Porphyry Copper Deposits of the World: Database And Grade and Tonnage Models, 2008

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INTRODUCTION

This report is an update of earlier publications about porphyry copper deposits (Singer, Berger, and Moring, 2002; Singer, D.A., Berger, V.I., and Moring, B.C., 2005). The update was necessary because of new information about substantial increases in resources in some deposits and because we revised locations of some deposits so that they are consistent with images in GoogleEarth. In this report we have added new porphyry copper deposits and removed a few incorrectly classed deposits. In addition, some errors have been corrected and a number of deposits have had some information, such as grades, tonnages, locations, or ages revised. Colleagues have helped identify places where improvements were needed.

Mineral deposit models are important in exploration planning and quantitative resource assessments for a number of reasons including: (1) grades and tonnages among deposit types are significantly different, and (2) many types occur in different geologic settings that can be identified from geologic maps. Mineral deposit models are the keystone in combining the diverse geoscience information on geology, mineral occurrences, geophysics, and geochemistry used in resource assessments and mineral exploration. Too few thoroughly explored mineral deposits are available in most local areas for reliable identification of the important geoscience variables or for robust estimation of undiscovered deposits—thus we need mineral-deposit models. Globally based deposit models allow recognition of important features because the global models demonstrate how common different features are. Well-designed and -constructed deposit models allow geologists to know from observed geologic environments the possible mineral deposit types that might exist, and allow economists to determine the possible economic viability of these resources in the region. Thus, mineral deposit models play the central role in transforming geoscience information to a form useful to policy makers. The foundation of mineral deposit models is information about known deposits. The purpose of this publication is to make this kind of information available in digital form for porphyry copper deposits. The consistently defined deposits in this file provide the foundation for grade and tonnage models included here and for mineral deposit density models (Singer and others, 2005: Singer, 2008).

This publication contains a computer file of information on porphyry copper deposits from around the world. It also presents new grade and tonnage models for porphyry copper deposits and for three subtypes of porphyry copper deposits and a file allowing locations of all deposits to be plotted in GoogleEarth. The data are presented in FileMaker Pro, Excel and text files to make the information available to as many as possible. The value of this information and any derived analyses depends critically on the consistent manner of data gathering. For this reason, we first discuss the rules applied in this compilation. Next, the fields of the data file are considered. Finally, we provide new grade and tonnage models and some analysis of the information in the file.

RULES APPLIED

A mineral deposit is a mineral occurrence of sufficient size and grade that might, under the most favorable circumstances, be considered to have economic potential (Cox, Barton, and Singer, 1986). Deposits sharing a relatively wide variety and large number of attributes are characterized as a "type," and a model representing that type can be developed. Porphyry copper deposits consist of stockwork, disseminated, and breccia-hosted copper mineralization that is generally restricted to plutons and their immediate wall rocks. They may have parts containing skarn. Deposits that may be derived from, or affected by, hypogene and supergene processes are included in the models. Deposits that are primarily breccia pipes or skarns were excluded from this database.

An important consideration at the data gathering stage is the question of what the sampling unit should be. Grade and tonnage data are available to varying degrees for districts, deposits, mines, and shafts. For the deposits in this file, the following rule was used to determine which ore bodies were combined. All mineralized rock or alteration within two (2) kilometers was combined into one deposit. Thus if the alteration zones of two deposits are within two kilometers of each other, they were combined. Such an operational spatial rule is necessary for defining deposits because we must be able to classify deposits in regions with highly variable geologic information and to avoid bias in estimating undiscovered deposits in resource assessments in areas where detailed information is lacking such as under cover. The two-kilometer rule was developed to try to insure that deposits in grade and tonnage and spatial density models correspond to deposits as geologic entities. Rules such as the two-kilometer rule applied here are essential in order to have an internally consistent assessment system where the estimate of number of undiscovered deposits is consistent with the grade and tonnage model. For example, El Pachon in Argentina and Los Pelambres in Chile are here reported as one record (deposit) because of the two-kilometer rule.

DATA FIELDS

The information on the porphyry copper deposits is contained in the files PorCu2008.fp7, PorCu.txt, and PorCufile2008.xls which are FileMaker Pro 9, tab-delineated text, and Excel, files respectively. The fields in the files are described below.

Deposit Name

The most recent deposit name, “NameDeposit”, is used. There is another field, "OtherNames," which contains alternative names that have been used for the deposit. A third field, "Includes," provides the names of deposits that have been combined with the primary deposit as a result of the two-kilometer minimum separation rule.

Locations

A number of fields are provided to show the deposit's location. "Country" and "StateProvince" are used for general locations. "CountryCode" is an abbreviated version of the country information. Degrees, minutes, and, in some cases seconds, of longitude and latitude are provided in the separate fields. Decimal degrees of latitude ("LatitudeDecimal") and longitude ("LongitudeDecimal") are calculated from the degrees, minutes and seconds fields. Southern latitudes and western longitudes are negative values.

Activity

Where the discovery date is known it is recorded ("DiscoveryDate"). If mining is known to have started, the date is listed in the "StartupDate" field.

Grades and tonnages

Data gathered for each deposit include average grade of each metal or mineral commodity of possible economic interest and the associated tonnage based on the total production, reserves, and resources at the lowest possible cutoff grade. All further references to tonnage follow this definition. All tonnages reported here ("Tonnage") are in millions of metric tons. Copper ("Copper grade") and molybdenum ("Molybdenum grade") grades are reported as percent of the metals. Gold ("Gold grade") and silver ("Silver grade") grades are reported as grams/metric ton of the metal. Grades not available (always for by-products) are treated as zero. Deposits that are known to be only partially drilled are considered as prospects and do not have their grades and tonnages reported in the grade and tonnage fields in order to avoid introduction of biases. The "Comments" field contains supplementary information about incompletely explored deposits and some grades such as Pt and Pd when available. Two significant digits are presented for gold, silver, and molybdenum grades, but three significant digits are used for tonnage and copper grades.

Age

In the field "DepositAge", ages are in standard divisions of geologic time or in millions of years when available (Remane, 1998). Ages are reported in millions of years before the present ("AgeMY" field) based on reported absolute (typically thermal dates) ages or midpoints of geologic time scale units (Remane, 1998).

Mineralogy

Information on the mineralogy of the deposits varies widely in quantity and quality. Depending on the purpose of a study and the researcher's interest, a report on a mineral deposit might contain a detailed list of alteration minerals and a mention of unnamed sulfide and sulfosalt minerals, a detailed list of ore minerals and mention of alteration in broad terms, a complete list of all minerals, or a sparse list of minerals. In some studies, the author attempted to list the relative or absolute amounts of each mineral. Unfortunately, these attempts are not common and frequently not comparable with many other reports because of different standards. Thus, it was decided to use only the presence or absence of minerals ("Minerals") in this file. Most rock forming minerals such as feldspar, calcite, and quartz are not included.

Types of porphyry copper deposits

Each deposit type is coded ("Type") as appropriate deposit type number as listed in USGS Bulletins 1693 (Cox, 1986a,b,c). Subtypes of porphyry copper deposits are defined in Cox and Singer (1992) as: porphyry Cu-Au (type 20c) if Au/Mo greater than or equal to 30, porphyry Cu-Mo (type 21a) if Au/Mo less than or equal to 3, and porphyry Cu (type 17) otherwise, where gold is in parts per million and molybdenum is in percent. Here deposits with no reported molybdenum grade and with a Au grade greater than 0.2 g/t were classed as porphyry Cu-Au, whereas those with no gold grade reported, but with a Mo grade greater than 0.03 were classed as porphyry Cu-Mo types. These limits were selected based on the observation that they are outside observed values in each subtype where both values are observed, and on the assumption that the missing grade was not reported because it was quite low. Skarn-related porphyry copper deposits (type 18a) were not addressed as a separate category because of the difficulty of making an operational definition.

In the original classification of subtypes of porphyry copper deposits (Cox and Singer, 1986, 1992) the classes were defined by the Au/Mo ratios, but the published grade and tonnage model for the Cu-Au-Mo (model 17) included all deposits from all subtypes and did not follow the separation of subtypes based on the Au/Mo ratio. Here we strictly follow the rules stated above to classify the subtypes and add a general grade and tonnage model that includes all deposits. The general grade and tonnage model is the most robust because of the sample size and is recommended in most situations.

It is important to note that the above operational classification of porphyry copper deposits into subtypes is not based on tectonic settings and may not necessarily be predictable from regional geological maps at 1:1,000,000 or broader scale. It is not uncommon for multiple subtypes to exist in the same broad igneous arcs that formed at approximately the same time.

Size and shape of alteration, sulfide, and ore bodies

To consistently capture information about the size and shape of alteration, sulfide (pyrite) and ore bodies as represented in two-dimensional projection to the surface, we use the rigorous procedures used for mineral grain images (Griffiths, 1967). The shortest dimension (b axis) is measured as the distance between parallel rules that just touch the object. After the short dimension is determined, the long axis is measured perpendicular to the b axis using the same criteria. Many of the alteration, ore, and sulfide zones can be well represented by an ellipse. Where published estimates of the projected area of the body are not available we estimated the area using the standard formula for area of an ellipse (area = 3.14159 a b / 4). In some cases however, the body has significant concave parts and use of an ellipse to estimate area of the body would result in an over estimate of the area. An example of these effects is seen in the Malanjkhand ore-body in India that has a markedly concave shape and a measured area that is about half of that calculated assuming an ellipse shape-we used the measured area. The field "SulfideArea" represents the area of sulfides in square kilometers; the sulfide minor axis in kilometers is in the field "SulfideBAxis", and the major axis is in the field "SulfideAAxis". Area of alteration, alteration major axis, and minor axis are represented by the fields "AlterArea", "AlterAAxis", "AlterBAxis" respectively. The area of ore in square kilometers is in the field "OreArea", the major axis of ore is in "OreAAxis", and the minor axis in "OreBAxis".

