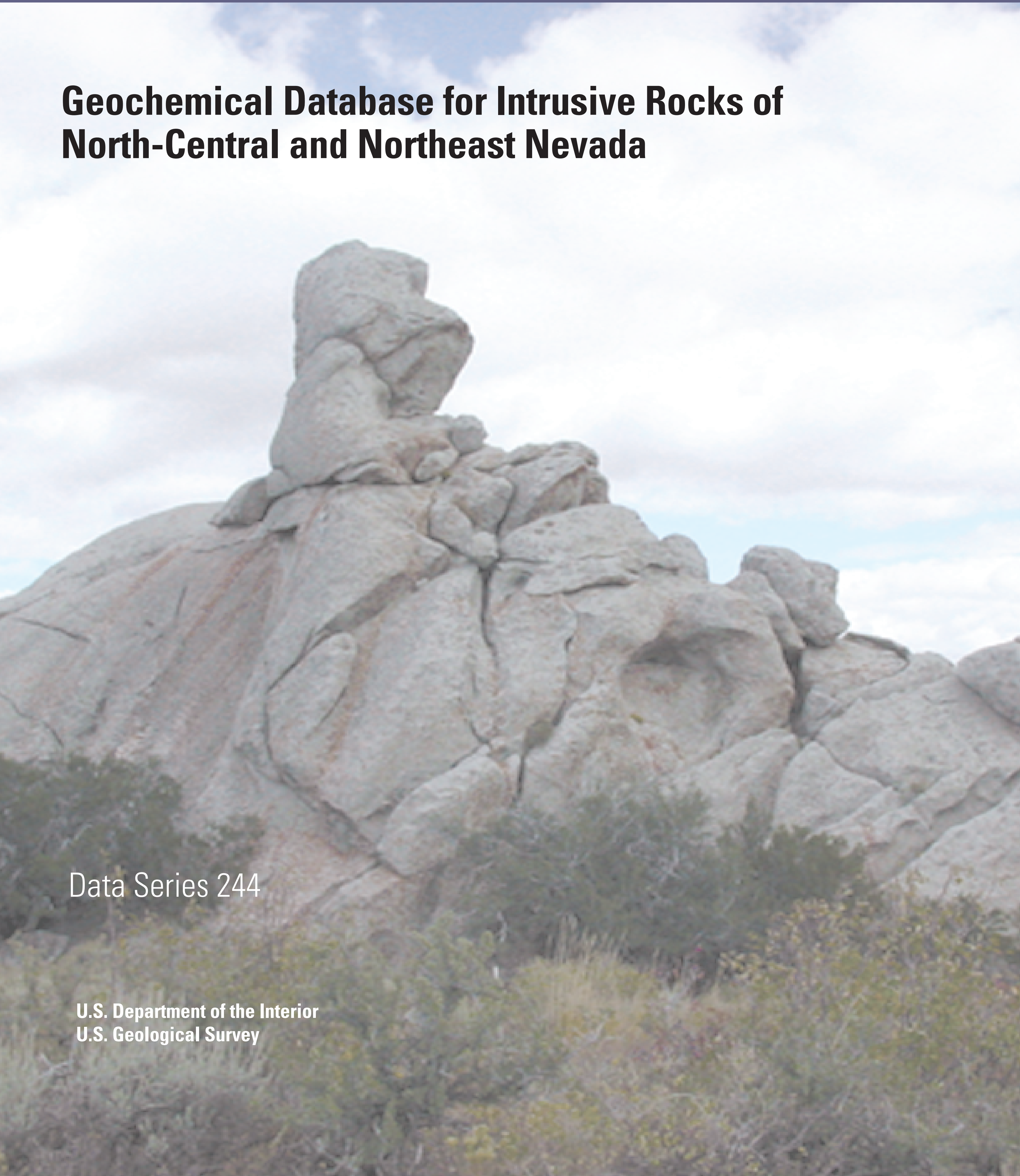
Geochemical Database for Intrusive Rocks of North-Central and Northeast Nevada



Data Series 244

U.S. Department of the Interior
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Cover: The granodiorite of Toyn Creek forms prominent outcrops at Harrison Pass, Ruby Mountains, Nevada.

Geochemical Database for Intrusive Rocks of North-Central and Northeast Nevada

By Edward A. du Bray, Michael W. Ressel, and Calvin G. Barnes

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Geochemical Database for Intrusive Rocks of North-Central and Northeast Nevada

By Edward A. du Bray, Michael W. Ressel[1], and Calvin G. Barnes[2]

Introduction

Data presented in this report pertain to the igneous intrusions of north-central and northeast Nevada and were compiled as part of the Metallogeny of the Great Basin project conducted by the U.S. Geological Survey between 2001 and 2007. The geographic area addressed in this compilation is approximately bounded by lats 38.5° and 42°N., long 118.5° W., and the Nevada-Utah border (fig. 1). The area contains numerous large plutons and smaller stocks but also contains many small, shallowly emplaced intrusive bodies, including dikes, sills, and intrusive lava dome complexes. The age, composition, and geographic distribution of intrusions in north-central and northeast Nevada (hereafter, the study area) are summarized by du Bray and Crafford (2007). Intrusive igneous rocks, of multiple ages, are known to be major constituents of the geologic framework in the study area (Stewart and Carlson, 1978). Abundant middle to late Mesozoic and early to middle Cenozoic intrusions in the study area are probably byproducts of subduction-related processes, including back-arc magmatism, that prevailed along the west edge of the North American plate during this interval.

Ressel and others (2000) and Ressel and Henry (2006), for example, have highlighted the association between magmatism and ore deposits along the Carlin trend. Similarly, Theodore (2000) has demonstrated the association between igneous intrusions and ore deposits in the Battle Mountain area. Decades of geologic investigations in the study area demonstrate that many ore deposits, representing diverse ore deposit types, are spatially, and probably temporally and genetically, associated with igneous intrusions. Because of these associations, studies of many individual igneous intrusions have been completed, including those by a large number of Master's and Doctoral thesis students (particularly University of Nevada at Reno students and associated faculty), economic geologists working on behalf of exploration and mining companies, and U.S. Geological Survey earth scientists. However, despite the number and importance of igneous intrusions in the study area, no synthesis of geochemical data available for these rocks has been completed.

Data compilations that are available for igneous intrusions in Nevada pertain to relatively restricted geographic areas and (or), in most cases, do not include the broad array of data that would aid interpretation of these rocks. Smith and others (1971) presented potassium-argon geochronologic and basic petrographic data for a few intrusions in north-central Nevada. Similarly, Silberman and McKee (1971) presented potassium-argon geochronologic data for a significant number of central Nevada intrusions. More recently, Mortenson and others (2000) presented uranium-lead geochronology for a small number of intrusions in the study area. Sloan and others (2003) released a national geochronologic database that contains age determinations made prior to 1991 for rocks of Nevada. Finally, Henry and Sloan (2003) compiled geochronologic data for igneous rocks of Nevada produced subsequent to completion of the Sloan and others (2003) compilation. Consequently, although age data for igneous rocks of Nevada have been compiled, data pertaining to compositional features of these rocks have not been systematically synthesized. Maldonado and others (1988) compiled the distribution and some basic characteristics of intrusive rocks throughout Nevada. Lee (1984), John (1983, 1987, and 1992), John and others (1994), and Ressel (2005) have compiled data that partially characterize igneous intrusions in various parts of Nevada. Contained in the text and data that follow is a more complete synthesis of composition and age data for igneous intrusions of the study area. The ultimate goal of this effort is an evaluation of the time-space-compositional evolution of Mesozoic and Cenozoic magmatism in the study area and identification of genetic associations between magmatism and mineralizing processes in this region.

Acknowledgments

We would like to thank a number of individuals who helped make this effort possible. The staff of the USGS

[1]Newmont Mining Corporation

[2]Texas Tech University

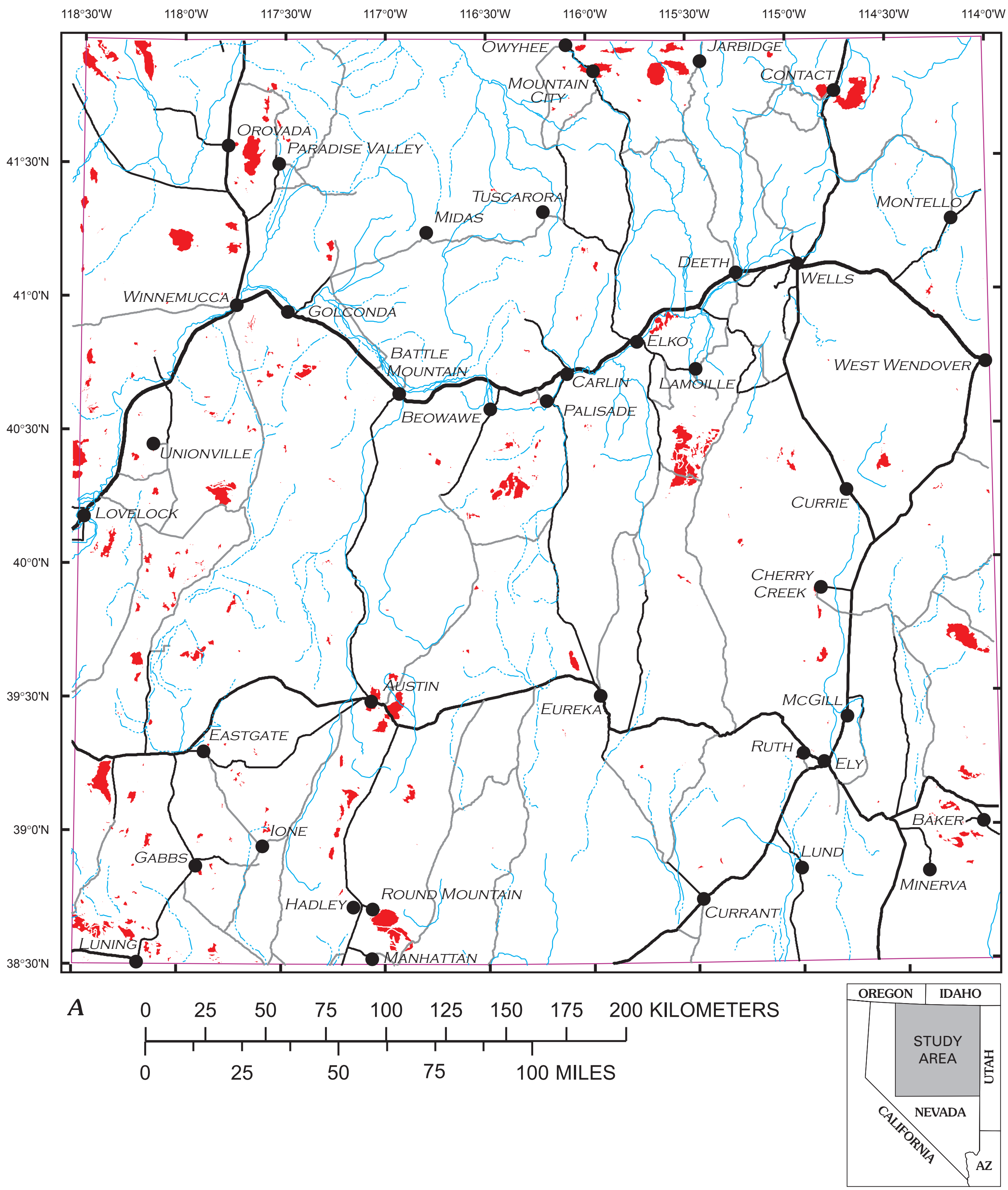

Figure 1 (above and following page). Index map (compiled from Crafford, in press) showing approximate distributions of intrusive rocks and analyzed samples, north-central and northeast Nevada. Thin purple line outlines the Metallogeny of the Great Basin project area (the geographic area within which analyses were compiled). *A*, Locations of intrusions, in red. *B*, Collection sites for samples included in database, indicated by blue plus symbols.

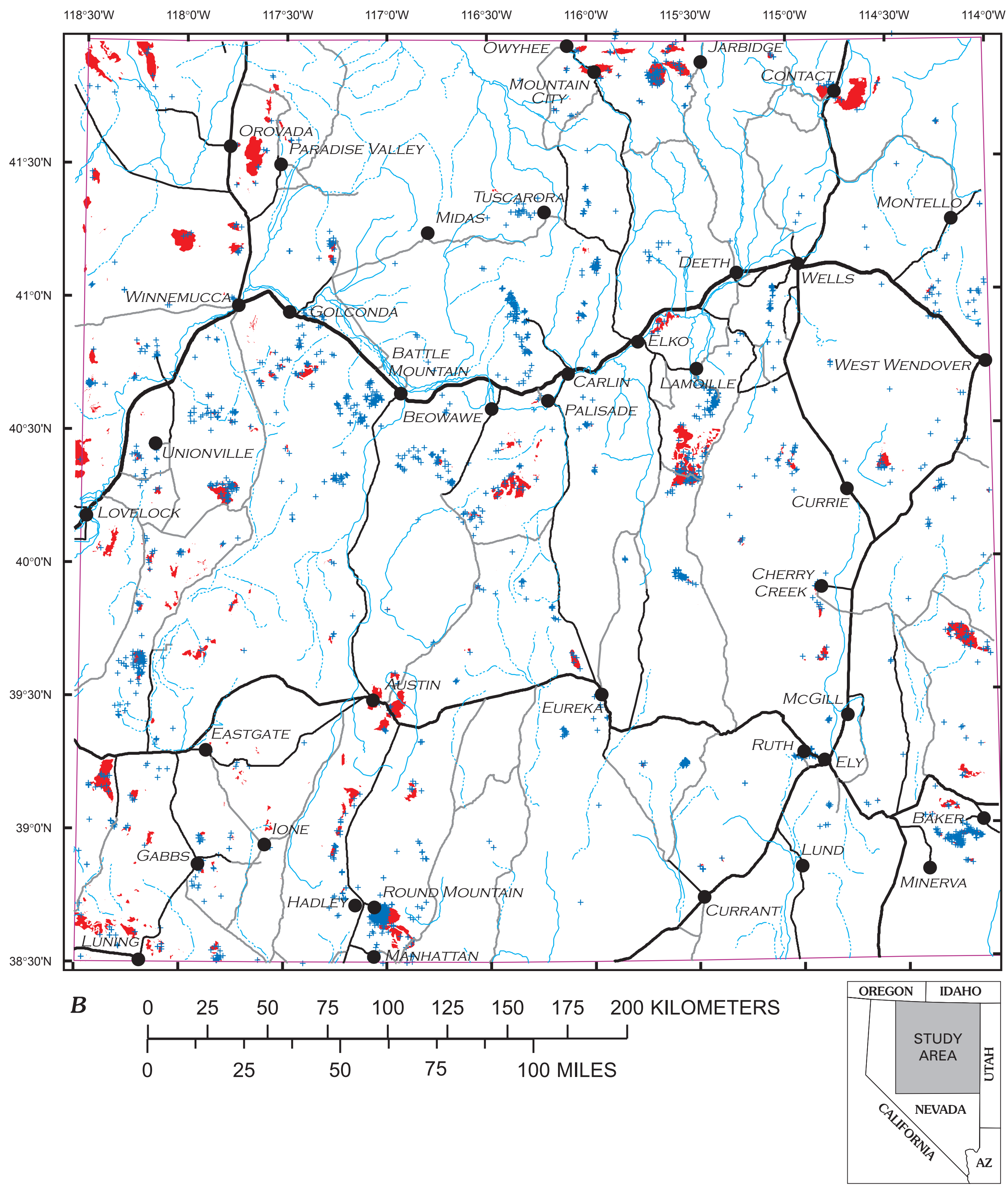

Figure 1. Index map showing approximate distributions of intrusive rocks and analyzed samples, north-central and northeast Nevada—Continued.

Denver library were critical to the success of this compilation. In particular, the library staff used the interlibrary loan process to obtain many of the geologic reports on which this compilation is based. We thank Joan Luce and Frances Vialpando for their tireless typing; data from many sources were available only in analog form and had to be painstakingly typed. Many geologic researchers gave tirelessly of their time to track down missing bits of information that allow this database to be as complete as it is. These individuals include M. Granitto, M.D. Barton, E. Seedorff, J. Nicholes, A.J. McGrew, J.F. Slack, S.W. Nelson, L.J. Garside, S.B. Keith, A.R. Wallace, J.L. Doebrich, D.R. Shawe, R.W. Kistler, E.H. McKee, R.L. Smith, T.G. Theodore, J.M. Hammarstrom, D.A. John, C.S. Rombach, A.W. Snoke, A.T. Strike, K.A. Howard, and S.P. Marsh. In addition we would like to thank Stan Keith (MagmaChem Exploration, Inc), Newmont Mining Corporation, and AngloGold Ashanti for contributing significant amounts of intrusive rock geochemical data. Finally, we gratefully acknowledge technical reviews by D.A. John and C.D. Henry that helped improve this report.

Intrusions of North-Central and Northeast Nevada—Constituents of the Database

The study area contains numerous large plutons and smaller stocks but also contains many smaller, shallowly emplaced intrusive bodies, including dikes, sills, and intrusive lava dome complexes. Many geologic investigations have demonstrated that intrusions in the study area are principally of three ages, Jurassic, Cretaceous, and Eocene. However, in the western part of the study area, a number of intrusions are thought to be of Triassic age (Johnson, 1977). Several small, shallowly emplaced Miocene-age intrusions have been delineated in various parts of the study area. This report pertains to intrusions of these ages but does not contain data for Paleozoic intrusions, principally very mafic, that are likely parts of detached, allocthonous thrust sheets.

Crafford (in press) recently completed compilation of a digital geologic map of Nevada using the Nevada Bureau of Mines and Geology county reports and accompanying geologic maps as primary sources. The new compilation is based mostly on the existing county maps and generally depicts geologic relations shown on those maps. As part of the digital recompilation, discontinuities across county boundaries were reconciled. The resulting compilation identifies many of the intrusions for which geochemical data were compiled. However, the database also includes data for intrusions, in many cases small intrusions, that were not identified on the county geologic maps. Background documentation for some analytical data presented in this report is incomplete and (or) may be misleading or incorrect, any of which could cause inclusion of inappropriate information in the database. Every effort has been made to preclude inclusion of misleading data; the amount of this type of data inadvertently included in the database is probably small and should not significantly affect data interpretation.

Data Compilation Methods

Several significant efforts to obtain new compositional data for intrusions in the study area preceded and served as a starting point for the effort documented here. S.B. Keith (MagmaChem Exploration, Inc.) obtained data for samples from several hundred intrusions in the Great Basin. Geologists employed by AngloGold Ashanti collected and analyzed an additional several hundred samples of intrusions in the study area as part of an exploration program. Most recently, as part of Ph.D. thesis research and subsequent investigations, M.W. Ressel collected and analyzed several hundred more samples of intrusions in the study area in an attempt to establish links between various intrusions and Carlin gold deposits.

Copies of original data source materials (subsequently referred to as sources), including published reports and Master's and Doctoral theses, were used to add data to the database. Reference lists contained in sources of data were examined and used to identify additional data sources. In this way, data for about 2,800 samples from 93 sources were identified and incorporated in the database. We believe that this process has probably resulted in identification and incorporation of most of the compositional data that have been produced for samples of intrusions in the study area. In order for a sample to be included in the database, at least a sample number and major oxide analysis were required. Samples for which only trace element data were available were not included in the database. Additional trace element (for instance, the rare earths) and (or) isotopic data are available for some samples, but because the number of these samples is very small, these data were not included in the database. Small amounts of additional data can be gleaned by consulting the appropriate data sources. No effort was made to exclude hydrothermally altered samples from the compilation. Rather, all intrusive rock compositional data were compiled and samples known to be altered were coded accordingly. In a subsequent interpretive phase of this work, additional altered samples will be identified using standard geochemical criteria. The winnowing process will result in two derivative databases. The derivative database for essentially unaltered intrusive rocks will allow evaluation of time-space-composition relations between magmatism and ore genesis. The derivative database containing data for altered rocks will allow evaluation of hydrothermal alteration effects on primary rock compositions. Database users should be wary of samples with SiO_2 abundances greater than 77 percent, initial analytic totals less than 95 percent or greater than 103 percent, Al_2O_3 abundances less than 10 percent or greater than 20 percent, total volatile contents greater than 5 percent, or Na_2O/K_2O ratios less than 1 or greater than about 12; samples with any of these characteristics are likely altered and probably do not preserve primary igneous rock compositions. Data presented in source materials were included in the database, without modification (with the exception of normalization of major oxide, as described below), and all input subsequently verified.

Data were compiled using Microsoft Excel and can be accessed using software compatible with .xls files. The database release (file, NoNVintrusionGX.xls) includes several worksheets that are accessed using tabs arrayed along the base of the spreadsheet screen display. The tab labeled "Main NV db" accesses the primary data compilation. The tab labeled "db w censored data deleted" accesses a copy of the primary data compilation in which censored data (data coded as less than some specified value) were deleted prior to calculation of summary statistics and creation of histograms. The tab labeled "no loc" accesses data for samples contained in the U.S. Geological Survey National Geochemical Database for which accurate location data are unavailable. The database release also includes a tab-delimited, text file version of the database (file, NoNVintrusionGX.txt).

Data Fields

Data fields presented and described below represent those considered most critical to addressing questions concerning the tectonic, petrologic, and metallogenic evolution of magmatism in the study area. Data for each of these fields constitute a column, or set of related columns, in the database. Data in these columns can be sorted, queried, and interpreted to address questions concerning the history, development, and implications of magmatic activity in the study area. Sample number records are aggregated in blocks of data that share a primary geochemical data source.

Blank cells in the database indicate that no data are available for the corresponding column. Some sources report values of zero for some database fields. These values indicate that an abundance determination was attempted but that the constituent was not detected in the sample. Similarly, some sources present qualified data. In particular, records for some samples include less than (<) symbols. These data indicate that the constituent was detected but that its concentration was unquantifiable beyond the fact that its concentration is less than the indicated value. Actual analytical precision (number of significant figures) associated with each database entry is portrayed by each displayed onscreen value. Data in some cells appear to be more precise than displayed values, but this is a misleading artifact of computational processes (for instance, normalization to 100 percent volatile free), which may have been used to create data cell contents. Precision varies within individual columns in accordance with specific analytical protocols and the way data are reported in individual sources. In most cases, the number of significant figures defined in data sources was retained. However, in some cases, the level of precision implied is implausible given either the analytical protocol or the corresponding analytical state of the art; accordingly, some numeric data contained in the database have been rounded to indicate a plausible level of analytical precision.

field_no.

Identifiers for analyzed samples materials were compiled from sources and presented, without modification.

lithology

In most cases, a lithologic description of analyzed samples was compiled from information contained in sources. In accordance with procedures defined by the International Union of Geological Sciences, composition names for intrusive rocks are best defined using the relative modal proportions of quartz, alkali feldspar, and plagioclase relative to the classification scheme of Streckeisen (1973). The most informative sources present relative proportions of the feldspars and quartz in text accompanying geologic reports; this information was used to establish composition (or composition range) names for intrusions in the study area. Many publications that serve as sources for our compilation predate the classification recommendations of Streckeisen (1973); most of these used the classification of Johannsen (1931) to define compositions of intrusions in the study area. To the extent possible, and using whatever ancillary data were available, intrusion compositions were converted from the nomenclature of Johannsen (1931) to that of Streckeisen (1973). Most of these transformations were simple and obvious. However, the two nomenclature systems use the term quartz monzonite to define significantly different rocks. Most of the composition field called quartz monzonite by Johannsen (1931) is now referred to as monzogranite in the Streckeisen (1973) system. Not all source authors define which of the two classification schemes was used to categorize intrusion compositions, so some ambiguity persists. An effort was made to recast compositions to the Streckeisen (1973) system in cases for which sufficient data were available to achieve this with confidence that the integrity of primary source data was not compromised.

Many intrusions of the study area are shallowly emplaced and (or) subvolcanic bodies. As such, their grain size precludes petrographic modal analysis and classification using the Streckeisen (1973) system. These rocks are instead treated as volcanic rocks and their composition names were established based on their chemistry and the nomenclature grid described by Le Bas and others (1986).

ign_form

The form of the igneous intrusion represented by each sample is given where known. Samples coded as representing dikes or sills represent thin tabular bodies that are discordant and concordant with enclosing rocks, respectively. Larger intrusive bodies, generally discordant to enclosing rocks, are coded as plutons, stocks, and plugs depending on their size; plutons are the largest of these bodies, whereas plugs are the smallest. In most cases, samples from intrusions coded as plutons represent bodies that cooled slowly, at the greatest depths, and are phaneritic, whereas samples from intrusions coded as plugs represent the subvolcanic environment, many have a quenched groundmass, and some may represent parts of endogenous to exogenous volcanic flow domes.

alteration

Many sources explicitly indicate that some analyzed samples are altered. Other sources provide sufficient descriptive information about samples that alteration can be inferred. Some sources simply indicate that samples are altered; these samples are simply coded as “Yes” in the “alteration” column. Other alteration terms used to code altered samples include advanced argillic (abbreviated “adv argillic”), phyllic, argillic, propylitic, potassic, skarn, greisen, silicification, oxidation, tourmaline, metamorphic, and deuteric. Each of these terms is applied in accordance with their standard usage, defined for instance by Guilbert and Park (1986). These terms are appended with a “?” when the proper alteration nomenclature is ambiguous due to the nature of available descriptive information.

long and lat

An effort was made to obtain location data for all samples with composition data. Most sources contain some form of location information. Missing sample location data were requested from authors, most of whom were able to provide missing information. Accordingly, location data are available for all but two samples. Latitude and longitude data are reported as decimal degrees (relative to the 1927 North American Datum). In the study area, longitude is reported as a negative value (western hemisphere) and latitude as a positive value (northern hemisphere).

Location data are of variable quality as a consequence of the manner in which they were initially acquired and subsequently reported. The number of significant figures presented as part of location data in the “long” and “lat” columns defines relative levels of sample location precision, as follows:

- four significant figures indicates that the given location is accurate within 10’s of meters,
- three significant figures indicates that the given location is accurate within 100’s of meters, and
- two significant figures indicates that the given location is accurate within 1,000’s of meters.

