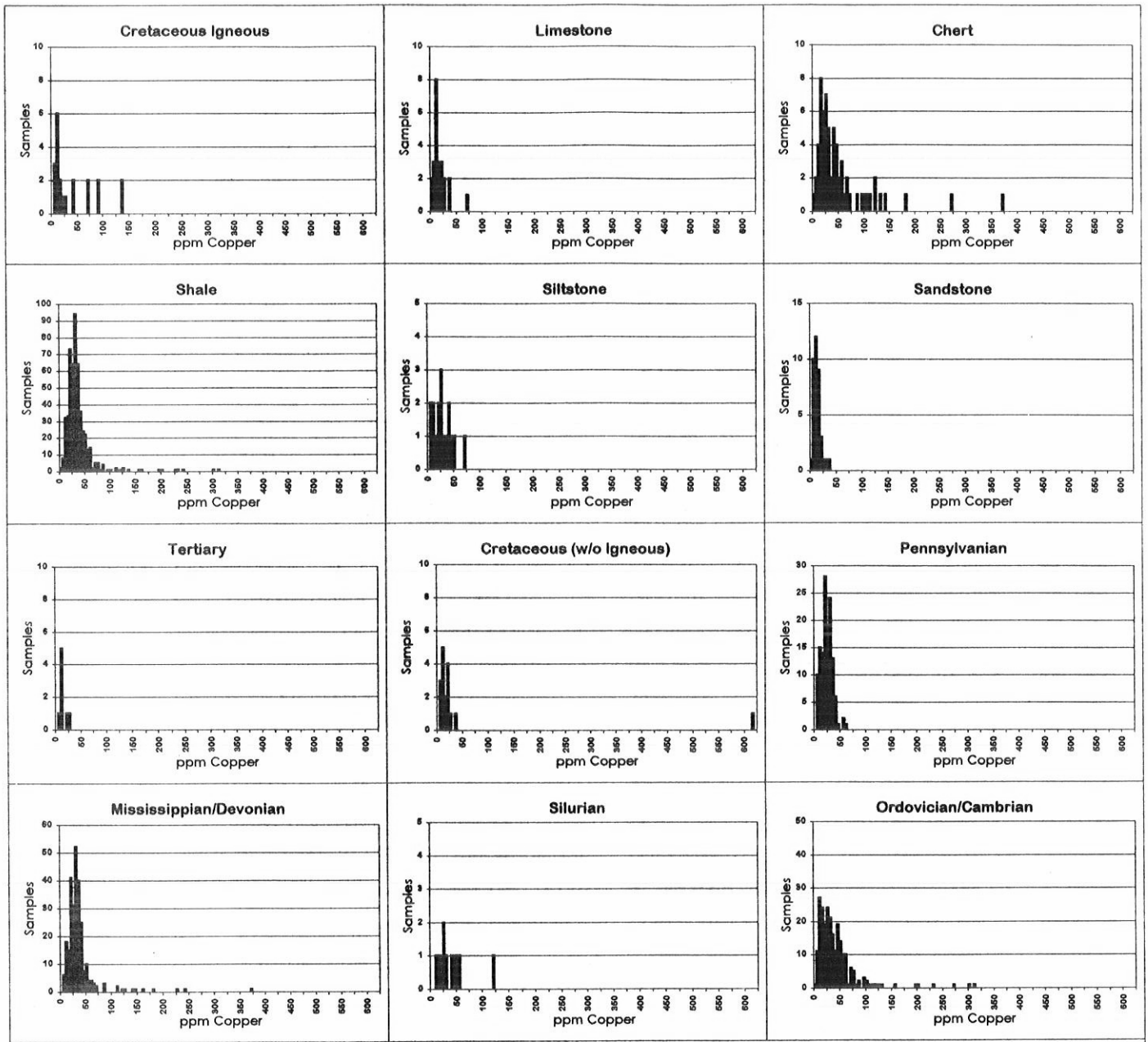
COPPER



GRAPH SET 4

These graphs show the distribution of sample copper concentrations in the rocks of the Ouachita Mountains of Arkansas. A separate sample concentration histogram is provided for each of the formations, periods, and lithologies listed in Table 4.

COPPER


Cretaceous Igneous
Limestone
Chert
Shale
Siltstone
Sandstone
Tertiary
Cretaceous (w/o Igneous)
Pennsylvanian
Mississippian/Devonian
Silurian
Ordovician/Cambrian
Samples
ppm Copper

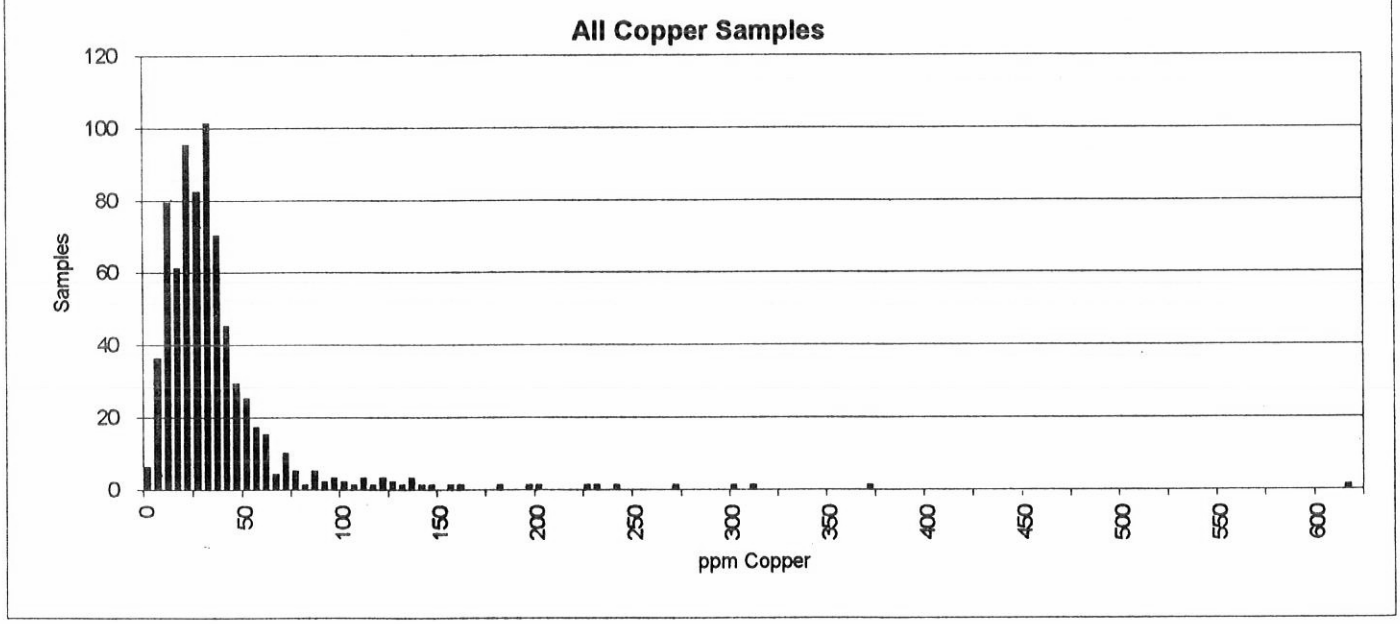

All Copper Samples
Samples
ppm Copper

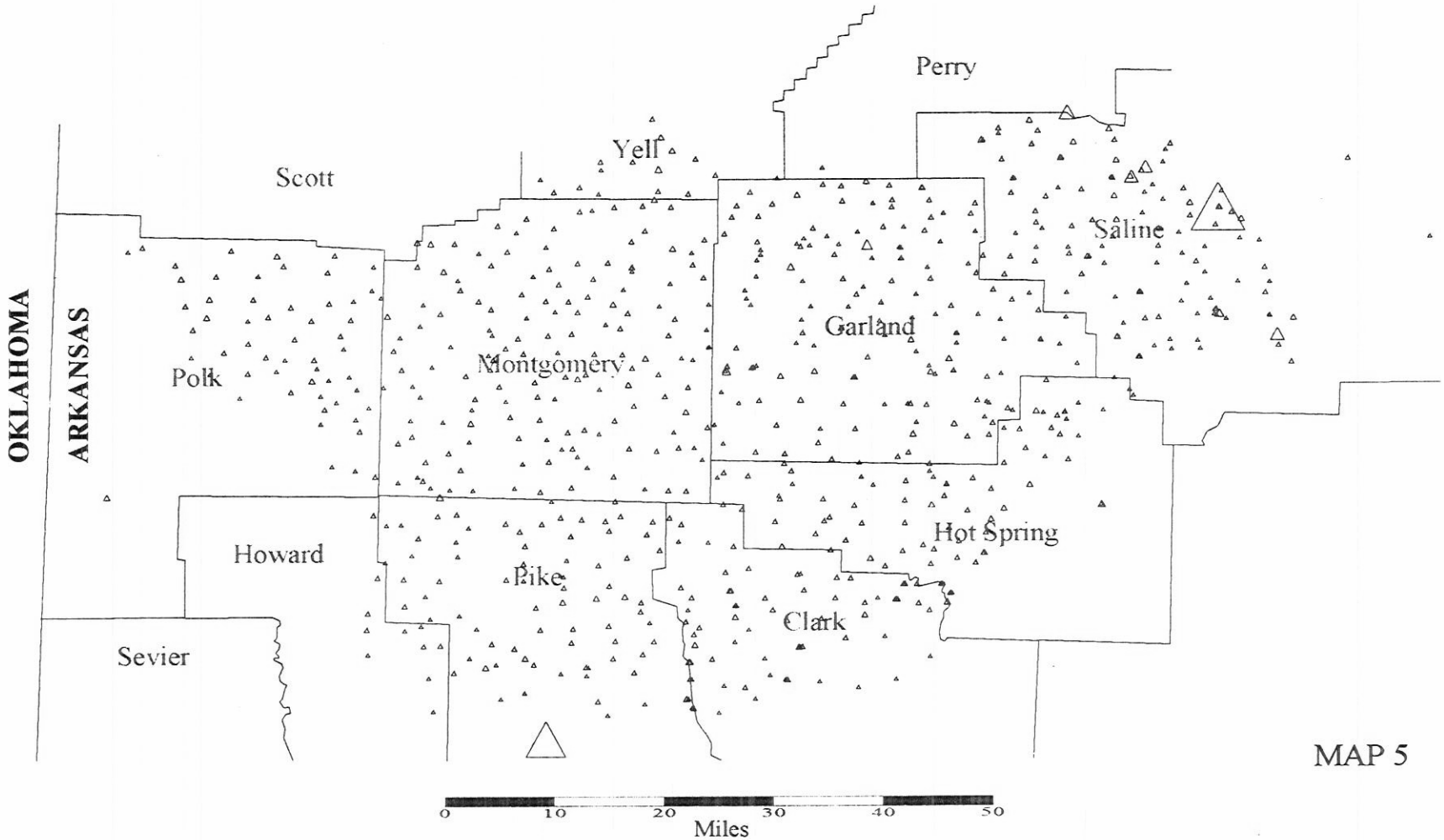
TABLE 5: NICKEL

All values reported in parts per million (ppm). Arithmetic means and standard deviations used. Some of the anomalously high nickel values were removed from consideration for the indicated calculations. Formations listed only when more than 10 samples were analyzed.

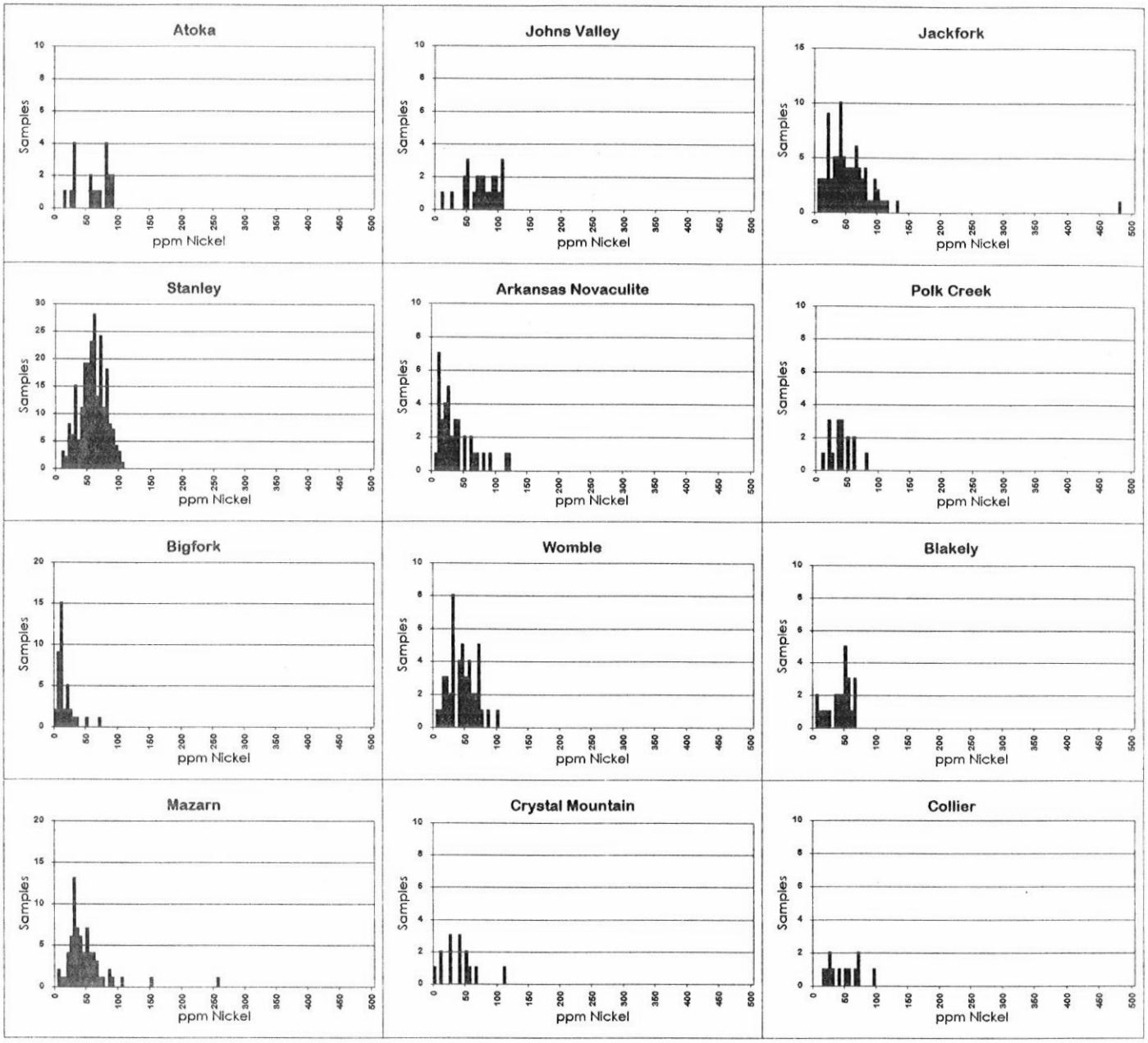
All Samples	Number of Samples	Mean	Deviation	Observed Range
All	722	53	94.557	0 - 1924.6
All w/o highest 7	715	46	26.813	0 - 199.6
by Formation				
Atoka	19	58	24.641	14 - 89.6
Johns Valley	24	69	25.288	6 - 103.6
Jackfork	87	52	53.798	2 - 478
Jackfork w/o highest 1	86	47	28.232	2 - 126
Stanley	228	55	20.314	5.9 - 103.2
Arkansas Novaculite	38	34	28.385	4 - 119.5
Polk Creek	16	37	18.252	6 - 79.7
Bigfork	39	12	12.861	0 - 66
Womble	46	42	20.935	4 - 98.8
Blakely	24	39	18.456	2 - 64
Mazarn	70	44	34.133	2 - 252
Mazarn w/o highest 1	69	41	23.409	2 - 148
Crystal Mountain	14	36	26.359	0 - 106
Collier	12	45	23.504	13.8 - 94
by Period				
Tertiary	8	52	42.068	2 - 136
Cretaceous (sed rx only)	18	25	13.273	6 - 51.8
Pennsylvanian	135	56	45.923	2 - 478
Pennsylvanian w/o highest 1	134	53	28.007	1 - 126
Mississippian/Devonian	272	52	22.775	4 - 119.5
Silurian	11	47	28.632	14 - 115.5
Ordovician/Cambrian	242	37	26.959	0 - 252
by Principle Lithology				
Cretaceous Ingeous	21	153	302.173	12 - 1420
Cretaceous Ingeous w/o hi 3	18	58	53.036	12 - 199.6
Limestone	24	29	18.250	2 - 83.7
Chert	65	22	21.146	0 - 112
Shale	513	54	34.221	2 - 478
Shale w/o highest 3	510	52	23.325	2 - 148
Siltstone	17	36	21.413	3.9 - 92.4
Sandstone	38	27	19.515	0 - 87.3

Nickel Distribution

Symbol size denotes relative nickel concentration ranging from 0 ppm to 1924.6 ppm.