Spatially associated rocks

Rocks in and around the porphyry copper deposit are recorded here in the same terms used in the published maps and reports. Reports of rocks from different sources were treated equally. We have used three fields in an attempt to provide some spatial and map scale information. The field "RocksInDeposit" is used for rocks that are only represented in the deposit itself and not observable on a regional map. That is, the "RocksInDeposit" field is based on deposit-scale mapping at something like 1:24,000 or larger, such as 1:2,000. Rocks that are recorded both in the deposit and on a regional map are placed in the field "RocksOnMapInDeposit". Rocks on a regional map, but not in the deposit are in the field "RocksOnMap". Regional-scale maps commonly are at scales of 1:100,000 to1:1,000,000.

Emplacement Depth

The depth of emplacement of the porphyry copper deposits in kilometers is recorded ("EmplacementDepthkm") when an estimate was available in the literature.

Spatially related deposits

Here we record other deposits by type that are within 5 ("Assoc Deposits less 5km") and within 10 ("Assoc Deposits less 10km") km of a porphyry copper deposit. In many situations, these other deposits are merely occurrences and not economic mineral deposits. Nevertheless, many of these occurrences can be typed and their types might provide important information about possible porphyry copper deposits. Each deposit type is coded as the deposit type number and deposit type as listed in USGS Bulletins 1693 (Cox and Singer, 1986) and 2004 (Bliss, 1992). In most cases the age of spatially associated deposits is not known. No attempt is made here to record the age in the rare case where it is known.

Sources

An attempt was made to refer to the papers/web sites that were used for each deposit ("References"). In a few cases unpublished sources were used.

PRELIMINARY ANALYSIS

GRADE AND TONNAGE MODELS

Grade and tonnage models of mineral deposits are useful in quantitative resource assessments and exploration planning. Having some idea of the possible values of alternative kinds of deposits that might be sought is critical to good exploration planning. In quantitative resource assessments these models play two roles: first, grade and tonnage models can help classify the known deposits in a region into types and therefore aid in delineation of areas permissive for types; second, the models provide information about the potential value of undiscovered deposits in the assessment area and are key to economic analyses of these resources. Construction of grade and tonnage models involves multiple steps; the first is the identification of a group of well-explored deposits that are believed to belong to the mineral deposit type being modeled. Well-explored here means completely drilled in three dimensions. After deposits are identified, data from each are compiled. These data consist of average grades of each metal or mineral commodity of possible economic interest and tonnages based on the total production, reserves, and resources at the lowest available cutoff grade. Here we use the deposits that have tonnages recorded in the "Tonnage" field and exclude deposits with grades and tonnages only in the "Comments" field because we believe more exploration is needed for these deposits.

Relationships among variables are important for simulations of resources, for their affect on our understanding of how deposits form, and for their affect on our assumptions about resource availability. A plot of average copper grade versus tonnage of all porphyry coppers **(Fig. 1)** shows a low positive correlation (r = 0.1) that is not significant at the one percent level. The independence of grade and tonnage is expected when the relationship between copper content and tonnage of ore is examined—the two are highly correlated and grade is a ratio of the two. Ratios of highly correlated variables tend to be independent of either. Tonnage is correlated with gold grade (r = -0.28**, n = 256) and gold is correlated with molybdenum (r = -0.16*, n = 148) and with silver (r = 0.26**). (* means significant at the 5 percent level, **means significant at the 1 percent level.)

Frequency distributions of the tonnages, copper, molybdenum, gold and silver grades for the 422 deposits of the well-explored porphyry copper deposits reported in the file can be employed as models of the grades and tonnages of undiscovered deposits. Here these frequencies are plotted in **Figures 2-6** and are summarized in Table 1. Grade and tonnage models are presented in a graphical format to make it easy to compare deposit types and to display the data. The grade and tonnage plots show the cumulative proportion of deposits versus the tonnage or grade of the deposits. Individual symbols represent the deposits and intercepts for the 90th, 50th, and 10th percentiles are plotted. Percentiles of grades that contain unreported values, such as Mo, Ag, and Au, were based on the observed distributions. Based on the Shapiro-Wilk W test, Cu, Mo, and Au grades are each significantly different than the lognormal distribution at the one percent level. In each case the departures from normality appear to be due to some deposits that have very low grades. Because these are at the low-grade tail of the distributions and represent a small number of deposits, they may not be important for modeling purposes.

If there were no differences in grades or tonnages among deposit types, we could use one model for all types. For this reason, it is desirable to perform some tests to determine if the types are significantly different with respect to grade or tonnages. Analysis of variance tests of differences in mean (in logarithms) tonnage, copper, molybdenum, gold, and silver grades by type of porphyry copper deposit reveal significant differences in gold and molybdenum grade as expected because of how subtypes were defined. In addition, tonnages of the molybdenum-rich subtype are significantly larger than the porphyry copper and the porphyry copper-gold subtypes (p

= 0.004). The analysis of variance tests demonstrate an important reason for separating the porphyry coppers into subtypes where appropriate—they have different grades and tonnages and perhaps different economic values. Within the types, other statistical tests were performed to determine if a lognormal model adequately describes the frequencies of tonnages and grades and to determine if there are significant correlations among the variables.

Frequency distributions of the tonnages, copper, molybdenum, gold and silver grades for the deposits of the well-explored subtypes of porphyry copper deposits reported in the file can be used models of the grades and tonnages of undiscovered deposits. The frequencies for the porphyry Cu-Au subtype are plotted in **Figures 7-11** and are summarized in Table 1. Frequencies for the Cu and the Cu-Mo subtypes are plotted in **Figures 12-16**, and **17-21** respectively and are summarized in Table 1. Based on the Shapiro-Wilk W test, Cu grades for the Cu and Cu-Mo subtypes are each significantly different than the lognormal distribution at the five percent level. For the Cu-Au subtype, Au grade is significantly different than lognormal at the one percent level. In each case the departures from normality appear to be due to some deposits that have very low grades. Molybdenum grades are inversely related to tonnages in the Cu-Mo subtype (r = -0.40**. N = 51).

Table 1—Grade and tonnage models of porphyry copper-gold, porphyry copper, porphyry copper-molybdenum, and porphyry copper deposits in general.

		Number deposits	10^{th} percentile of deposits	50^{th} percentile of deposits	90^{th} percentile of deposits
Cu-Au (20c)	Tons	115	1,200	200	34
	Cu grade	115	0.79	0.44	0.23
	Mo grade	115	0.006	0.0	0.00
	Ag grade	115	4.0	0.0	0.0
	Au grade	115	0.76	0.38	0.21
Cu (17)	Tons	256	1,400	250	30
	Cu grade	256	0.73	0.44	0.26
	Mo grade	256	0.023	0.004	0.0
	Ag grade	256	3.0	0.0	0.0
	Au grade	256	0.20	0.0	0.0
Cu-Mo (21a)	Tons	51	4,800	280	48
	Cu grade	51	0.83	0.48	0.19
	Mo grade	51	0.076	0.031	0.01
	Ag grade	51	4.1	0.9	0.0
	Au grade	51	0.05	0.009	0.0
General Cu	Tons	422	1,500	240	33
	Cu grade	422	0.75	0.44	0.24
	Mo grade	422	0.03	0.002	0.0
	Ag grade	422	3.8	0.0	0.0
	Au grade	422	0.5	0.05	0.0

Subtypes through time

For both economic and scientific reasons, there are questions about the distribution of the metals in porphyry copper deposits over geologic time. Are there preferential times in the earth's history of formation of gold-rich or molybdenum-rich varieties of porphyry copper deposits? Using the dated deposits classed by subtype we performed an analysis of variance that shows that the porphyry Cu-Au deposits are somewhat younger than the other two groups at the 0.02 probability level as shown in the histogram plot in **Figure 22**.

Spatially related deposit types

Associated deposits are listed in the descriptive models of Cox and Singer (1986) as deposit types whose presence might indicate suitable conditions for deposits of the type portrayed by the model. Here we have specific information both about types of associated deposits and about their spatial relations to known deposits. It is probably no surprise that similar deposits are found near each other; gold-rich porphyry copper deposits occur more commonly near gold-rich porphyry copper deposits than near the other porphyry copper types and the same pattern is seen for molybdenum-rich porphyry copper deposits **(Fig. 23)**. Placer gold deposits are more common near gold-rich porphyry copper deposits. Gold-rich porphyry copper deposits more frequently have quartz-alunite epithermal gold deposits than do the deeper molybdenum porphyry deposits but the pattern is even stronger for the quartz-adularia epithermal gold deposits. Subtypes of porphyry copper deposits are most commonly reported near porphyry copper deposits. Polymetallic vein deposits are the next most commonly reported type within 10 km of porphyry Cu deposits. Polymetallic replacement deposits are reported more frequently near gold-rich porphyry copper deposits than near molybdenum-rich deposits and the reverse is true of zinc-lead skarns, perhaps reflecting depth of emplacement of these types. These spatially associated deposit types could prove useful in mineral assessments and in exploration.

Subtypes through depth of emplacement

Consistent with the distribution of associated deposit types discussed above is the depth of emplacement of porphyry copper deposits by subtype shown in the box plot in **Figure 24**. Deposit types that, based on other evidence, formed at shallow depths such as various epithermal gold deposit types, are spatially associated with the gold-rich type of porphyry copper deposit. The gold-rich class of porphyry copper deposits clearly formed at shallower depths than the molybdenum-rich class as documented by an analysis of variance where the probability of such a large difference happening by chance is less than 0.001.