Some sources report sample location in terms of Township, Range, and section values, usually to the closest 1/4 of a section. Township-Range-section data were digitized to obtain decimal degree location; within the appropriate 1/4 section quadrilaterals, digitized points were usually selected to coincide with a road, trail, stream bottom, quarry, or natural cliff, any of which might represent a likely sampling location. Some sources do not include numerical sample location data but do contain sample maps. Location data for these samples were obtained by digitizing sample sites. A very few sources merely describe sample locations; these were used to estimate a sample location, which was then digitized.

Some early records contained in the U.S. Geological Survey National Geochemical Database contain location data keyed to quadrangle corners. These location data, and therefore the associated composition data, are of uncertain utility. For the sake of completeness, and in the hope that location data can ultimately be recovered for these samples, composition data for these samples are compiled in a separate worksheet (tab = no loc) in the database. Data for these samples are not included in the histograms or the statistical measures.

SiO_2, TiO_2, Al_2O_3, FeO*, MnO, MgO, CaO, Na_2O, K_2O, and P_2O_5

Sources report whole rock, major oxide data in a variety of formats. In addition, these data were produced by a wide array of analytical procedures, each with its own associated analytical precision and accuracy. Compositions for many of the samples included in the database are presented in their sources already normalized to 100 percent volatile free. Some information loss occurs when data are reported solely in this fashion. Compiling analytical methods and associated estimates of precision and accuracy associated with the reported data was beyond the scope of this effort. Analytical protocols, precision, and accuracy were highly variable among sources. Fortunately, most sources document these parameters so that associated questions can be resolved by referring to the appropriate data source. The database includes columns for the abundances of SiO_2, TiO_2, Al_2O_3, FeO, MnO, MgO, CaO, Na_2O, K_2O, and P_2O_5. However, because diverse analytical protocols were used to analyze samples, not all sources contain data for each of these constituents.

Several different schemes are possible for reporting iron contents. In addition, reported abundances of ferrous versus ferric iron in many of these rocks are unlikely to represent magmatic values, because of oxidation during late- to post-magmatic hydrothermal alteration. Consequently, total iron abundances were recalculated as ferrous iron oxide and denoted as FeO*. Interaction with postmagmatic fluids caused compositions of many intrusive rocks of the study area to change in other ways as well. In particular, many of these rocks were hydrothermally altered (as indicated by secondary clay minerals, sericite, and (or) chlorite). Both processes caused volatile contents of the affected samples to increase, and correspondingly caused relative abundances of all other constituents to decrease. Therefore, to facilitate meaningful oxide abundance comparisons among samples, all analyses were normalized to 100 percent on a volatile-free basis. The resulting data are reported in columns identified by SiO_2, TiO_2, Al_2O_3, FeO*, MnO, MgO, CaO, Na_2O, K_2O, and P_2O_5. All data are reported as weight percent.

LOI, H_2O+, H_2O-, CO_2, Cl, F, and S

Data sources report volatile constituent contents of samples from intrusions in the study area in widely disparate ways. In order to capture important information concerning the volatile contents of these rocks, an array of data columns was designated to account for various analytical protocols and data reporting formats. Volatile constituents whose abundances are commonly determined include LOI (loss on ignition), H_2O+ (bound), H_2O- (nonessential, moisture), CO_2, Cl, F, and S. Of these, few sources contain halogen and S abundance data. Similarly, data for H_2O+, H_2O-, and CO_2 are rarely and nonsystematically reported. However, given the potential importance of these constituents in hydrothermal processes, compiling all available data for these components seems warranted. Several sources present data for H_2O and do not specify whether this species is bound water (+) or nonessential moisture (-). These data have been included in the H_2O+ column of the database.

total_I

One measure of major oxide analytical accuracy is how nearly the sum of the determined constituents approaches 100 percent. Consequently, the database includes a column that reports initial analytical totals as reported by the source. Some sources do not include totals; totals for these samples were computed and added to the database. Initial analytical totals reported in the sources were spot checked for accuracy; discrepancies were noted and corrected in a number of cases. Many sources present abundances for the oxides listed above but include no abundance data for volatile constituents. Initial analytical totals for these samples tend to be several to 5 or 6 percent less than 100 percent. Unfortunately, it is impossible to determine whether these low initial totals result from inaccurate analyses and (or) unreported volatile constituent abundances.

vol_sum

The total volatile content of intrusions in the study area can provide some insight concerning whether abundances of other constituents accurately represent primary magmatic values. Samples with elevated volatile contents, for example greater than 3 weight percent, are likely to have experienced some fluid-mediated, postmagmatic chemical modification. Given the wide range of analytical protocols used in analysis of these samples, the best possible measure of sample volatile content is total volatile content. For the purposes of the compilation, if LOI data are the only information contained in source data compilations concerning volatile content, LOI values were designated as total volatile content. Alternatively, if the source includes data for H_2O+, H_2O-, CO_2, Cl, F, or S, these data were summed to yield total volatile content. All data are presented as weight percent.

Ba, La, Ce, Rb, Sr, Y, Zr, Nb, Th, Ga, Co, Cr, Ni, Sc, V, Ag, Cu, Mo, Pb, Zn, and Au

The sources present data for inconsistent sets of trace elements. Of these, data for Ba, La, Ce, Rb, Sr, Y, Zr, Nb, Th, Ga, Co, Cr, Ni, Sc, V, Ag, Cu, Mo, Pb, Zn, and Au were compiled; all data are in parts per million. These constituents are among those for which sources most often contain data and also are considered sufficient to address many petrologic, tectonic, and metallogenic questions.

chem_src

Chemical, petrographic, and location data for each sample included in the database were compiled from primary data sources, in most cases a single source. For a few samples, data were culled from two or more sources; for example, major oxide data may have been compiled from one source and trace element data from another. Most entries in the “chem_src” column of the database are keyed numerically to sources identified in the following list. However, some of these data were compiled from sources principally dedicated to presenting geochronologic data. Alpha-coded entries in the “chem_src” column correspond to sources identified in the “age_src” section of this report. Sources of geochemical information include publications of the U.S. Geological Survey, unpublished data contained in the U.S. Geological Survey National Geochemical Database, Master’s theses, Doctoral dissertations, articles published in journals, and publications of the Nevada Bureau of Mines and Geology.

1. Henry and Faulds (1999)
2. Gilluly and Masursky (1965)
3. Erickson and others (1978)
4. Henry and Boden (1998)
5. Henry, C.D., Nevada Bureau of Mines and Geology, unpublished data, 2006
6. Henry and others (1999)
7. Willden (1964)
8. Shaver and Jeanne (1996)
9. Muffler (1964)
10. Gilluly and Gates (1965)
11. Shawe and others (1962)
12. Hotz and Willden (1964)
13. Johnson (1977)
14. Theodore (2000)
15. du Bray, E.A., U.S. Geological Survey, unpublished data, 2006
16. Roberts (1964)

17. Theodore and others (1973)
18. Theodore and others (1992)
19. Doebrich (1995)
20. Smith and others (1971)
21. Lee and others (1981)
22. Lee and Van Loenen (1971)
23. Barnes and others (2001)
24. Lee and others (2003)
25. Emsbo and others (2003)
26. Lee (1984)
27. Ressel, M.W., Newmont Mining Corporation, unpublished data, 2006
28. Ressel (2005)
29. Seymour (1980)
30. Emmons and Eng (1995)
31. Thole and Prihar (1998)
32. James (1976)
33. Lawson (1906)
34. Bauer and others (1966)
35. Drewes (1967)
36. Spencer (1917)
37. Shawe (1961)
38. Fournier (1967)
39. Phinisey (1995)
40. Evans (1974)
41. Radtke (1985)
42. Nosker (1981)
43. John (1997)
44. Hargrove (1982)
45. Taylor (1982)
46. Pullman (1983)
47. Smith (1981)
48. Henry (1996)
49. McKee (1976a)
50. Ferguson (1924)
51. Knopf (1924)
52. Hague (1892)
53. Clark (1922)
54. Vikre (1985)
55. McGrew, A.J., University of Dayton, unpublished data, 2006
56. Hofstra (1994)
57. Barnes, C.G., Texas Tech University, unpublished data, 2006
58. Boden (1987)
59. John (1992)
60. U.S. Geological Survey, National Geochemical Database, 2006
61. Shawe and Lepry (1985)
62. Starkey (1987)
63. Myers (1994)
64. Merriam and Anderson (1942)
65. Smith and Ketner (1976)
66. Silberman and others (1974)
67. Thurber (1982)
68. Gibbons (1973)
69. Nelson (1975)
70. Kistler and others (1981)
71. Sayeed (1973)
72. Bonham and others (1991)
73. Brooks (1994)
74. Brooks and others (1991)
75. Keith, S.B., MagmaChem Exploration, Inc., unpublished data, 2006
76. Anglo Gold Ashanti, unpublished data, 2006
77. Putney (1985)
78. Clarke (1915)
79. Johnson and Keith (1991)
80. John and others (2000)
81. Ressel and others (2000)
82. Missallati (1973)
83. John, D.A., U.S. Geological Survey, and Henry, C.D., Nevada Bureau of Mines and Geology, unpublished data, 2006
84. John, D.A., U.S. Geological Survey, unpublished data, 2006
85. Wrucke and Silberman (1975)
86. Shawe (2003)
87. Wrucke and Armbrustmacher (1973)
88. Strike (2000)
89. Burton (1997)
90. Lee (1999)
91. Batum (1999)
92. Burling (1996)
93. Jeon (1999)

rad_age

The ages of the intrusions in the study area have been of keen interest and a large number of age determinations have been made. The database column titled "rad_age" contains geochronologically determined ages, in millions of years, for samples of intrusions in the study area. Multiple geochronologic age determinations (including U-Pb zircon, Ar-Ar, Rb-Sr, and K-Ar ages) have been obtained for some intrusions. A listing of the various geochronologic techniques, arranged in order of decreasing accuracy, is as follows: U-Pb zircon, Ar-Ar, Rb-Sr, and K-Ar. Preferred age estimates recorded in the "rad_age" column reflect this reliability ranking. K-Ar age determinations have been made for both biotite and hornblende mineral separates of some samples. In these cases, age determinations derived from hornblende are included in the database in preference to those for biotite. Fission-track age determinations were not included in the compilation.

uncert

The database column titled "uncert" contains data, in millions of years, for the analytical uncertainties (as presented in the source) associated with each of the age determinations reported in the "rad_age" column.

age_src

Sloan and others (2003) and C.D. Henry (Nevada Bureau of Mines and Geology, unpublished data, 2006) have compiled (and recalculated ages using currently accepted decay constants, as appropriate) most of the isotopic age data available for intrusions in the study area. Their compilations were used to identify the primary data sources (identified in the database column titled “age_src”) from which moderately abundant geochronologic data for the intrusions in the study area were extracted to compile ages of samples included in the database. In most cases, geochemical and geochronologic data are contained in the same source; the age source for each of these samples is numerically keyed to a previously identified source of geochemical data (database column “chem_src”). For the relatively small number of samples for which geochemical and geochronologic data have different sources, age source(s) data are keyed to alpha-coded citations listed below:

A. Silberman and McKee (1971)
B. Lee and others (1980)
C. Lee and others (1970)
D. Lee and others (1986)
E. Mortensen and others (2000)
F. Kistler and Lee (1989)
G. Coats and others (1965)
H. McDowell and Kulp (1967)
I. Miller and others (1988)
J. Kelson and others (2000)
K. Farmer (1996)
L. Armstrong (1970a)
M. Ketner (1998)
N. Evans and Ketner (1971)
O. McKee (1992)
P. Doebrich (1994)
Q. Wells and others (1971)
R. Shawe (1999)
S. Mueller (1992)
T. James (1972)
U. Gans and others (1989)
V. Hofstra and others (1999)
W. Ketner (1990)
X. McKee and others (1971)
Y. McKee and Silberman (1970)
Z. Marvin and Cole (1978)
AA. Shawe (1995)
AB. Maher and others (1990)
AC. Tingley (1975)
AD. Carlson and others (1975)
AE. Morabbi (1980)
AF. Armstrong (1966)
AG. Rahl and others (2002)
AH. Morton and others (1977)
AI. Armstrong (1970b)
AJ. Marvin and Dobson (1979)
AK. Maher (1989)
AL. Hudson and others (2000)
AM. Elison and others (1990)
AN. John and Robinson (1989)
AO. Stablein (1969)
AP. Krueger and Schilling (1971)
AQ. Miller and others (1990)
AR. Marvin and others (1989)
AS. Schilling (1965)
AT. Pullman (1984)
AU. John (1983)
AV. McGrew and others (2000)
AW. Ross (1961)
AX. Garside and others (1981)
AY. Bryan (1972)
AZ. Shawe and others (1986)
BA. John (1993)
BB. Coats (1987)
BC. Whitebread (1994)
BD. Gilluly (1967)
BE. Decker (1962)
BF. Coats (1971)
BG. Willden and Speed (1974)
BH. Armstrong and Suppe (1973)
BI. Hose and others (1976)
BJ. Lee and others (1999)
BK. McKee and others (1976)
BL. Nolan and others (1974)
BM. Kleinhampl and Ziony (1984)
BN. Speed and McKee (1976)
BO. Slack (1974)
BP. Coats and McKee (1972)
BQ. Coats and Greene (1984)
BR. Coash (1967)
BS. McKee (1976b)
BT. Ekren and Byers (1985)
BU. Evernden and Kistler (1970)
BV. Miller and others (1987)
BW. Edwards and McLaughlin (1972)
BX. Westra and Riedell (1996)
BY. Moores and others (1968)
BZ. Hart and Carlson (1985)
CA. Speed and Armstrong (1971)
CB. Hardyman and others (1988)
CC. McKee (1968)
CD. Stewart and McKee (1977)
CE. Ressel, M.W., Newmont Mining Corporation, and Henry, C.D., Nevada Bureau of Mines and Geology, unpublished data, 2006
CF. Silberling and John (1989)
CG. Ekren and Byers (1986)
CH. Hope (1972)
CI. O’Neill (1968)
CJ. Wooden and others (1999)

geol_age

Radiometric ages have not been determined for most samples included in the database. However, all identified age determinations and geologic and geochronologic reasoning have been used to develop preferred geologic age estimates for most volumetrically significant intrusions in the study area. Geologic ages where given in years are rounded to the nearest million, which seems appropriate given the nature of this compilation. No effort was made to establish geologic ages for samples of dikes, sills, and other volumetrically insignificant intrusions. No entry is recorded in the “geol_age” column when the associated sample has been radiometrically dated.

geol_age_src

Estimates of geologic age for many of the intrusions in the study area rely upon geologic inference, correlations, and other diverse data sources; these sources are identified in the “geol_age_src” column of the database. Digits left of the “\” symbol identify the principal source used to establish geologic age. These digits are keyed to entries previously identified in either the “chem_src” or “age_src” discussions above. Digits to the right of the “\” symbol identify the rationale used to establish geologic age. Entries coded as “\1” indicate that a correlation of map units figure or some discussion of intrusion age in the source provides the basis for the geologic age assignment. In contrast, entries coded as “\2” indicate that the radiometric age of sample(s) that are not part of the database, but representative of the same intrusion as sample(s) that are included in the database, was used to establish geologic age.

intrusion_name

We established a unique geographic name for each phaneritic intrusion delineated on the digital geologic map of Nevada (Crafford, in press); these designations are compiled in the “intrusion_name” column of the database. The sources used to establish intrusion ages and compositions were also consulted for geographic name designation. Intrusion names identified in the sources were adopted in our compilation. The sources did not identify geographic names for all intrusions in the study area. In these cases, a nearby named geographic feature was adopted and assigned as the intrusion name. Assigned geographic intrusion names are not designations in the sense of stratigraphic nomenclature. However, geographic names presented in this compilation are in accord with established stratigraphic nomenclature for intrusions for which either formal or informal stratigraphic nomenclature exists, and to the extent that the sources identified these names.

Qtz, Kfs, Pl, Maf, Opq, Ol, Pyx, Hbl, Bt, Ms, Acc, Gnm, and Alt

In addition to their geochemical characteristics, the composition of intrusive rocks can be quantified in terms of the relative abundances of the minerals they contain. This type of characterization, modal analysis, is accomplished by point counting either thin sections using a petrographic microscope or stained slabs using a low magnification binocular microscope. The effort involved in conducting these types of modal analyses is time consuming and difficult, with the consequence that this type of data is rarely collected. However, since modal data are precisely the type of information required to classify the composition of phaneritic intrusive rocks (Streckeisen, 1973), compilation of this type of data, as it was encountered in the literature, seemed warranted. This section of the database contains columns for the relative abundances (summing to about 100 percent) in volume percent of quartz (Qtz), alkali-feldspar (Kfs), plagioclase (Pl), the sum of all mafic minerals, including micas, hornblende, and iron-titanium oxides (Maf), opaque iron-titanium oxide minerals (Opq), olivine (Ol), pyroxene (Pyx), hornblende (Hbl), biotite (Bt), muscovite (Ms), accessory minerals (Acc), groundmass minerals (Gnm), and alteration minerals (Alt). Most of these species are self evident. The common accessory minerals include zircon, titanite, apatite, allanite, and fluorite. Groundmass pertains to typically very finely crystalline, aphanitic, or glassy rock whose mineral identity is not easily decipherable using a microscope. Alteration minerals include epidote, sericite, carbonate minerals, chlorite, clay minerals, zeolite, and anhydrite. All modal data were extracted from the same sources as those containing compiled geochemical data.

Histograms

A series of histograms (fig. 2) is included in order to provide a basic graphical depiction of the compiled data. These histograms portray frequency distributions for the abundances of each geochemical constituent for which data were compiled. In order to prepare each histogram, a table of data abundance classes (bins) versus frequency within each class was computed (table 1). A set of descriptive statistical abundance parameters, including mean and standard deviation, median, minimum, maximum, and count (number of samples for which abundance data for the particular constituent are available), were computed for each database geochemical constituent and are included on the histograms. For the purpose of constructing the histograms and calculating statistics, all censored (less than) values were deleted. The worksheet tab labeled “db w censored data deleted” is a copy of the primary database with all censored data deleted.

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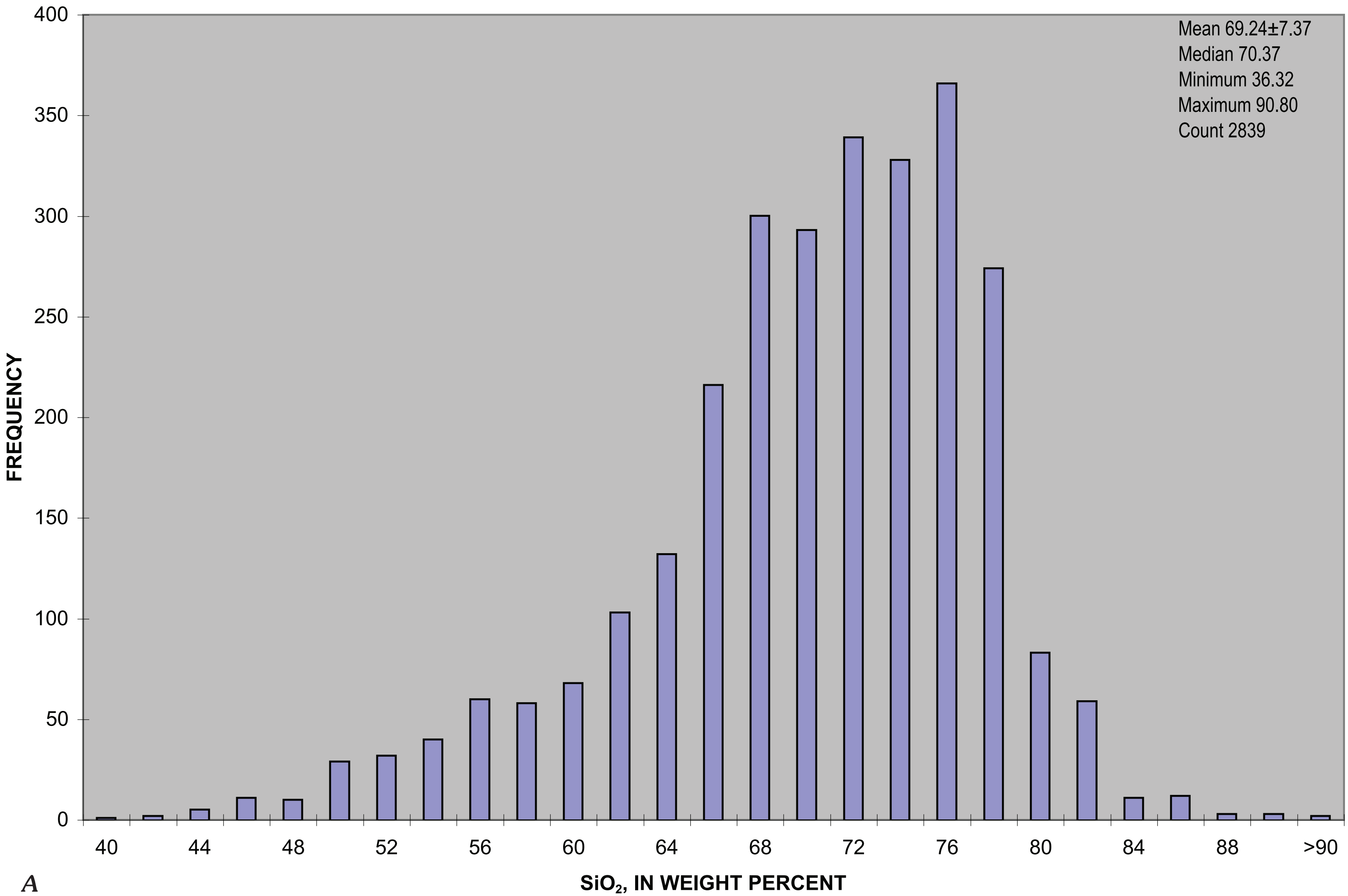
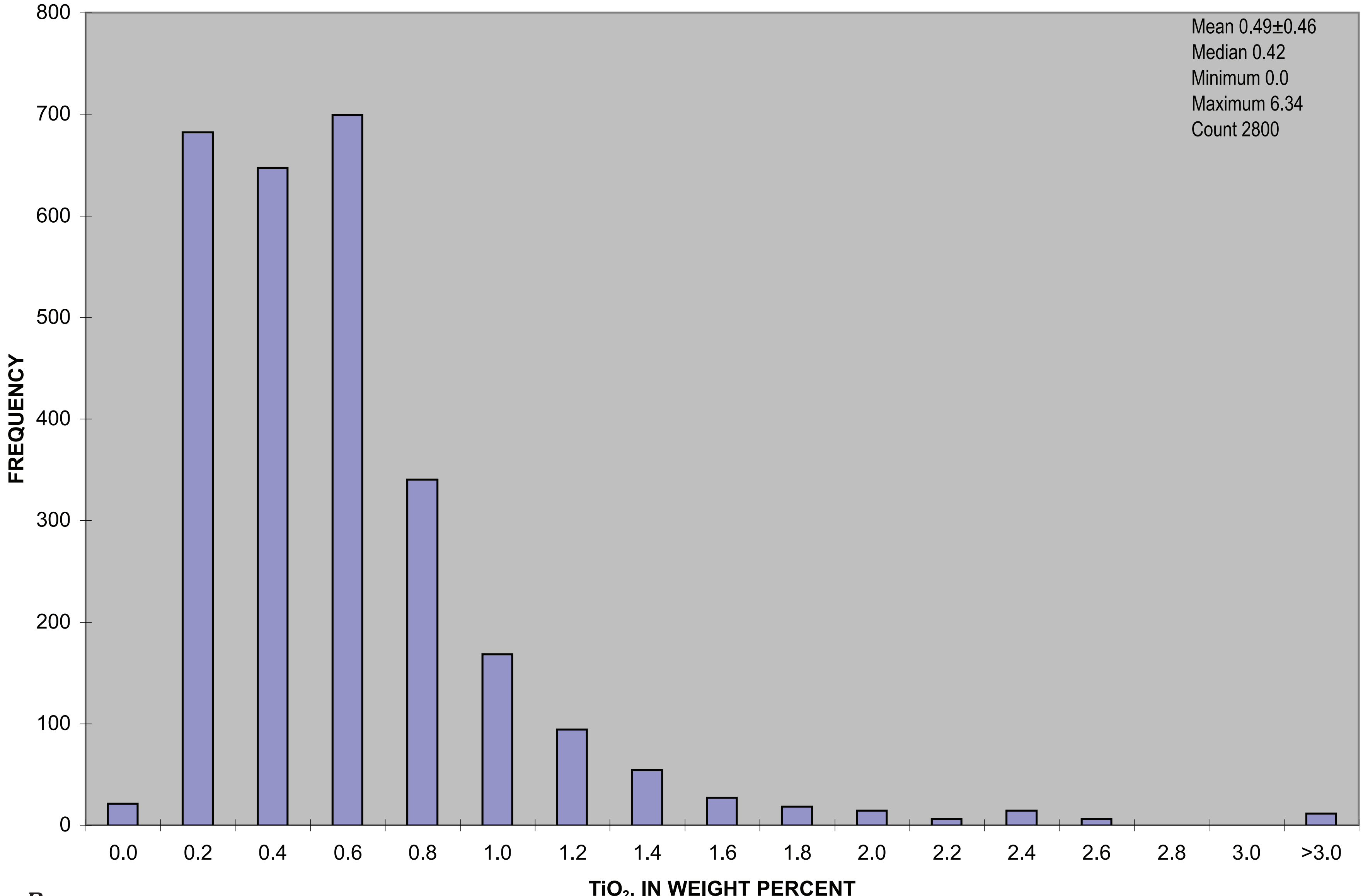