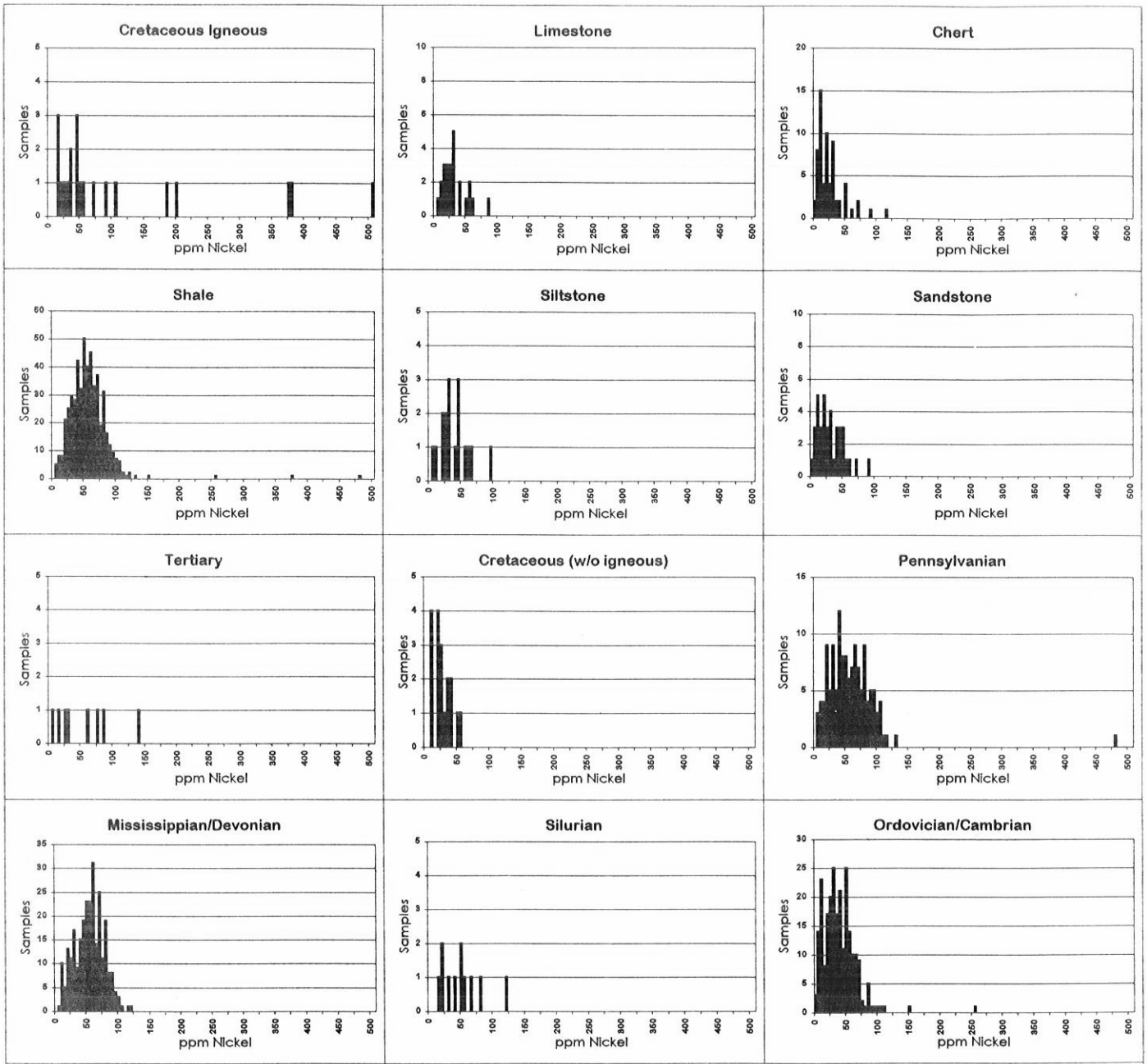
MAP 5



GRAPH SET 5

These graphs show the distribution of sample nickel concentrations in the rocks of the Ouachita Mountains of Arkansas. A separate sample concentration histogram is provided for each of the formations, periods, and lithologies listed in Table 5. Samples indicated at the maximum concentration value on a graph may reflect element concentrations beyond the value indicated.

NICKEL


Cretaceous Igneous
Limestone
Chert
Shale
Siltstone
Sandstone
Tertiary
Cretaceous (w/o igneous)
Pennsylvanian
Mississippian/Devonian
Silurian
Ordovician/Cambrian
Samples
ppm Nickel

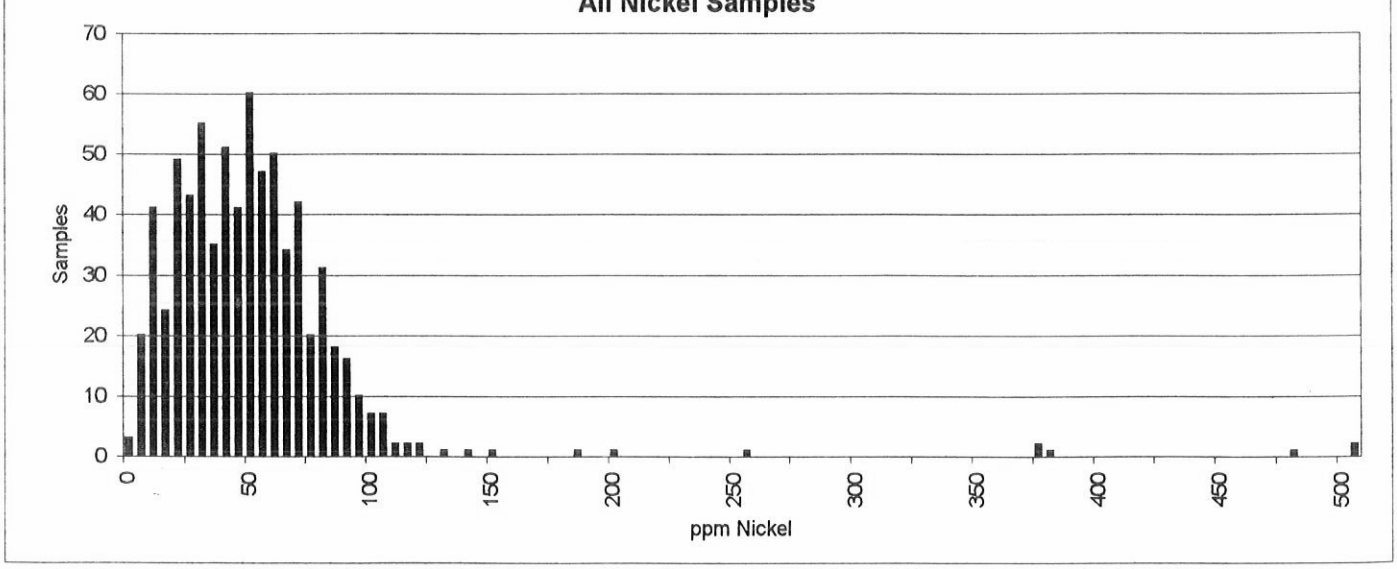

All Nickel Samples
Samples
ppm Nickel

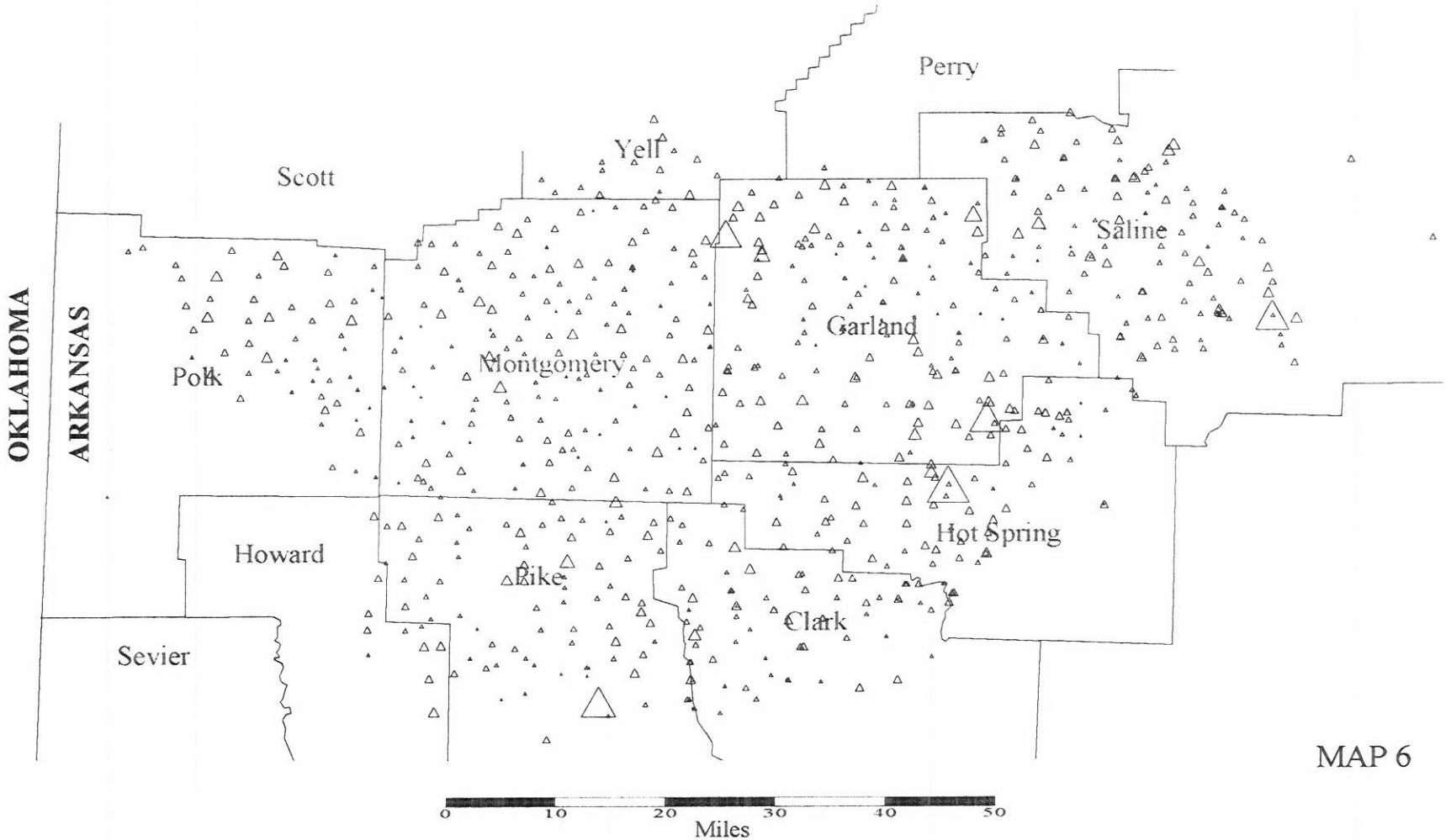
TABLE 6: LEAD

All values reported in parts per million (ppm). Arithmetric means and standard deviations used. Five samples had lead values anomalously higher than the rest of the sample set and were removed from consideration in all but the indicated calculation. Formations listed only when more than 10 samples were analyzed.

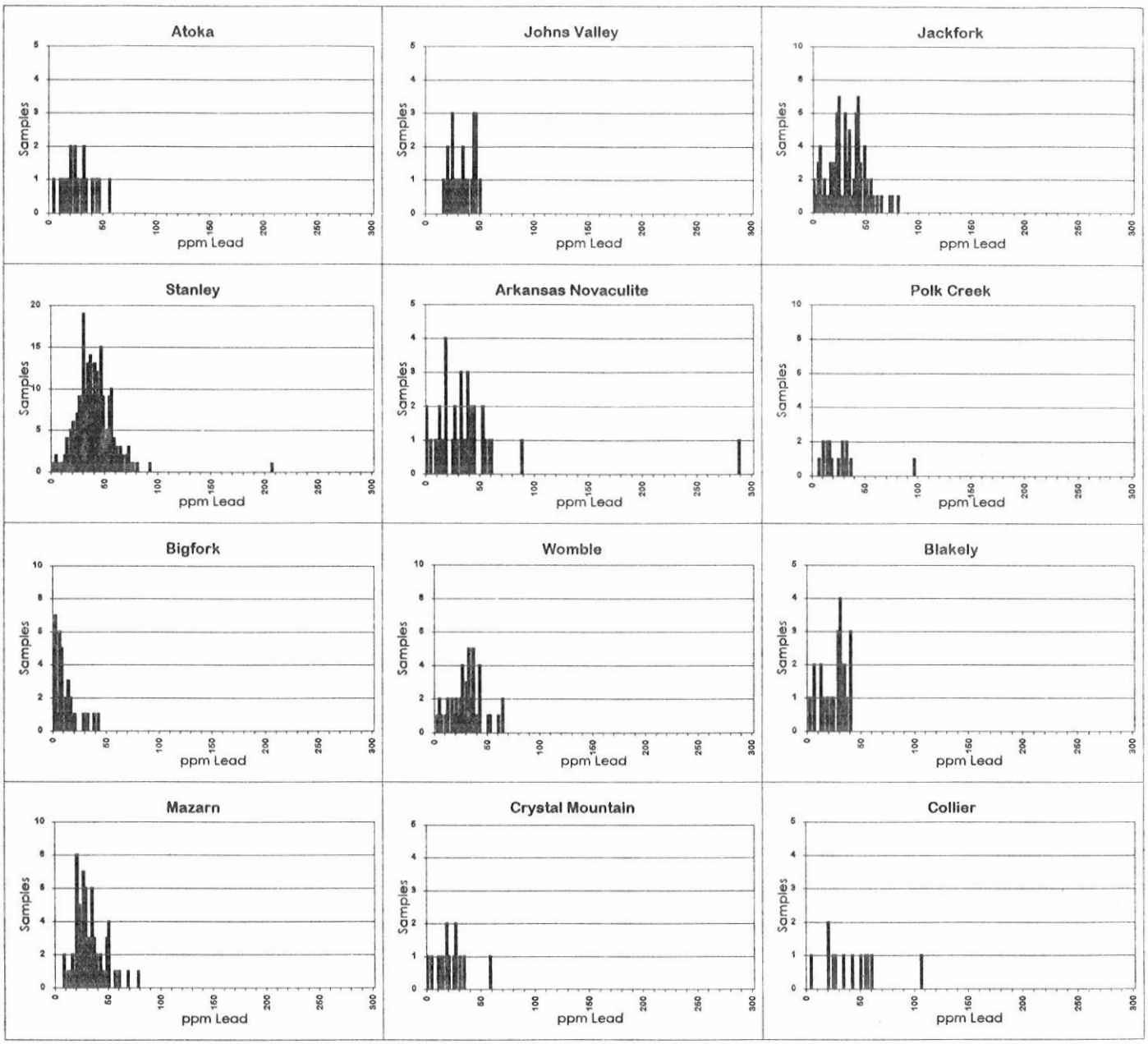
All Samples	**Number of Samples**	**Mean**	**Deviation**	**Observed Range**
All Samples	721	33	23.799	0 - 286.9
All w/o 5 highest values	716	32	16.923	0 - 105.6
by Formation				
Atoka	19	26	12.918	3.9 - 56.0
Johns Valley	24	32	10.467	16.0 - 49.4
Jackfork	87	31	17.158	0 - 79.7
Stanley	228	38	14.954	2.0 - 92.0
Arkansas Novaculite	37	31	18.494	0 - 87.3
Polk Creek	16	25	20.188	6.0 - 96.0
Bigfork	38	10	10.720	0 - 42.0
Womble	46	29	14.329	2.0 - 64.0
Blakely	24	25	10.781	2 - 39.7
Mazarn	70	32	13.413	8 - 76.3
Crystal Mountain	14	21	13.830	0 - 58
Collier	12	41	25.467	4 - 105.6
by Period				
Tertiary	7	31	19.771	2 - 68
Cretaceous (sed rx only)	16	26	16.877	4 - 61.5
Pennsylvanian	135	30	15.478	0 - 79.7
Mississippian/Devonian	271	37	15.853	0 - 92
Silurian	11	35	20.419	8 - 84
Ordovician/Cambrian	241	26	16.363	0 - 105.6
by Principle Lithology				
Cretaceous Igneous	20	42	14.772	7.9 - 68.3
Limestone	23	33	12.424	6 - 56
Chert	63	19	16.699	0 - 87.3
Shale	513	34	16.167	0 - 105.6
Siltstone	16	25	14.308	1.9 - 58
Sandstone	38	21	13.316	0 - 48

Lead Distribution

Symbol size denotes relative lead concentration ranging from 0 ppm to 286.9 ppm.