Rocks on regional maps by subtypes

Can regional geologic maps be used to determine whether the gold-rich or molybdenum-rich varieties of porphyry copper deposits are more likely? In **Figure 25** the frequency of reported igneous rock types on regional maps near porphyry copper deposits classed by subtype are plotted. Although some rocks are more common near molybdenum-rich porphyry copper deposits than gold-rich deposits, such as andesite and rhyolite, the patterns are not strong. Quartz diorite is more common near the gold-rich variety than the molybdenum-rich, but it is not a high frequency occurrence. Regional maps do not appear to contain information to clearly distinguish which subtype might occur.

Sulfide areas

Because there is a strong positive relation between area of sulfides (disseminated pyrite) and the deposits' contained copper, one might only examine large sulfide systems if looking for large porphyry copper deposits (Singer and Mosier, 1981). Reexamination of the relation between area of sulfide minerals and deposits' contained Cu shows the strength of the relationship remains strong after 27 years of new information **(Fig. 26)**.

LOCATION MAP

Rather than providing a map, we have included a file (2008 PorCu.kml) that plots the locations of the deposits in GoogleEarth and we have provided a shapefile (porCuShape) to allow ease mapmaking.

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DISCLAIMERS

SYSTEM REQUIREMENTS

The data and text require either a Macintosh or compatible computer or an IBM or compatible personal computer. The Macintosh should have a 68020 or higher processor (PowerPC recommended), 8 megabytes RAM (16 MB recommended), Apple System Software version 7.0 or later (7.1.2 or later recommended), and a 13- inch color monitor that can display thousands of colors. The PC should have a 386 or higher processor (Pentium recommended), Microsoft Windows 3.1 or higher (Windows 95, 98, or NT recommended), 8 megabytes RAM (16 MB recommended), and a VGA color monitor that can display 256 colors. Both platforms require Adobe Acrobat Reader 5.0 or higher or other software that can translate PDF files.

This was produced in accordance with the ISO 9660 and Macintosh HFS standards. All ASCII and TXT files can be accessed from DOS, Macintosh, and Unix platforms, the display software packages provided are designed for use under a DOS- based, Windows-based, or Macintosh system, as appropriate.

FILES

of2008-1155.pdf (PDF file describing all contents.)

data/country_codes.xls (A text file relating country codes to country names.)

data/PorCuFM2008.fp7 (A FileMaker Pro 9 file containing the porphyry copper database.)

data/PorCuTX2008.txt (A tab-delineated text file containing the porphyry copper database.)

data/PorCuEX2008.xls (An Excel file containing the porphyry copper database.)

PorCuGE2008.kml (a GoogleEarth file that can be used with Google Earth to show the locations of the deposits)

data/PorCu_meta.txtt (metatdata in FGDC format)

data/PorCu_2008.shp (shapefile) to aid mapmaking

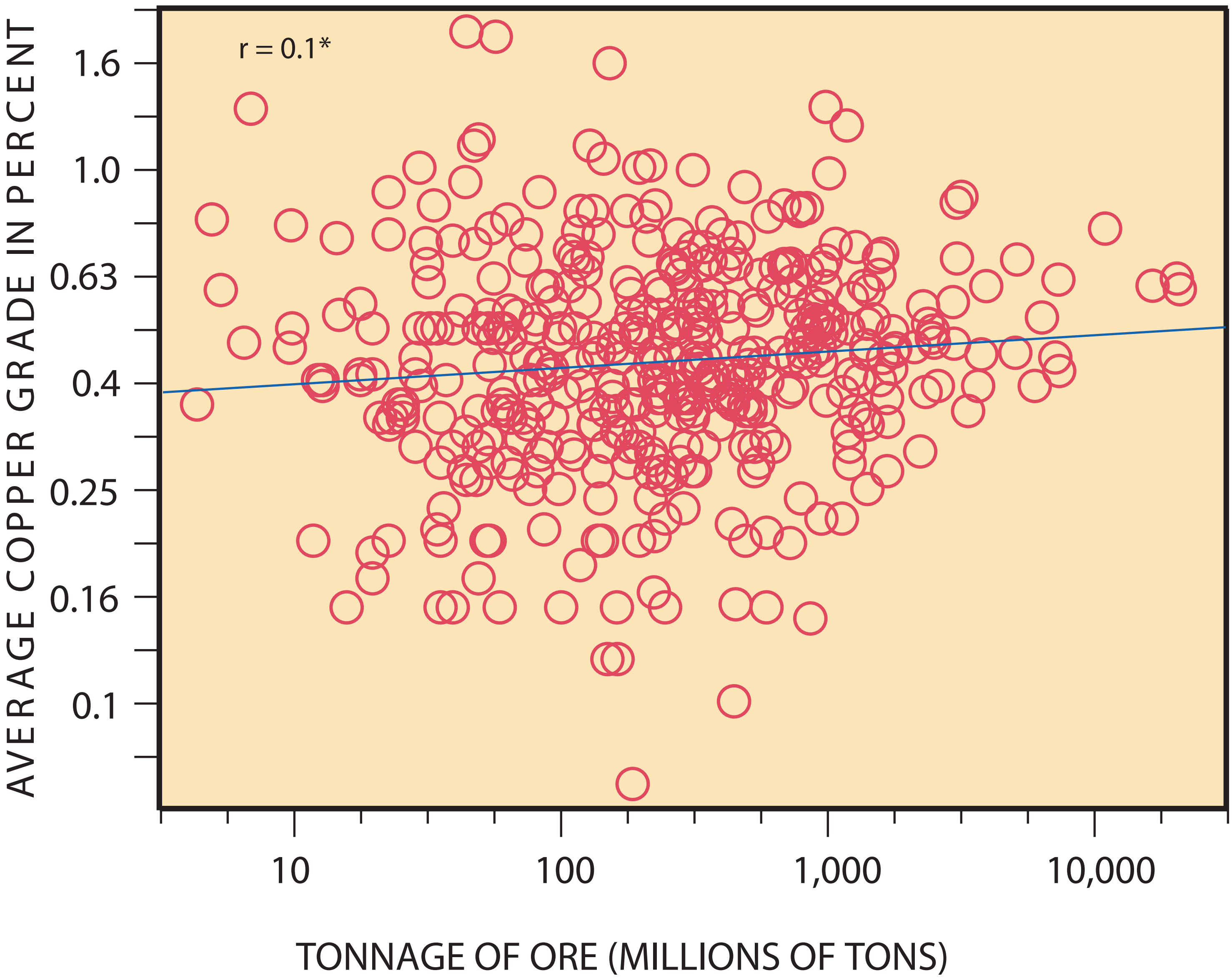

Fig. 1. Tonnage of porphyry copper deposits versus average copper grades.