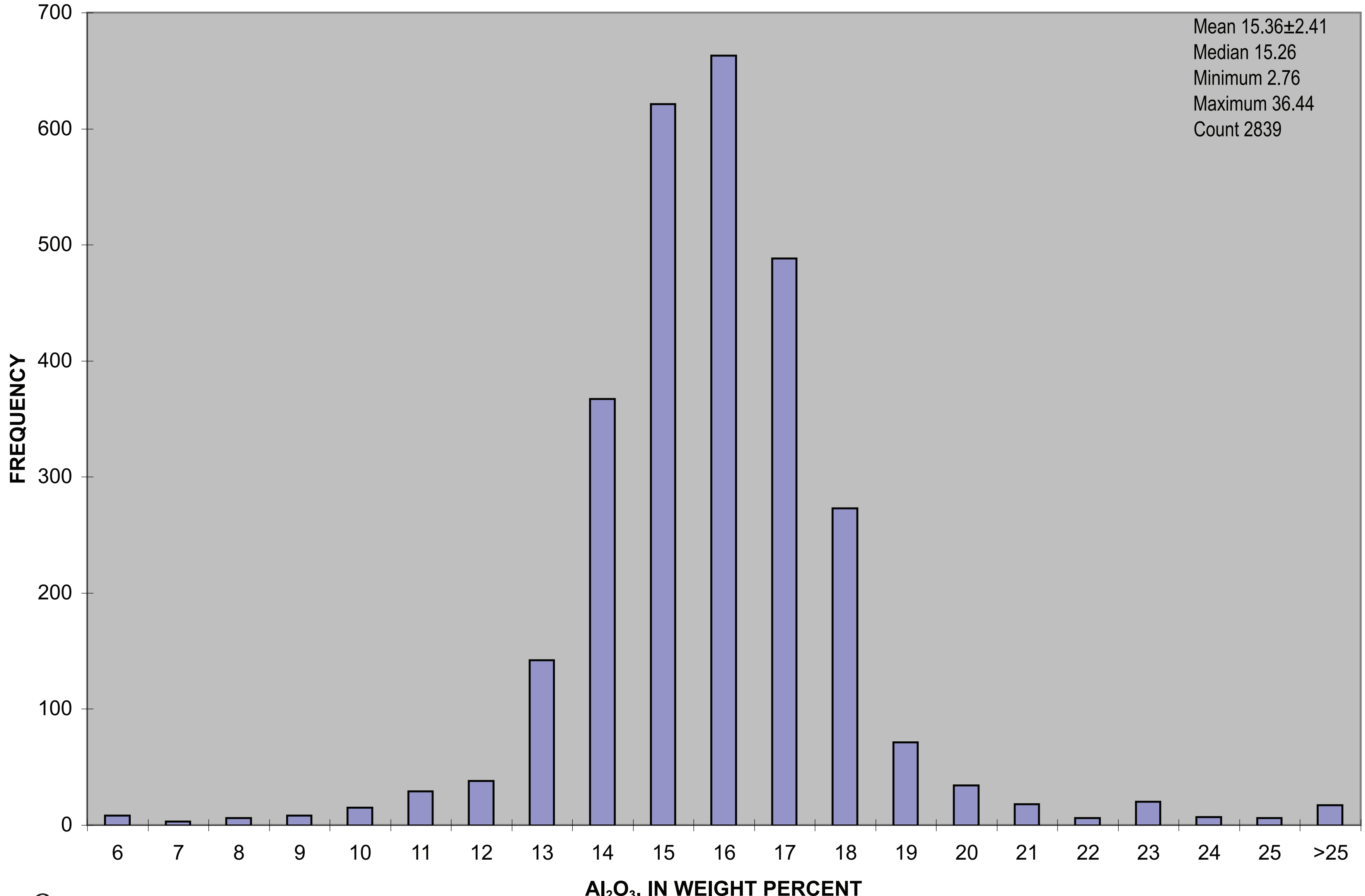
A

Figure 2 (above and following pages). Frequency distribution histograms showing compositions of north-central and northeast Nevada intrusive rock samples. Height of each histogram bar indicates number of samples whose abundances of indicated component are as much as numeric label beneath bar but greater than value associated with next lower abundance bar (for instance, if two adjacent bars are labeled 90 and 100 and if associated data are reported as whole numbers, the height bar labeled 100 depicts the number of samples with abundances of 91 to 100). Also presented are basic descriptive statistics, including mean and standard deviation, median, minimum, maximum, and count, for each distribution. *A*, SiO_2; *B*, TiO_2; *C*, Al_2O_3; *D*, FeO*; *E*, MnO; *F*, MgO; *G*, CaO; *H*, Na_2O; *I*, K_2O; *J*, P_2O_5; *K*, H_2O+; *L*, H_2O-; *M*, CO_2; *N*, Cl; *O*, F; *P*, S; *Q*, initial analytical total; *R*, total volatile content; *S*, Ba; *T*, La; *U*, Ce; *V*, Rb; *W*, Sr; *X*, Y; *Y*, Zr; *Z*, Nb; *AA*, Th; *BB*, Ga; *CC*, Co; *DD*, Cr; *EE*, Ni; *FF*, Sc; *GG*, V; *HH*, Ag; *II*, Cu; *JJ*, Mo; *KK*, Pb; *LL*, Zn; *MM*, Au.



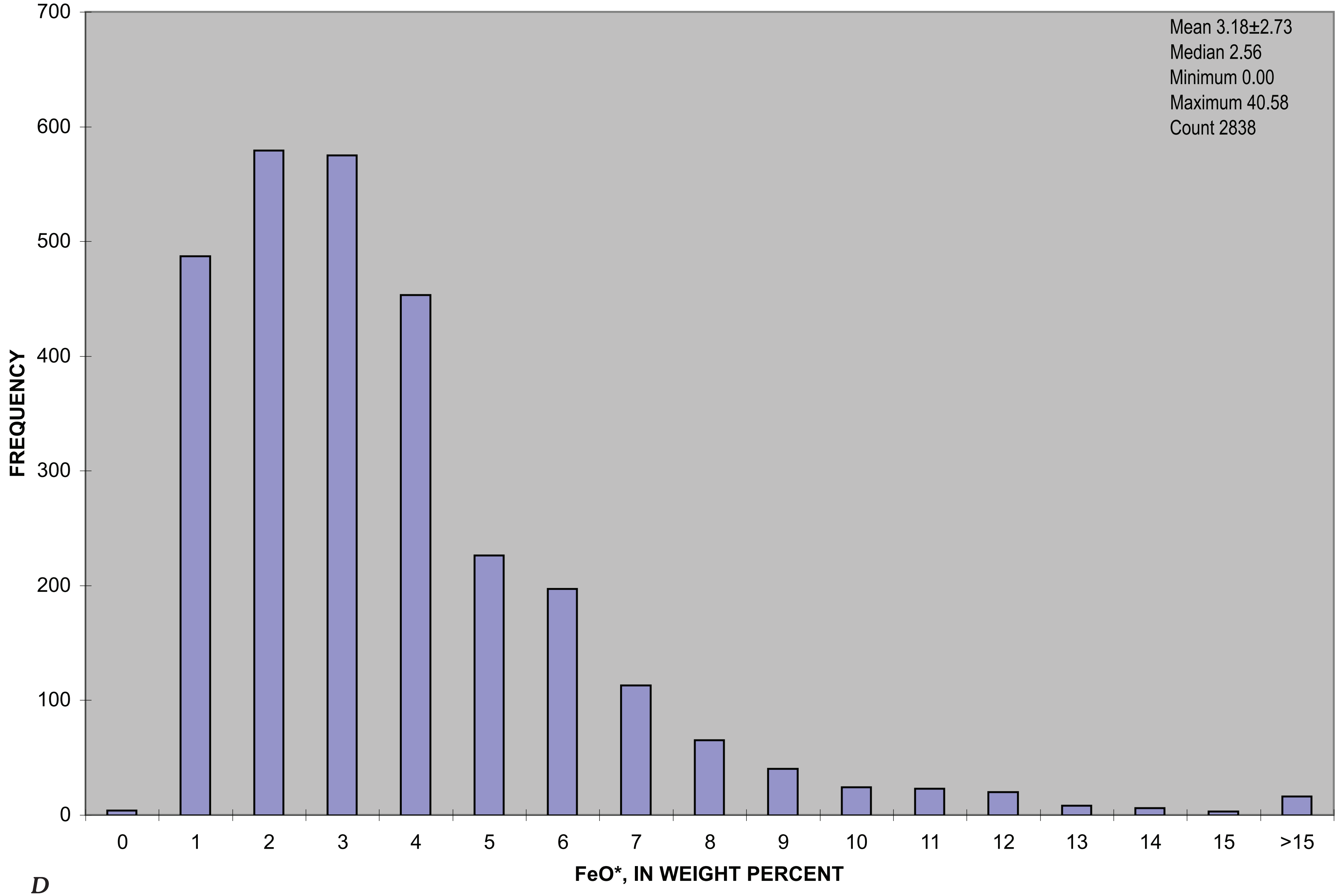
B

Figure 2. Frequency distribution histograms showing compositions of north-central and northeast Nevada intrusive rock samples—Continued.



C

Figure 2. Frequency distribution histograms showing compositions of north-central and northeast Nevada intrusive rock samples—Continued.



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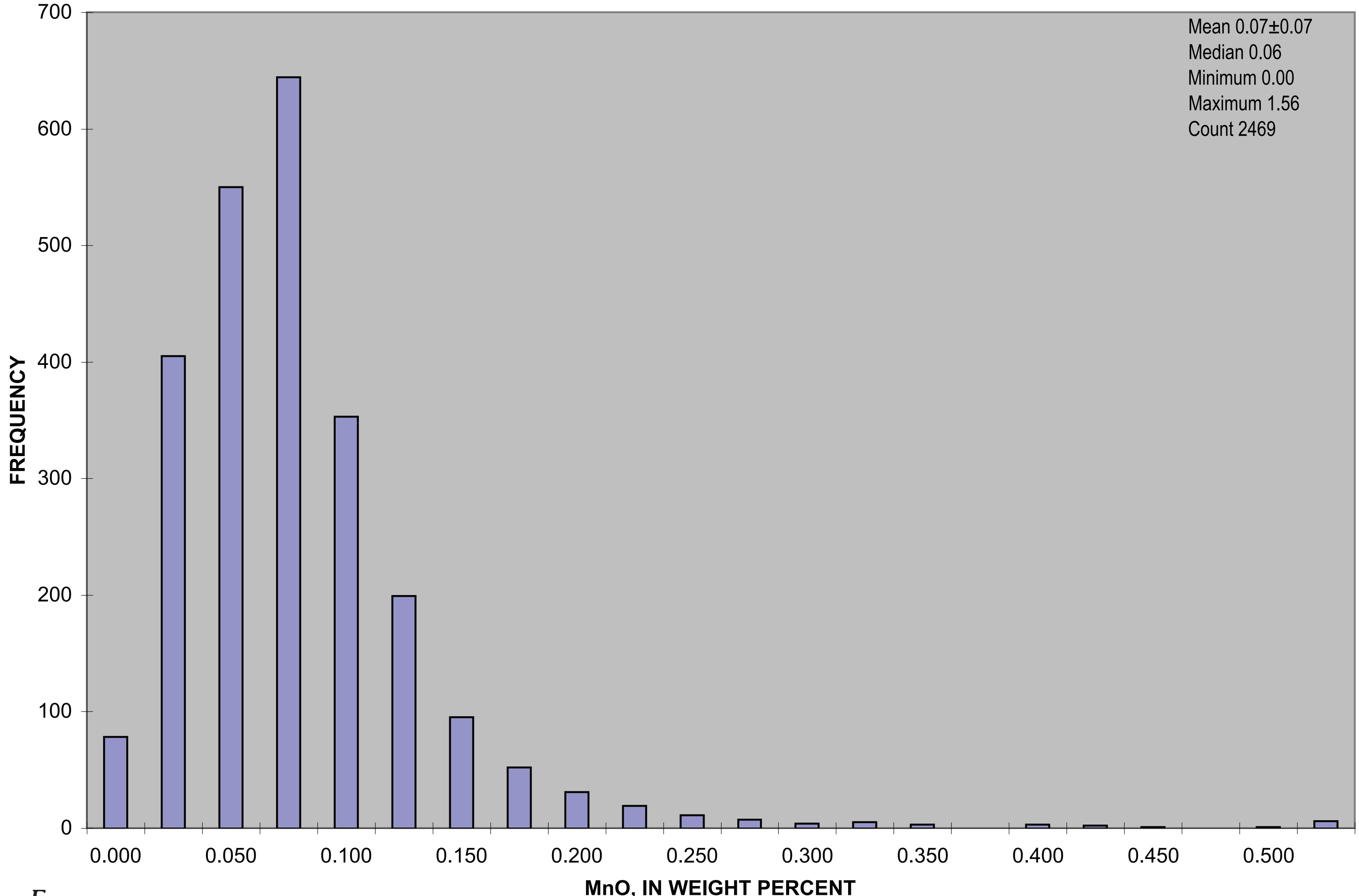

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Figure 2. Frequency distribution histograms showing compositions of north-central and northeast Nevada intrusive rock samples—Continued.

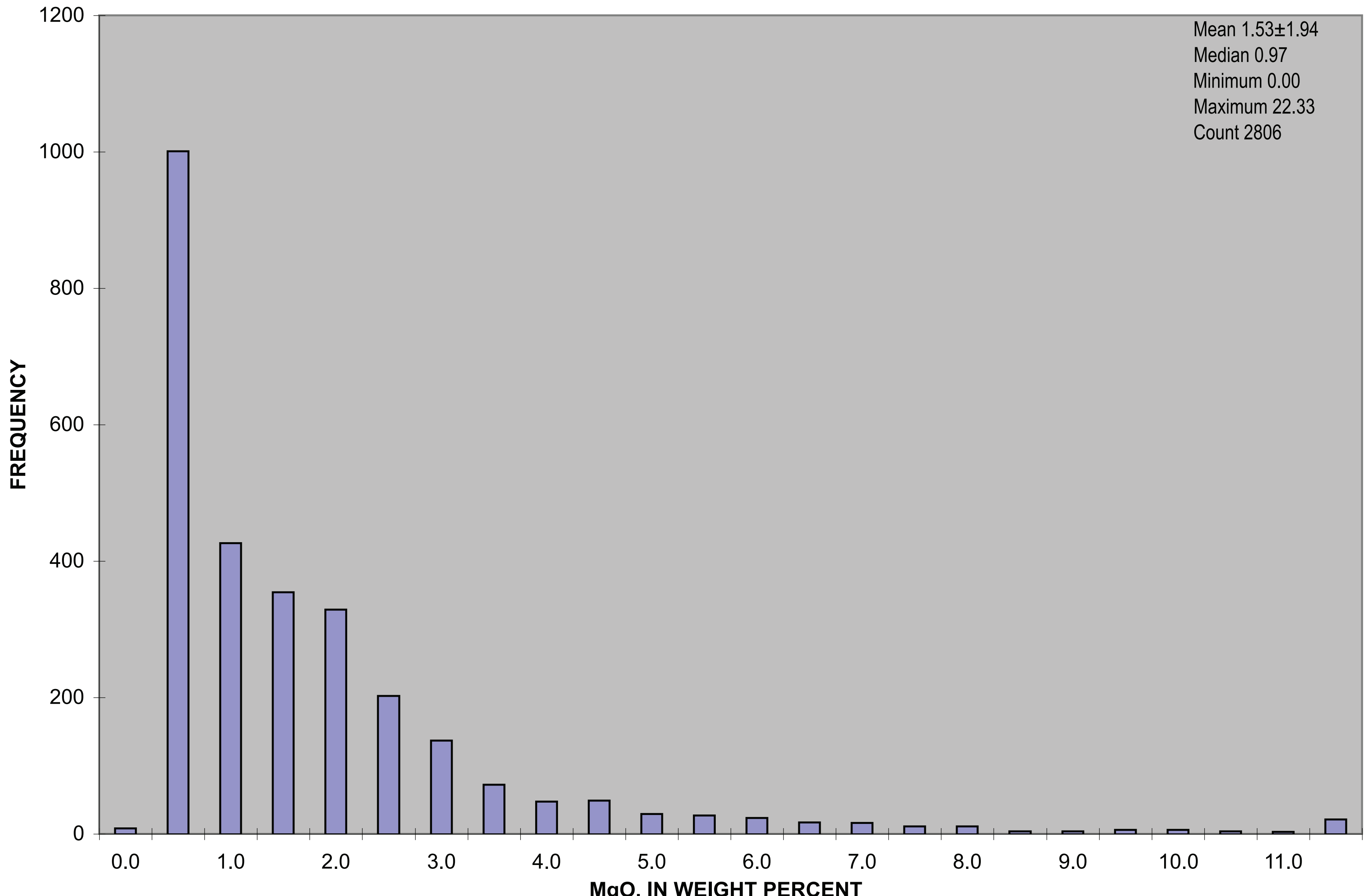

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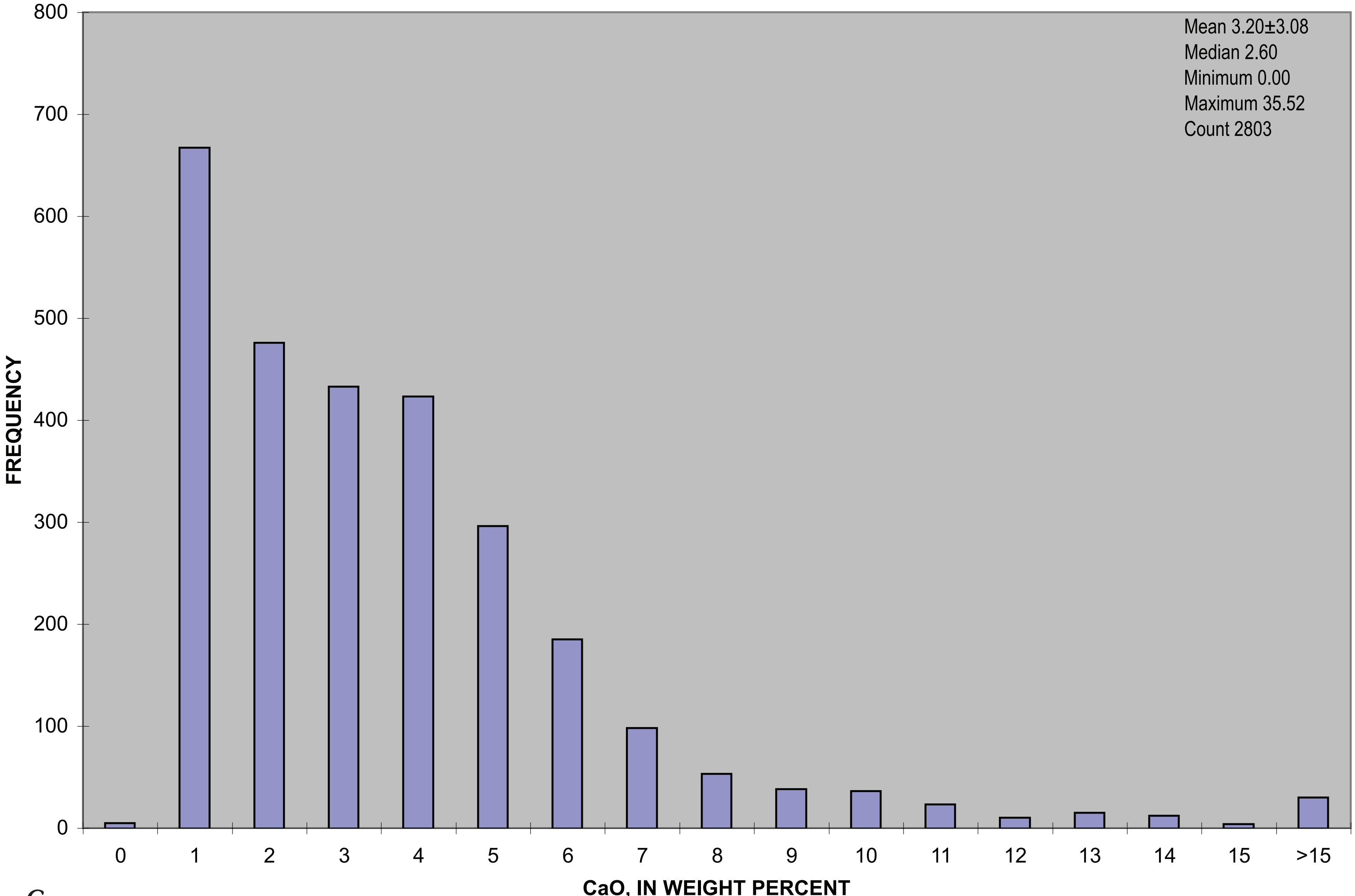
Figure 2. Frequency distribution histograms showing compositions of north-central and northeast Nevada intrusive rock samples—Continued.



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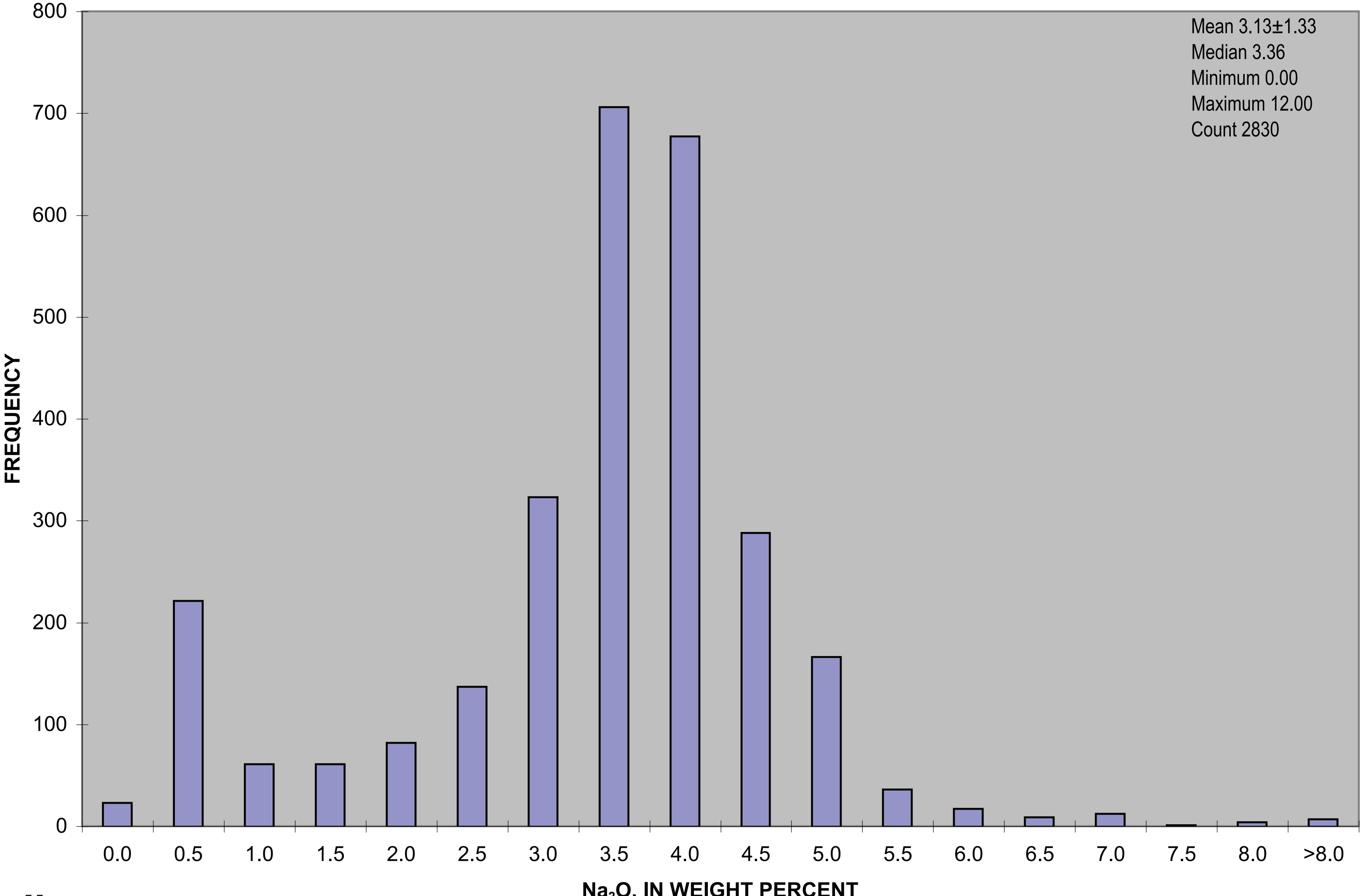

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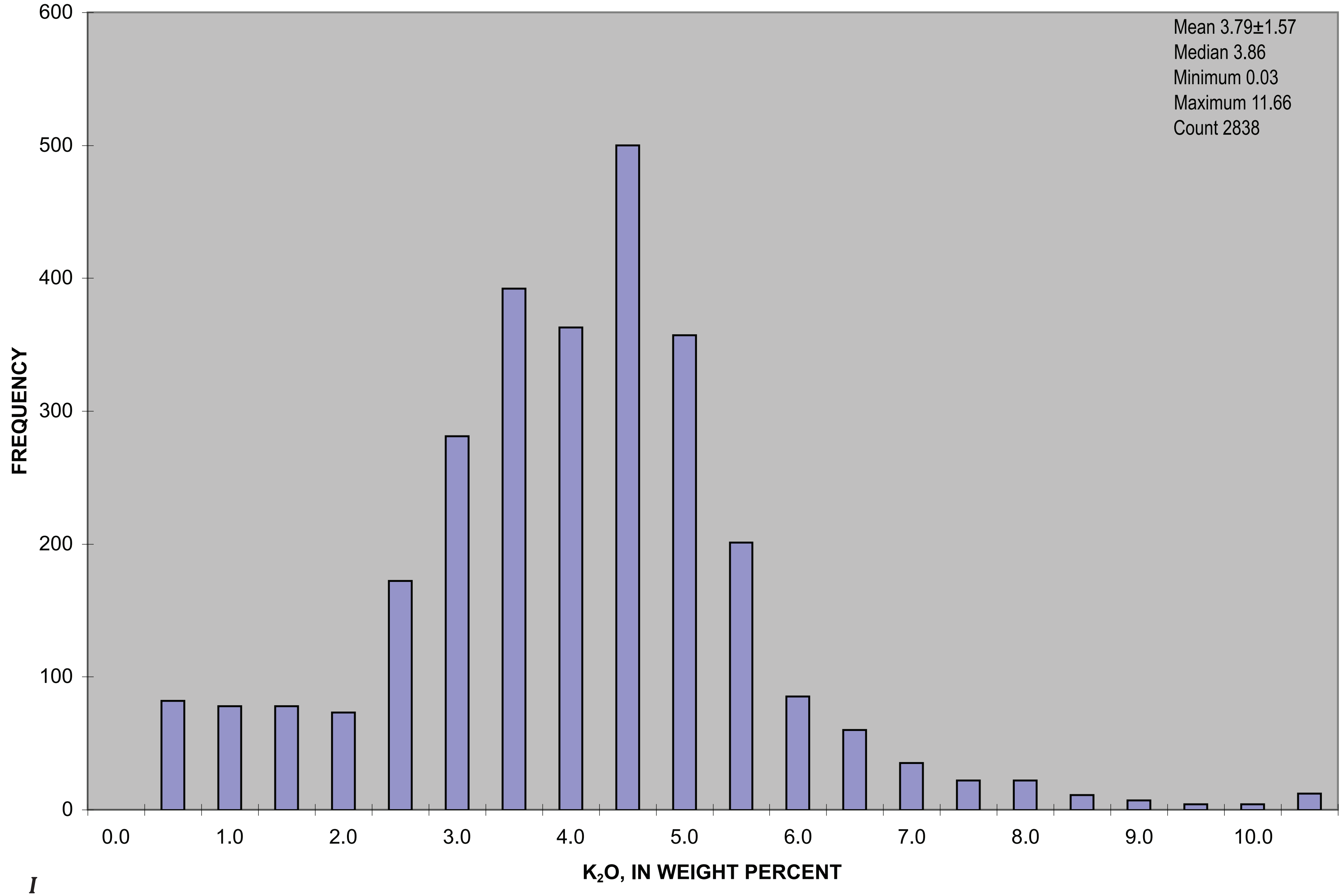

Figure 2. Frequency distribution histograms showing compositions of north-central and northeast Nevada intrusive rock samples—Continued.