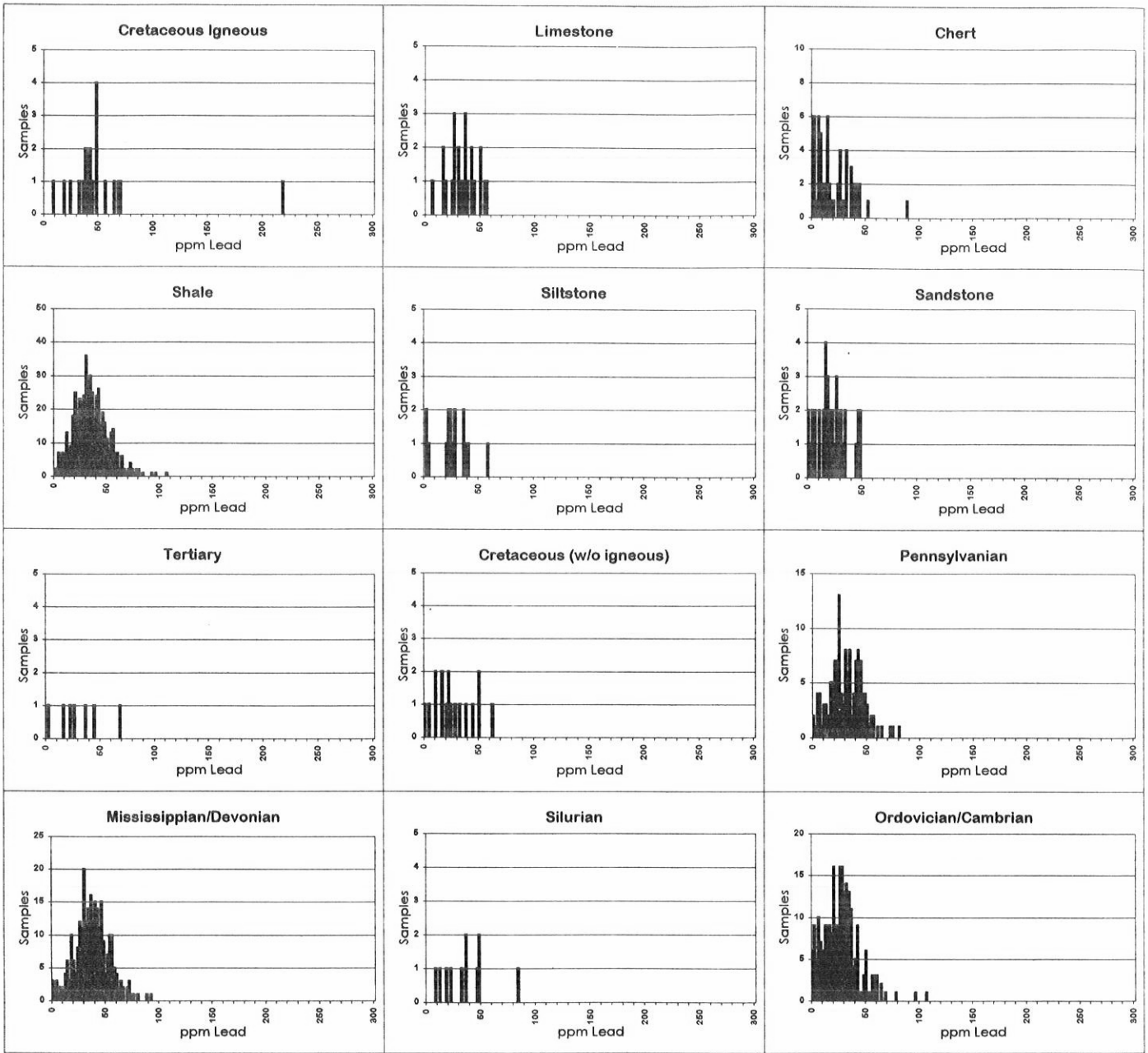
MAP 6



GRAPH SET 6

These graphs show the distribution of sample lead concentrations in the rocks of the Ouachita Mountains of Arkansas. A separate sample concentration histogram is provided for each of the formations, periods, and lithologies listed in Table 6.

LEAD


Cretaceous Igneous
Limestone
Chert
Shale
Siltstone
Sandstone
Tertiary
Cretaceous (w/o igneous)
Pennsylvanian
Mississippian/Devonian
Silurian
Ordovician/Cambrian
Samples
ppm Lead

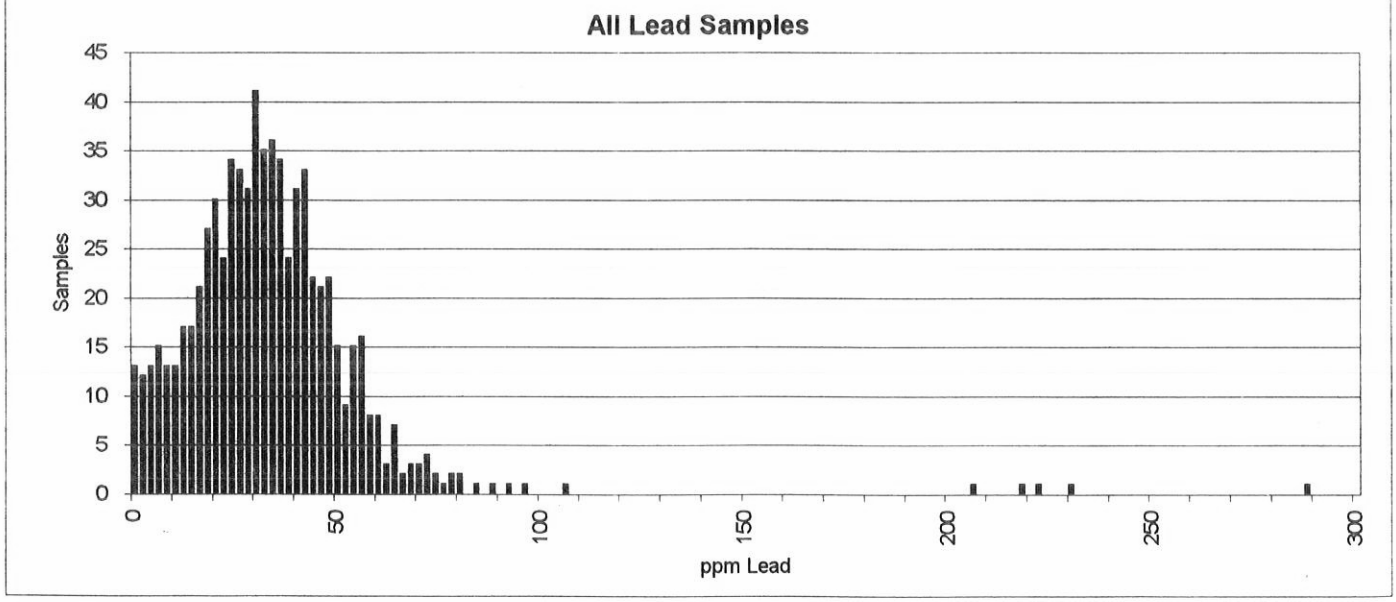

All Lead Samples
Samples
ppm Lead

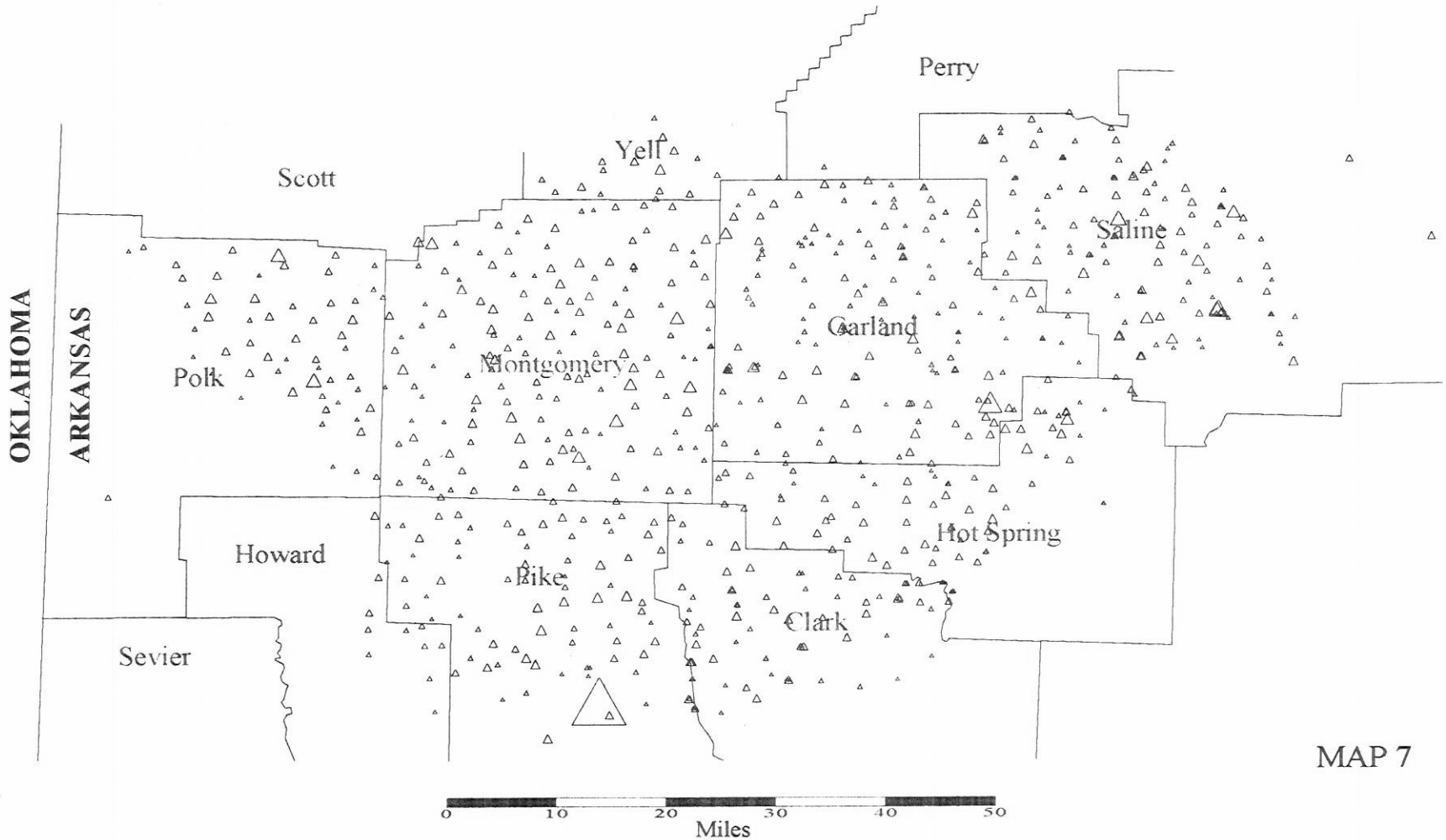
TABLE 7: ZINC

All values reported in parts per million (ppm). Arithmetric means and standard deviations used. Anomalously high sample zinc values were removed from consideration for the Cretaceous and Limestone (*) calculations. Formations listed only when more than 10 samples were analyzed.

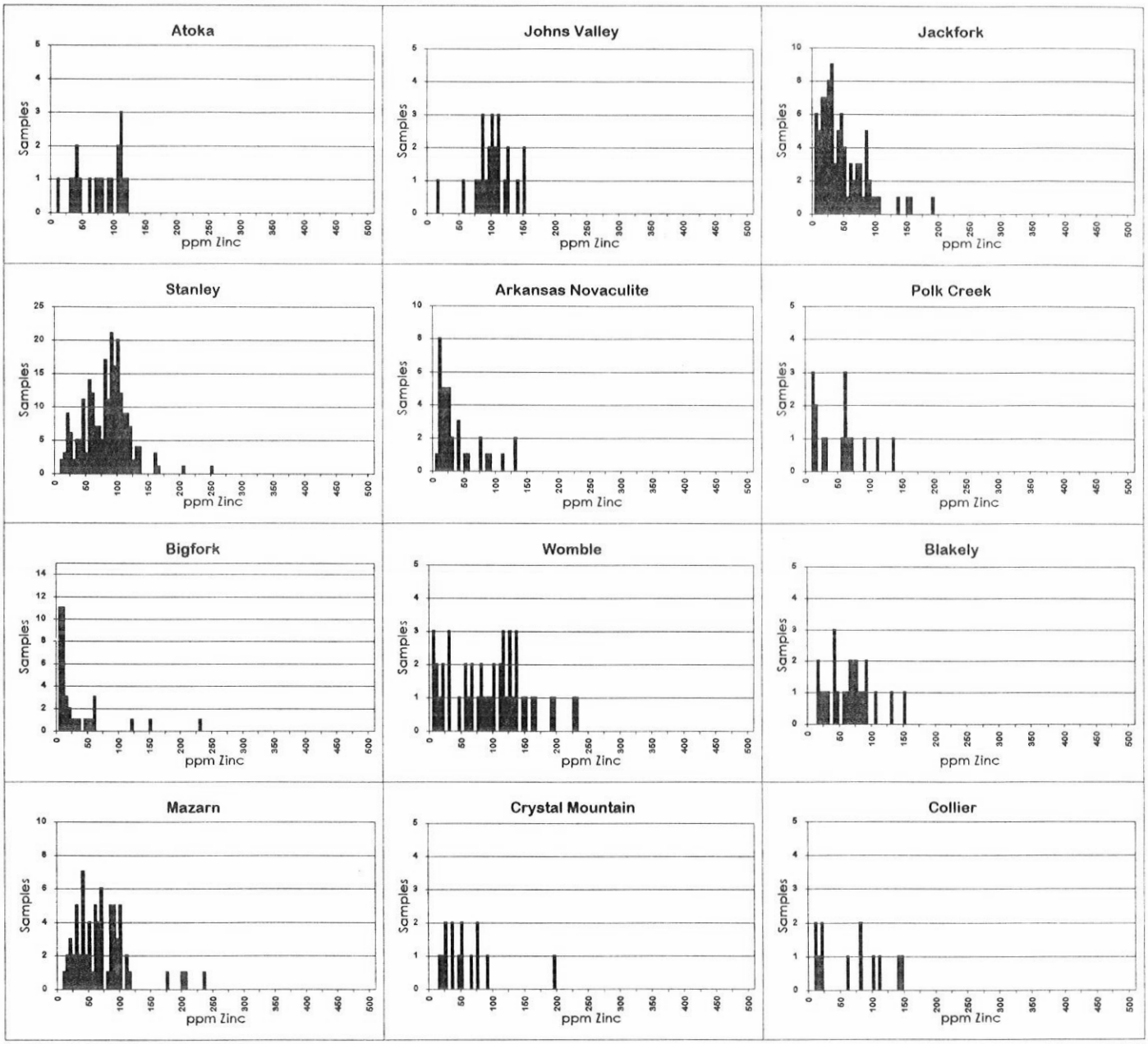
All Samples	**Number of Samples**	**Mean**	**Deviation**	**Observed Range**
All Samples	722	67	60.621	2 - 1090
All w/o highest 2 values	720	66	45.241	2 - 310.8
by Formation				
Atoka	19	74	33.280	9.8 - 117.5
Johns Valley	24	98	28.425	12 - 148
Jackfork	87	44	36.074	2 - 186.7
Stanley	229	79	34.809	8 - 250
Arkansas Novaculite	38	34	33.403	2 - 128
Polk Creek	16	50	36.818	8 - 132
Bigfork	39	28	45.165	2 - 230
Womble	46	91	58.711	4 - 228.9
Blakely	24	62	33.634	12 - 146
Mazarn	70	67	43.028	6 - 232
Crystal Mountain	14	54	44.416	14 - 194
Collier	12	64	48.078	9.9 - 143.4
by Period				
Tertiary	8	29	24.263	8 - 85.7
Cretaceous (sed rx only)*	17	41	33.551	6 - 112.4
Pennsylvanian	135	58	40.149	2 - 186.7
Mississippian/Devonian	273	72	37.746	2 - 250
Silurian	10	72	62.206	13.9 - 239
Ordovician/Cambrian	242	63	50.479	2 - 256
by Principle Lithology				
Cretaceous Igneous	21	120	95.173	8 - 429.7
Limestone*	23	47	44.678	4 - 143.4
Chert	65	37	47.304	2 - 230
Shale	512	74	40.325	4 - 256
Siltstone	17	73	68.079	2 - 221.1
Sandstone	38	28	23.500	2 - 107.1

Zinc Distribution

Symbol size denotes relative zinc concentration ranging from 2 ppm to 1090 ppm.