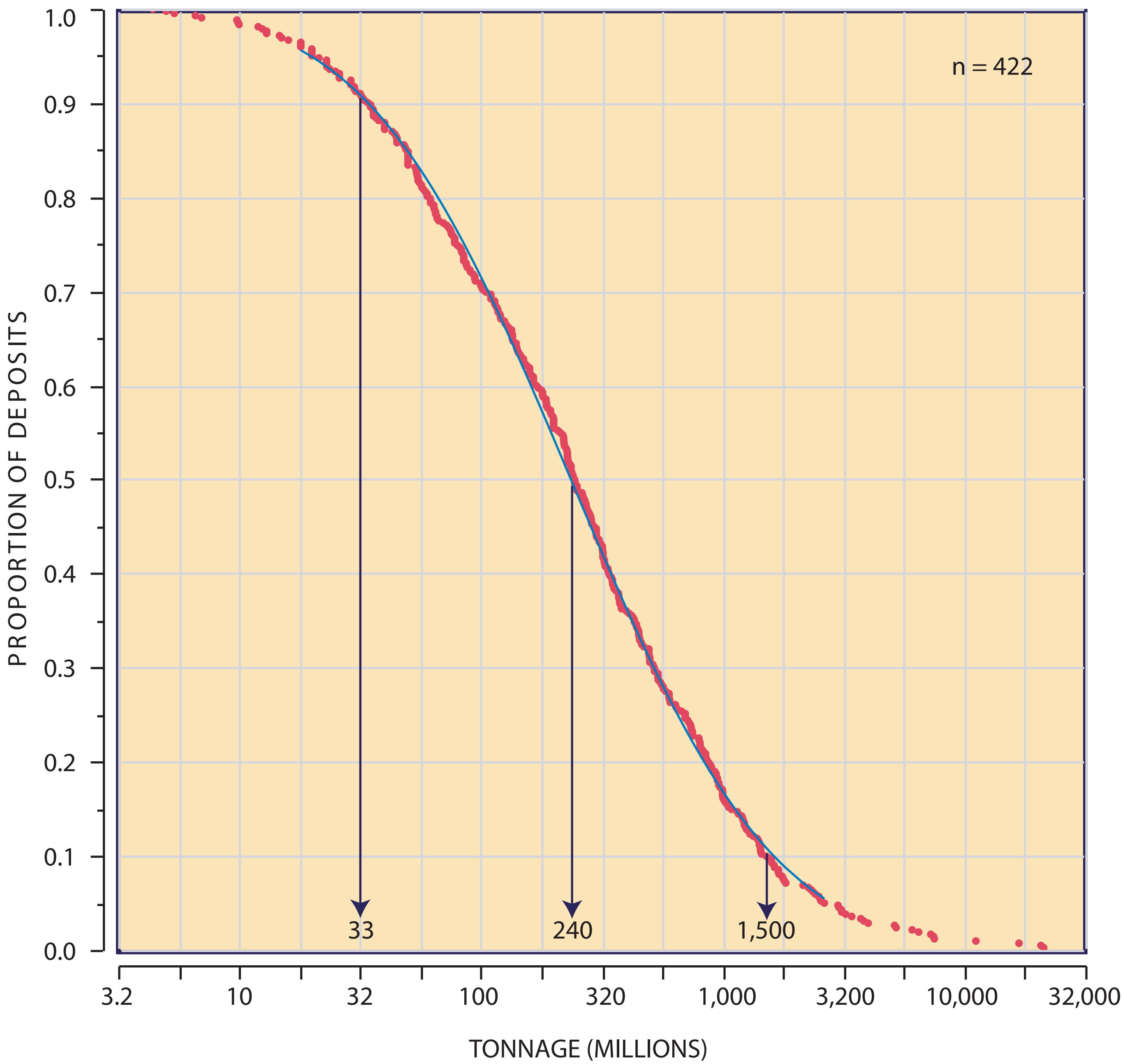

Fig. 2 Tonnage model for all porphyry copper deposits

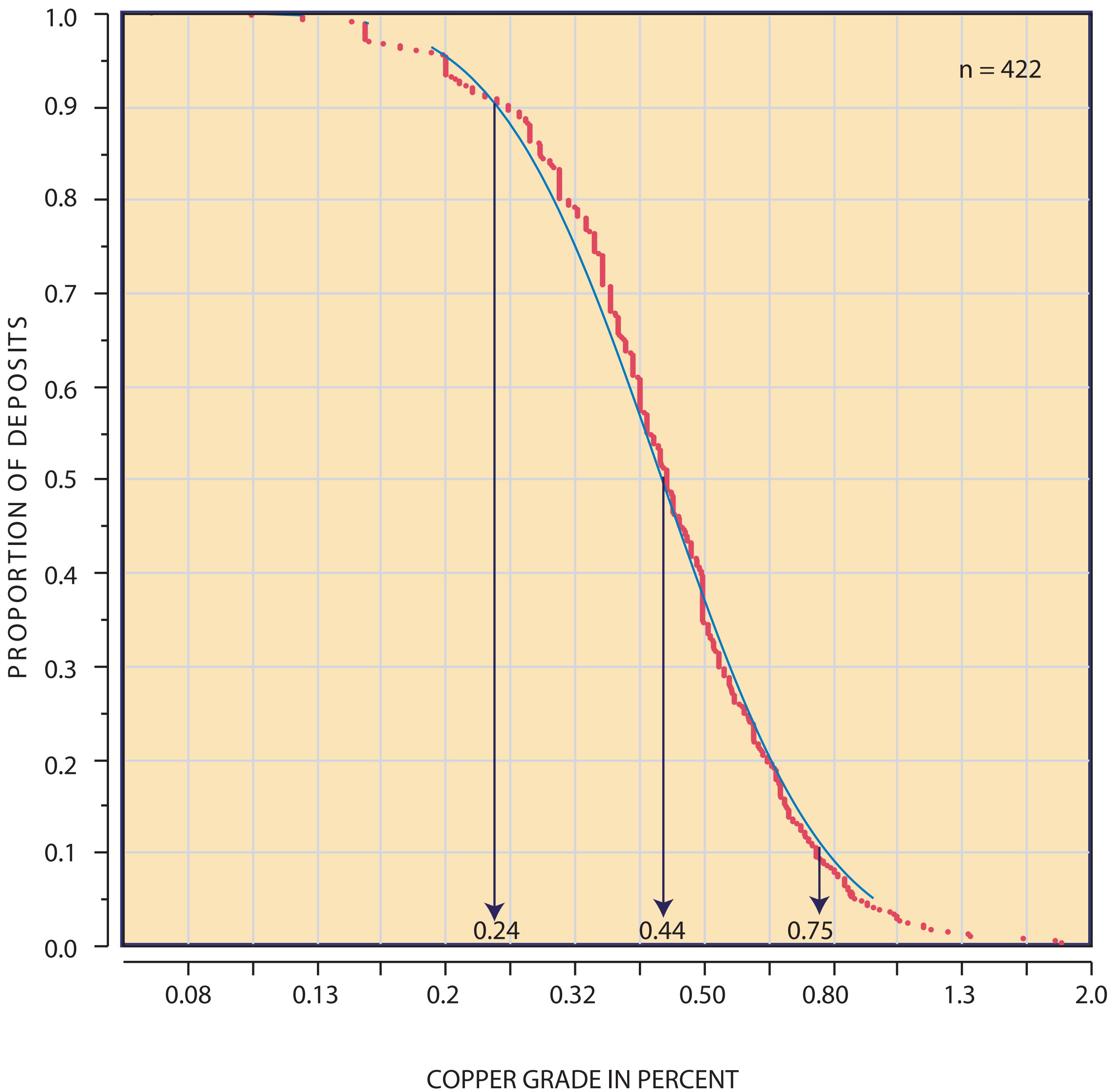

Fig. 3. Copper grade model for all porphyry copper deposits

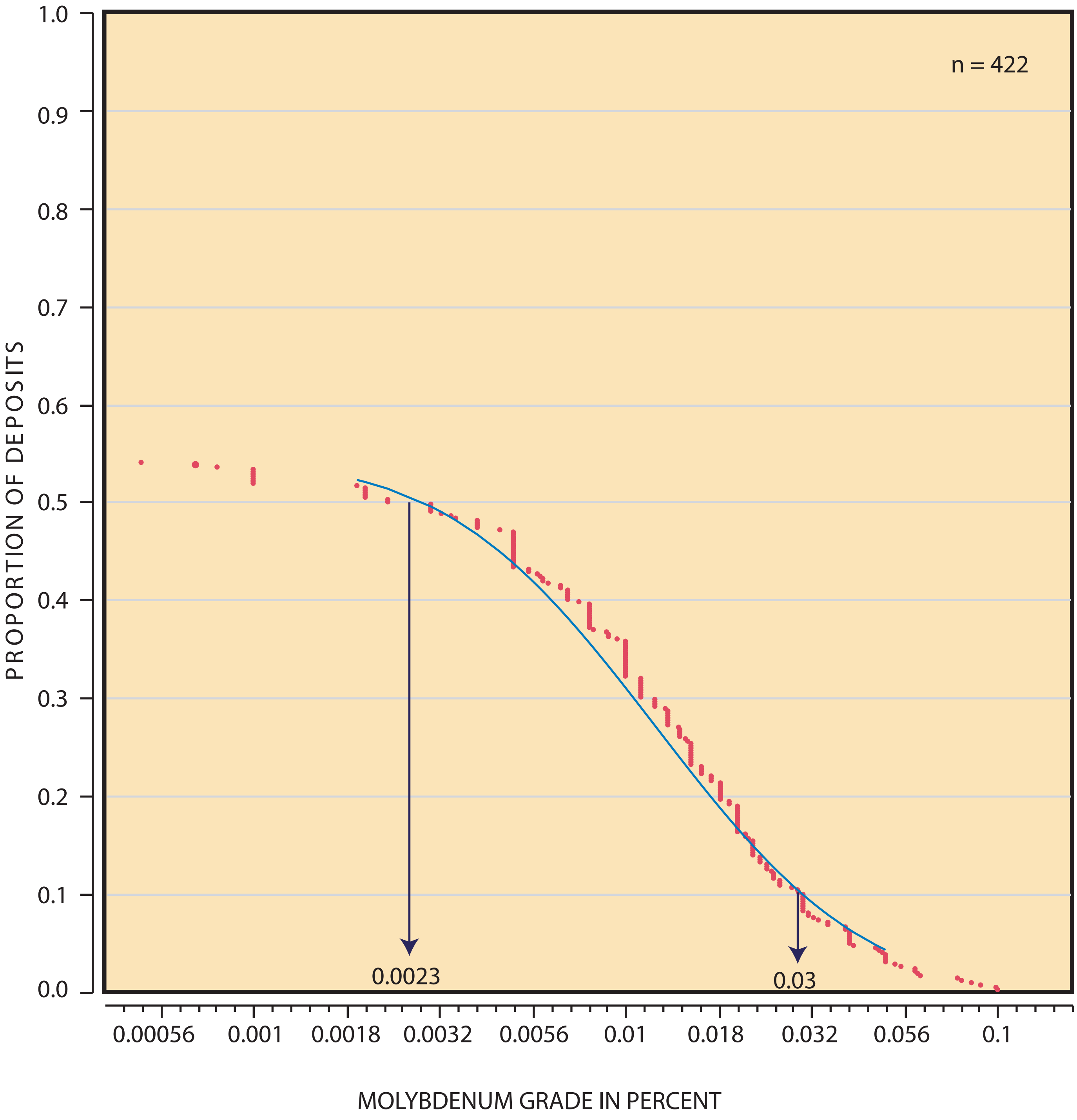