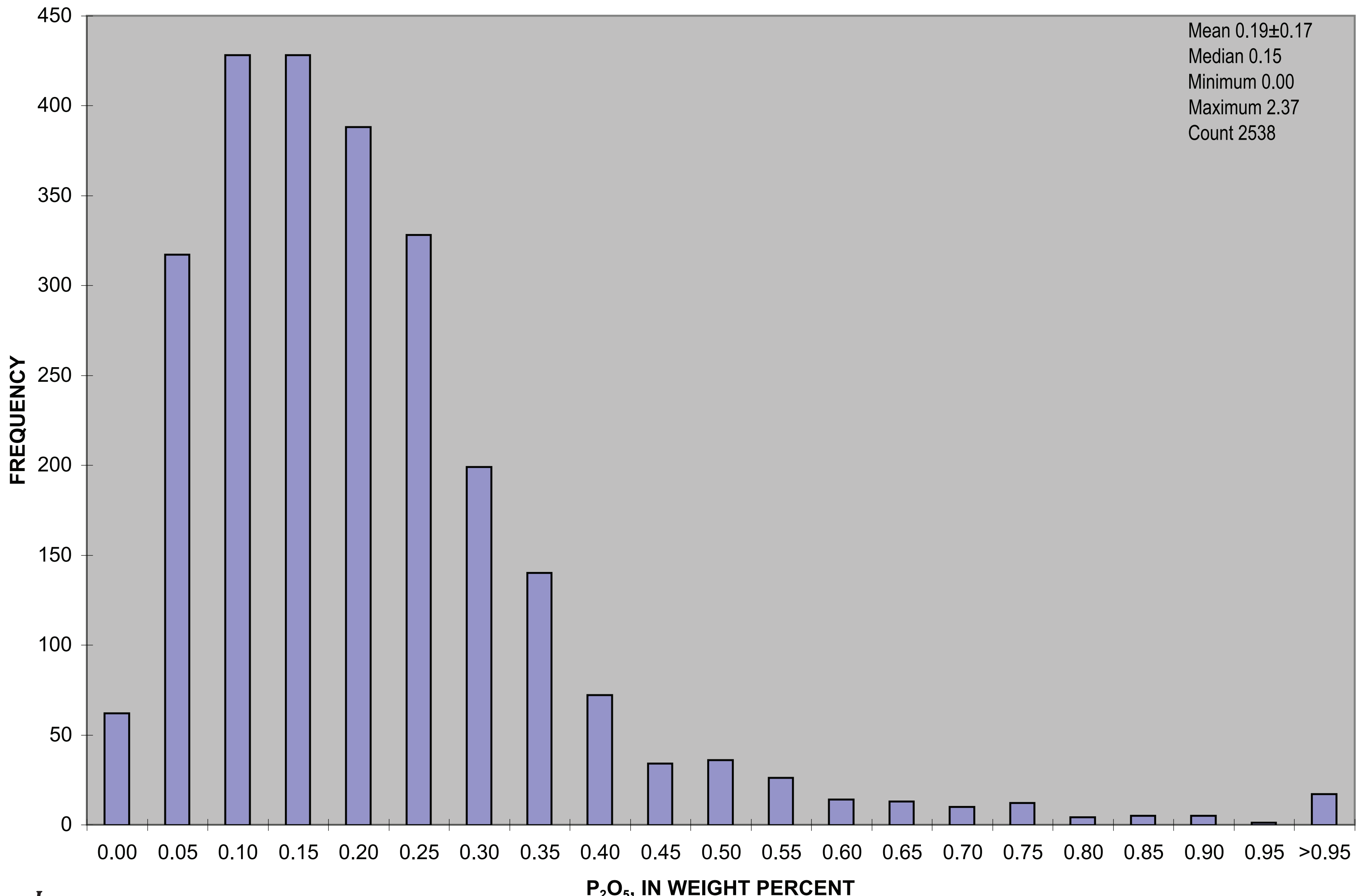

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Figure 2. Frequency distribution histograms showing compositions of north-central and northeast Nevada intrusive rock samples—Continued.

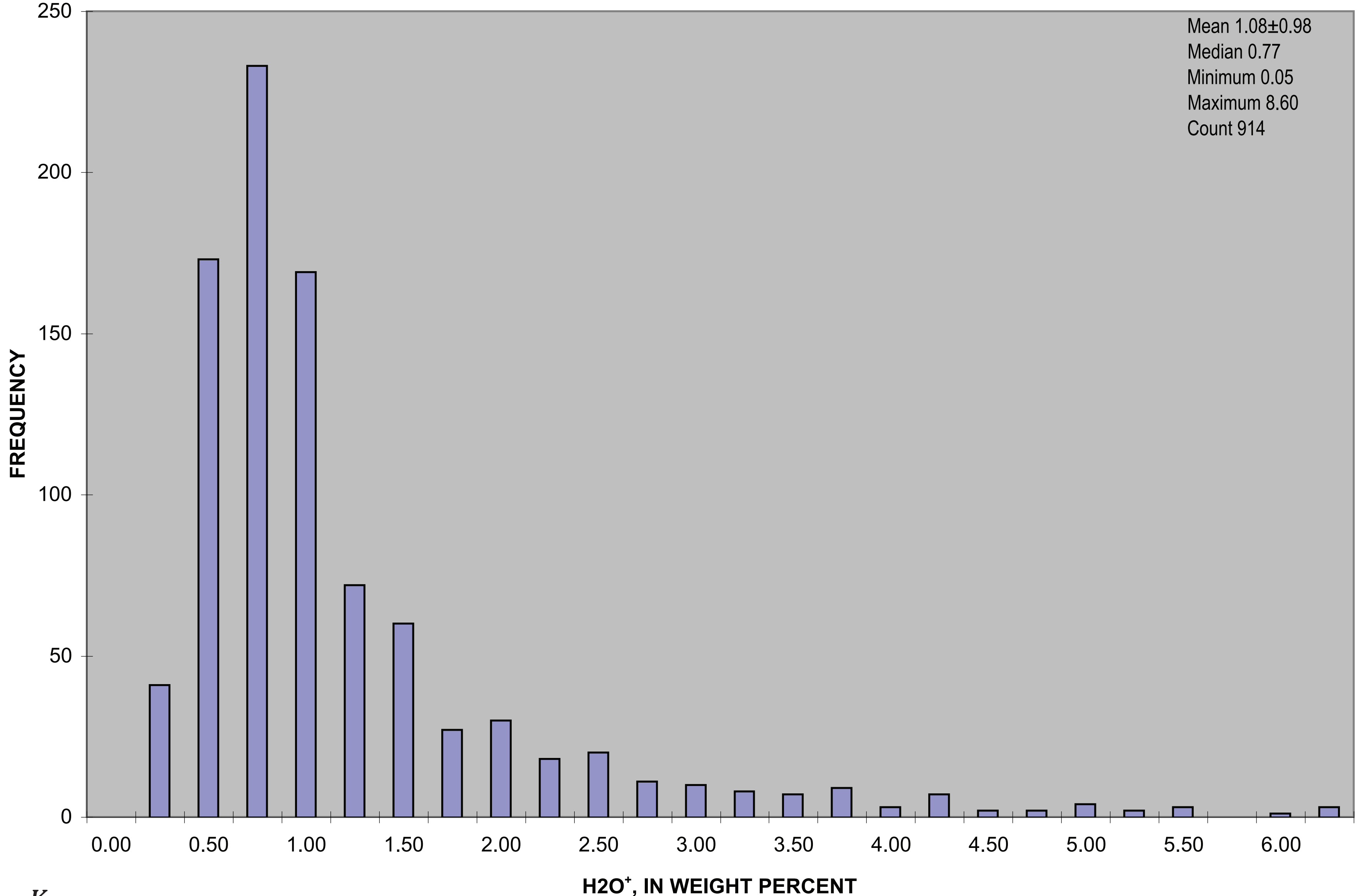

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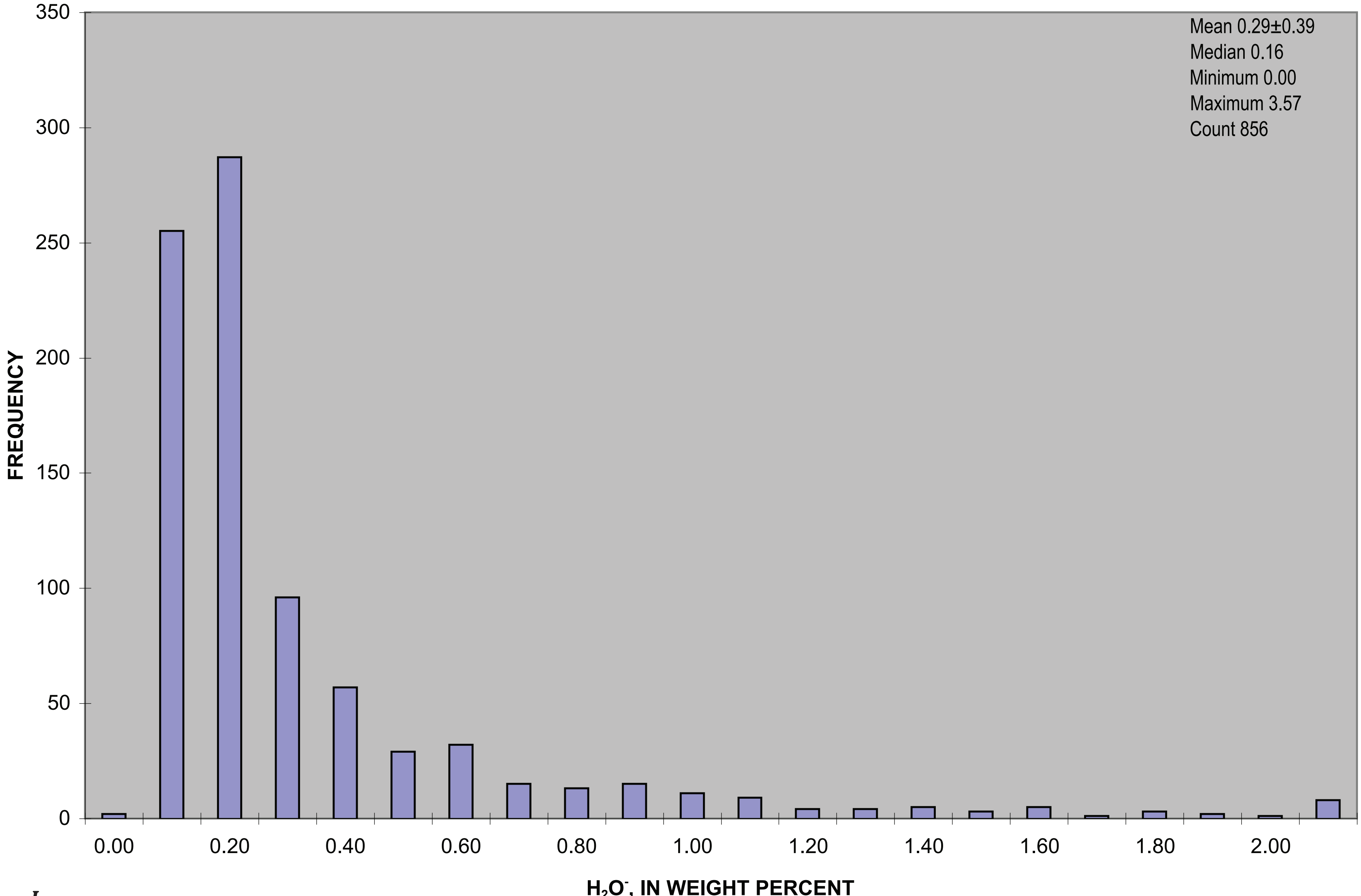
Figure 2. Frequency distribution histograms showing compositions of north-central and northeast Nevada intrusive rock samples—Continued.



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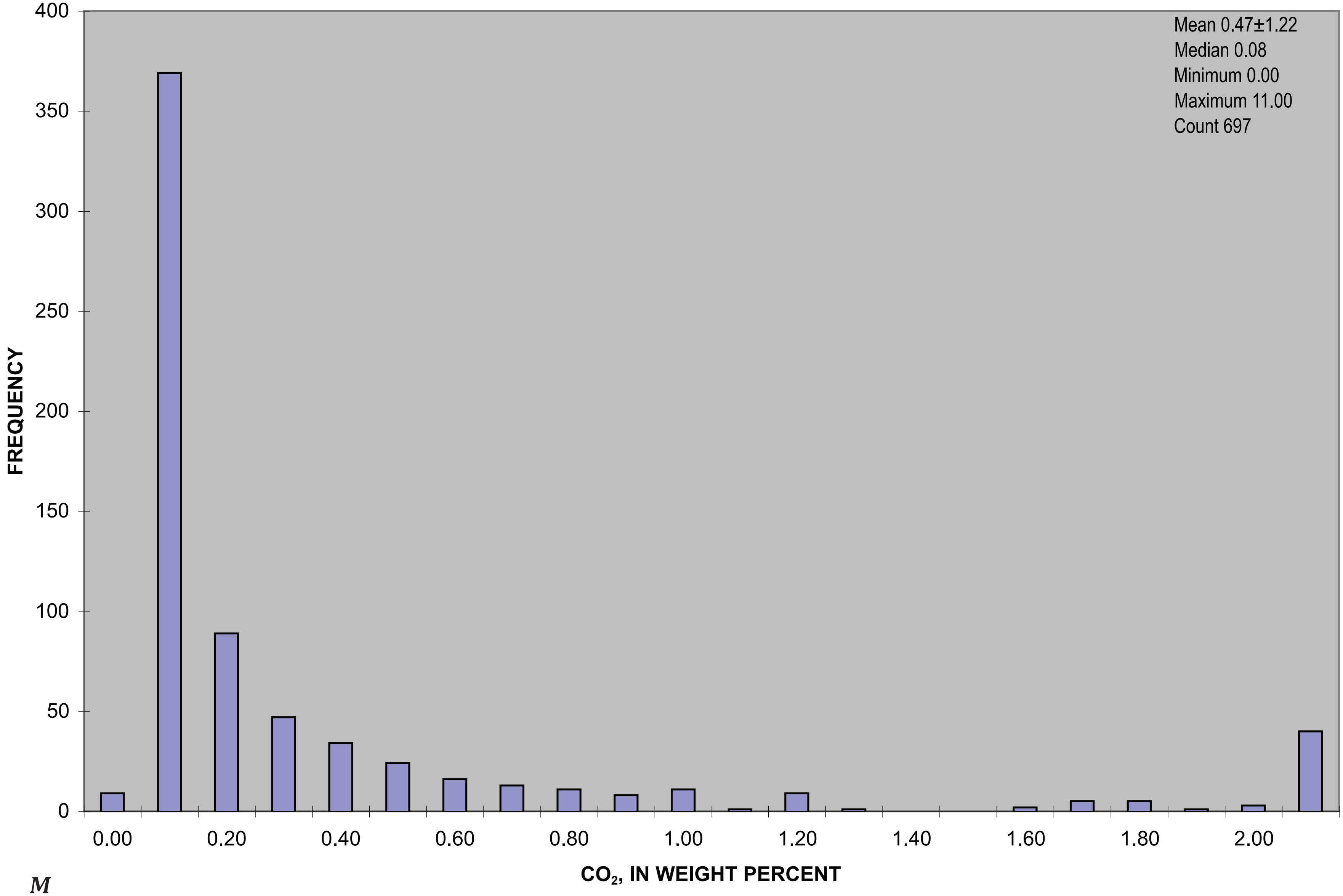

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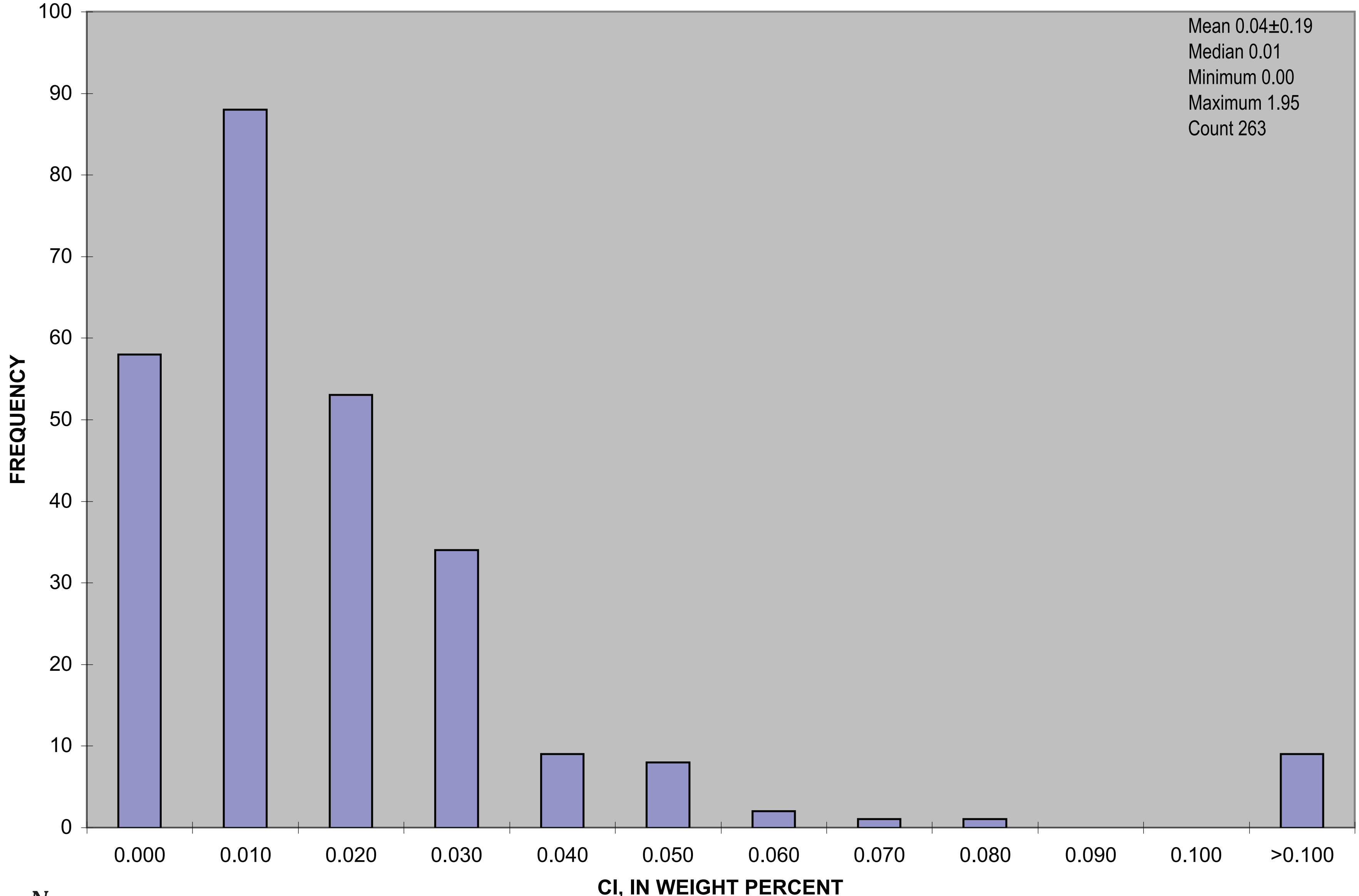

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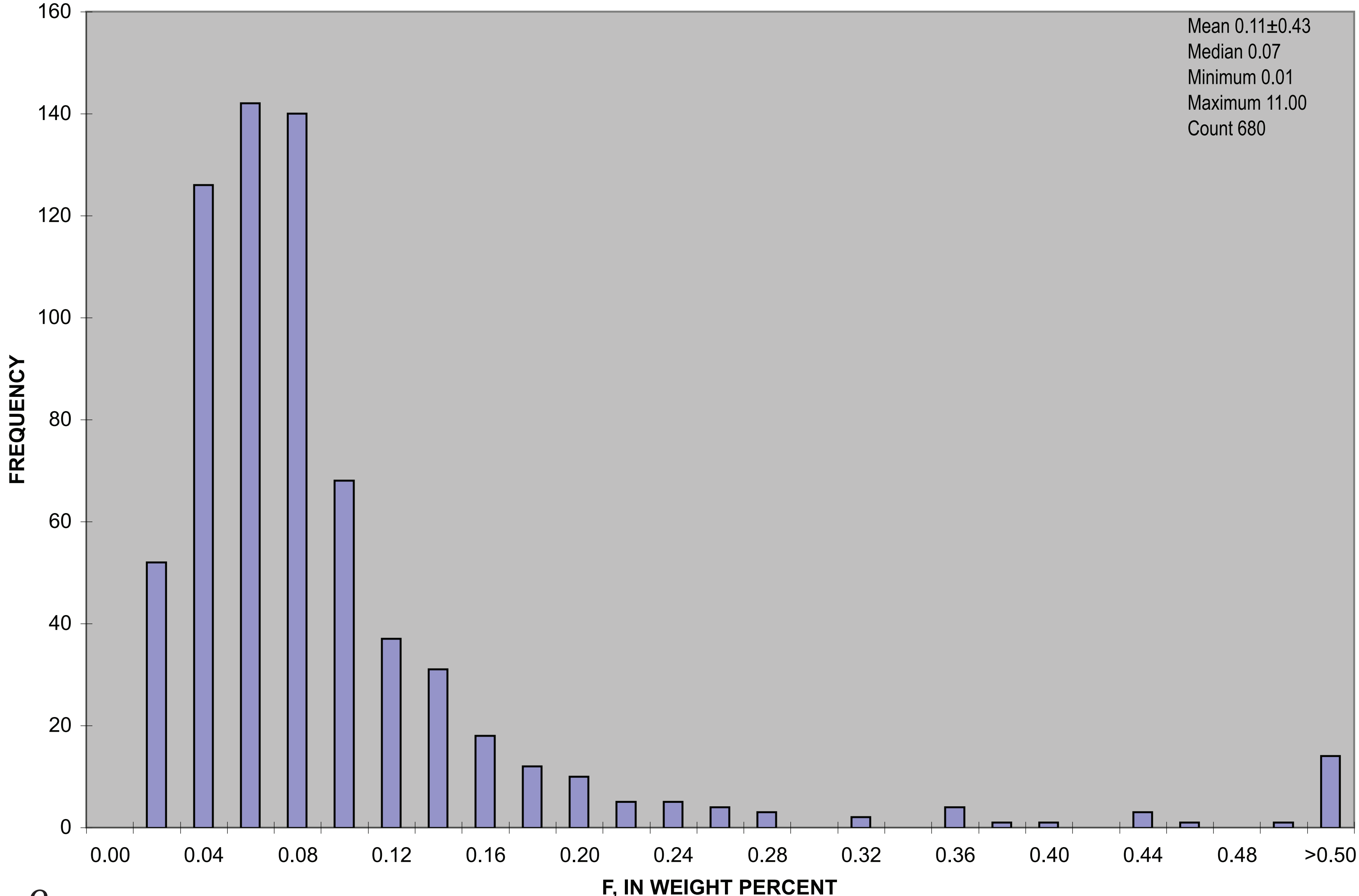

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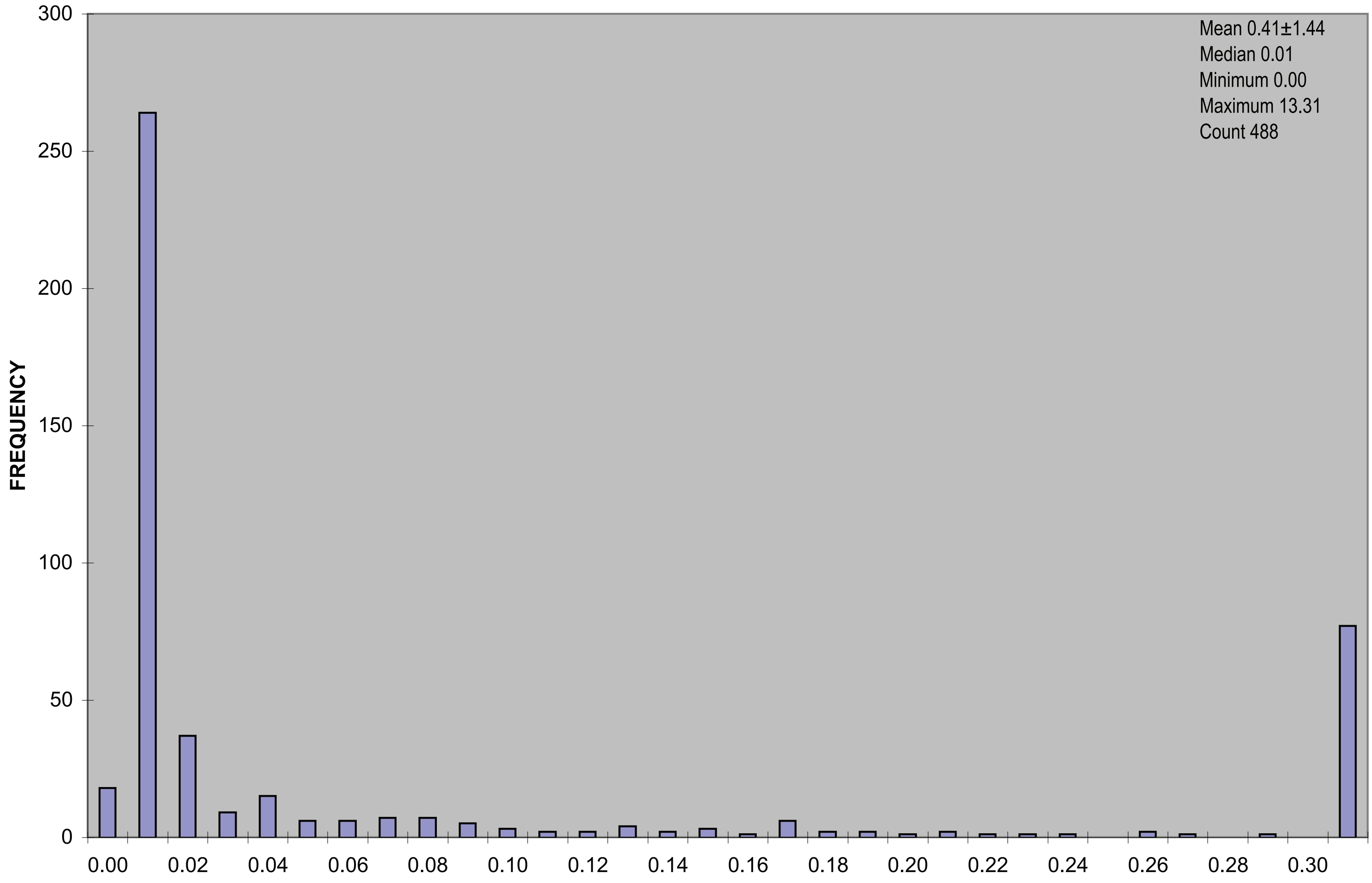
Figure 2. Frequency distribution histograms showing compositions of north-central and northeast Nevada intrusive rock samples—Continued.