MAP 7



GRAPH SET 7

These graphs show the distribution of sample zinc concentrations in the rocks of the Ouachita Mountains of Arkansas. A separate sample concentration histogram is provided for each of the formations, periods, and lithologies listed in Table 7. Samples indicated at the maximum concentration value on a graph may reflect element concentrations beyond the value indicated.

ZINC

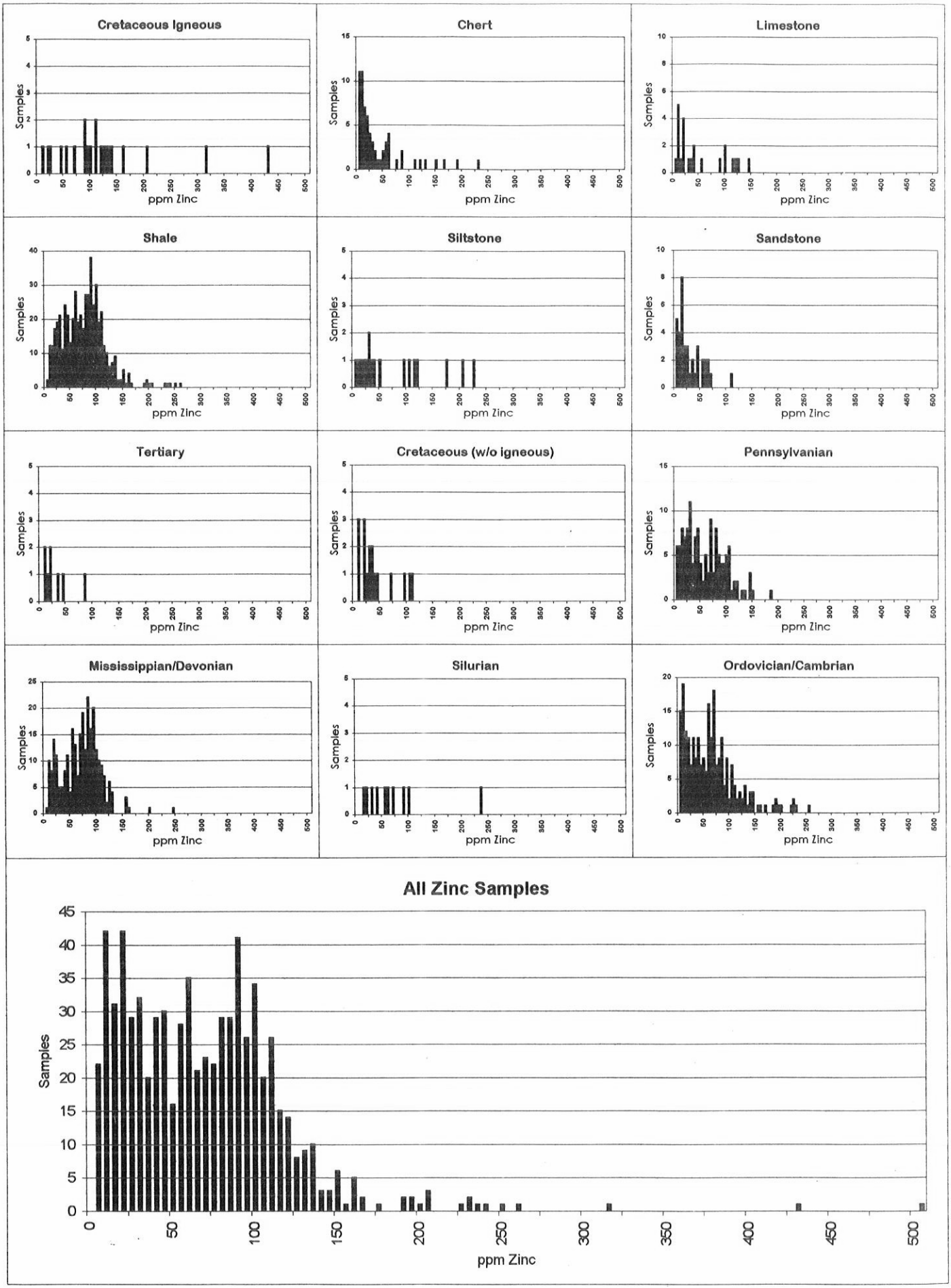

Cretaceous Igneous
Chert
Limestone
Shale
Siltstone
Sandstone
Tertiary
Cretaceous (w/o igneous)
Pennsylvanian
Mississippian/Devonian
Silurian
Ordovician/Cambrian
All Zinc Samples
Samples
ppm Zinc

TABLE 8

Correlation Coefficient by Formation

Those correlation coefficients in bold type are considered statistically significant to the 95% confidence level.

Samples:	19	24	88	231	40	16	39	46	24	70	14	12
Unit:	**Pa**	**Pjv**	**Pj**	**Ms**	**MDa**	**Opc**	**Obf**	**Ow**	**Oby**	**Om**	**Ocm**	**OCc**
Ag:Cr	0.0396	0.2341	**0.2131**	0.0770	0.1691	0.3229	0.1384	**-0.3760**	0.2777	-0.1033	0.1304	-0.5636
Ag:Cu	-0.0447	0.1573	**0.3666**	0.0585	**0.3182**	-0.1637	0.1296	-0.0969	0.1207	-0.1897	**0.5763**	**-0.6102**
Ag:Hg	0.1877	-0.1431	-0.0746	0.0583	0.2794	-0.1540	0.2674	-0.0830	0.0330	-0.1987	-0.4908	-0.4263
Ag:Ni	-0.0587	-0.0527	**0.2458**	0.1519	**0.3198**	0.0291	0.0099	-0.1139	0.2217	-0.0842	0.1940	**-0.7044**
Ag:Pb	0.2679	0.2347	**0.4079**	0.1495	0.1835	0.2034	0.1757	0.1266	0.2112	**0.3714**	-0.2019	0.2631
Ag:Zn	0.1553	0.1027	0.2022	0.1378	0.2052	-0.0756	-0.0492	-0.1849	0.2931	**-0.2701**	-0.1199	**-0.7782**
Cr:Cu	**0.7324**	**0.6531**	**0.3331**	**0.2233**	0.1180	0.2501	**0.6823**	**0.3160**	**0.4187**	0.0885	0.4067	0.3939
Cr:Hg	**0.5274**	0.1762	-0.0450	0.1125	**0.3636**	-0.1361	0.2494	**0.3231**	**0.5413**	0.0054	0.2300	0.1263
Cr:Ni	**0.5639**	**0.5844**	**0.9210**	**0.3074**	0.2485	**0.4977**	**0.6471**	**0.3898**	**0.4484**	**0.8528**	0.5120	**0.8457**
Cr:Pb	**0.7031**	**0.4657**	**0.3763**	0.0868	0.2742	**0.6785**	**0.3204**	0.1999	**0.4254**	-0.0213	0.3153	0.1646
Cr:Zn	**0.4920**	**0.5912**	**0.2267**	**0.2101**	0.0372	**0.6166**	**0.4589**	0.2641	**0.4269**	0.1616	0.3659	0.5542
Cu:Hg	**0.4781**	0.0814	-0.0086	0.1343	0.1730	0.1442	-0.0110	**0.2993**	-0.2082	0.0449	**0.6578**	0.3411
Cu:Ni	0.3995	**0.4598**	**0.3493**	0.1527	**0.5564**	0.3411	**0.5926**	0.0536	**0.5099**	0.1723	**0.6839**	0.4170
Cu:Pb	**0.5345**	**0.4631**	**0.6328**	0.0619	0.0700	-0.1148	**0.3132**	0.2055	0.2709	0.0796	0.3416	0.3666
Cu:Zn	**0.5115**	**0.5794**	**0.4401**	**0.2568**	**0.4733**	0.4502	**0.7374**	0.1616	0.3982	**0.4693**	**0.7382**	**0.8401**
Hg:Ni	0.2692	**0.5865**	0.0139	-0.0084	0.2470	-0.1814	0.0957	0.0880	-0.1682	-0.1205	**0.6899**	0.2633
Hg:Pb	**0.6079**	0.1006	-0.0633	-0.0919	0.3029	0.0137	0.0281	-0.0252	0.2532	0.0290	0.3745	-0.3140
Hg:Zn	0.3167	0.2155	0.0111	-0.0373	-0.1055	-0.3157	0.0966	0.0778	-0.1263	0.1773	**0.8720**	**0.7009**
Ni:Pb	**0.4801**	0.0560	**0.3666**	**0.1924**	0.1296	-0.0562	0.2755	0.2340	**0.5567**	0.0100	0.2204	-0.1541
Ni:Zn	**0.8906**	**0.7204**	**0.4535**	**0.6062**	**0.7956**	**0.6762**	**0.7067**	**0.3888**	**0.8106**	**0.2953**	**0.8878**	**0.6438**
Pb:Zn	**0.4954**	0.0394	**0.3058**	**0.4084**	0.0155	0.1634	0.1881	-0.2125	**0.4596**	0.1992	0.3371	0.0495

Formation symbols: Pa = Atoka, Pjv = Johns Valley, Pj = Jackfork, Ms = Stanley, MDa = Arkansas Novaculite, Opc = Polk Creek, Obf = Bigfork, Ow = Womble, Oby = Blakely, Om = Mazarn, Ocm = Crystal Mtn., OCc = Collier.

TABLE 9

Correlation Coefficient by Principle Lithology and Geologic Period

Those correlation coefficients in bold type are considered statistically significant to the 95% confidence level.

Samples:	68	24	519	13	38	21	8	18	136	277	11	242
Lith/Age:	Chert	Ls	Shale	Silt	Ss	Ki	T	K (-Ki)	P	MD	S	OC
Ag:Cr	0.1772	**-0.5588**	0.0952	-0.2256	0.1646	-0.1230	-0.1900	-0.1263	0.1818	0.1386	-0.1336	0.0060
Ag:Cu	0.1503	-0.2574	0.0601	-0.1325	0.0495	**0.6048**	-0.2993	-0.2675	**0.3066**	0.0785	-0.4817	-0.0457
Ag:Hg	0.2211	-0.2473	0.0235	-0.4900	0.0828	0.2701	-0.1188	0.2812	-0.0726	0.0612	-0.2954	0.0267
Ag:Ni	0.0809	-0.3823	0.1477	0.0047	**0.4152**	-0.1279	0.1006	0.3262	**0.2059**	**0.2217**	0.1852	0.0571
Ag:Pb	0.1315	0.2100	**0.2009**	0.0610	0.1336	0.0424	0.1515	**0.5629**	**0.3492**	0.1554	-0.1036	**0.3116**
Ag:Zn	0.0173	-0.0022	0.0812	0.0862	**0.4691**	-0.1707	-0.0084	0.3082	**0.2285**	**0.1919**	0.2222	-0.0440
Cr:Cu	**0.3084**	0.3939	0.0639	0.4984	**0.4870**	0.3390	0.0995	-0.1392	**0.2803**	0.0599	0.5644	**0.2629**
Cr:Hg	0.0718	0.1317	-0.0238	0.4257	0.2582	0.2265	-0.1547	-0.0805	-0.0351	0.0522	0.5621	0.0509
Cr:Ni	**0.3982**	**0.6670**	**0.7077**	0.5414	**0.5195**	**0.5069**	**0.9046**	**0.4764**	**0.8773**	**0.3632**	-0.1579	**0.7012**
Cr:Pb	**0.2454**	-0.1209	0.1679	0.4993	**0.5730**	-0.1888	-0.0439	-0.2043	**0.3802**	0.1326	-0.1155	**0.2295**
Cr:Zn	0.2338	0.0162	0.1182	0.4525	0.2839	-0.1324	-0.0362	-0.1889	**0.1902**	**0.2915**	-0.0153	**0.2895**
Cu:Hg	-0.0326	**0.8117**	**0.2596**	0.2051	0.1208	**0.5863**	-0.1607	-0.0496	-0.0265	0.1706	0.2341	0.1628
Cu:Ni	**0.5097**	**0.8113**	0.0965	0.2026	**0.4352**	0.2015	-0.0886	-0.0391	**0.3370**	0.1367	0.0366	**0.1991**
Cu:Pb	0.1120	0.0928	0.0727	0.3423	**0.4784**	0.0106	0.5867	-0.1305	**0.4679**	0.0355	0.0325	0.1558
Cu:Zn	**0.5328**	0.2291	**0.2500**	**0.6043**	0.2546	0.0115	0.2807	0.0254	**0.5561**	0.1164	0.0676	**0.4139**
Hg:Ni	-0.0439	**0.6308**	-0.0352	0.3770	0.1211	0.0357	0.0366	0.4118	0.0094	-0.0546	-0.0963	-0.0361
Hg:Pb	-0.0045	0.1901	-0.0575	-0.0433	0.2189	0.1208	-0.0792	**0.8112**	-0.0436	0.0462	0.0364	-0.0538
Hg:Zn	0.0121	0.3765	-0.0047	0.0370	0.0602	0.2827	0.3469	**0.8509**	-0.0433	-0.1577	-0.2340	0.0855
Ni:Pb	**0.2740**	0.1349	**0.1907**	0.3395	**0.4930**	-0.1026	-0.0696	0.3536	**0.3497**	0.1673	0.1070	**0.2835**
Ni:Zn	**0.6813**	0.2384	**0.3971**	**0.5938**	**0.8718**	-0.0276	0.1819	0.3628	**0.4844**	**0.6813**	**0.8234**	**0.5044**
Pb:Zn	0.0201	**0.9169**	**0.1990**	0.5441	**0.3606**	0.0292	0.2632	**0.9312**	**0.2519**	**0.2617**	-0.2920	**0.2464**

Abbreviations and symbols used: Ls = limestone, Silt = siltstone, SS = sandstone, Ki = igneous rocks of Cretaceous age, T = Tertiary, K = Cretaceous, P = Pennsylvanian, MD = Mississippian/Devonian, S = Silurian, OC = Ordovician/Cambrian.

Acknowledgments:
We wish to thank Fred Buzen, Clark Kuyper, Kent Thomas, Jim Maxwell, Kevin Chambliss, Steve Gonzalez, Dee Healey, and Harell Beckwith, the technicians and students who assisted with the sample preparation and chemical analysis, for their tireless efforts. We also wish to thank Susan Young for preparing some of the figures and the staff of the Arkansas Geological Commission for all the many things that they helped with in the preparation of this report. Without their dedication to the task this study could not have been accomplished.

Research Note:
The data used to compile this report and listed in Appendix A is availabel as an Excel 5.0 spreadsheet. Send a self-addressed stamped envelope with a 3.5" diskette to the senior author for a copy of the datafile.

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Appendix A

Tabulation of Ouachita Mountain rock samples listing metal concentration, strata, and lithology.