Fig. 4. Molybdenum grade model for all porphyry copper deposits

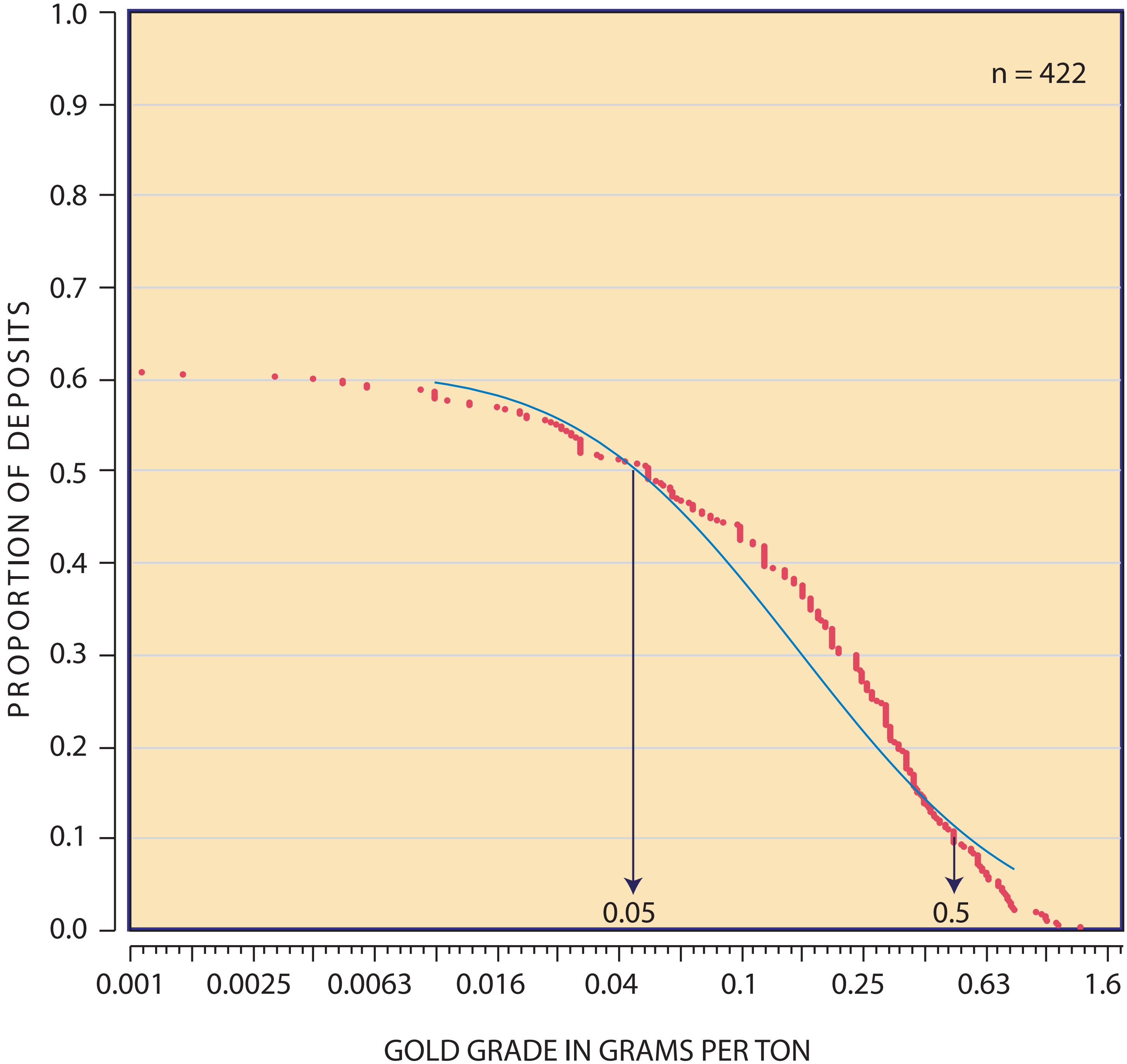

Fig. 5. Gold grade model for all porphyry copper deposits

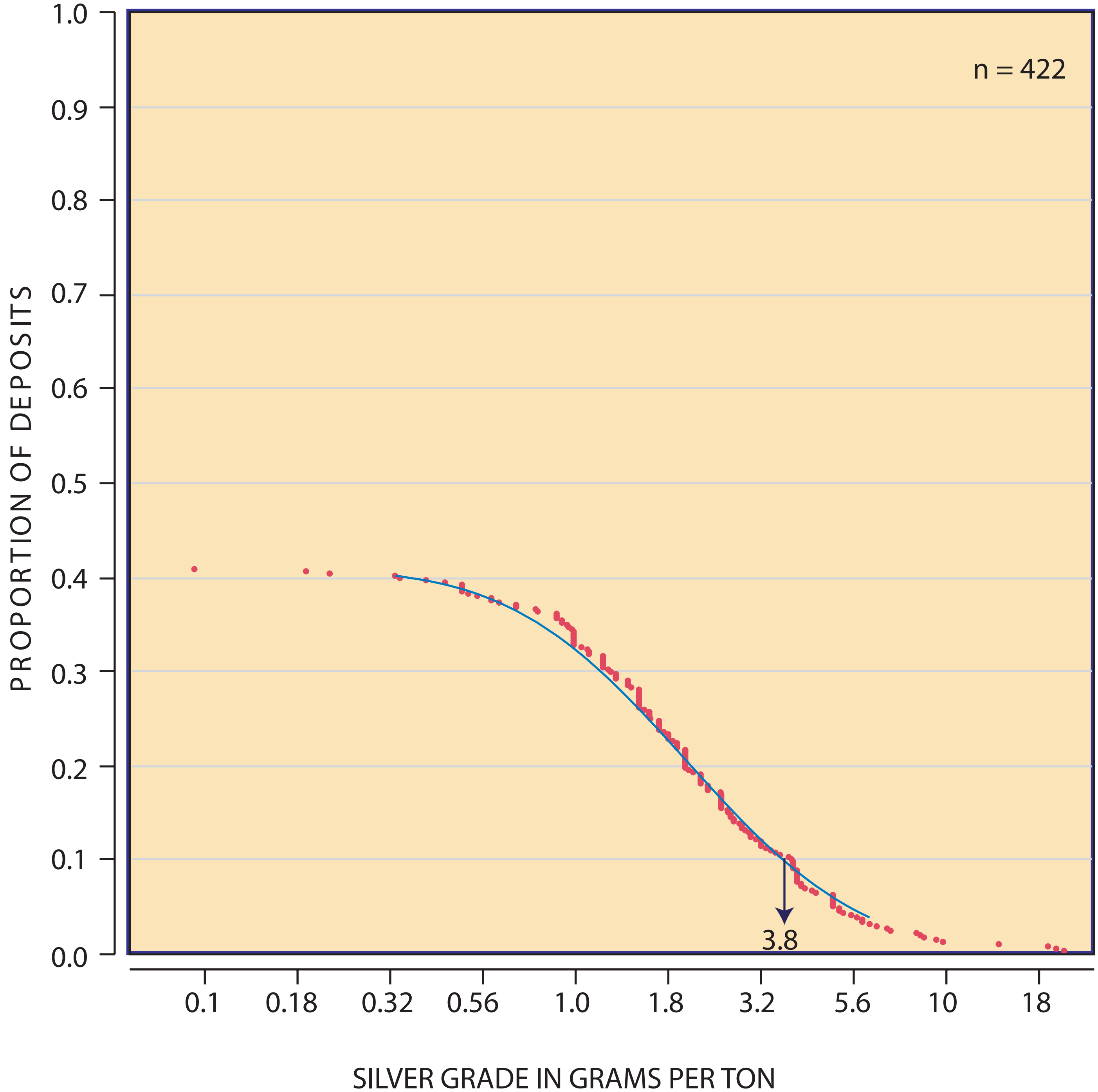

Fig. 6. Silver grade model for all porphyry copper deposits

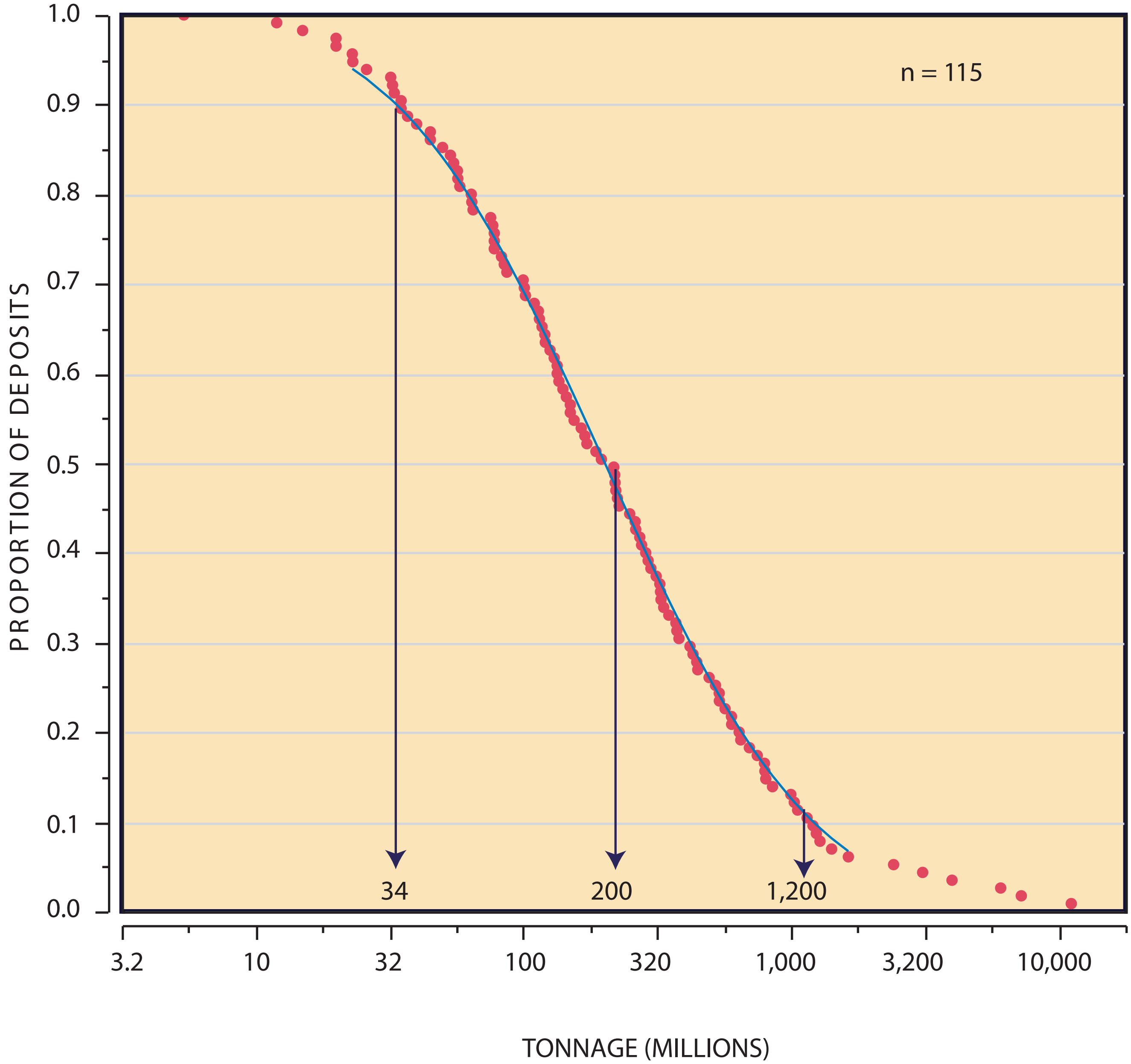