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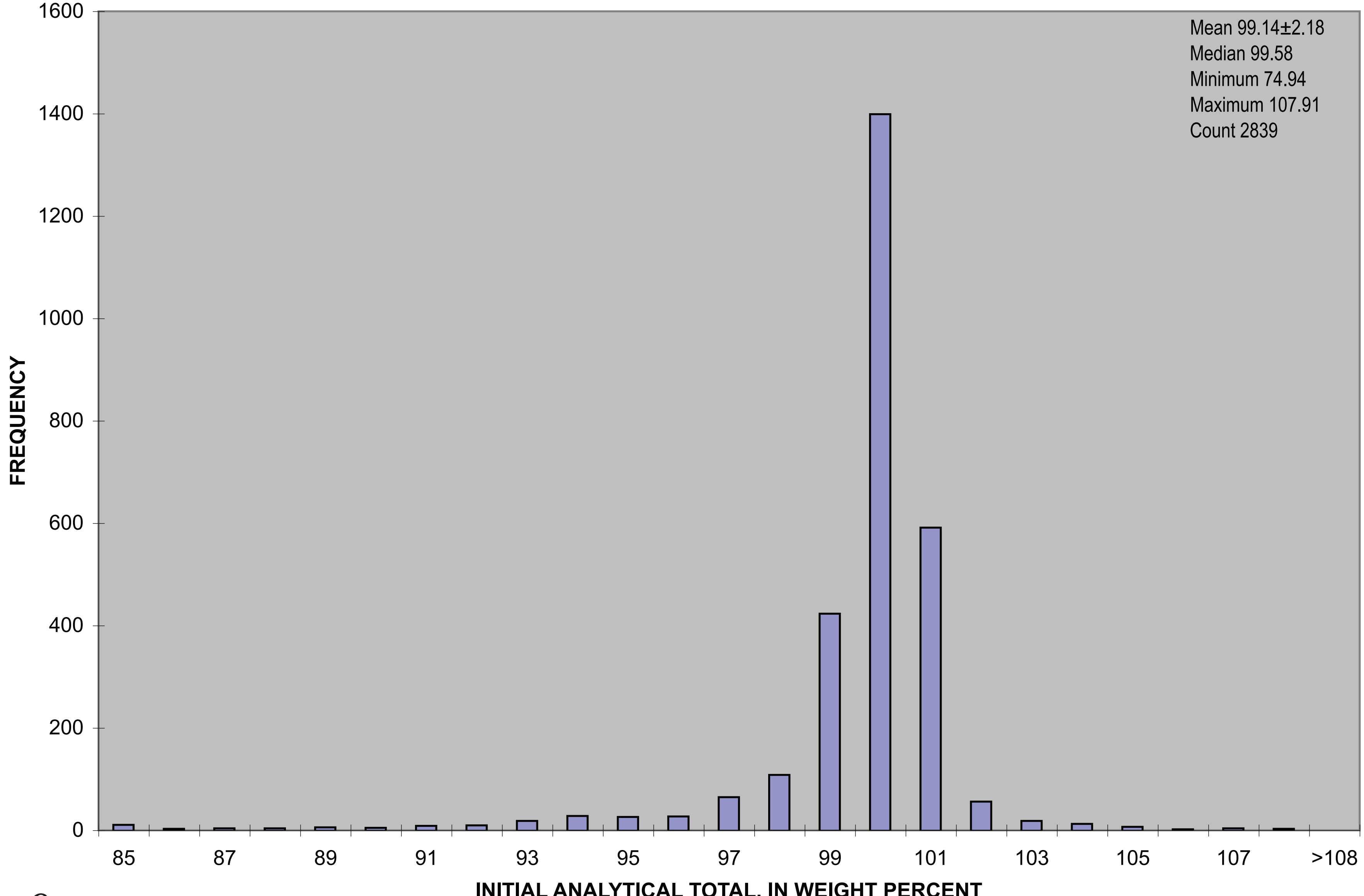

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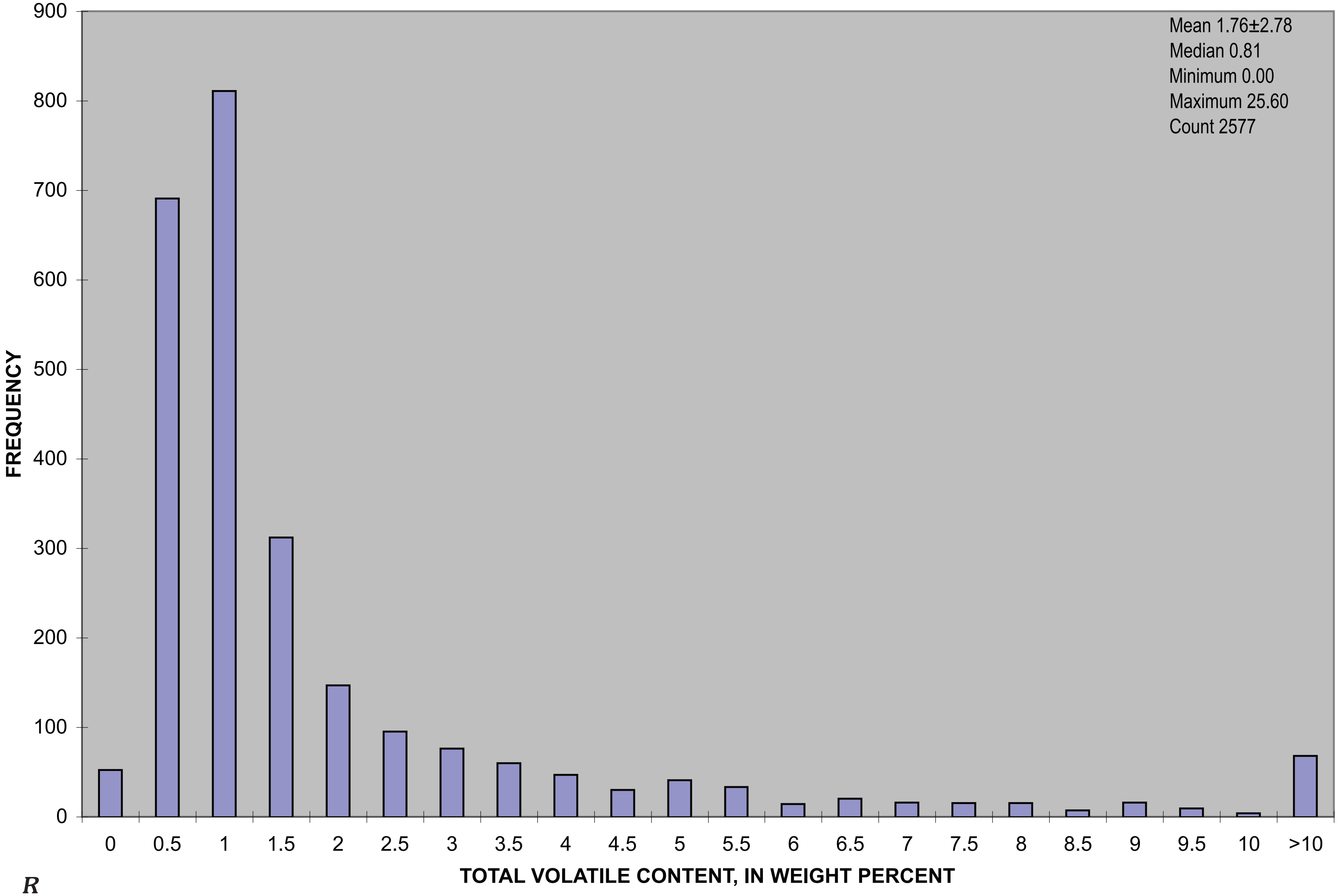

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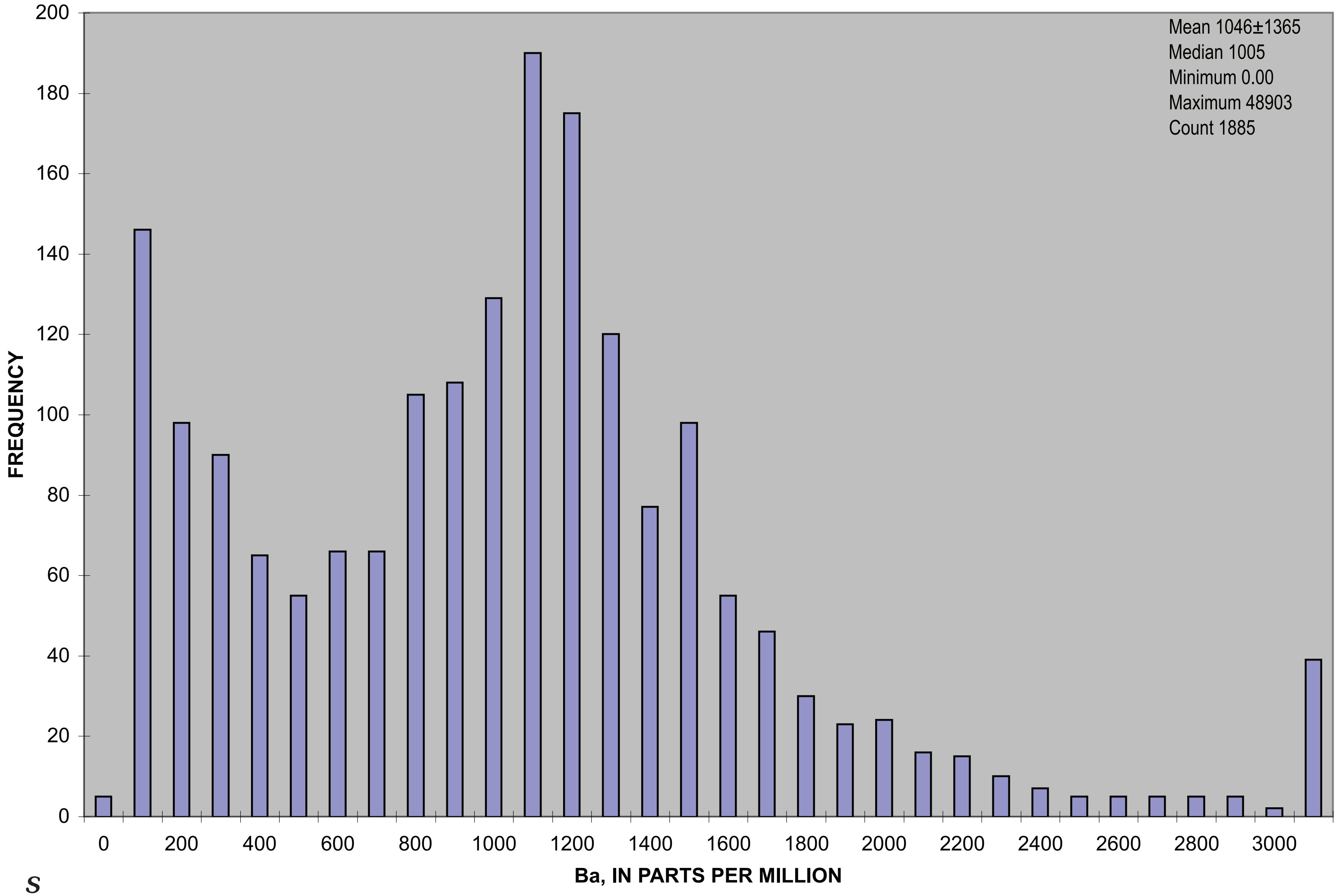

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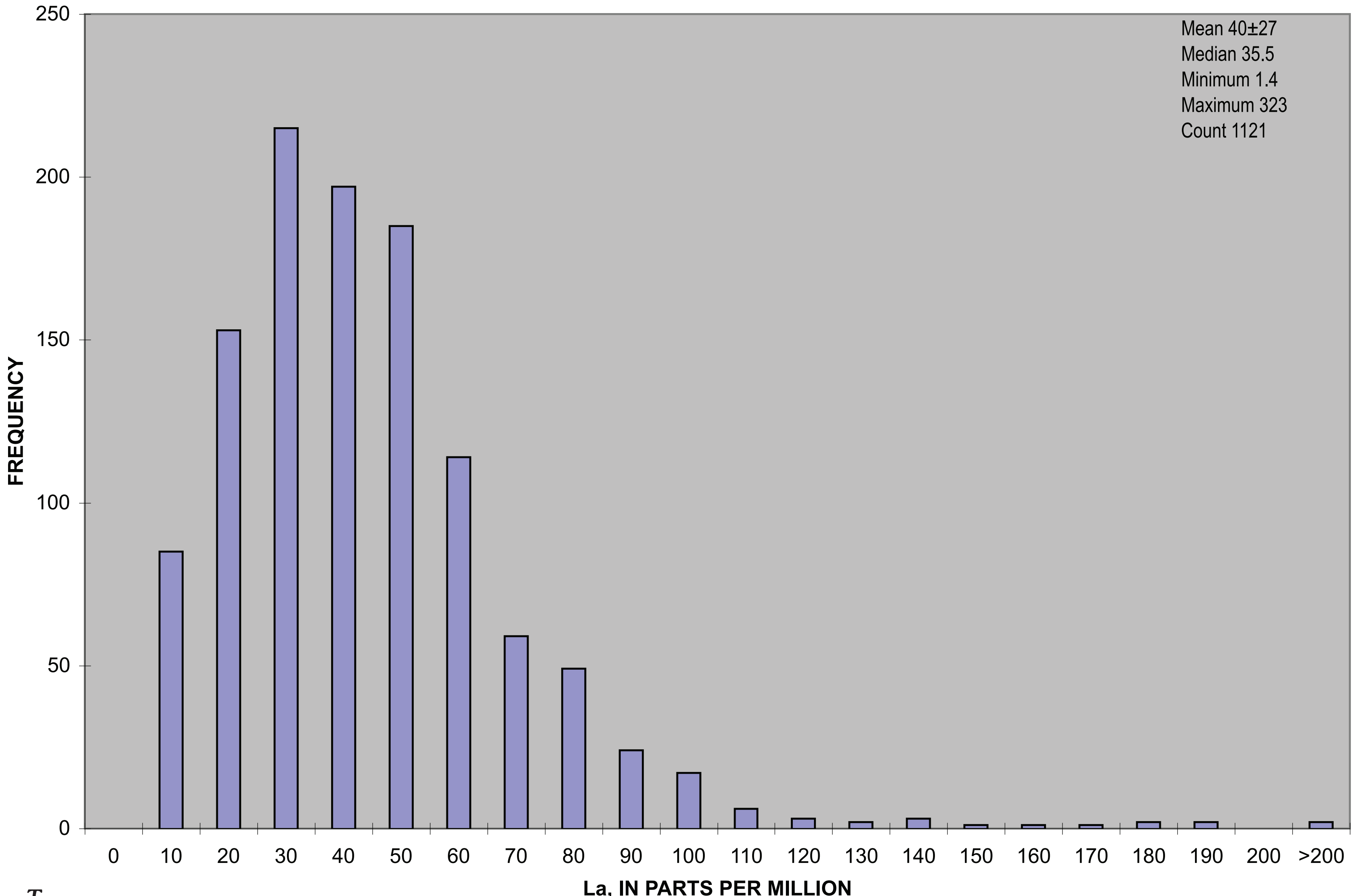

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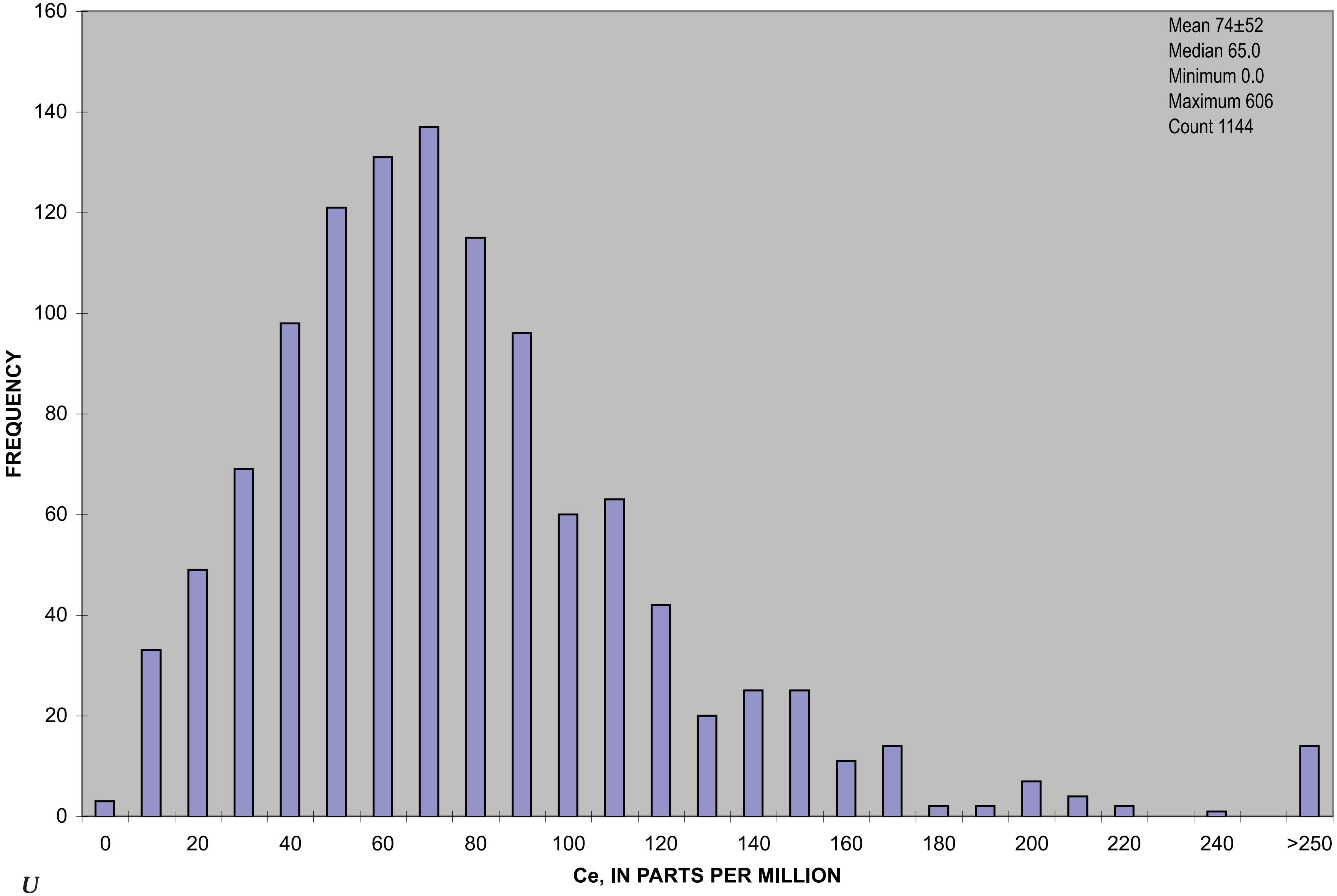
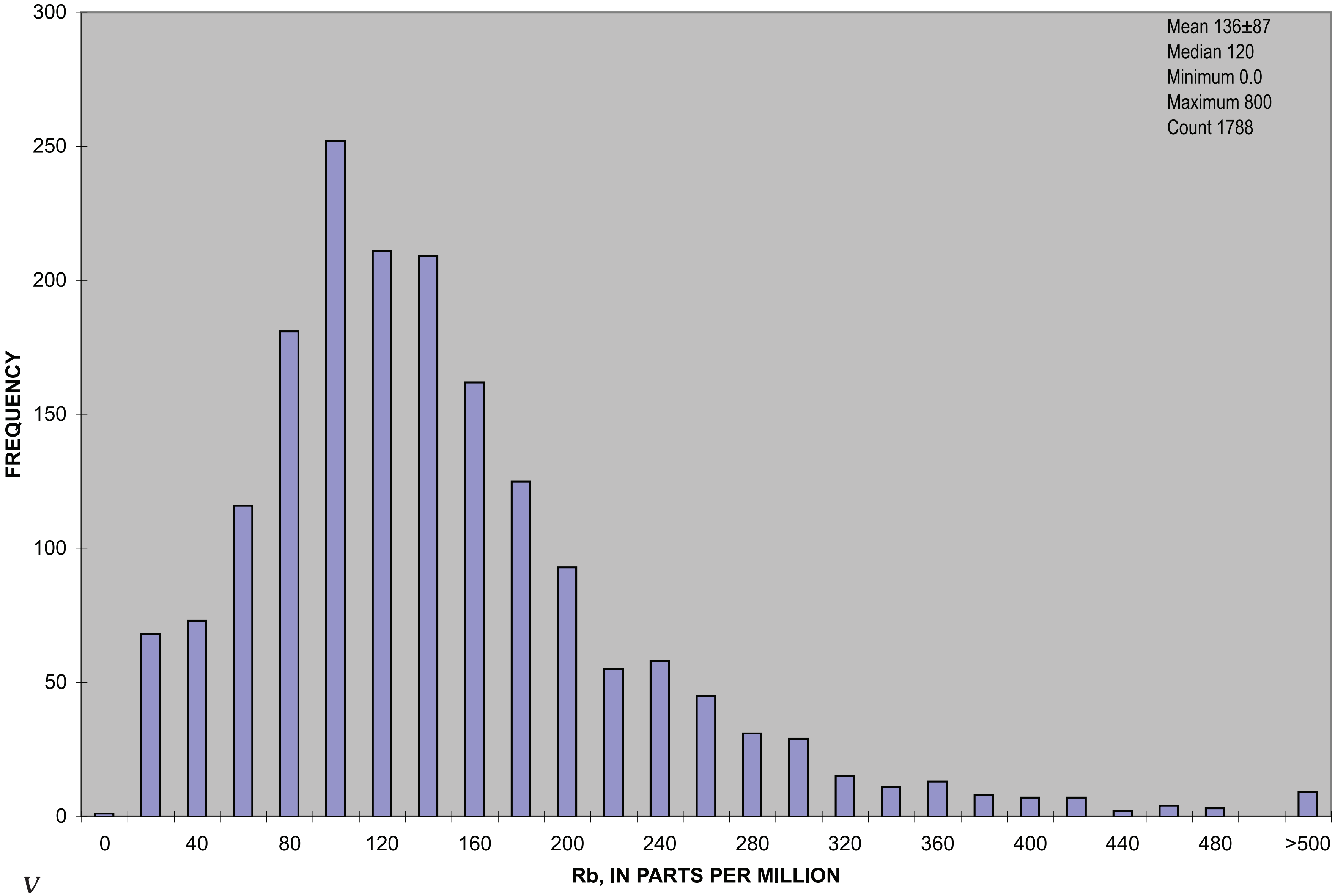
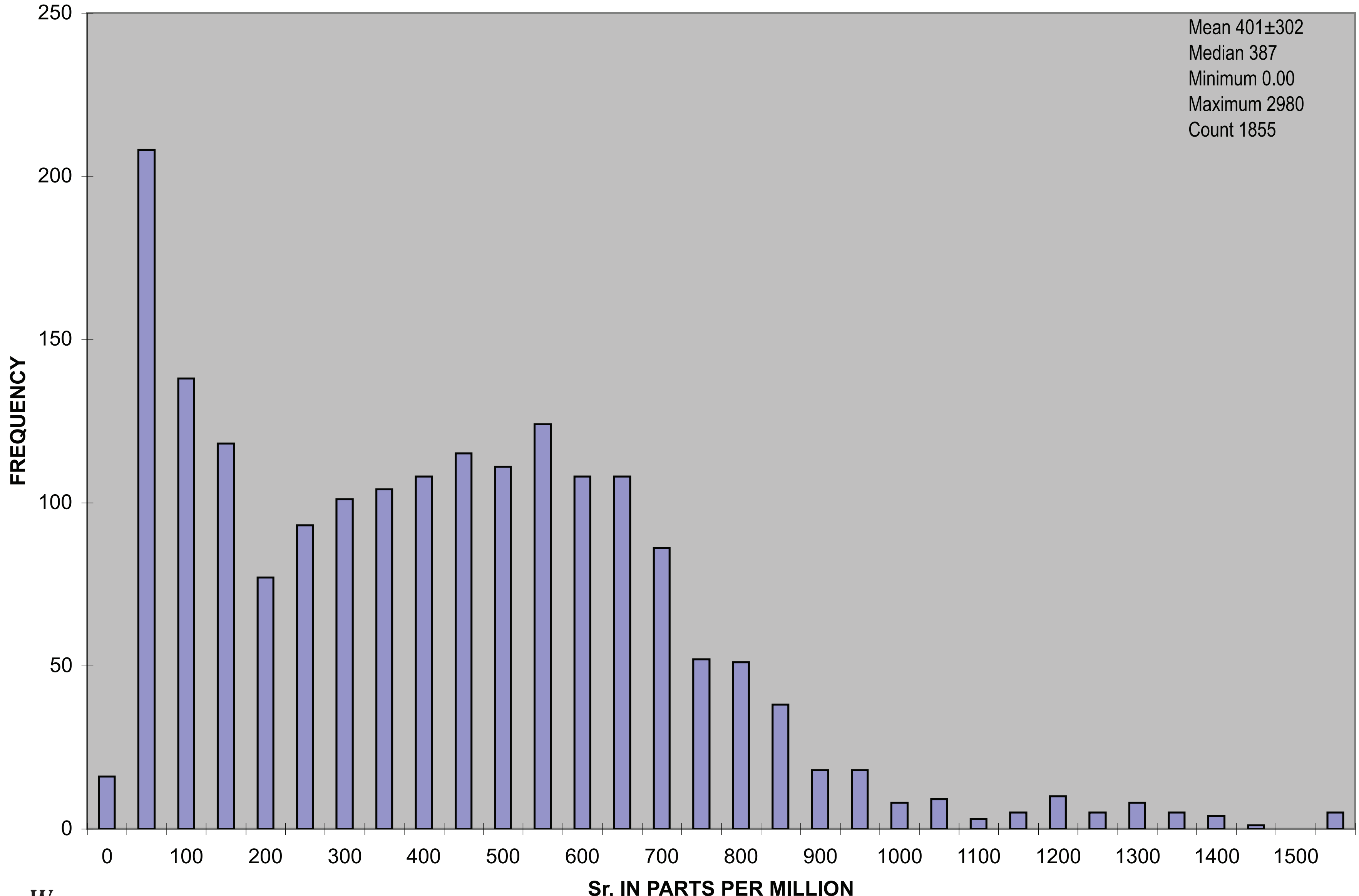


Figure 2. Frequency distribution histograms showing compositions of north-central and northeast Nevada intrusive rock samples—Continued.