Sample locations shown in Figure 1. Metal concentration expressed in parts per million (ppm). Stratigraphic notation is as follows: pЄi=Precambrian igneous, OЄc=Collier, Ocm=Crystal Mt., Om=Mazarn, Oby=Blakely, Ow=Womble, Obf=Bigfork, Opc=Polk Creek, Sbl=Blaylock, Smm=Missouri Mt., MDa=Arkansas Novaculite, Ms=Stanley, Pj=Jackfork, Pjv=Johns Valley, Pa=Atoka, Kt=Trinity, Kto=Tokio, Kb=Brownstown, Ks=Saratoga, Kn=Nacatoch, Ki=igneous, Tm=Midway, Tw=Wilcox, Qt=terrace, Q=other Quaternary. Lithology expressed in order of abundance/importance.

Sample	Ag	As	Cr	Cu	Ni	Pb	Zn	Formation	Member	Lithology
1	4		36	6.0	24.0	56.0	10.0	OЄc		limestone
2	6		32	10.0	24.1	52.2	18.1	OЄc		limestone
3	6		38	12.0	27.9	43.8	37.8	Om		limestone, shale
4	6		48	67.5	89.3	41.7	109.1	Ki	dike	lamprophyre
5	2		87	19.8	69.4	39.7	85.3	Ms	lower	shale
6	2		32	8.0	30.1	28.1	40.2	Ms	lower	sandstone, siltstone
7	2		8	7.8	19.5	15.6	27.3	Obf	upper	chert
8	4		96	106.0	88.0	42.0	22.0	MDa	middle	shale, chert
9								MDa	lower	novaculite, conglomerate
10	2		90	23.9	21.9	45.8	91.6	Ms	middle	shale, siltstone
11	2		78	21.4	50.6	25.3	56.4	Ms	middle	sandstone, quartz veinlets
12	2		92	38.0	54.0	30.0	146.0	Oby		shale
13	0		2	6.0	8.0	6.0	24.1	Oby		sandstone, siltstone
14	4		18	2.0	13.8	15.7	5.9	Ow		limestone, conglomerate
15	4		30	41.5	43.5	29.6	134.4	Ow		shale, siltstone
16	2		81	51.2	57.1	31.5	78.7	Oby		shale
17	2		19	7.9	19.7	27.6	13.8	Oby		sandstone
18	6		393	132.4	199.6	39.5	87.0	Ki	dike	lamprophyre
19	2		70	8.0	46.2	32.1	48.2	Om	upper	shale
20	4		24	4.0	13.8	25.7	11.9	OЄc		limestone, shale
21	0		39	9.8	35.3	19.6	45.1	Ocm		shale
22	0		0	2.0	5.9	13.8	23.6	Ocm		sandstone, quartz veinlets
23	0		48	30.0	54.0	36.0	54.0	Smm/MDa		shale, chert
24	0		57	52.7	58.6	13.7	78.1	MDa/Ms		novaculite, shale

Sample	Ag	As	Cr	Cu	Ni	Pb	Zn	Formation	Part	Lithology
25	0		50	13.9	55.8	33.9	53.8	Ms	middle	sandstone, siltstone, shale
26	0		118	41.8	59.8	13.9	81.7	Ms	upper	chert, shale
27	0		114	24.0	126.0	38.0	150.0	ℙj	upper	shale, sandstone
28	0		116	17.9	103.6	23.9	95.6	ℙjv		shale, sandstone, siltstone
29	2		73	19.7	72.8	55.1	76.8	Ms	upper	shale, siltstone, sandstone
30	2		115	21.7	79.1	37.5	85.0	Ms	upper	shale, sandstone
31	2		113	33.1	89.5	17.5	114.8	Ms	upper	shale, siltstone
32	2		136	13.8	77.1	19.8	43.5	ℙj	lower	shale, sandstone
33	2		84	15.9	65.7	35.9	87.6	Ms	lower	shale
34	2		94	10.0	79.7	15.9	55.8	Opc		shale
35	4		36	4.0	17.8	53.4	5.9	Q		tufa, (hot springs)
36	2		67	127.0	29.8	7.9	146.8	Obf		chert, shale
37	2		42	21.9	35.9	19.9	31.9	Om		siltstone, shale
38	2		20	8.0	14.0	24.0	18.0	Ki		igneous breccia
39	2		16	6.0	25.9	23.9	21.9	Om		siltstone, shale
40	2		122	13.7	94.1	41.2	66.7	ℙj		shale, sandstone
41	2		111	33.1	81.7	19.5	52.5	Ms		shale,
42	2		111	15.9	103.2	37.7	43.7	Ms	lower	shale, pyrite
43	4		338	134.4	373.5	67.2	120.6	Ki	dike	lamprophyre
44	4		341	133.3	374.5	39.2	119.6	Ms/ℙj		shale
45	2		90	14.0	28.0	28.0	4.0	Ow		shale
46	0		36	4.0	11.9	5.9	4.0	Obf		chert
47	0		40	0.0	27.7	29.6	4.0	Ow		limestone
48	2		88	7.8	49.0	45.1	66.7	Om	upper	shale
49	2		18	21.5	29.3	25.4	35.2	Om		siltstone, shale
50	2		58	20.1	90.4	62.2	56.2	Ms	lower	shale
51	4		8	0.0	13.9	25.9	15.9	Ow		limestone
52	0		8	52.3	3.9	5.8	3.9	Obf		chert
53	2		64	22.0	46.0	30.0	38.0	Oby		limestone, shale, conglomerate
54	0		24	4.0	10.0	2.0	2.0	Obf		chert, siltstone
55	0		8	3.9	3.9	1.9	7.8	Obf		chert, siltstone
56	2		58	44.6	40.7	27.1	25.2	Om		shale, siltstone
57	0		22	13.9	21.8	25.8	15.9	Ocm	upper	sandstone
58	2		108	92.4	68.3	40.2	72.3	Ow		shale
59	4		12	2.0	23.5	23.5	7.8	Ow		limestone
60	2		44	67.7	67.7	4.0	163.3	Ow		shale
61	2		49	11.9	98.8	41.5	53.4	Ow		shale, limestone

Sample	Ag	As	Cr	Cu	Ni	Pb	Zn	Formation	Part	Lithology
62	4		54	12.0	40.0	64.0	26.0	Ow		shale, limestone
63	2		73	41.7	81.3	27.8	33.7	Om/Oby		shale
64	2		124	28.0	36.0	24.0	36.0	MDa		shale, chert
65	2		32	12.0	6.0	6.0	2.0	Obf		chert, shale
66	2		91	25.8	89.3	37.7	47.6	Ms	upper	shale, siltstone
67	2		41	15.7	7.8	17.6	5.9	MDa		sandstone, shale, chert, conglomerate
68	2		46	22.0	76.0	84.0	40.0	Smm		shale, siltstone
69	4		45	23.5	37.3	41.2	15.7	Ow		limestone, shale
70	2		90	17.9	75.7	35.9	61.8	Ms	lower	shale
71	2		57	17.7	33.5	39.4	35.4	Om		shale, siltstone
72	2		80	19.6	94.1	39.2	56.9	Ms	upper	shale, chert
73	2		20	8.0	25.9	23.9	13.9	Ms	upper	sandstone
74	2		108	10.0	110.0	34.0	46.0	Pj	lower	shale, siltstone
75	2		102	28.0	100.0	30.0	54.0	Ms	lower/middle	shale, siltstone
76	2		80	19.5	78.1	44.9	54.7	Ms	middle	shale, siltstone
77	0		51	15.6	42.8	33.1	23.3	Pj	lower	sandstone, siltstone
78	2		139	23.8	83.3	63.5	33.7	Pj	lower	shale
79	0		20	7.8	27.5	3.9	2.0	Pj	lower	sandstone
80	0		75	5.9	41.2	19.6	15.7	Pj	lower	shale, siltstone
81	0		33	11.8	21.7	27.6	13.8	Pj	upper	sandstone
82	2		93	27.8	75.4	39.7	23.8	Pj	upper	shale, siltstone
83	2		70	2.0	20.0	50.0	2.0	Pj	upper	sandstone, quartz veinlets, fault zone
84	2		103	31.6	102.8	49.4	75.1	Pjv		shale, siltstone
85	2		123	27.7	94.9	47.4	75.1	Ms	middle	shale, siltstone
86	4		133	37.3	56.9	25.5	96.1	Ms	lower	shale, siltstone
87	2		96	37.8	39.8	286.9	25.9	MDa	middle	chert, shale, novaculite
88	0		4	4.0	6.0	26.1	10.0	MDa	lower	novaculite
89	2		140	2.0	34.0	38.0	20.0	MDa	lower	shale
90	2		26	15.9	31.7	87.3	11.9	MDa	middle	chert, shale, novaculite
91	2		131	121.5	59.8	53.8	85.7	Ms	lower	shale, chert, siltstone
92	2		89	21.8	91.3	55.6	83.3	Ms	middle	shale, sandstone
93	2		117	25.7	75.1	49.4	94.9	Ms	middle	shale, siltstone
94	2		98	21.7	70.9	37.4	84.6	Ms/Pj		shale, siltstone
95	2		64	22.0	44.0	30.0	58.0	Ms	upper	shale, siltstone, sandstone
96	2		85	11.8	41.3	33.5	41.3	Pj	lower	shale, siltstone, sandstone
97	0		20	5.9	15.6	3.9	15.6	Pj	upper	siltstone, sandstone
98	2		143	27.8	97.2	49.6	131.0	Pj	upper	shale, siltstone

Sample	Ag	As	Cr	Cu	Ni	Pb	Zn	Formation	Part	Lithology
99	2		67	9.9	47.6	19.8	61.5	ℙj	upper	sandstone
100	2		32	23.9	27.9	41.8	43.8	Om		shale, siltstone
101	2		116	16.1	72.3	58.2	98.4	Ow		shale
102	2		63	23.6	65.0	23.6	110.2	Ow		siltstone, sandstone
103	4		92	33.3	52.9	31.4	82.4	Om		shale
104	6		37	88.6	102.4	47.2	159.4	Ki	dike	lamprophyre
105	0		24	0.0	0.0	8.0	4.0	Obf		chert, siltstone
106	2		4	3.9	5.9	0.0	7.8	MDa	lower	novaculite
107	4		24	17.9	49.6	55.6	23.8	Ki	dike	lamprophyre
108	2		16	6.0	27.9	39.8	43.8	Ms	lower	tuff, sandstone
109	2		88	28.0	70.0	60.0	130.0	Ms	lower	shale
110	4		110	32.1	34.1	30.1	20.1	Opc		shale
111	0		16	7.9	21.7	7.9	4.0	Obf		chert, siltstone, (iron oxides)
112	2		44	20.1	16.1	10.0	10.0	Opc		shale
113	2		101	21.7	49.4	35.6	88.9	Oby		shale, sandstone
114	2		152	12.0	60.0	42.0	40.0	ℙj		shale
115	0		70	2.0	14.0	18.0	6.0	ℙj		sandstone
116	2		137	25.9	87.6	35.9	125.5	Ms	lower	shale
117	2		49	11.9	35.6	13.8	53.4	Ms	lower	sandstone
118	2		136	6.0	88.0	24.0	70.0	ℙj	lower	shale
119	2		14	5.9	17.6	3.9	7.8	ℙj	lower	sandstone, quartz veinlets
120	2		74	13.9	53.8	41.8	77.7	Ms	lower	shale, siltstone
121	2		86	21.6	52.9	27.5	58.8	Om		shale
122	2		65	25.6	68.9	23.6	57.1	O€c		shale, siltstone
123	2		86	22.1	30.1	34.1	84.3	Ocm/Om		shale
124	0		14	2.0	0.0	0.0	14.0	Ocm		sandstone, conglomerate
125	2		82	37.1	66.4	48.8	76.2	O€c	upper	shale, siltstone
126	0		26	12.0	51.8	33.9	71.7	Ocm		conglomerate, sandstone
127	0		12	2.0	8.0	10.0	31.9	Ocm		granitic meta-arkose erratic
128	2		66	16.0	30.0	16.0	100.0	Om	lower	limestone, shale
129	2		16	27.8	15.9	15.9	27.8	Om		chert, shale
130	0		74	26.1	62.2	26.1	64.3	Oby	upper	shale, sandstone
131	0		35	23.6	21.7	3.9	9.8	ℙa	lower	shale, siltstone
132	2		62	12.0	65.7	19.9	69.7	ℙa	lower	sandstone
133	2		125	25.7	85.0	31.6	110.7	ℙa	lower	shale, siltstone
134	2		34	5.9	29.6	15.8	41.5	ℙa	lower	sandstone
135	2		118	20.0	56.0	56.0	26.0	ℙj		shale

Sample	Ag	As	Cr	Cu	Ni	Pb	Zn	Formation	Part	Lithology
136	0		22	32.0	14.0	18.0	14.0	Pj		sandstone
137	2		93	31.5	80.7	33.5	108.3	Pa	lower	shale, siltstone
138	2		58	13.9	87.3	25.8	107.1	Pa	lower	sandstone
139	0		43	0.0	17.6	15.7	15.7	Pj		shale, sandstone
140	2		32	8.0	26.0	18.0	38.0	Pa	lower	shale, siltstone
141	0		96	20.1	98.4	22.1	122.5	Pjv		shale, sandstone
142	2		102	11.8	55.1	53.1	37.4	Ms/Pj		shale
143	0		36	4.0	23.7	15.8	27.7	Ms/Pj		sandstone
144	2		109	23.8	85.3	31.7	97.2	Ms	upper	shale
145	2		46	10.0	44.2	20.1	42.2	Ms	upper	sandstone
146	2		18	14.0	42.0	44.0	64.0	Ms		sandstone
147	2		66	8.0	44.2	42.2	30.1	Ms		shale
148	2		16	2.0	15.9	21.9	15.9	Ms		sandstone
149	4		96	33.3	74.5	60.8	98.0	Ms	lower	shale
150	2		42	11.9	45.6	29.8	55.6	Ms	lower	sandstone
151	2		114	52.0	80.0	32.0	102.0	Ms	lower	shale, siltstone
152	6		16	7.9	29.6	49.4	51.4	Ow	upper	limestone, shale
153	2		54	180.0	112.0	44.0	128.0	MDa	lower/middle	chert, novaculite, shale
154	2		88	22.1	58.2	38.2	88.4	Ms		shale, sandstone
155	0		42	2.0	37.7	4.0	23.8	Ms	upper	shale, sandstone
156	0		12	4.0	15.9	6.0	9.9	Pj	lower	shale, sandstone
157	2		0	10.0	33.9	35.9	41.8	Ms	lower	shale, sandstone
158	2		153	21.9	51.8	49.8	49.8	Ms	middle	shale, sandstone
159	2		32	8.0	68.0	32.0	48.0	Ms	lower	shale, sandstone
160	2		85	25.6	17.7	27.6	25.6	MDa/Ms		shale, chert
161	2		104	24.0	58.0	30.0	78.0	Ms	middle	shale, sandstone
162	2		169	25.9	67.7	39.8	45.8	Pj	lower	shale, sandstone
163	2		108	29.5	70.9	43.3	94.5	Pjv		shale, sandstone
164	2		144	24.4	95.5	40.7	83.3	Pj	upper	shale
165	0		12	4.0	10.1	8.1	2.0	Pj	upper	sandstone, siltstone
166	2		126	36.0	62.0	44.0	106.0	Pjv		shale, sandstone
167	0		925	13.9	1924.6	23.8	15.9	pCi		serpentine
168	0		122	27.6	100.4	31.5	88.6	Om		shale
169	0		88	119.5	13.9	6.0	10.0	Obf		chert, shale
170	2		26	18.0	24.0	26.0	32.0	Ocm		shale, chert, granitic meta-arkose
171	2		58	68.0	48.0	22.0	104.0	Ocm/Om		shale, chert
172	2		124	30.0	84.0	34.0	98.0	Om		shale, siltstone