Fig. 7. Tonnage model for porphyry copper-gold deposits

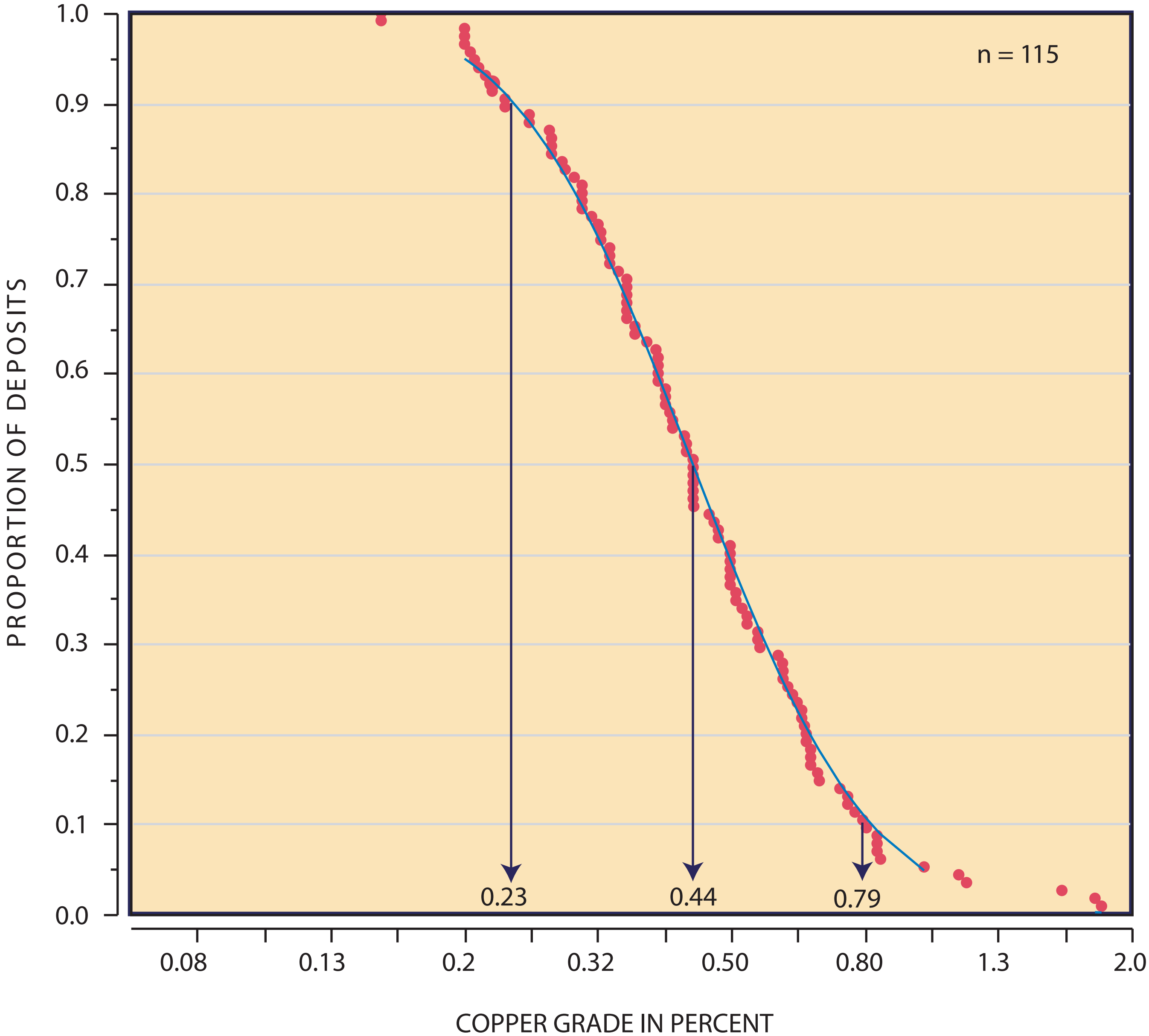

Fig. 8. Copper grade model for porphyry copper-gold deposits

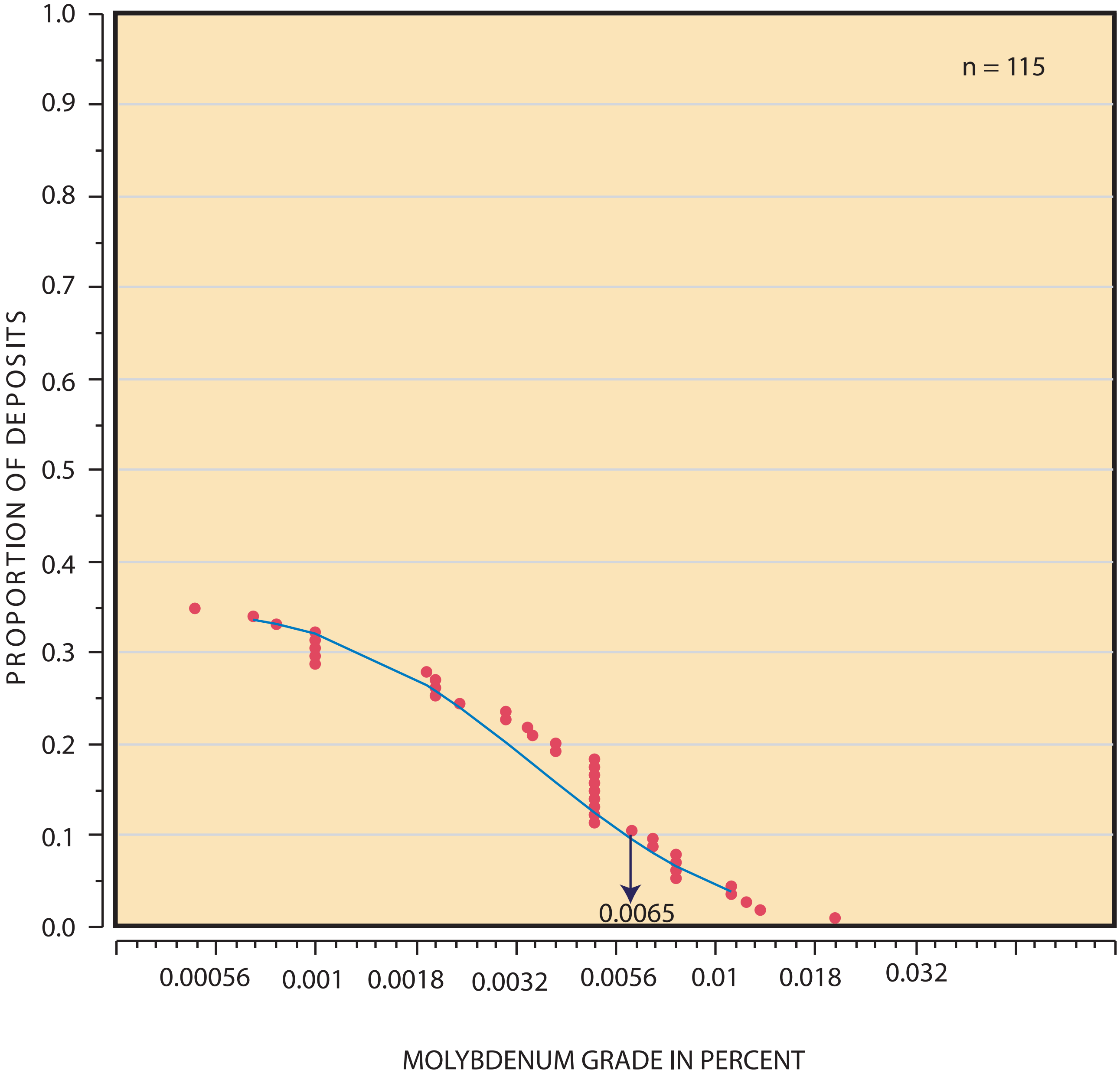

Fig. 9. Molybdenum grade model for porphyry copper-gold deposits