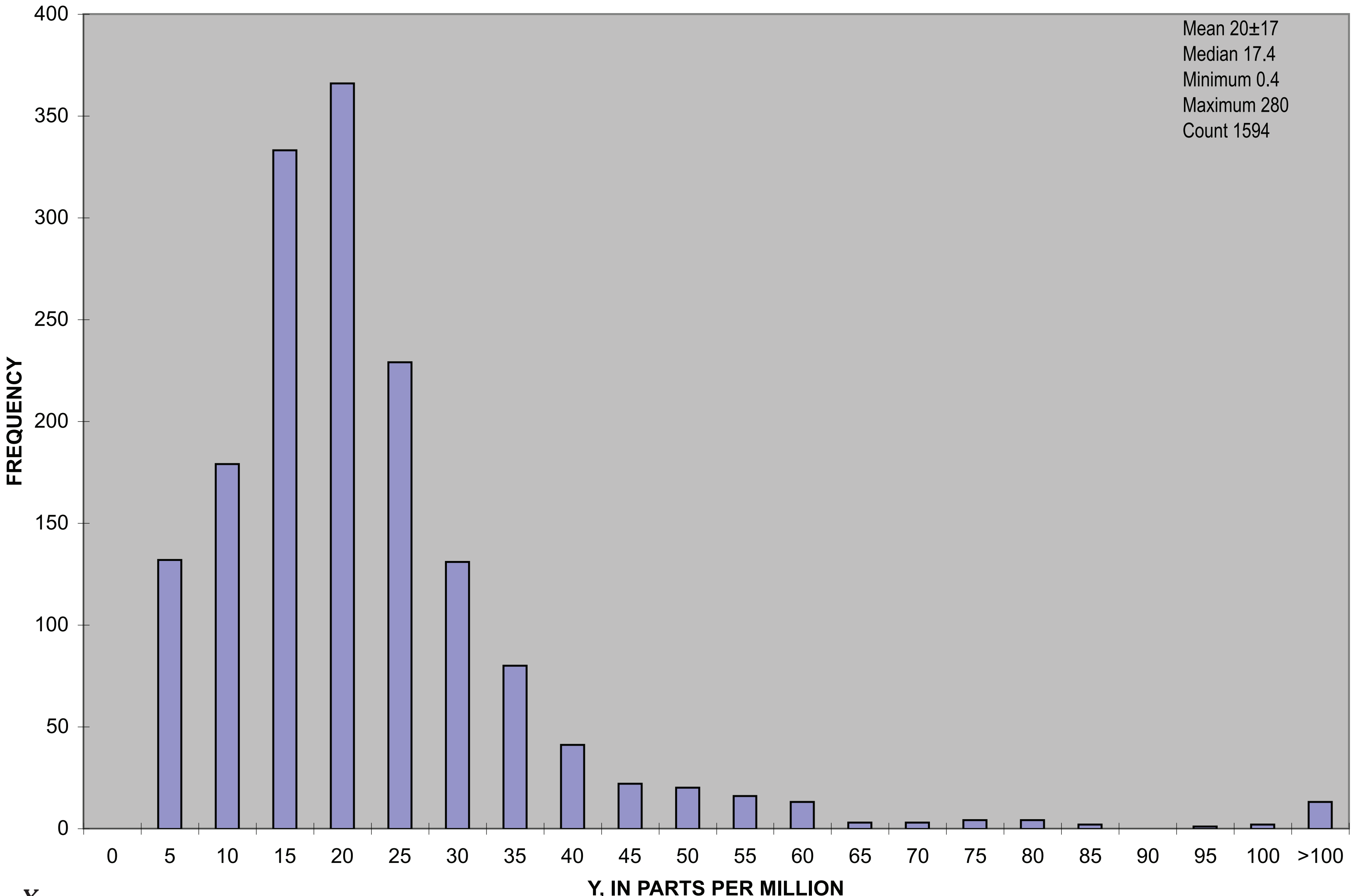
V

Figure 2. Frequency distribution histograms showing compositions of north-central and northeast Nevada intrusive rock samples—Continued.



W

Figure 2. Frequency distribution histograms showing compositions of north-central and northeast Nevada intrusive rock samples—Continued.



X

Figure 2. Frequency distribution histograms showing compositions of north-central and northeast Nevada intrusive rock samples—Continued.

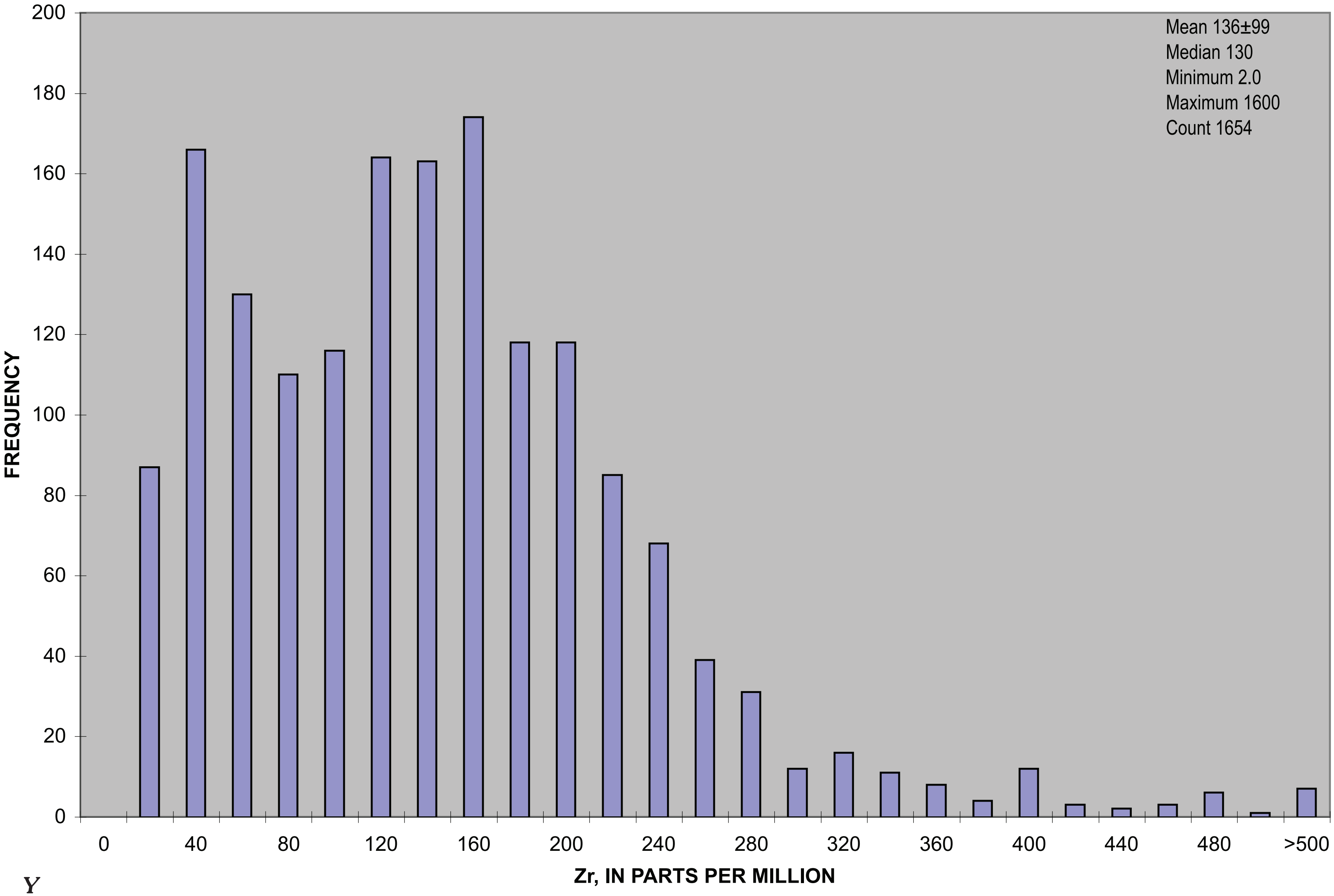
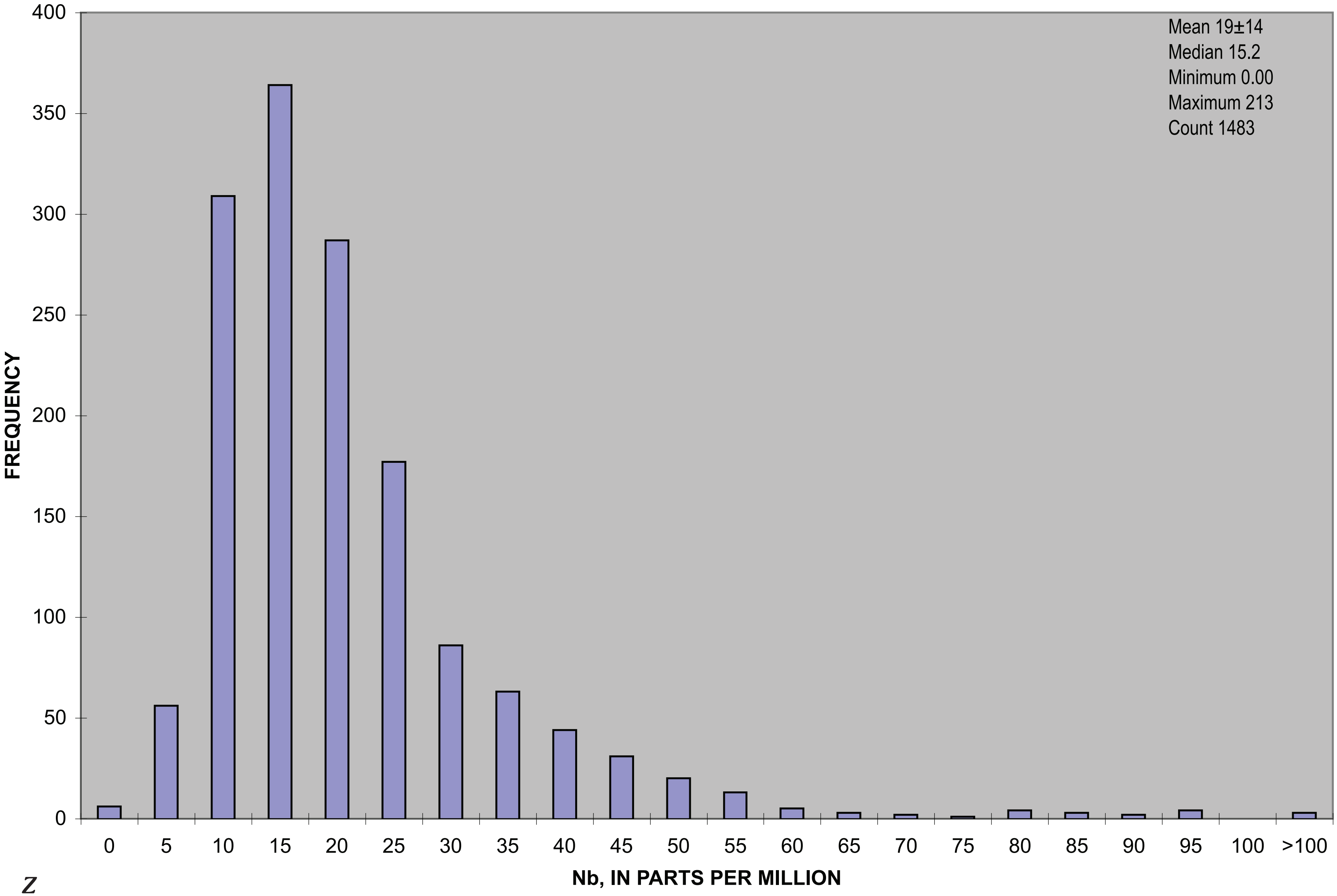
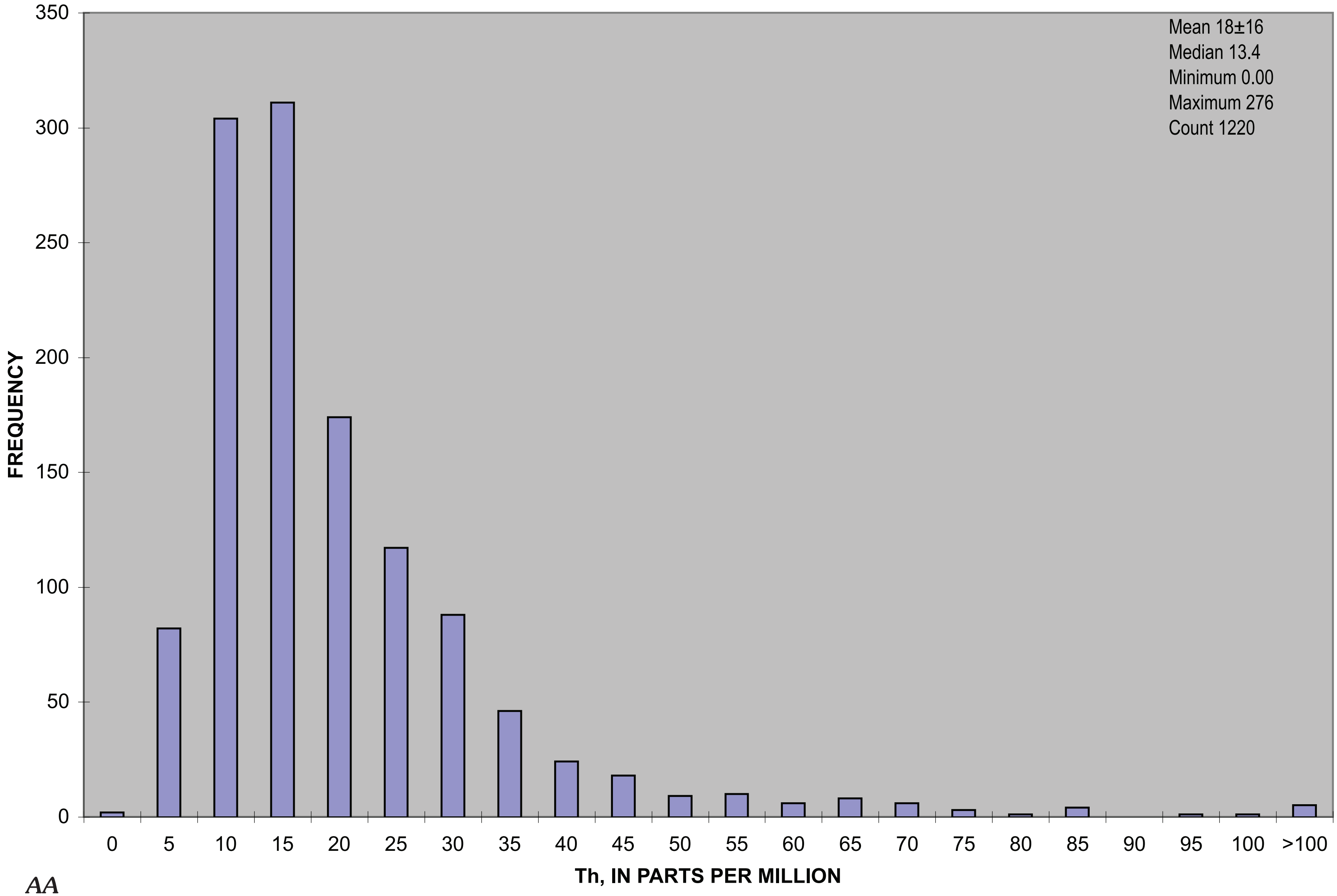


Figure 2. Frequency distribution histograms showing compositions of north-central and northeast Nevada intrusive rock samples—Continued.



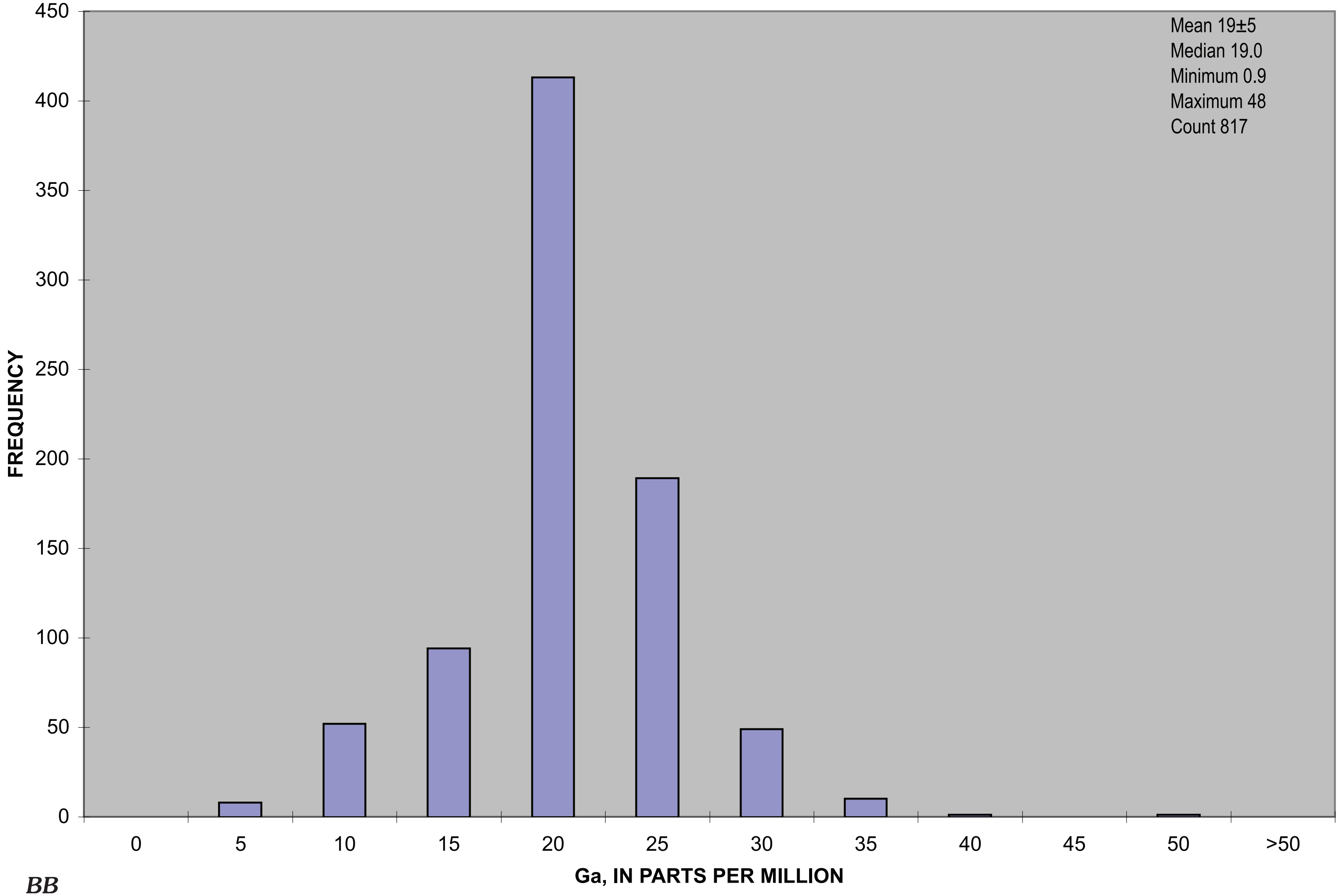
Z

Figure 2. Frequency distribution histograms showing compositions of north-central and northeast Nevada intrusive rock samples—Continued.



AA

Figure 2. Frequency distribution histograms showing compositions of north-central and northeast Nevada intrusive rock samples—Continued.



BB

Figure 2. Frequency distribution histograms showing compositions of north-central and northeast Nevada intrusive rock samples—Continued.