Sample	Ag	As	Cr	Cu	Ni	Pb	Zn	Formation	Part	Lithology
173	2		58	49.8	43.8	29.9	65.7	Om		shale, siltstone
174	2		102	84.3	58.2	66.3	200.8	Om		shale
175	4		34	14.1	26.1	48.2	52.2	Om		shale, limestone
176	2		32	31.9	19.9	27.9	21.9	Om		shale, limestone
177	0		102	60.0	66.0	34.0	232.0	Om		shale, siltstone
178	2		8	6.0	67.7	63.7	310.8	Ki	dike	phonolite-trachyte
179	4		396	68.3	182.7	46.2	130.5	Ki	dike	lamprophyre
180	2		78	73.7	49.8	59.8	89.6	Om		shale
181	2		90	74.3	32.1	40.2	16.1	Om		shale, siltstone
182	2		129	59.8	63.7	55.8	83.7	Om		shale
183	0		62	12.0	22.1	32.1	28.1	Ow	upper	shale, chert
184	2		82	49.8	51.8	25.9	91.6	Om		shale
185	2		108	27.9	83.7	69.7	119.5	Ms	middle	shale, sandstone
186	0		24	6.0	27.8	29.8	21.8	Ms	middle	shale, sandstone
187	2		120	20.1	64.3	52.2	60.2	Ms	middle	shale, sandstone
188	2		56	18.0	48.0	48.0	66.0	Ms	middle	shale, sandstone
189	0		10	10.0	6.0	12.0	2.0	MDa		novaculite, chert
190	2		4	8.0	4.0	12.0	20.0	MDa		novaculite
191	2		74	30.0	52.0	6.0	60.0	Ms	lower	shale, siltstone
192	2		100	28.0	68.0	46.0	106.0	Ms	lower	shale, sandstone
193	2		113	22.2	86.7	42.3	100.8	Ms	lower	shale, sandstone
194	2		94	25.9	69.7	45.8	87.6	Ms	lower	shale, sandstone
195	0		6	8.0	6.0	2.0	15.9	Obf		chert, siltstone, wavellite
196	2		42	61.8	55.8	31.9	73.7	MDa		shale, conglomerate, chert
197	2		60	16.1	52.2	24.1	72.3	Ms	lower	shale, siltstone, sandstone
198	0		94	24.0	78.0	46.0	100.0	Ms	middle	shale
199	0		44	12.0	28.1	28.1	30.1	Ms	upper	shale, sandstone
200	0		82	16.0	62.0	22.0	40.0	Pj	middle	shale, sandstone
201	2		104	24.1	92.4	32.1	186.7	Pj	upper	shale
202	2		129	22.1	114.5	40.2	154.6	Pj	upper	shale, sandstone, quartz veinlets
203	2		96	14.1	66.3	28.1	24.1	Pj	middle	shale, sandstone
204	2		160	18.0	92.0	48.0	82.0	Pj	lower	shale, sandstone
205	0		28	17.9	23.8	17.9	17.9	Ms	upper	shale, sandstone
206	2		72	22.0	76.0	28.0	120.0	Ms	upper	shale, sandstone
207	2	1.4	164	30.0	22.0	36.0	18.0	Ms	middle	chert, shale, sandstone
208	2	1	92	29.9	81.7	39.8	105.6	Ms	middle	shale
209	0		80	26.0	66.0	34.0	92.0	Ms	middle	shale

Sample	Ag	As	Cr	Cu	Ni	Pb	Zn	Formation	Part	Lithology
210	2		86	23.9	73.7	57.8	95.6	Ms	middle	shale, siltstone
211	0		36	16.0	36.0	34.0	40.0	Ms	middle	shale, sandstone
212	0		82	26.1	84.3	72.3	134.5	Ms	middle	shale, sandstone
213	2		75	57.5	87.3	31.7	162.7	Ms	middle	chert, shale, sandstone
214	2		71	27.6	51.2	68.9	94.5	Ms	middle	shale, cone-in-cone
215	2		46	16.0	44.0	38.0	82.0	Ms	upper	shale, sandstone
216	2		100	34.1	76.3	48.2	98.4	Ms	middle	shale
217	2		183	47.8	17.9	23.9	12.0	Ms	middle/upper	chert, shale
218	2		48	18.1	48.2	32.1	72.3	Ms	middle	shale, sandstone
219	2		54	16.0	46.0	34.0	58.0	Ms	middle	shale
220	0		68	19.9	31.9	23.9	12.0	ℙj	lower	shale, sandstone
221	2		74	26.0	80.0	36.0	90.0	ℙj	lower	shale, sandstone
222	4		149	18.1	62.2	40.2	24.1	Ms	upper	shale, sandstone
223	2		98	17.9	41.8	41.8	27.9	Ms	middle	shale, sandstone
224	2		96	30.0	76.0	42.0	104.0	Ms	lower	shale, siltstone
225	2		104	31.9	75.7	61.8	113.5	Ms	lower	shale, siltstone
226	2		30	20.0	62.0	18.0	86.0	MDa		shale, chert
227	0	1.9	34	41.5	9.9	13.8	11.9	Obf		chert, shale
228	0	1.3	54	28.0	36.0	24.0	58.0	Opc		shale
229	2	1.1	36	15.9	19.9	6.0	99.6	Ow		limestone, shale
230	0	3.9	18	17.9	19.9	10.0	10.0	Opc		shale, chert
231	2	2.2	48	65.7	83.7	31.9	115.5	Ow		limestone, shale
232	4		36	31.9	51.8	35.9	143.4	Ow		limestone, shale
233	2		58	26.0	44.0	22.0	54.0	Oby		shale, siltstone
234	0		30	50.0	46.0	18.0	74.0	Ocm		shale, sandstone
235	4		10	7.9	19.8	41.7	9.9	O€c		limestone, chert
236	6		38	10.0	30.0	60.0	18.0	O€c		conglomerate, limestone, shale
237	2		81	53.4	59.3	33.6	106.7	Om/Oby		shale, siltstone, sandstone
238	0		64	44.0	46.0	4.0	112.0	Ow		shale, siltstone
239	4		28	10.0	28.0	36.0	28.0	Ow		limestone, siltstone, shale
240	0		47	39.5	31.6	13.8	13.8	Opc		shale
241	0		86	25.9	67.7	33.9	77.7	Ms	lower	shale, siltstone
242	0		100	28.0	84.0	42.0	82.0	Ms	lower	shale, siltstone, contact metamorphism
243	4		12	4.0	13.9	47.8	8.0	Ki	pluton	carbonatite
244	2		20	141.4	23.9	33.9	71.7	MDa	lower	novaculite, vanadium, titanium ore
245	2		58	6.0	15.9	4.0	15.9	Ms	lower	shale, barite
246	0		12	14.1	8.0	16.1	6.0	MDa	lower	novaculite

Sample	Ag	As	Cr	Cu	Ni	Pb	Zn	Formation	Part	Lithology
247	0		6	16.0	10.0	4.0	20.0	MDa	lower	novaculite
248	2		94	31.9	67.7	19.9	131.5	Ms	lower	shale, sandstone
249	2		30	13.9	41.7	7.9	87.3	Ki	pluton	nepheline syenite
250	2		98	10.0	59.8	25.9	85.7	Tm	lower	limestone, fossils
251	2		40	18.0	60.0	26.0	88.0	Ms	upper	shale, sandstone
252	2		69	4.0	37.7	31.7	37.7	Kb		sand, marl
253	2		94	26.0	78.0	20.0	90.0	Pjv		shale, sandstone
254	2		40	12.0	48.0	22.0	56.0	Ms	lower	shale, sandstone
255	0		69	21.8	67.5	35.7	81.3	Ms	middle	shale, sandstone
256	2		120	34.1	60.2	24.1	52.2	Ms	upper	shale, chert
257	2		90	20.0	46.0	24.0	28.0	Pj	lower	shale, sandstone
258	2		95	49.4	77.1	35.6	88.9	Ms	middle/upper	shale, chert, sandstone
259	2		94	33.9	71.7	33.9	83.7	Ms	lower	shale, sandstone
260	0		16	10.0	17.9	15.9	27.9	Ms	lower	barite, shale, chert
261	2		82	29.9	69.7	57.8	107.6	Ms	lower	shale, siltstone, sandstone
262	2		60	50.0	28.0	36.0	14.0	MDa	middle	chert, shale
263	2		36	67.7	45.8	0.0	53.8	MDa/Ms		chert, shale
264	2		30	14.1	42.2	38.2	42.2	Ms	middle	shale, sandstone
265	2		90	23.9	75.7	47.8	59.8	Pj	lower	shale, sandstone
266	0		16	6.0	20.1	18.1	14.1	Ms	middle	shale, sandstone
267	0		68	18.1	50.2	16.1	56.2	Pj	lower	shale, sandstone
268	2		98	28.0	88.0	18.0	122.0	Pjv	lower	shale, sandstone
269	0		62	19.9	51.8	31.9	57.8	Pj	lower	shale, sandstone
270	2		80	20.1	56.2	26.1	64.3	Pjv/Pa		shale, sandstone
271	0		36	10.0	20.1	0.0	18.1	Kt	lower	gravel, sand, clay
272	2		24	12.0	20.0	8.0	38.0	Pj	upper	shale, siltstone, sandstone, carbon
273	2		76	23.9	77.7	12.0	117.5	Pa	lower	shale, sandstone
274	2		122	38.2	92.4	20.1	116.5	Pjv		shale, siltstone, sandstone
275	2		60	18.0	62.0	32.0	74.0	Pj	upper	shale, siltstone, sandstone, quartz veinlets
276	2		88	31.9	63.7	33.9	93.6	Ms	upper	shale
277	0		56	4.0	19.9	6.0	25.9	Pj		shale, sandstone
278	0		84	10.0	34.1	20.1	18.1	Pj	lower	shale, sandstone
279	2		101	29.6	73.1	33.6	110.7	Ms	upper/middle	shale, siltstone
280	0		48	4.0	20.1	20.1	10.0	Pj		shale, sandstone
281	2		71	17.9	55.6	47.6	87.3	Ms	lower	shale, sandstone
282	2		46	157.4	119.5	17.9	83.7	MDa	middle/lower	shale, chert, fault gouge
283	2		38	28.1	28.1	24.1	30.1	Obf/Opc		chert, shale

Sample	Ag	As	Cr	Cu	Ni	Pb	Zn	Formation	Part	Lithology
284	2		112	46.0	50.0	32.0	60.0	Sbl		shale, sandstone
285	0		22	18.0	22.0	40.0	12.0	MDa	middle/lower	shale, chert, novaculite
286	2		94	18.0	60.0	44.0	80.0	Ms	lower	shale
287	0		66	52.0	54.0	36.0	68.0	Smm		shale, chert
288	0		110	56.0	56.0	12.0	100.0	Ms	lower	shale, siltstone
289	0	2.4	12	12.0	6.0	14.1	8.0	Obf		shale, chert
290	2		52	26.1	46.2	38.2	74.3	Oby		shale, sandstone
291	2	2.5	50	28.0	42.0	26.0	62.0	Ow	lower	shale, siltstone
292	2		30	30.0	28.0	2.0	186.0	Ow	upper	chert, shale, siltstone
293	2		78	20.0	58.0	76.0	92.0	Ms	lower	shale, sandstone
294	2		107	21.8	71.4	39.7	81.3	Pj	middle	shale, siltstone
295	2		14	4.0	24.1	42.2	429.7	Ki		vanadium ore, contact metamorphism
296	6		32	8.0	16.1	68.3	50.2	Ki		miserite/wollastonite, contact metamorphism
297	2		4	22.0	12.0	218.0	108.0	Ki		flourite, quartz vein
298	2		26	22.0	60.0	72.0	96.0	Ms	middle	shale, siltstone
299	2		52	45.6	77.4	53.6	127.0	MDa		shale, chert
300	0		12	36.1	30.1	0.0	118.5	Obf		chert, shale
301	2		72	16.1	36.1	26.1	58.2	Om/Oby		shale, siltstone
302	2		44	20.1	34.1	56.2	86.3	Om	lower	shale, siltstone
303	2		38	50.0	38.0	20.0	138.0	OCc	upper	shale, limestone, chert
304	2		56	41.7	43.7	13.9	63.5	Om	lower	shale, limestone
305	4		76	42.2	38.2	76.3	58.2	Om	upper	shale, siltstone
306	2		58	50.2	22.1	24.1	86.3	Ow/Obf		shale, chert
307	2		38	26.0	70.0	32.0	156.0	Ow	upper	shale, siltstone
308	0		4	33.9	23.9	6.0	59.8	Obf		chert
309	0	4.1	46	106.0	70.0	32.0	108.0	MDa	middle	chert, novaculite, shale
310	0		96	30.1	76.3	46.2	90.4	Ms	lower	shale, siltstone
311	0		44	20.0	32.0	18.0	76.0	MDa/Ms		novaculite, shale, barite
312	0		28	15.9	19.8		23.8	Obf		chert, shale
313	0		34	6.0	25.8	45.6	33.7	Ms	middle	sandstone, shale
314	0		28	2.0	16.1	12.0	16.1	Pj	lower	shale, sandstone
315	2		12	10.0	38.2	24.1	56.2	Ms	upper	shale, sandstone
316	0		70	16.0	44.0	42.0	60.0	Ms	upper	shale, sandstone
317	2		70	18.0	32.0	26.0	26.0	Pj	lower	shale, sandstone
318	2		312	40.0	1420.0	40.0	118.0	Ki	pipe	kimberlite breccia
319	4		124	6.0	82.0	68.0	32.0	Tw	lower	bauxite
320	2		18	6.0	34.1	30.1	92.4	Ki	pluton	nepheline syenite

Sample	Ag	As	Cr	Cu	Ni	Pb	Zn	Formation	Part	Lithology
321	2		42	95.2	6.0	2.0	6.0	Obf		chert, shale
322	0		32	2.0	6.0	8.0	6.0	Obf		chert, shale
323	0		12	8.0	2.0	2.0	12.0	Oby		shale, sandstone
324	2		38	8.0	8.0	12.0	34.0	O€c/Ocm		shale, sandstone
325	2		77	47.6	47.6	17.9	77.4	Ocm/Om		shale, siltstone
326	2		140	102.0	66.0	28.0	58.0	Obf		chert, shale
327	2		66	44.2	46.2	22.1	84.3	Om		shale
328	0		56	20.0	26.0	26.0	16.0	MDa	middle/lower	chert, conglomerate, shale
329	2		26	4.0	43.8	37.8	95.6	Ki	dike	phonolite
330	4		22	87.6	31.9	35.9	201.2	Ki		smoky quartz, brookite, red clay, contact meta.
331	4		14	36.1	42.2	46.2	44.2	Ki	pluton	ijolite
332	2		72	36.0	64.0	30.0	102.0	Oby	upper	shale, sandstone
333	0		6	16.1	6.0	4.0	8.0	Obf		chert, siltstone, shale
334	2		58	57.8	49.8	41.8	55.8	Om/Oby		shale, sandstone
335	2		100	32.0	62.0	48.0	70.0	Om	upper	shale
336	0		16	14.0	4.0	42.0	8.0	Obf		chert, shale
337	2		60	107.6	53.8	105.6	143.4	O€c		shale, siliceous concretions
338	0		44	196.8	12.0	62.2	14.1	Ow		shale, siltstone
339	0		98	46.0	22.0	58.0	50.0	Ocm	upper	siltstone, shale
340	0		88	298.0	84.0	58.0	256.0	Ow/Obf		shale, chert
341	2		138	50.0	90.0	50.0	100.0	Om		shale
342	2		2	43.8	19.9	77.7	17.9	Opc/MDa		shale, chert
343	2		167	29.9	71.7	79.7	43.8	ℙj	lower	shale, sandstone
344	0		80	24.0	54.0	56.0	94.0	Ms	middle	shale, sandstone
345	0		54	16.0	28.0	54.0	38.0	Ms	middle	shale, sandstone
346	2		120	48.0	80.0	80.0	132.0	Ms	middle	shale, sandstone
347	0		112	66.3	64.3	20.1	98.4	Ms	lower	shale, siltstone, pyrite
348	0		84	84.0	48.0	52.0	36.0	MDa	middle	shale, chert
349	0		80	56.0	20.0	60.0	8.0	MDa	middle	shale, chert, black
350	2		48	13.9	19.8	21.8	13.9	Sbl		siltstone, shale
351	2		94	25.9	57.8	45.8	77.7	Ms	lower	shale, sandstone
352	2		111	33.7	73.4	43.7	99.2	Ms	middle	shale, sandstone
353	2		133	41.8	81.7	45.8	115.5	Ms	middle	shale, sandstone
354	2		125	39.8	75.7	27.9	97.6	Ms	middle	shale, sandstone
355	2		133	35.7	59.5	29.8	75.4	Ms	lower	shale, siltstone
356	2		76	26.0	56.0	38.0	92.0	Ms	lower	shale, sandstone
357	0		86	118.0	48.0	26.0	48.0	MDa	upper	chert, shale