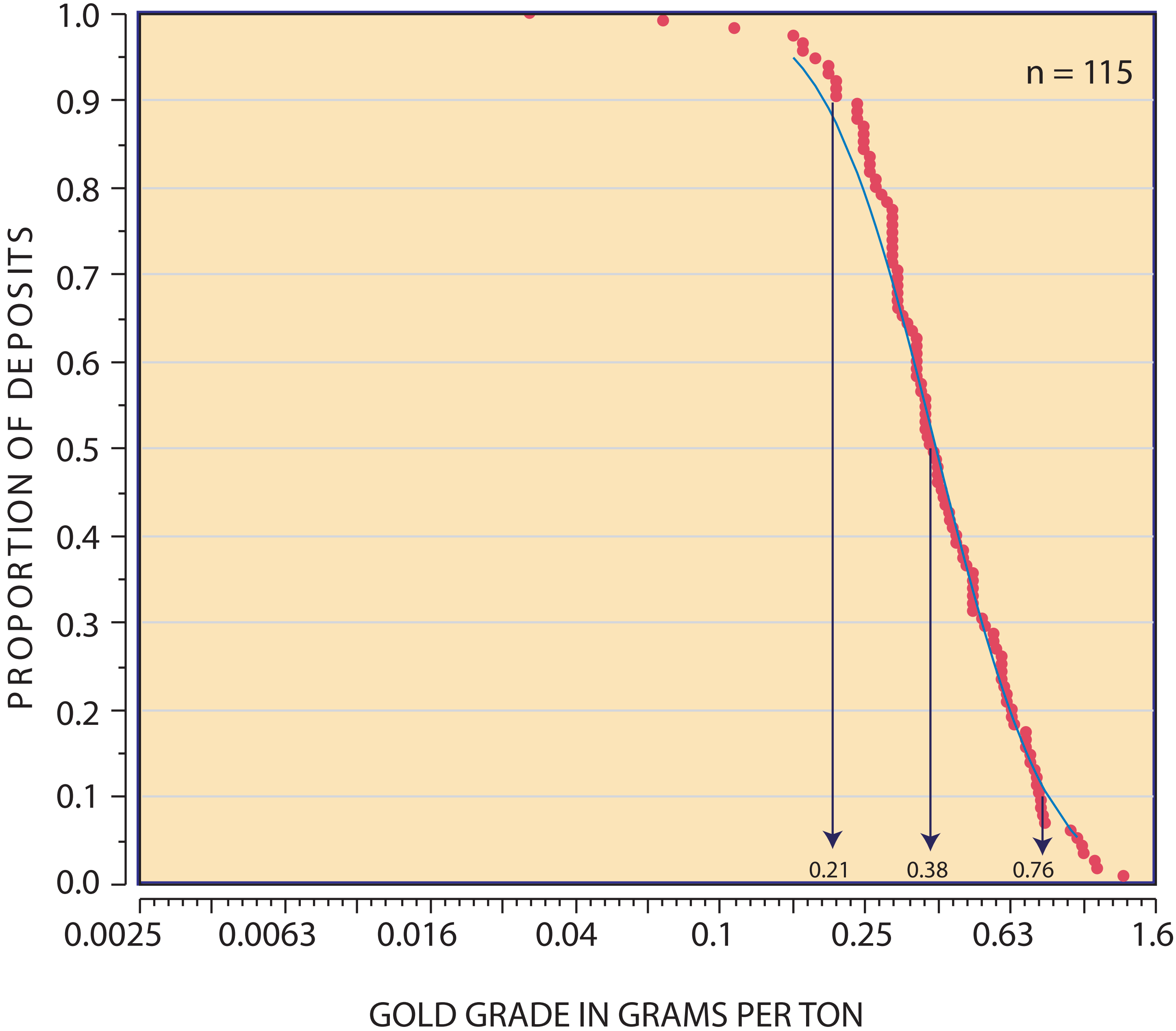

Fig. 10. Gold grade model for porphyry copper-gold deposits

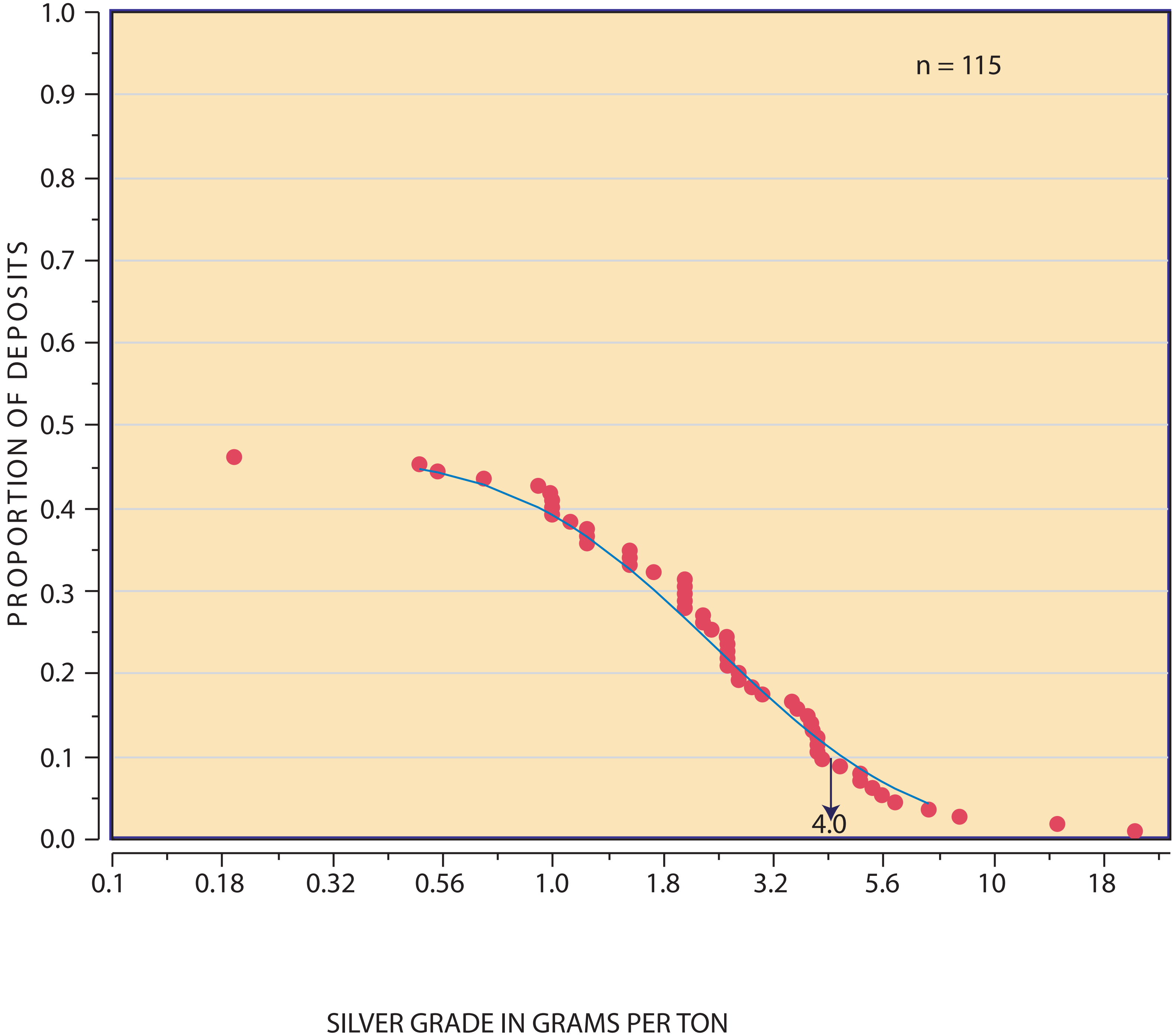

Fig. 11. Silver grade model for porphyry copper-gold deposits

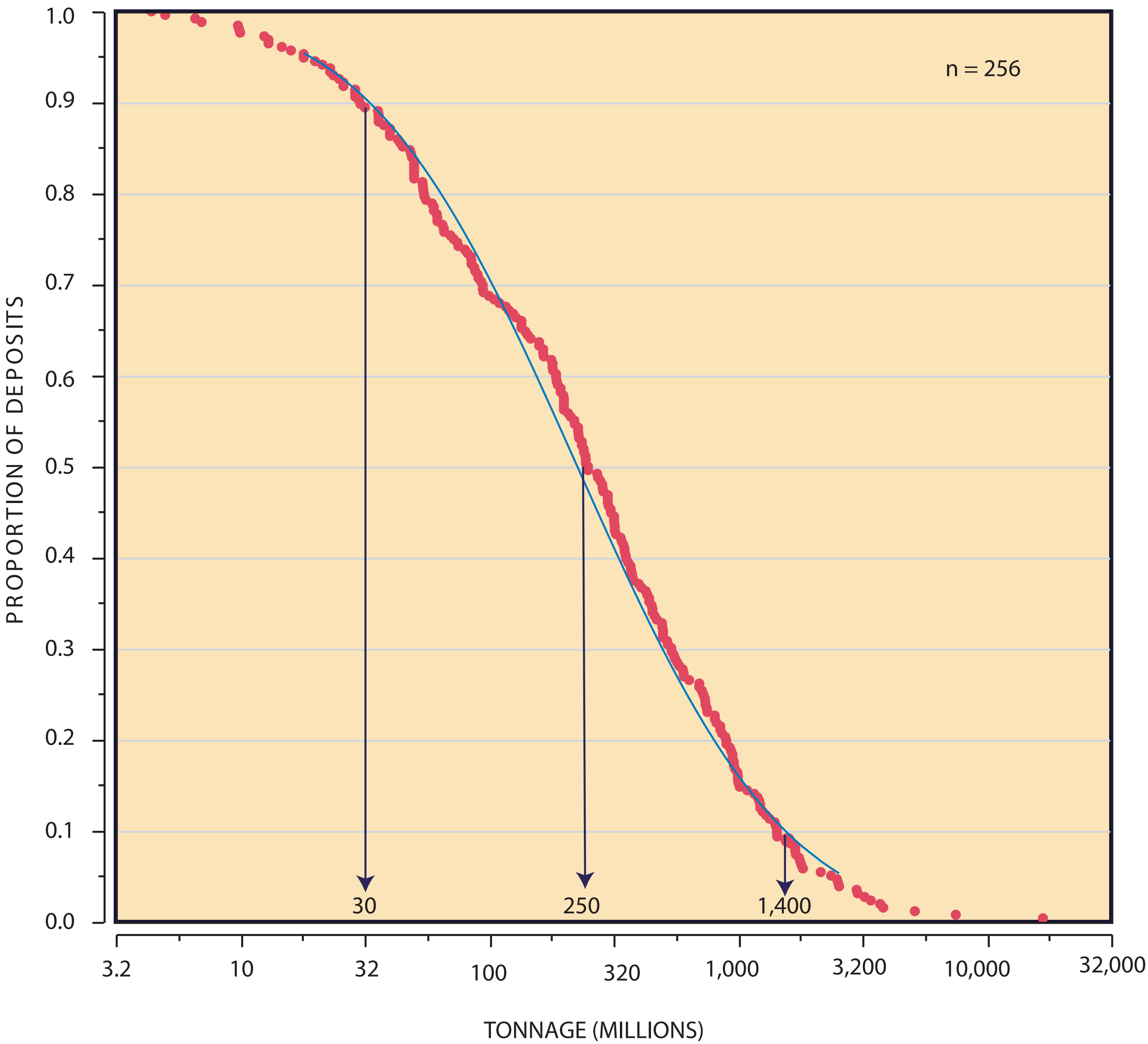