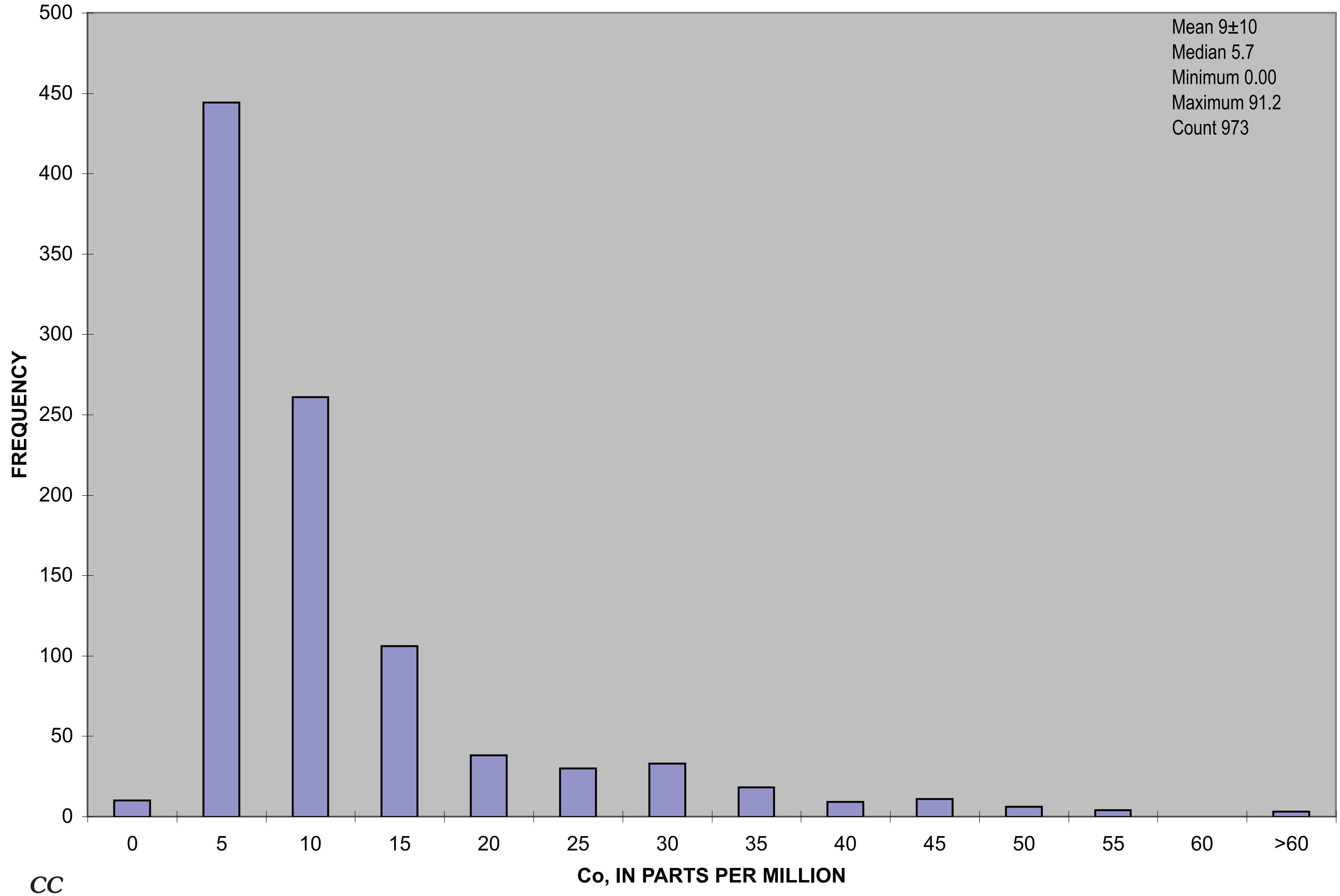
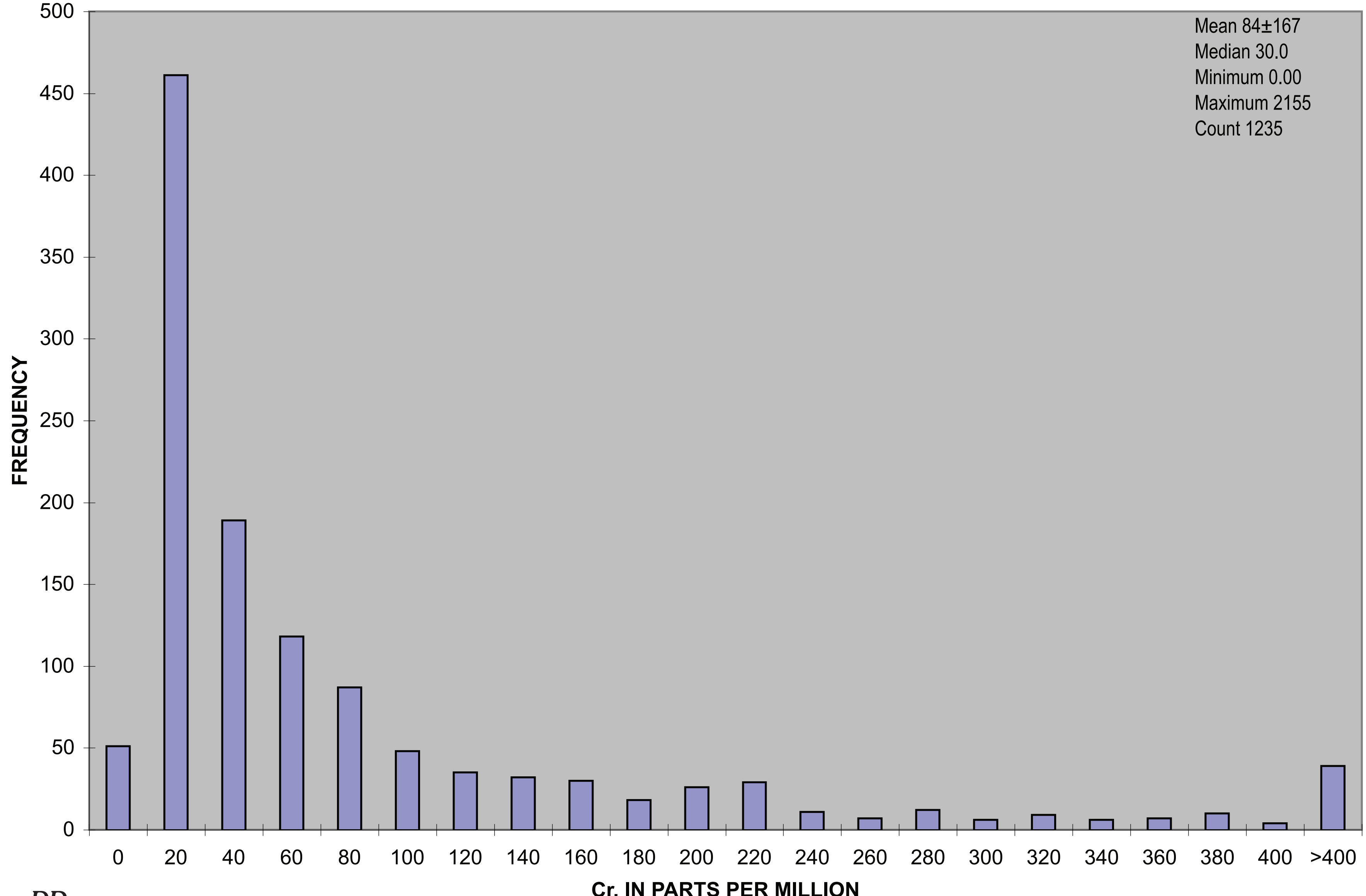
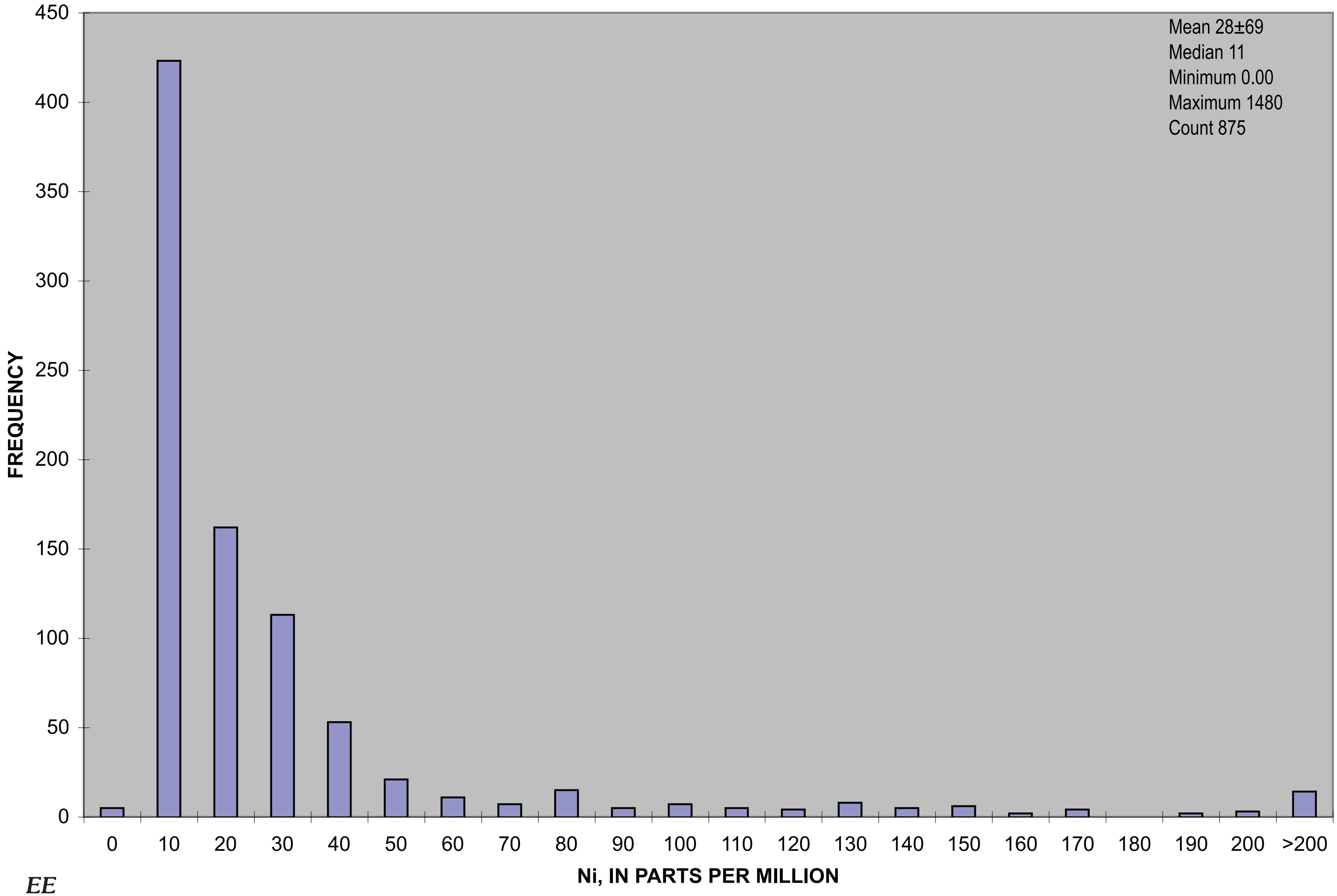


Figure 2. Frequency distribution histograms showing compositions of north-central and northeast Nevada intrusive rock samples—Continued.



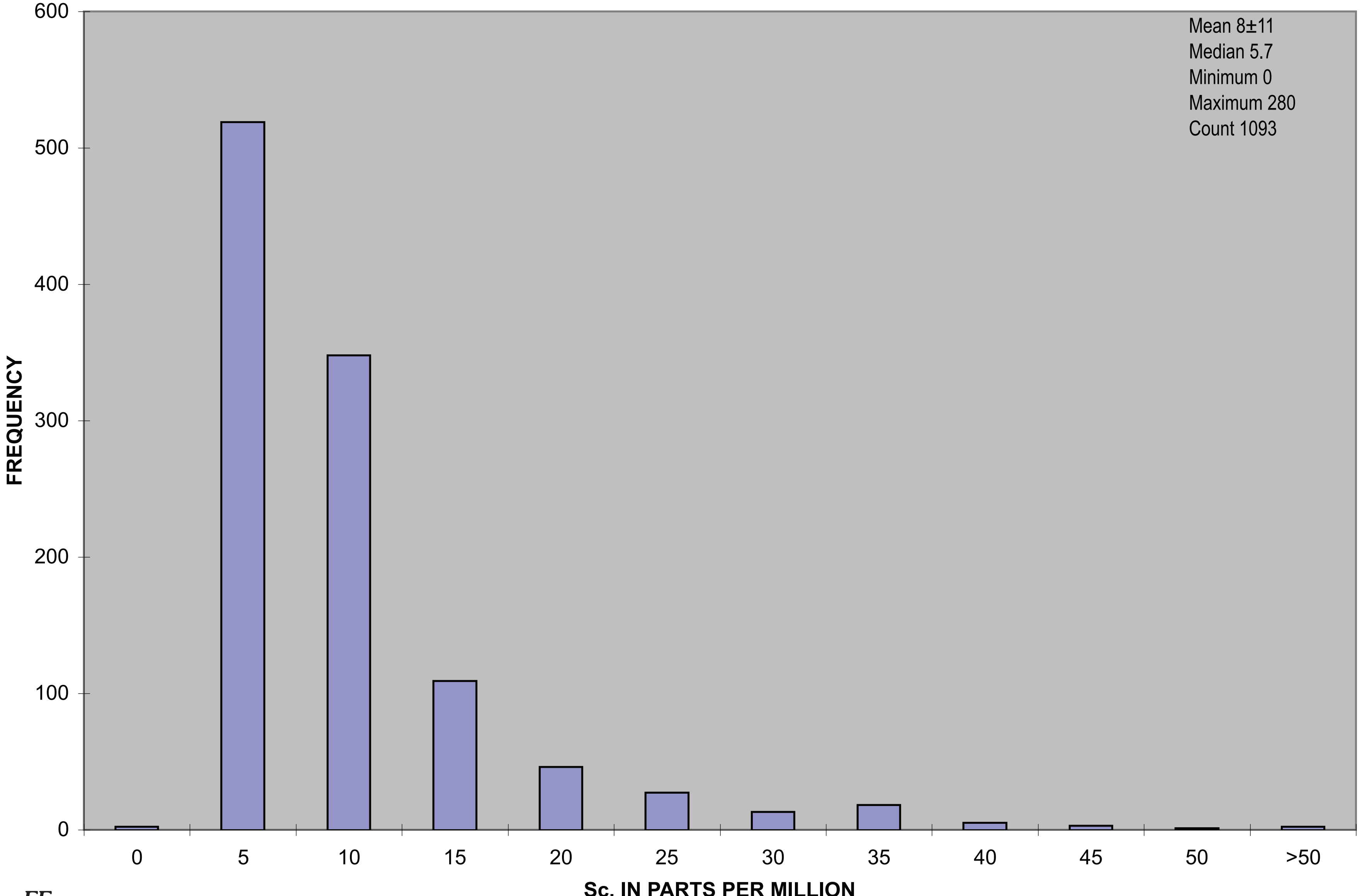
DD

Figure 2. Frequency distribution histograms showing compositions of north-central and northeast Nevada intrusive rock samples—Continued.



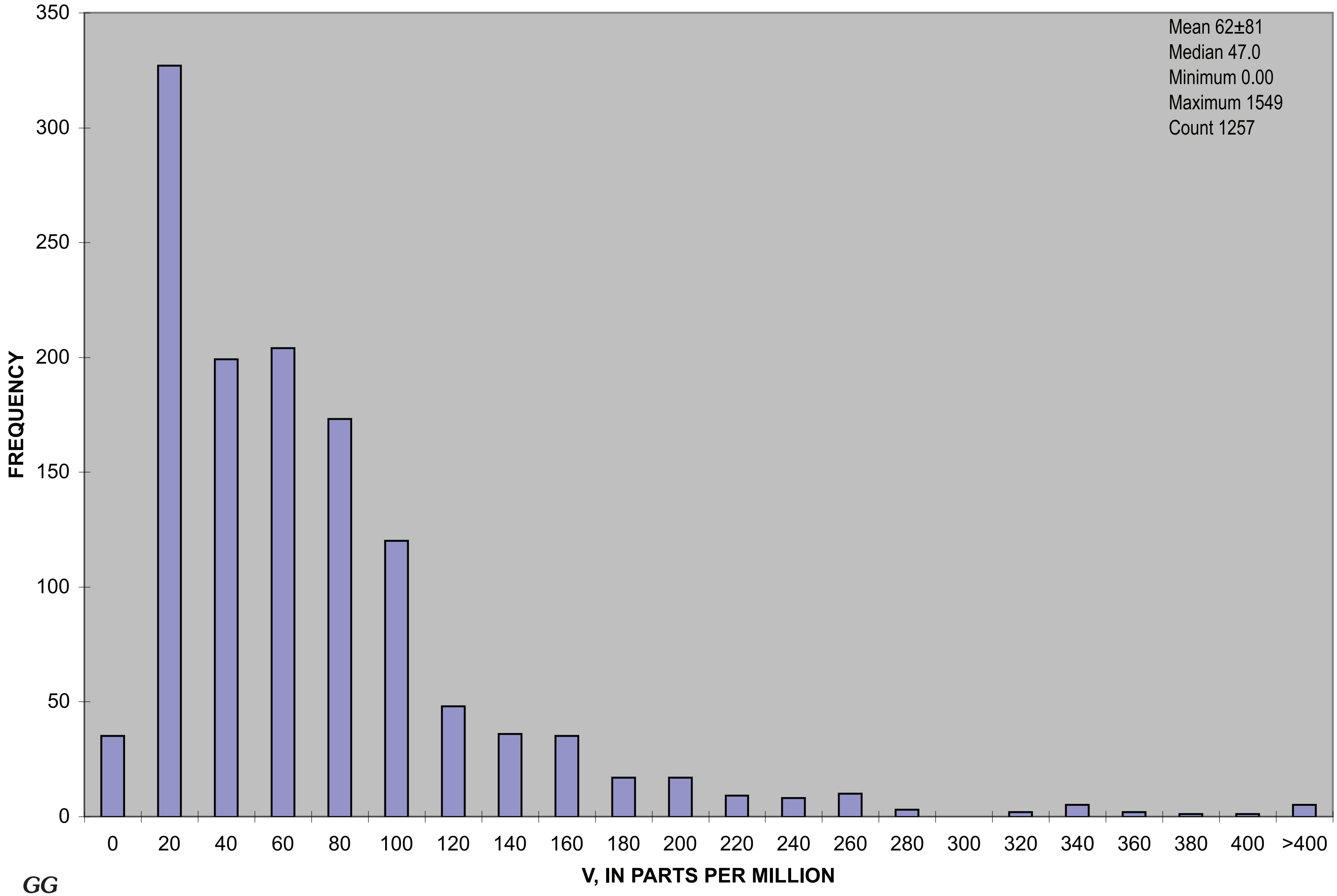
EE

Figure 2. Frequency distribution histograms showing compositions of north-central and northeast Nevada intrusive rock samples—Continued.



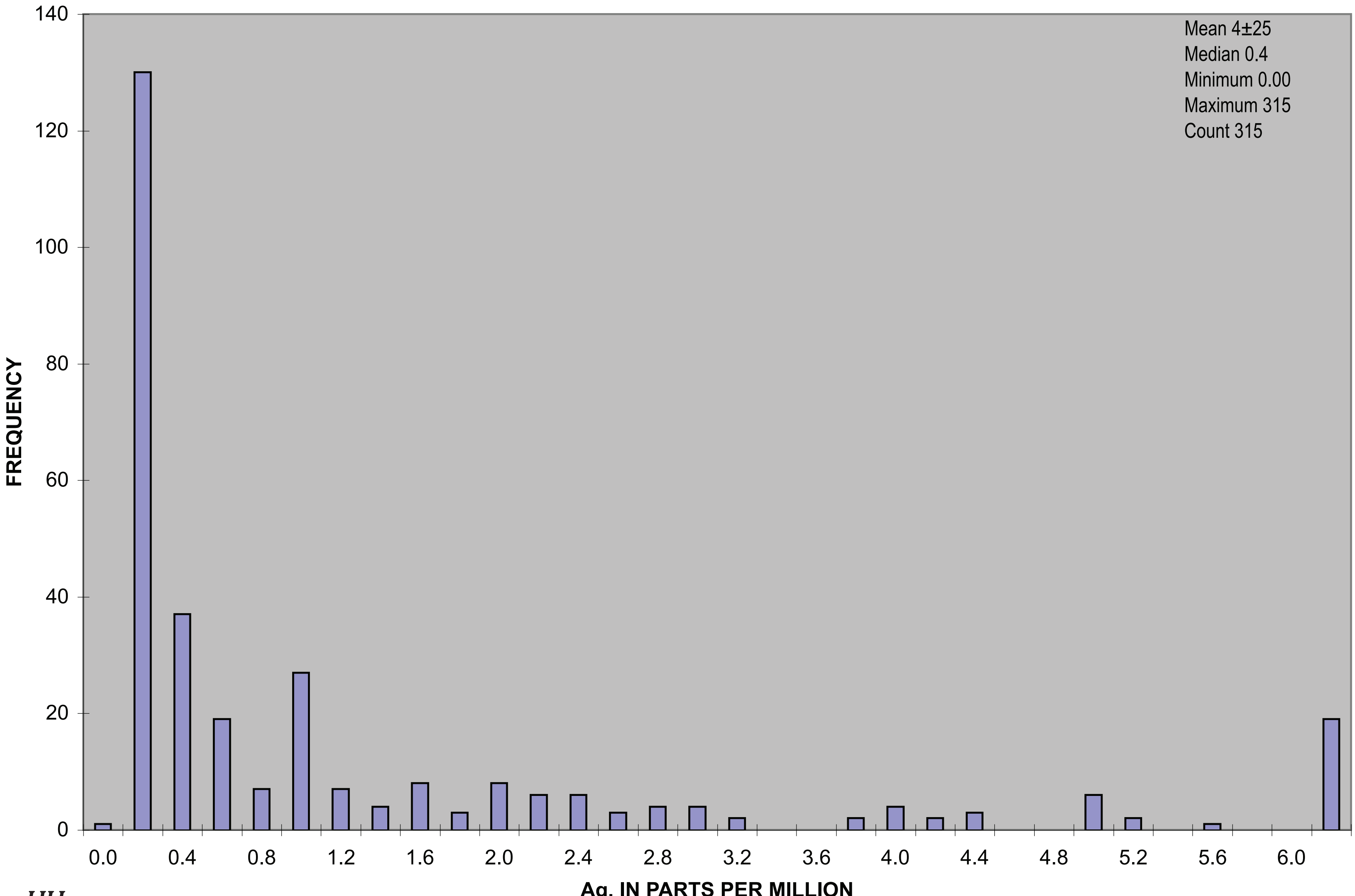
FF

Figure 2. Frequency distribution histograms showing compositions of north-central and northeast Nevada intrusive rock samples—Continued.



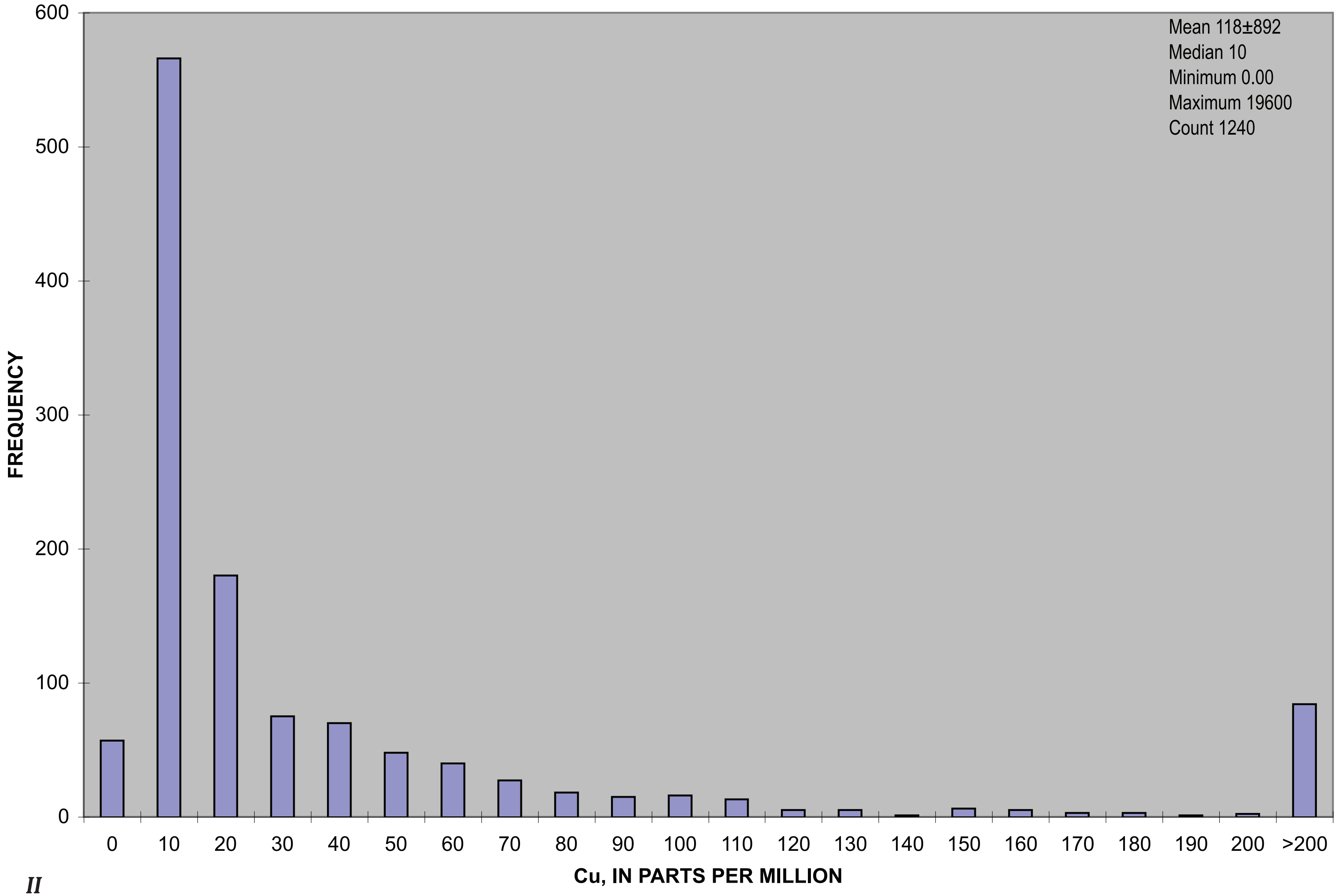
GG

Figure 2. Frequency distribution histograms showing compositions of north-central and northeast Nevada intrusive rock samples—Continued.



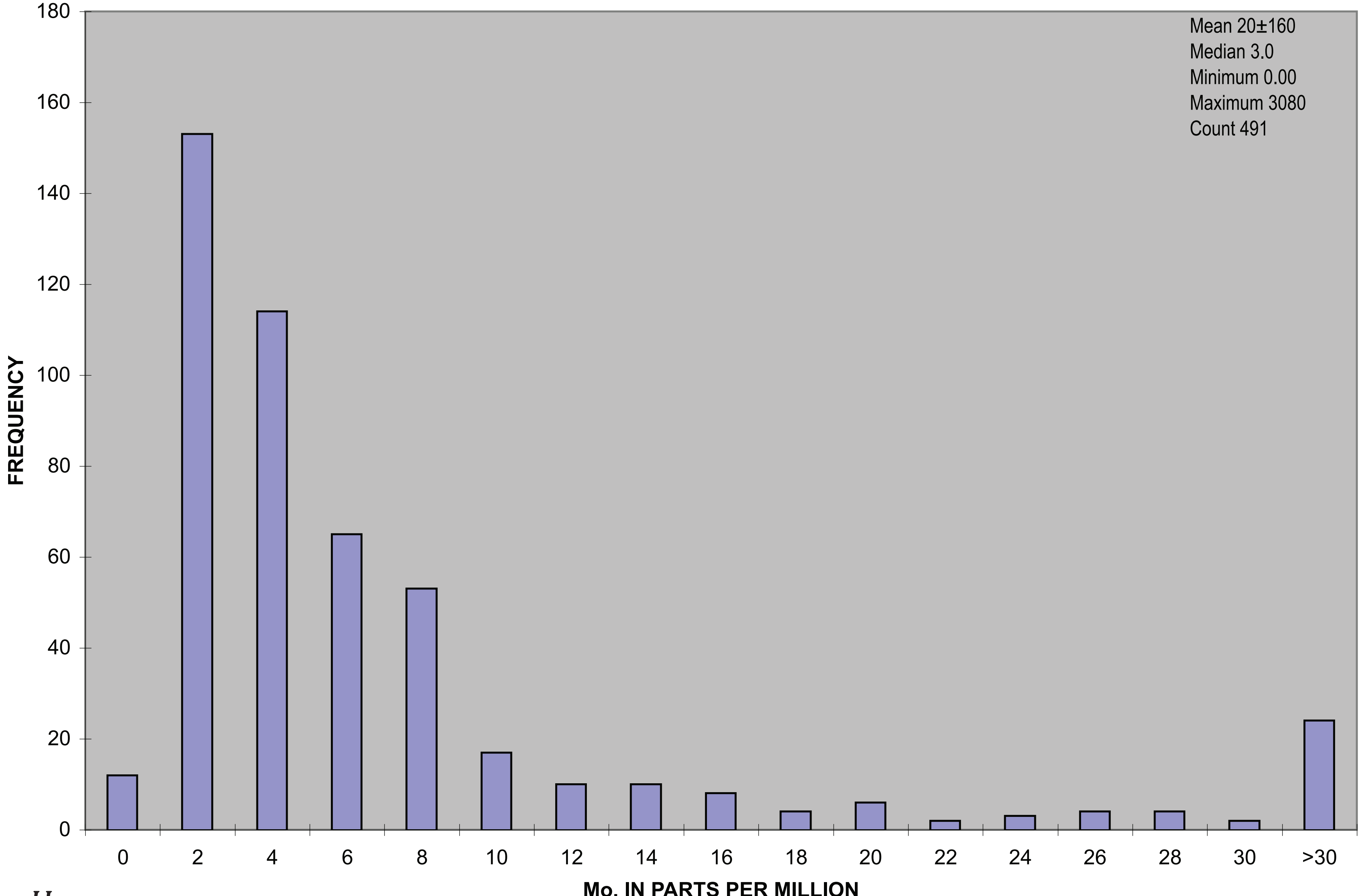
HH

Figure 2. Frequency distribution histograms showing compositions of north-central and northeast Nevada intrusive rock samples—Continued.