Sample	Ag	As	Cr	Cu	Ni	Pb	Zn	Formation	Part	Lithology
358	2		116	34.1	50.2	70.3	122.5	Ms	middle	shale, sandstone
359	2		50	22.0	28.0	32.0	54.0	Ms	lower	shale, siltstone
360	2		106	29.9	47.8	29.9	73.7	MDa/Ms		shale, chert
361	2		48	20.0	32.0	36.0	58.0	Ms	middle	shale, siltstone
362	2		68	223.1	37.8	25.9	55.8	MDa/Ms		shale, chert
363	0		89	31.7	47.6	31.7	103.2	Ms	lower	shale, sandstone
364	2		143	83.7	37.8	35.9	73.7	Ms	lower	chert, shale
365	2		28	12.0	20.0	28.0	36.0	Ms	lower	shale, sandstone
366	2		46	9.9	19.8	31.7	35.7	Ms	lower	shale, sandstone
367	2		44	16.0	12.0	16.0	40.0	Ms	upper	shale, sandstone
368	0		137	28.1	40.2	70.3	54.2	Ms	middle	shale, siltstone, sandstone
369	2		62	21.9	25.9	47.8	61.8	Ms	middle	shale, siltstone, sandstone
370	2		48	20.0	28.0	92.0	54.0	Ms	middle	shale, sandstone
371	2		141	28.1	2.0	8.0	12.0	Om		shale
372	4		58	18.0	24.0	36.0	30.0	Om		siltstone, shale
373	4		28	6.0	10.0	33.9	15.9	Om	upper	limestone, shale
374	6		72	28.1	38.2	62.2	92.4	Ms	middle	shale, siltstone
375	6		30	24.0	2.0	30.0	4.0	Obf		chert, shale
376	4		84	51.8	4.0	21.9	4.0	Ow	upper	shale, chert
377	4		60	25.8	37.7	35.7	25.8	Opc		shale
378	4		36	138.9	15.9	37.7	21.8	MDa	middle	chert, shale, siltstone
379	2		145	35.9	49.8	53.8	99.6	Ms	lower	shale
380	2		54	236.0	34.0	58.0	22.0	MDa		shale, chert
381	2		144	6.0	24.0	96.0	54.0	Opc		shale
382	2		22	14.1	2.0	0.0	4.0	Obf		chert, shale
383	2		40	37.8	27.9	49.8	39.8	Om		shale, limestone
384	2		50	22.1	32.1	54.2	64.3	O€c/Ocm		shale, limestone
385	4		43	11.8	23.6	49.2	45.3	Om		shale, siltstone, limestone
386	2		57	7.9	15.8	17.8	25.7	Qt		clay, sand, gravel
387	2		110	32.1	48.2	44.2	96.4	Ms	middle	shale, sandstone
388	0		152	14.0	38.0	72.0	20.0	Pj	middle	shale, sandstone
389	2		90	30.0	54.0	36.0	90.0	Ms	middle	shale, siltstone
390	0		98	33.9	53.8	47.8	95.6	Ms	middle	shale, sandstone
391	2		92	29.9	47.8	55.8	91.6	Ms	middle	shale, siltstone, sandstone
392	2		151	25.9	43.8	53.8	35.9	Pj	lower/middle	shale, sandstone
393	0		116	29.9	27.9	23.9	19.9	Pj	lower	shale, sandstone
394	0		132	28.0	38.0	44.0	42.0	Pj	lower	shale, sandstone

Sample	Ag	As	Cr	Cu	Ni	Pb	Zn	Formation	Part	Lithology
395	0		102	18.1	38.2	28.1	46.2	Pj	middle	shale, sandstone
396	2		114	22.0	26.0	24.0	32.0	Pj	middle	shale
397	4		91	31.7	41.7	65.5	101.2	Ms	middle/upper	shale, sandstone
398	2		92	17.9	31.9	23.9	41.8	Pj	middle	shale, sandstone
399	2		126	28.0	38.0	30.0	54.0	Pj	lower/middle	shale, sandstone
400	2		86	20.1	48.2	32.1	96.4	Pjv		shale, siltstone
401	0		32	6.0	22.0	24.0	54.0	Pjv		shale, siltstone
402	2		128	26.0	44.0	26.0	88.0	Pj/Pjv		shale, sandstone
403	2		174	38.0	28.0	42.0	42.0	Ms	upper	shale, chert
404	0		26	10.0	10.0	0.0	20.1	Pj	middle	shale, sandstone
405	0		116	36.0	54.0	18.0	86.0	Ms	middle	shale, siltstone, siderite concretion
406	0		116	39.8	37.8	29.9	89.6	Ms	middle	shale, siltstone
407										
408	0		112	34.0	52.0	56.0	134.0	Ms	lower	shale, siltstone
409	2		98	36.1	52.2	204.8	200.8	Ms	lower	siltstone, shale
410	2		36	10.0	30.0	16.0	78.0	Ow		shale, sandstone
411	2		66	28.0	44.0	52.0	128.0	Ow		shale
412	2		52	2.0	42.0	20.0	124.0	Ow		shale
413	2		56	18.0	22.0	8.0	38.0	Om		shale
414	2		74	44.0	22.0	20.0	70.0	Om		shale
415	2		76	52.0	28.0	12.0	110.0	Ow		shale, siltstone, chert
416	2		56	29.9	43.8	35.9	221.1	Ow		siltstone, shale
417	2		129	35.9	51.8	41.8	105.6	Ms	lower	shale
418	2		106	38.0	46.0	52.0	124.0	Ms	lower	shale
419	0		110	32.0	48.0	44.0	106.0	Ms	lower	shale
420	2		200	0.0	14.0	20.0	8.0	Ms	lower	shale, chert
421	0		44	10.0	19.9	13.9	43.8	Ms	middle	shale, sandstone
422	0		120	25.9	61.8	37.8	95.6	Pj	middle	shale
423	2		120	19.9	37.8	39.8	43.8	Pj	middle	shale, sandstone
424	2		99	19.8	43.7	27.8	101.2	Pjv		siltstone, shale
425	2		104	37.8	29.9	23.9	55.8	Pa	lower	chert, shale, sandstone
426	0		116	16.0	38.0	24.0	56.0	Pj/Pjv		shale
427	0		118	24.0	54.0	30.0	104.0	Pj	upper	shale, sandstone
428	2		129	25.8	47.6	45.6	81.3	Pjv	lower	shale, siltstone
429	4		24	36.1	20.1	52.2	12.0	Pj	upper	shale, sandstone
430	2		112	32.0	46.0	36.0	88.0	Ms	middle	shale, sandstone
431	2		104	30.0		36.0	42.0	Ms	lower	shale

Sample	Ag	As	Cr	Cu	Ni	Pb	Zn	Formation	Part	Lithology
432	2		70	14.0	4.0	0.0	4.0	Obf		chert
433	2		40	16.0	6.0	6.0	8.0	Opc		shale
434	0		88	22.0	24.0	32.0	14.0	MDa	middle	shale, black
435	2		104	20.1	26.1	220.9	44.2	Tm	upper	clay/shale
436	2		98	4.0	22.0	16.0	10.0	Tw		lignitic sand
437	2		46	8.0	14.1	22.1	16.1	Qt		clay, sand, gravel
438	4		16	6.0	2.0	36.0	8.0	Tm	lower	limestone, conglomerate
439	0		38	6.0	2.0	18.0	14.0	Om		shale, siltstone, pyrite concretion
440	2		68	40.2	26.1	22.1	78.3	Om		shale, siltstone
441	2		57	66.9	29.5	37.4	171.3	Om		siltstone, shale
442	0		30	23.8	2.0	33.7	11.9	K/T		clay, conglomerate, novaculite
443	2		82	24.0	14.0	18.0	54.0	Sbl		shale, sandstone
444	0		58	20.1	16.1	24.1	82.3	Ow	upper	shale, siltstone, sandstone
445	0		70	10.0	16.0	46.0	20.0	Sbl		sandstone, shale
446	0		103	37.7	49.6	37.7	156.7	Ms	lower	shale, sandstone
447	0		88	26.1	40.2	42.2	102.4	Ms	lower	shale, siltstone
448	2		48	22.1	44.2	44.2	104.4	Ms	lower	shale, sandstone
449	0		20	14.0	26.0	38.0	136.0	Ki	dike	lamprophyre, biotite, xenolith-bearing
450	4		94	26.0	44.0	34.0	100.0	Ms	lower	shale, sandstone
451	2		98	28.0	44.0	42.0	86.0	Ms	lower	shale, siltstone
452	2		378	38.0	44.0	36.0	66.0	Ms	Hot Springs	shale, siltstone, pyrite
453	0		94	38.0	50.0	56.0	114.0	Ms	lower	shale
454	2		12	12.1	10.1	38.3	44.4	pCi	RR aggregate	rhyolite porphyry (from Missouri)
455	2		32	16.0	14.0	28.0	28.0	Om		shale, siltstone
456	2		70	35.9	21.9	25.9	45.8	Om		shale, siltstone
457	2		97	41.5	37.5	31.6	140.3	Ocm/Om		shale
458	2		68	28.0	30.0	36.0	60.0	Om		shale, siltstone, limy
459	0		64	50.0	20.0	12.0	106.0	Ow		shale, siltstone
460	0		24	10.0	23.9	21.9	37.8	Om		shale, siltstone, limy
461	0		60	41.8	27.9	27.9	95.6	Om		shale
462	0		132	66.0	32.0	30.0	42.0	Om		shale, siltstone, limy
463	2		125	57.5	71.4	21.8	65.5	Om		shale
464	0		143	25.8	63.5	17.9	85.3	Ocm		shale, chert
465	2		426	34.0	252.0	22.0	86.0	Om	lower	shale, siltstone, limy
466	2		68	13.9	49.8	4.0	21.9	Ocm		shale, chert, limestone, sandstone
467	2		334	12.0	148.0	20.0	50.0	Om		shale
468	0		182	24.0	86.0	0.0	54.0	Ms	Hatton Tuff	tuff

Sample	Ag	As	Cr	Cu	Ni	Pb	Zn	Formation	Part	Lithology
469	0		776	8.0	378.0	18.0	68.0	Ki	pluton	nepheline syenite, pegmatite
470	2		63	6.0	53.6	41.7	129.0	Ki	pluton	nepheline syenite
471	2		203	17.9	73.7	21.9	19.9	Tw		sand, lignite
472	0		84	10.0	12.0	2.0	12.0	Tw		clay, lignite
473	2		290	6.0	136.0	44.0	20.0	Tw		clay
474	2		990	28.0	478.0	48.0	62.0	Pj	middle	shale
475	2		122	22.0	104.0	42.0	92.0	Pj	middle	shale, sandstone
476	0		167	16.1	60.2	30.1	24.1	Pj	lower/lower	shale, sandstone
477	2		134	22.0	78.0	54.0	98.0	Ms	lower	shale
478	4		108	20.0	48.0	40.0	26.0	Pj	middle	shale, sandstone
479	0		172	11.9	25.7	29.6	15.8	Ms	upper	shale, chert
480	0		84	14.0	54.0	34.0	90.0	Pj	middle	shale, sandstone
481	2									
482	0		128	28.0	74.0	44.0	74.0	Pj	middle/lower	shale, siltstone, sandstone
483	0		110	266.0	46.0	32.0	230.0	Obf		chert, quartz veinlets
484	0		88	50.0	84.0	30.0	86.0	Om		shale
485	4		46	6.0	18.0	44.0	20.0	Ks		chalk, marly
486	4		70	6.0	34.1	48.2	28.1	Ks		chalk, marly
487	2		72	15.9	25.9	10.0	31.9	Kb		sand, silt
488	0		20	4.0	6.0	4.0	6.0	Kb		clay, sand, gravel
489	2		72	23.9	51.8	21.9	99.6	Kb		clay, siltstone, carbon
490	2		34	2.0	4.0	6.0	4.0	Pj	upper	sandstone, siltstone
491	0		34	2.0	6.0	15.9	2.0	Pj		sandstone, siltstone
492	2		32	10.0	6.0	16.0	12.0	Pjv		sandstone
493	0		28	4.0	2.0	9.9	4.0	Pj	upper	sandstone
494	2		118	52.2	56.2	38.2	104.4	Pa	lower	shale, sandstone
495	0		80	20.0	64.0	34.0	84.0	Pjv		shale, sandstone
496	2		94	32.0	84.0	36.0	110.0	Pjv		shale, sandstone
497	2		134	32.0	58.0	74.0	24.0	Pj		shale, sandstone
498	2		111	31.7	65.5	29.8	83.3	Pj		shale, siltstone
499	2		26	4.0	6.0	8.0	8.0	Ms	upper	shale, sandstone
500	2		90	34.0	52.0	56.0	24.0	Ms	middle/lower	shale, sandstone
501	0		60	17.9	63.7	41.8	75.7	Pj	upper	shale, siltstone, sandstone
502	0		54	21.8	53.6	51.6	73.4	Ms	upper	shale, sandstone
503										
504	0		76	28.1	70.3	18.1	94.4	Pjv		shale, sandstone
505	0		122	30.0	36.0	48.0	14.0	Pj		sandstone, shale

Sample	Ag	As	Cr	Cu	Ni	Pb	Zn	Formation	Part	Lithology
506	2		112	43.8	77.7	43.8	105.6	Pa	lower	shale, sandstone
507	2		120	26.1	42.2	58.2	30.1	Pj		shale, sandstone
508	0		36	15.9	7.9	27.8	9.9	Kto		sand, clay, gravel
509	0		76	32.0	34.0	22.0	106.0	Kto		silt, carbon rich
510	2		132	28.0	30.0	58.0	54.0	Ms	lower	shale, sandstone, siltstone
511	2		150	48.0	96.0	64.0	158.0	Ms	lower	shale, sandstone, siltstone
512	2		105	31.7	67.5	45.6	107.1	Ms	lower	shale, cone-in-cone concretion
513	2		106	37.8	83.7	23.9	125.5	Ms	lower	shale, sandstone, siltstone
514								MDa	upper	chert, shale, sandstone
515	0		18	21.9	6.0	13.9	12.0	Obf		chert
516	2		75	59.3	43.5	33.6	85.0	Oby		shale, chert, conglomerate
517	2		120	20.0	38.0	54.0	42.0	Ms	lower	shale, sandstone, siltstone
518	2		50	26.0	24.0	40.0	14.0	MDa	middle	chert, shale
519	0		16	7.9	5.9	25.7	17.8	Ms	middle/lower	shale, sandstone
520	2		34	15.8	35.6	43.5	53.4	Ms	upper	shale, sandstone
521	2		142	18.0	50.0	48.0	32.0	Ms	upper	sandstone, shale
522	0		122	26.1	54.2	48.2	60.2	Ms	upper	shale, sandstone
523	0		74	24.0	52.0	38.0	76.0	Ms	lower	shale, sandstone
524	0		44	40.0	8.0	10.0	6.0	MDa	middle	chert, shale, pyrite
525	2		90	26.0	58.0	30.0	98.0	Ms	middle	shale, sandstone, siltstone
526	2		116	39.8	69.7	29.9	105.6	Ms	middle	shale, sandstone
527	2		36	12.0	10.0	33.9	15.9	Ms	middle	shale, sandstone
528	2		64	44.2	34.1	24.1	114.5	Om		shale, siltstone
529	2	0.3	70	10.0	12.0	13.9	37.8	Oby		shale, sandstone, siltstone
530	8	0.1	28	91.6	10.0	19.9	10.0	Obf		chert, siltstone
531	2	2.2	48	23.9	8.0	2.0	49.8	Obf		chert, siltstone
532	2	1.7	112	70.0	62.0	32.0	148.0	Ow		shale
533	0	2.5	82	46.0	44.0	26.0	84.0	Om		shale
534	0	2.3	26	37.5	4.0	7.9	4.0	Obf		chert
535	0	1.3	32	34.0	36.0	0.0	28.0	MDa		shale, chert
536	0		46	12.0	34.1	2.0	42.2	Ms	middle	shale, sandstone
537	2		106	48.0	22.0	10.0	24.0	Ms	upper	shale, chert
538	0		42	16.0	28.0	22.0	46.0	Pj	lower	shale, sandstone
539	2		115	17.8	63.2	13.8	83.0	Pj	lower	shale, sandstone
540	2		94	24.1	66.3	38.2	70.3	Pj	lower	shale, sandstone
541	2		94	34.0	84.0	58.0	250.0	Ms	upper	shale, cone-in-cone concretion
542	2		104	24.1	64.3	38.2	118.5	Ms	lower	shale, siltstone, sandstone, cone-in-cone

Sample	Ag	As	Cr	Cu	Ni	Pb	Zn	Formation	Part	Lithology
543	2		113	31.7	61.5	29.8	65.5	Ms	lower	shale, siltstone
544	2		108	25.9	67.7	23.9	103.6	Ms	lower	shale, siltstone
545	0		89	37.5	23.7	15.8	37.5	MDa		shale, chert
546	2		106	26.1	76.3	8.0	118.5	Smm/Opc		shale
547	2	2.8	82	24.1	32.1	30.1	64.3	Opc		shale
548	0	3	32	17.9	4.0	37.8	6.0	Obf		chert, shale
549	2	2.5	70	43.8	39.8	47.8	91.6	Smm		shale, siltstone
550	2	2.5	56	25.9	21.9	17.9	23.9	Smm/MDa		shale
551	0		40	6.0	17.9	29.9	13.9	Opc		shale, siltstone
552	2		68	28.0	28.0	12.0	28.0	Sbl		shale, siltstone
553	2		62	24.0	50.0	14.0	60.0	Opc		shale
554	2		22	12.0	16.0	0.0	56.0	Obf		chert
555	4		34	9.9	23.8	61.5	19.8	Kt	DeQueen	gypsum, limestone, shale
556	2		44	20.0	48.0	38.0	72.0	Kt		marl, clay, gravel
557	2		88	20.0	44.0	54.0	52.0	Ms	upper	shale, sandstone
558	2		63	23.8	57.5	53.6	67.5	Ms	upper	shale, cone-in-cone
559	0		32	14.1	26.1	18.1	54.2	Ms	middle	shale, sandstone
560	0		110	6.0	32.1	20.1	20.1	Pj	lower	shale, sandstone
561	2		85	43.7	25.8	25.8	19.8	Ms	upper	chert, sandstone
562	2		118	42.2	42.2	50.2	92.4	Ms	lower	shale, sandstone
563	2		130	20.0	40.0	22.0	28.0	Pj	lower	shale, sandstone
564	2		80	34.0	58.0	56.0	88.0	Ms	middle	shale, siltstone
565	2		84	27.9	63.7	29.9	93.6	Ms	lower	shale
566	2		100	30.0	62.0	30.0	104.0	Ms	lower	shale, siltstone
567	0		66	28.1	32.1	34.1	74.3	Ms	lower	shale, siltstone
568	2		110	37.8	65.7	51.8	87.6	Ms	lower	shale, siltstone
569	2	3.4	139	43.8	21.9	12.0	61.8	Ms	lower	shale
570	0		109	33.6	57.3	39.5	90.9	Ow	upper	siltstone, chert, shale
571	4		22	13.9	9.9	17.9	111.1	Ow	upper	limestone, siltstone
572	2		98	190.8	26.1	34.1	124.5	Ow		shale, black
573	0		83	23.8	31.7	39.7	37.7	Oby		shale, sandstone
574	2		54	37.7	57.5	19.8	67.5	Om		shale, siltstone
575	2		62	97.6	59.8	25.9	93.6	Om		shale
576	2		62	12.0	37.8	15.9	89.6	Opc		shale,
577	2		84	32.1	70.3	26.1	116.5	Ms	lower	shale, siltstone
578	2		68	33.9	63.7	29.9	111.6	Ms	lower	shale, siltstone
579	0		82	16.0	50.0	18.0	68.0	Opc		shale

Sample	Ag	As	Cr	Cu	Ni	Pb	Zn	Formation	Part	Lithology
580	2		70	30.1	52.2	36.1	122.5	Ow		limestone, shale
581	2		56	25.9	47.8	33.9	41.8	Ow		shale
582	2		58	57.8	53.8	27.9	71.7	Ocm/Om		shale
583	2		52	80.0	54.0	20.0	64.0	Om		shale, siltstone
584	2	3.4	28	54.0	46.0	4.0	78.0	O€c		shale, siltstone
585	2		66	36.0	94.0	20.0	106.0	O€c		shale
586	2		54	42.0	38.0	24.0	62.0	Ocm		shale
587	2		66	16.1	38.2	18.1	56.2	Ow		shale
588	4		52	230.0	48.0	30.0	80.0	Ow	upper	shale, limestone
589	2		62	64.0	64.0	26.0	20.0	Om		shale
590	2		76	56.0	48.0	20.0	60.0	Om		shale, sandstone
591	2		82	13.9	51.8	10.0	131.5	Ow		shale
592	2		70	52.0	48.0	30.0	66.0	Oby		shale
593	2		28	6.0	18.0	22.0	6.0	Om		shale, quartz veinlets
594	2		84	17.9	2.0	12.0	15.9	Oby		shale, chert
595	2		54	32.0	32.0	10.0	46.0	Ocm/Om		shale, siltstone
596	0		86	51.8	45.8	19.9	71.7	Ocm/Om		shale, limy
597	0		66	48.0	24.0	24.0	30.0	Oby		shale, sandstone
598	0		124	29.9	19.9	27.9	15.9	Ms	lower	shale, siltstone
599	2		22	10.0	8.0	14.0	2.0	Obf	upper	chert, limy
600	0		32	21.8	0.0	0.0	6.0	Obf	lower	chert, shale
601	0		94	58.0	54.0	34.0	90.0	Oby		shale
602	2		60	22.0	64.0	34.0	96.0	O€c		shale
603		3.7	62	94.0	106.0	30.0	194.0	Ocm		shale, siltstone
604	2		56	30.1	62.2	30.1	126.5	Oby		shale, siltstone
605	2		68	30.1	68.3	34.1	64.3	Ow		shale, siltstone
606	0		32	27.8	37.7	31.7	132.9	Ow		shale, siltstone, limestone
607	4		60	72.3	36.1	12.0	40.2	Ocm		shale
608	0		52	36.0	36.0	20.0	64.0	Om		shale
609	0		83	31.7	47.6	17.9	67.5	Oby		shale, siltstone
610	2		96	28.1	54.2	24.1	228.9	Ow		shale
611	2		100	44.2	52.2	12.0	74.3	Oby	upper	shale, siltstone
612	2		14	42.2	6.0	2.0	6.0	Obf		chert
613	0		104	55.8	47.8	17.9	75.7	Ms	lower	shale, chert
614	0		89	25.8	71.4	59.5	93.3	Ms	middle	shale, siltstone
615	0		192	20.0	36.0	56.0	24.0	Ms	middle	shale
616	2		84	44.0	40.0	6.0	56.0	Oby	upper	shale

Sample	Ag	As	Cr	Cu	Ni	Pb	Zn	Formation	Part	Lithology
617	2		112	154.0	58.0	42.0	194.0	Ow	upper	shale, black
618	2		139	20.1	54.2	44.2	38.2	Pa	lower	shale
619	2		114	30.0	86.0	46.0	104.0	Pjv		shale
620	2		104	16.0	48.0	38.0	28.0	Pjv/Pa		shale, silty
621	2		86	24.0	52.0	38.0	76.0	Ms	middle	shale
622	0		54	12.0	20.0	44.0	16.0	MDa	middle	chert, shale
623	2		97	45.6	65.5	31.7	85.3	Ow		shale, siltstone
624	2		54	114.0	40.0	22.0	92.0	Om		shale
625	2		216	46.0	90.0	26.0	94.0	Ms	lower	shale
626	2		72	26.1	52.2	44.2	86.3	Ms	lower	shale, silty
627	2		94	36.0	62.0	48.0	102.0	Sbl		shale, sandstone
628	0		108	42.0	60.0	54.0	112.0	Ms	lower	shale, siltstone
629	2		72	32.0	44.0	48.0	78.0	Ms	middle	shale, sandstone, silty
630	2		94	31.9	63.7	23.9	85.7	Ms	middle	shale, siltstone
631	2		66	21.9	43.8	35.9	61.8	Ms	middle	shale, siltstone
632	2		86	29.9	67.7	29.9	83.7	Ms	middle	shale
633	2		104	28.1	70.3	22.1	100.4	Ms	middle	shale
634	2		60	24.0	46.0	38.0	68.0	Ms	upper/middle	shale, silty
635	0		68	30.1	50.2	32.1	78.3	Ms	middle	shale, sandstone
636	2		92	32.1	48.2	50.2	66.3	Pj	lower	shale, sandstone
637	0		98	25.9	57.8	27.9	69.7	Ms	upper/middle	shale, silty
638	2		96	32.1	96.4	46.2	126.5	Ms	lower	shale
639	0		106	32.0	52.0	40.0	80.0	Ms	upper/upper	shale
640	0		36	614.5	22.1	10.0	112.4	Kto		clay, sandy
641	4		26	20.0	40.0	230.0	1090.0	Kt		limestone, carbon
642	0		28	0.0	4.0	0.0	7.9	Pj		sandstone
643	0		76	16.0	56.0	16.0	38.0	Pj		shale, siltstone, (mercury mine area)
644	0		44	12.0	19.9	2.0	13.9	Pj	mine tailings	sandstone, cinnabar
645	0		70	16.0	54.0	24.0	74.0	Pa	lower	shale, siltstone
646	2		116	32.0	64.0	56.0	90.0	Pa	lower	shale, siltstone
647	2		82	18.0	38.0	30.0	28.0	Pj		shale
648	2		98	37.8	101.6	37.8	147.4	Pjv		shale, siltstone, iron concretion
649	2		92	34.0	94.0	26.0	148.0	Pjv		shale
650	0		94	18.0	48.0	28.0	32.0	Ms	upper	shale, siltstone
651	0		84	36.0	76.0	40.0	118.0	Ms	middle	shale
652	0		62	27.9	59.8	31.9	79.7	Ms	middle	shale, silty, fault gouge
653	2		42	16.0	38.0	30.0	76.0	Ms	lower	shale, sandstone, asphaltite

Sample	Ag	As	Cr	Cu	Ni	Pb	Zn	Formation	Part	Lithology
654	2		102	30.0	58.0	52.0	104.0	Ms	lower	shale, sandstone
655	2		100	20.0	60.0	20.0	102.0	Ms	middle	shale, siltstone
656	2		71	33.7	57.5	59.5	99.2	Ms	middle	shale
657	0		133	42.2	66.3	22.1	68.3	Ms	upper	shale, carbon
658	0		98	116.5	46.2	34.1		Sbl		shale, siltstone, sandstone
659	0		58	82.3	58.2	36.1	50.2	MDa	lower	shale
660	2		102	35.9	69.7	13.9	107.6	Ms	lower	shale
661	4		104	35.9	77.7	45.8	109.6	Ms	middle	shale, siltstone
662	2		102	29.9	61.8	41.8	87.6	Ms	upper/middle	shale
663	2		106	14.0	38.0	42.0	28.0	Pj	lower	shale, sandstone
664	0		94	2.0	19.9	23.9	27.9	Kb		clay, sandy
665	2		77	24.2	44.4	42.3	74.6	Pjv		shale, sandstone
666	0		125	31.9	89.6	19.9	93.6	Pa	lower	shale
667	2		24		8.0	14.1	10.0	Kb		sand, gravel
668	2		86	26.1	58.2	30.1	98.4	Pjv		shale
669	2		66	366.0	48.0	40.0	84.0	Ms	lower	chert, concretions
670	2		90	72.0	36.0	28.0	42.0	Oby		shale, silty
671	0		112	33.9	77.7	29.9	77.7	Pa	lower/lower	shale, silty
672	2		96	50.2	36.1	12.0	40.2	Pjv/Pa		shale, siltstone
673	0		114	58.0	68.0	46.0	108.0	Pjv		shale, siltstone
674	2		106	34.0	48.0	42.0	84.0	Pjv		shale, siltstone
675	2		120	26.0	38.0	24.0	28.0	Pj	middle	shale
676	0		34	8.0	10.0	14.1	22.1	Kn		sand, glauconitic
677	0		92	31.9	69.7	55.8	113.5	Ms	lower	shale
678	2		100	31.9	69.7	65.7	117.5	Ms	middle	shale,
679	2		48	22.1	28.1	30.1	52.2	Ms	middle	chert, shale
680	2		88	36.0	60.0	44.0	90.0	Ms	middle	shale
681	0		106	82.0	58.0	28.0	110.0	Opc		shale, chert
682	2		54	13.9	17.9	12.0	41.8	Obf		chert, black
683	0		10	34.0	16.0	12.0	54.0	Obf		chert, black
684	2		129	23.9	25.9	10.0	35.9	Obf/Opc		chert, shale
685	0		4	14.0	6.0	6.0	12.0	Obf	upper	chert
686	2		111	34.3	68.5	44.4	112.9	Ms	lower	shale
687	0		18	62.2	16.1	40.2	22.1	MDa		chert, novaculite, shale
688	0		63	50.4	12.1	50.4	8.1	MDa	middle	chert, novaculite, shale
689	0		38	30.0	14.0	8.0	10.0	MDa	middle	shale, chert, novaculite
690	2		106	40.0	54.0	28.0	100.0	Ms	lower	shale, chert

Sample	Ag	As	Cr	Cu	Ni	Pb	Zn	Formation	Part	Lithology
691	2		92	30.1	70.3	38.2	84.3	Ms	middle	shale
692	2		126	62.0	14.0	14.0	22.0	MDa		chert, shale
693	2		56	17.9	115.5	8.0	239.0	Smm		shale, sandstone, manganiferous oxides
694	2		68	21.9	10.0	13.9	4.0	Ow/Obf		chert, shale
695	0		4	16.0	4.0	2.0	16.0	Obf		chert
696	4		74	48.0	38.0	48.0	34.0	Om		shale
697	0		62	52.0	10.0	18.0	32.0	Obf		chert
698	2		124	42.0	58.0	28.0	132.0	Opc		shale
699	0		104	74.3	48.2	18.1	82.3	Om		shale
700	0		24	32.1	24.1	20.1	72.3	O€c/Ocm		shale, chert
701	2		165	309.2	24.1	14.1	44.2	Ow/Obf		shale, chert
702	2		98	12.0	18.1	46.2	36.1	Om		shale, limestone
703	2		70	21.9	33.9	35.9	107.6	Om		shale, limestone
704	2		72	58.0	34.0	34.0	64.0	Om		shale
705	0		84	43.8	37.8	31.9	107.6	Om		shale
706	0		60	57.5	49.6	27.8	196.4	Om		shale, siltstone, limy
707	2		73	47.6	59.5	37.7	99.2	Om		shale
708	0		143	32.1	28.1	32.1	26.1	Om		shale, siltstone
709	0		76	122.0	32.0	20.0	68.0	Ow/Obf		shale, chert
710	0		42	19.9	29.9	12.0	55.8	Om		shale, siltstone
711	2		110	33.9	67.7	29.9	135.5	Pjv		shale, siltstone
712	4		98	54.0	62.0	28.0	156.0	Ms	upper	shale, silty
713	2		34	12.0	8.0	6.0	14.0	Pj	upper	shale, sandstone, conglomerate
714	2		36	14.0	18.0	20.0	44.0	Kt		clay, sand, gravel
715	2		122	36.0	80.0	32.0	102.0	Pa	lower	shale, siltstone
716	2		100	24.0	30.0	14.0	32.0	Pa	lower	shale, siltstone
717	4		22	11.9	17.9	49.6	33.7	Kt	Dierks	limestone, glauconitic, fossils
718	2		42	8.0	14.0	10.0	26.0	Pa	lower	shale, sandstone
719	2		84	17.9	55.8	41.8	55.8	Ms	middle	shale, siltstone
720	2		100	32.0	68.0	40.0	88.0	Ms	middle	shale
721	4		112	46.0	78.0	40.0	90.0	Ms	middle	shale
722	2		86	16.0	30.0	44.0	22.0	Pj	lower	shale, sandstone, iron oxides
723	0		98	38.0	66.0	30.0	98.0	Ms	upper	shale
724	2		97	31.7	69.4	45.6	111.1	Ms	lower	shale
725	0		118	45.8	59.8	17.9	81.7	Ms	lower/lower	shale
726	2		82	28.1	56.2	40.2	78.3	Ms	lower	shale
727	2		108	32.0	72.0	34.0	92.0	Ms	lower	shale

Sample	Ag	As	Cr	Cu	Ni	Pb	Zn	Formation	Part	Lithology
728	2		133	12.0	34.1	38.2	60.2	Oby		shale, siltstone