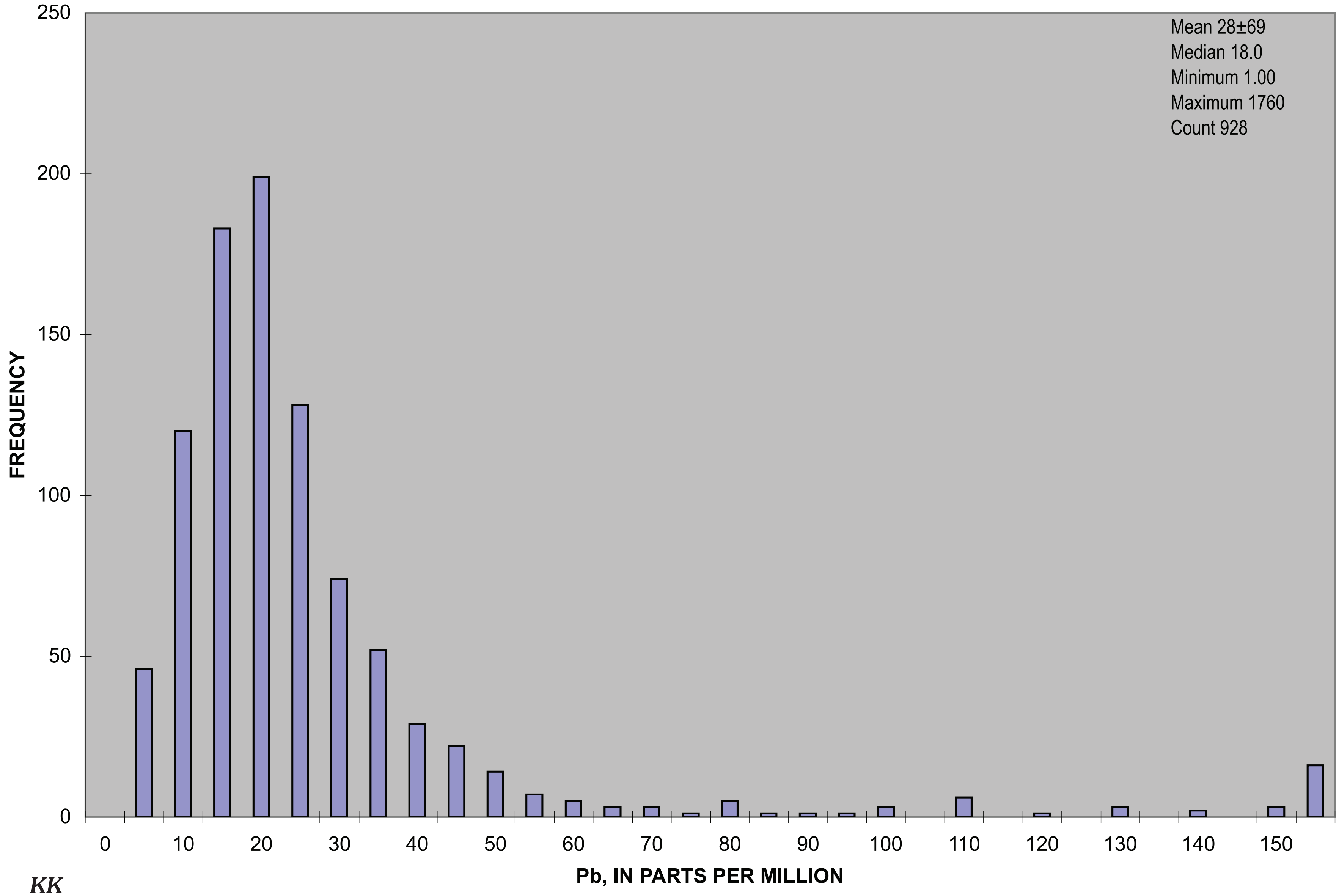
II

Figure 2. Frequency distribution histograms showing compositions of north-central and northeast Nevada intrusive rock samples—Continued.



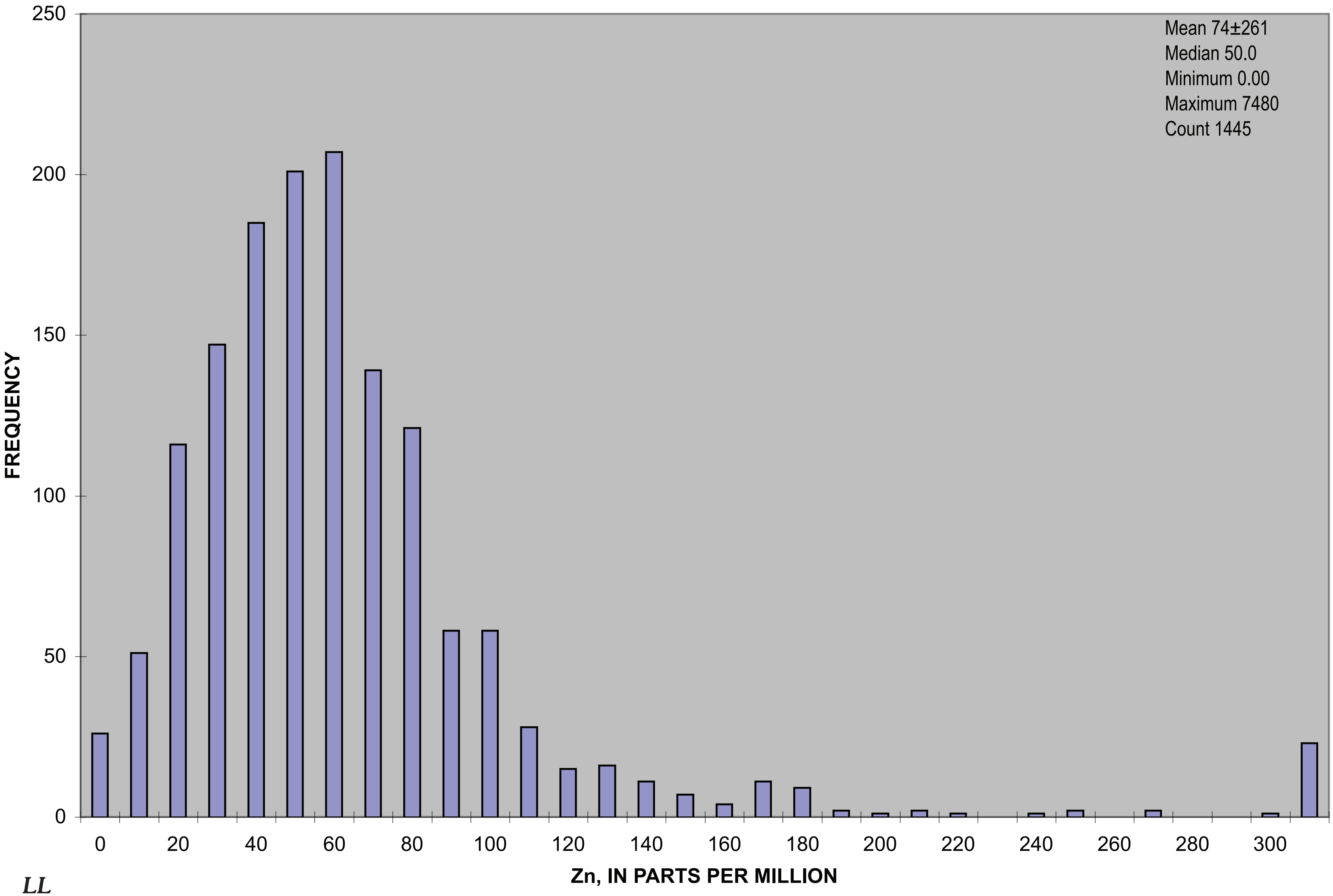
JJ

Figure 2. Frequency distribution histograms showing compositions of north-central and northeast Nevada intrusive rock samples—Continued.



KK

Figure 2. Frequency distribution histograms showing compositions of north-central and northeast Nevada intrusive rock samples—Continued.



LL

Figure 2. Frequency distribution histograms showing compositions of north-central and northeast Nevada intrusive rock samples—Continued.

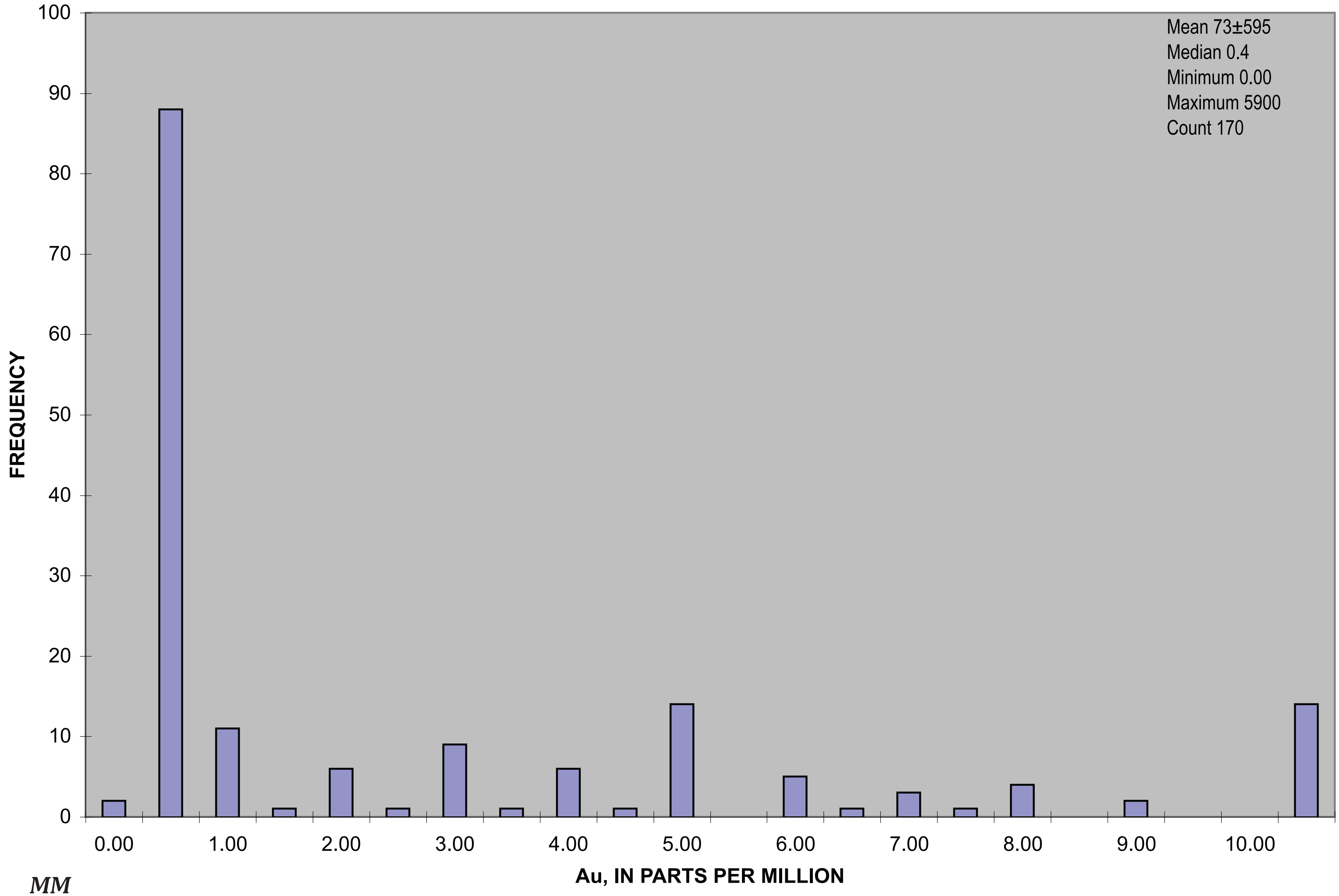


Figure 2. Frequency distribution histograms showing compositions of north-central and northeast Nevada intrusive rock samples—Continued.

Table 1. Number of observations (Freq) within each composition range (Bin) for north-central and northeast Nevada intrusion database.

[Each bin denotes an abundance less than or equal to the indicated value but greater than that specified by the bin with the next lowest abundance. Bins for SiO_2, TiO_2, Al_2O_3, FeO*, MnO, MgO, CaO, Na_2O, K_2O, P_2O_5, H_2O+, H_2O-, CO_2, Cl, F, S, initial analytical total (total_I), and total volatile content (vol_sum) are in weight percent; all others in parts per million]

SiO_2		TiO_2		Al_2O_3		FeO*		MnO		MgO		CaO		Na_2O		K_2O	
Bin	Freq	Bin	Freq	Bin	Freq	Bin	Freq	Bin	Freq	Bin	Freq	Bin	Freq	Bin	Freq	Bin	Freq
40	1	0.0	21	6	8	0	4	0.000	78	0.0	8	0	5	0.0	23	0.0	0
42	2	0.2	682	7	3	1	487	0.025	405	0.5	1001	1	667	0.5	221	0.5	82
44	5	0.4	647	8	6	2	579	0.050	550	1.0	426	2	476	1.0	61	1.0	78
46	11	0.6	699	9	8	3	575	0.075	644	1.5	354	3	433	1.5	61	1.5	78
48	10	0.8	340	10	15	4	453	0.100	353	2.0	329	4	423	2.0	82	2.0	73
50	29	1.0	168	11	29	5	226	0.125	199	2.5	202	5	296	2.5	137	2.5	172
52	32	1.2	94	12	38	6	197	0.150	95	3.0	137	6	185	3.0	323	3.0	281
54	40	1.4	54	13	142	7	113	0.175	52	3.5	72	7	98	3.5	706	3.5	392
56	60	1.6	27	14	367	8	65	0.200	31	4.0	47	8	53	4.0	677	4.0	363
58	58	1.8	18	15	621	9	40	0.225	19	4.5	49	9	38	4.5	288	4.5	500
60	68	2.0	14	16	663	10	24	0.250	11	5.0	29	10	36	5.0	166	5.0	357
62	103	2.2	6	17	488	11	23	0.275	7	5.5	27	11	23	5.5	36	5.5	201
64	132	2.4	14	18	273	12	20	0.300	4	6.0	23	12	10	6.0	17	6.0	85
66	216	2.6	6	19	71	13	8	0.325	5	6.5	17	13	15	6.5	9	6.5	60
68	300	2.8	0	20	34	14	6	0.350	3	7.0	16	14	12	7.0	12	7.0	35
70	293	3.0	0	21	18	15	3	0.375	0	7.5	11	15	4	7.5	1	7.5	22
72	339	>3.0	11	22	6	>15	16	0.400	3	8.0	11	>15	30	8.0	4	8.0	22
74	328			23	20			0.425	2	8.5	4			>8.0	7	8.5	11
76	366			24	7			0.450	1	9.0	4					9.0	7
78	274			25	6			0.475	0	9.5	6					9.5	4
80	83			>25	17			0.500	1	10.0	6					10.0	4
82	59							>0.500	6	10.5	4					>10.0	12
84	11									11.0	3						
86	12									>11.0	21						
88	3																
90	3																
>90	2																

Table 1. Number of observations (Freq) within each composition range (Bin) for north-central and northeast Nevada intrusion database—Continued.

P_2O_5		H_2O^+		H_2O^-		CO_2		Cl		F		S		total_I		vol_sum	
Bin	Freq	Bin	Freq	Bin	Freq	Bin	Freq	Bin	Freq	Bin	Freq	Bin	Freq	Bin	Freq	Bin	Freq
0.00	62	0.00	0	0.00	2	0.00	9	0.000	58	0.00	0	0.00	18	85	11	0.0	52
0.05	317	0.25	41	0.10	255	0.10	369	0.010	88	0.02	52	0.01	264	86	3	0.5	691
0.10	428	0.50	173	0.20	287	0.20	89	0.020	53	0.04	126	0.02	37	87	4	1.0	811
0.15	428	0.75	233	0.30	96	0.30	47	0.030	34	0.06	142	0.03	9	88	4	1.5	312
0.20	388	1.00	169	0.40	57	0.40	34	0.040	9	0.08	140	0.04	15	89	6	2.0	147
0.25	328	1.25	72	0.50	29	0.50	24	0.050	8	0.10	68	0.05	6	90	5	2.5	95
0.30	199	1.50	60	0.60	32	0.60	16	0.060	2	0.12	37	0.06	6	91	9	3.0	76
0.35	140	1.75	27	0.70	15	0.70	13	0.070	1	0.14	31	0.07	7	92	10	3.5	60
0.40	72	2.00	30	0.80	13	0.80	11	0.080	1	0.16	18	0.08	7	93	18	4.0	47
0.45	34	2.25	18	0.90	15	0.90	8	0.090	0	0.18	12	0.09	5	94	28	4.5	30
0.50	36	2.50	20	1.00	11	1.00	11	0.100	0	0.20	10	0.10	3	95	26	5.0	41
0.55	26	2.75	11	1.10	9	1.10	1	>0.100	9	0.22	5	0.11	2	96	27	5.5	33
0.60	14	3.00	10	1.20	4	1.20	9			0.24	5	0.12	2	97	65	6.0	14
0.65	13	3.25	8	1.30	4	1.30	1			0.26	4	0.13	4	98	108	6.5	20
0.70	10	3.50	7	1.40	5	1.40	0			0.28	3	0.14	2	99	423	7.0	16
0.75	12	3.75	9	1.50	3	1.50	0			0.30	0	0.15	3	100	1399	7.5	15
0.80	4	4.00	3	1.60	5	1.60	2			0.32	2	0.16	1	101	591	8.0	15
0.85	5	4.25	7	1.70	1	1.70	5			0.34	0	0.17	6	102	56	8.5	7
0.90	5	4.50	2	1.80	3	1.80	5			0.36	4	0.18	2	103	18	9.0	16
0.95	1	4.75	2	1.90	2	1.90	1			0.38	1	0.19	2	104	13	9.5	9
>0.95	17	5.00	4	2.00	1	2.00	3			0.40	1	0.20	1	105	7	10.0	4
		5.25	2	>2.00	8	>2.00	40			0.42	0	0.21	2	106	2	>10.0	68
		5.50	3							0.44	3	0.22	1	107	4		
		5.75	0							0.46	1	0.23	1	108	3		
		6.00	1							0.48	0	0.24	1	>108	0		
		>6.00	3							0.50	1	0.25	0				
										>0.50	14	0.26	2				
												0.27	1				
												0.28	0				
												0.29	1				
												0.30	0				
												>0.30	77				

Table 1. Number of observations (Freq) within each composition range (Bin) for north-central and northeast Nevada intrusion database—Continued.

Ba		La		Ce		Rb		Sr		Y		Zr		Nb		Th	
Bin	Freq	Bin	Freq	Bin	Freq	Bin	Freq	Bin	Freq	Bin	Freq	Bin	Freq	Bin	Freq	Bin	Freq
0	5	0	0	0	3	0	1	0	16	0	0	0	0	0	6	0	2
100	146	10	85	10	33	20	68	50	208	5	132	20	87	5	56	5	82
200	98	20	153	20	49	40	73	100	138	10	179	40	166	10	309	10	304
300	90	30	215	30	69	60	116	150	118	15	333	60	130	15	364	15	311
400	65	40	197	40	98	80	181	200	77	20	366	80	110	20	287	20	174
500	55	50	185	50	121	100	252	250	93	25	229	100	116	25	177	25	117
600	66	60	114	60	131	120	211	300	101	30	131	120	164	30	86	30	88
700	66	70	59	70	137	140	209	350	104	35	80	140	163	35	63	35	46
800	105	80	49	80	115	160	162	400	108	40	41	160	174	40	44	40	24
900	108	90	24	90	96	180	125	450	115	45	22	180	118	45	31	45	18
1000	129	100	17	100	60	200	93	500	111	50	20	200	118	50	20	50	9
1100	190	110	6	110	63	220	55	550	124	55	16	220	85	55	13	55	10
1200	175	120	3	120	42	240	58	600	108	60	13	240	68	60	5	60	6
1300	120	130	2	130	20	260	45	650	108	65	3	260	39	65	3	65	8
1400	77	140	3	140	25	280	31	700	86	70	3	280	31	70	2	70	6
1500	98	150	1	150	25	300	29	750	52	75	4	300	12	75	1	75	3
1600	55	160	1	160	11	320	15	800	51	80	4	320	16	80	4	80	1
1700	46	170	1	170	14	340	11	850	38	85	2	340	11	85	3	85	4
1800	30	180	2	180	2	360	13	900	18	90	0	360	8	90	2	90	0
1900	23	190	2	190	2	380	8	950	18	95	1	380	4	95	4	95	1
2000	24	200	0	200	7	400	7	1000	8	100	2	400	12	100	0	100	1
2100	16	>200	2	210	4	420	7	1050	9	>100	13	420	3	>100	3	>100	5
2200	15			220	2	440	2	1100	3			440	2				
2300	10			230	0	460	4	1150	5			460	3				
2400	7			240	1	480	3	1200	10			480	6				
2500	5			250	0	500	0	1250	5			500	1				
2600	5			>250	14	>500	9	1300	8			>500	7				
2700	5							1350	5								
2800	5							1400	4								
2900	5							1450	1								
3000	2							1500	0								
>3000	39							>1500	5								

Table 1. Number of observations (Freq) within each composition range (Bin) for north-central and northeast Nevada intrusion database—Continued.

Ga		Co		Cr		Ni		Sc		V		Ag		Cu		Mo	
Bin	Freq	Bin	Freq	Bin	Freq	Bin	Freq	Bin	Freq	Bin	Freq	Bin	Freq	Bin	Freq	Bin	Freq
0	0	0	10	0	51	0	5	0	2	0	35	0.0	1	0	57	0	12
5	8	5	444	20	461	10	423	5	519	20	327	0.2	130	10	566	2	153
10	52	10	261	40	189	20	162	10	348	40	199	0.4	37	20	180	4	114
15	94	15	106	60	118	30	113	15	109	60	204	0.6	19	30	75	6	65
20	413	20	38	80	87	40	53	20	46	80	173	0.8	7	40	70	8	53
25	189	25	30	100	48	50	21	25	27	100	120	1.0	27	50	48	10	17
30	49	30	33	120	35	60	11	30	13	120	48	1.2	7	60	40	12	10
35	10	35	18	140	32	70	7	35	18	140	36	1.4	4	70	27	14	10
40	1	40	9	160	30	80	15	40	5	160	35	1.6	8	80	18	16	8
45	0	45	11	180	18	90	5	45	3	180	17	1.8	3	90	15	18	4
50	1	50	6	200	26	100	7	50	1	200	17	2.0	8	100	16	20	6
>50	0	55	4	220	29	110	5	>50	2	220	9	2.2	6	110	13	22	2
		60	0	240	11	120	4			240	8	2.4	6	120	5	24	3
		>60	3	260	7	130	8			260	10	2.6	3	130	5	26	4
				280	12	140	5			280	3	2.8	4	140	1	28	4
				300	6	150	6			300	0	3.0	4	150	6	30	2
				320	9	160	2			320	2	3.2	2	160	5	>30	24
				340	6	170	4			340	5	3.4	0	170	3		
				360	7	180	0			360	2	3.6	0	180	3		
				380	10	190	2			380	1	3.8	2	190	1		
				400	4	200	3			400	1	4.0	4	200	2		
				>400	39	>200	14			>400	5	4.2	2	>200	84		
												4.4	3				
												4.6	0				
												4.8	0				
												5.0	6				
												5.2	2				
												5.4	0				
												5.6	1				
												5.8	0				
												6.0	0				
												>6.0	19				

Table 1. Number of observations (Freq) within each composition range (Bin) for north-central and northeast Nevada intrusion database—Continued.

Pb		Zn		Au	
Bin	Freq	Bin	Freq	Bin	Freq
0	0	0	26	0.00	2
5	46	10	51	0.50	88
10	120	20	116	1.00	11
15	183	30	147	1.50	1
20	199	40	185	2.00	6
25	128	50	201	2.50	1
30	74	60	207	3.00	9
35	52	70	139	3.50	1
40	29	80	121	4.00	6
45	22	90	58	4.50	1
50	14	100	58	5.00	14
55	7	110	28	5.50	0
60	5	120	15	6.00	5
65	3	130	16	6.50	1
70	3	140	11	7.00	3
75	1	150	7	7.50	1
80	5	160	4	8.00	4
85	1	170	11	8.50	0
90	1	180	9	9.00	2
95	1	190	2	9.50	0
100	3	200	1	10.00	0
105	0	210	2	>10.00	14
110	6	220	1		
115	0	230	0		
120	1	240	1		
125	0	250	2		
130	3	260	0		
135	0	270	2		
140	2	280	0		
145	0	290	0		
150	3	300	1		
>150	16	>300	23		