Fig. 12. Tonnage model for porphyry copper deposits model 17

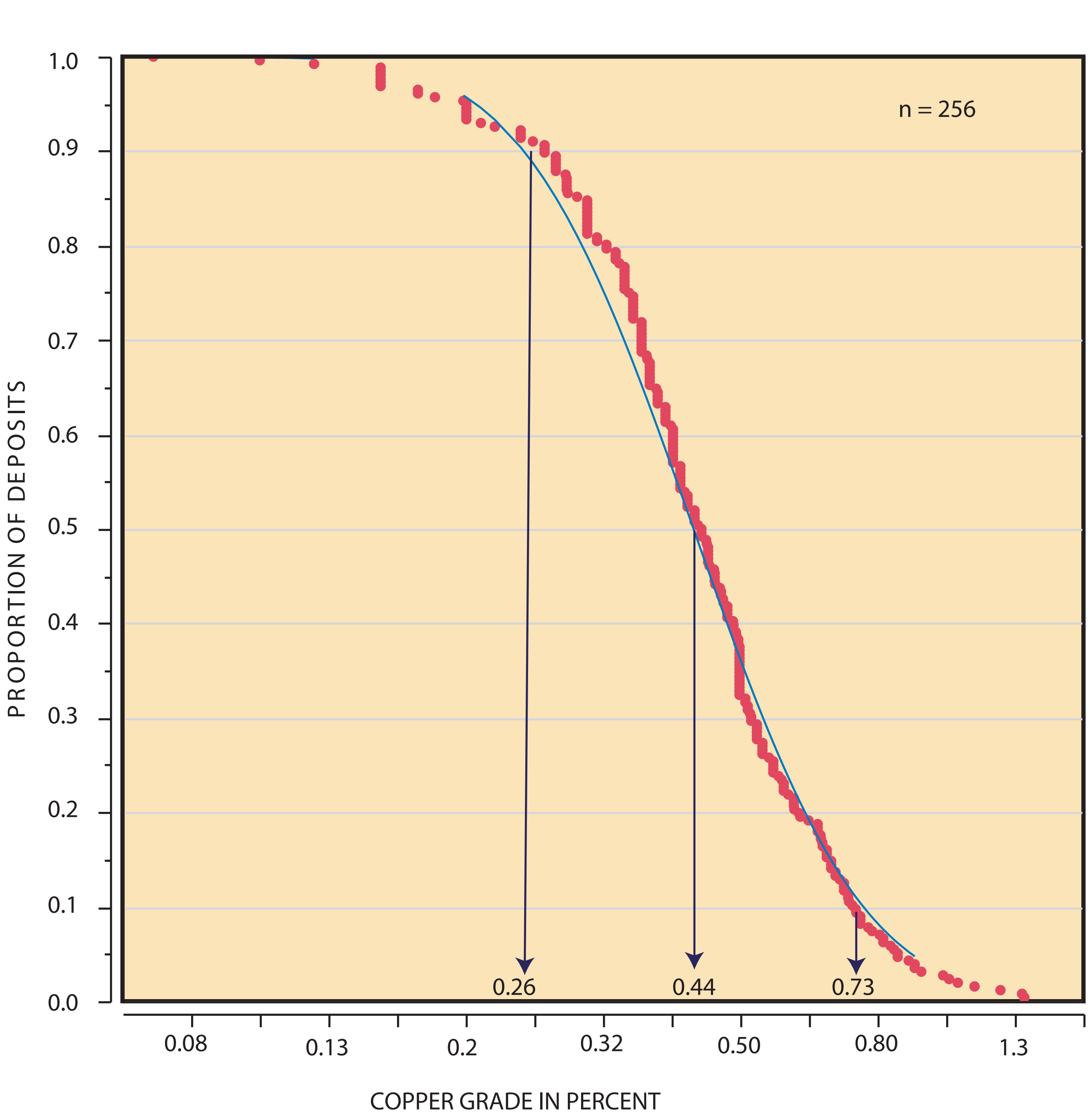

Fig. 13. Copper grade model for porphyry copper deposits (17)

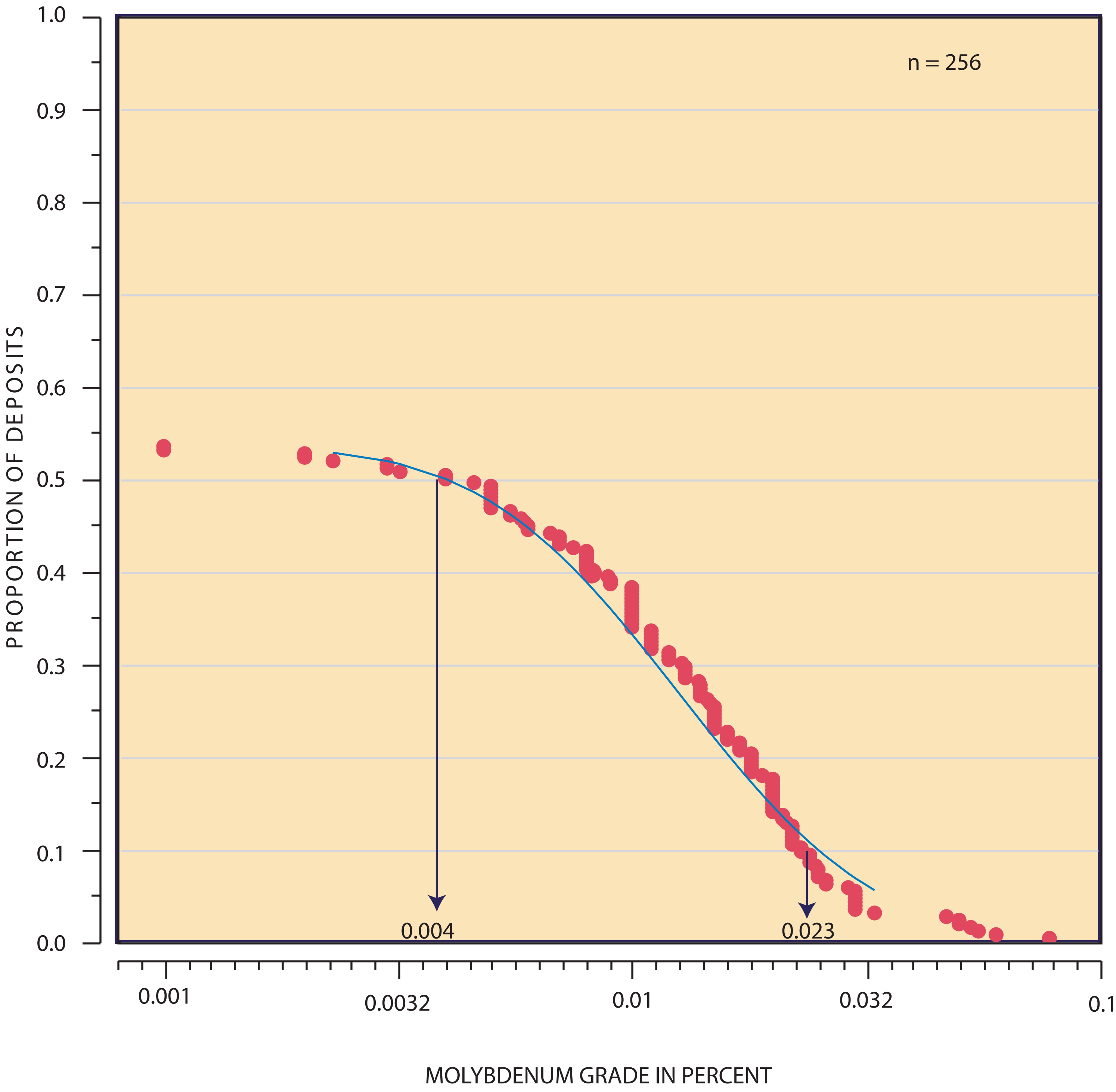

Fig. 14. Molybdenum grade model for porphyry copper deposits (17)

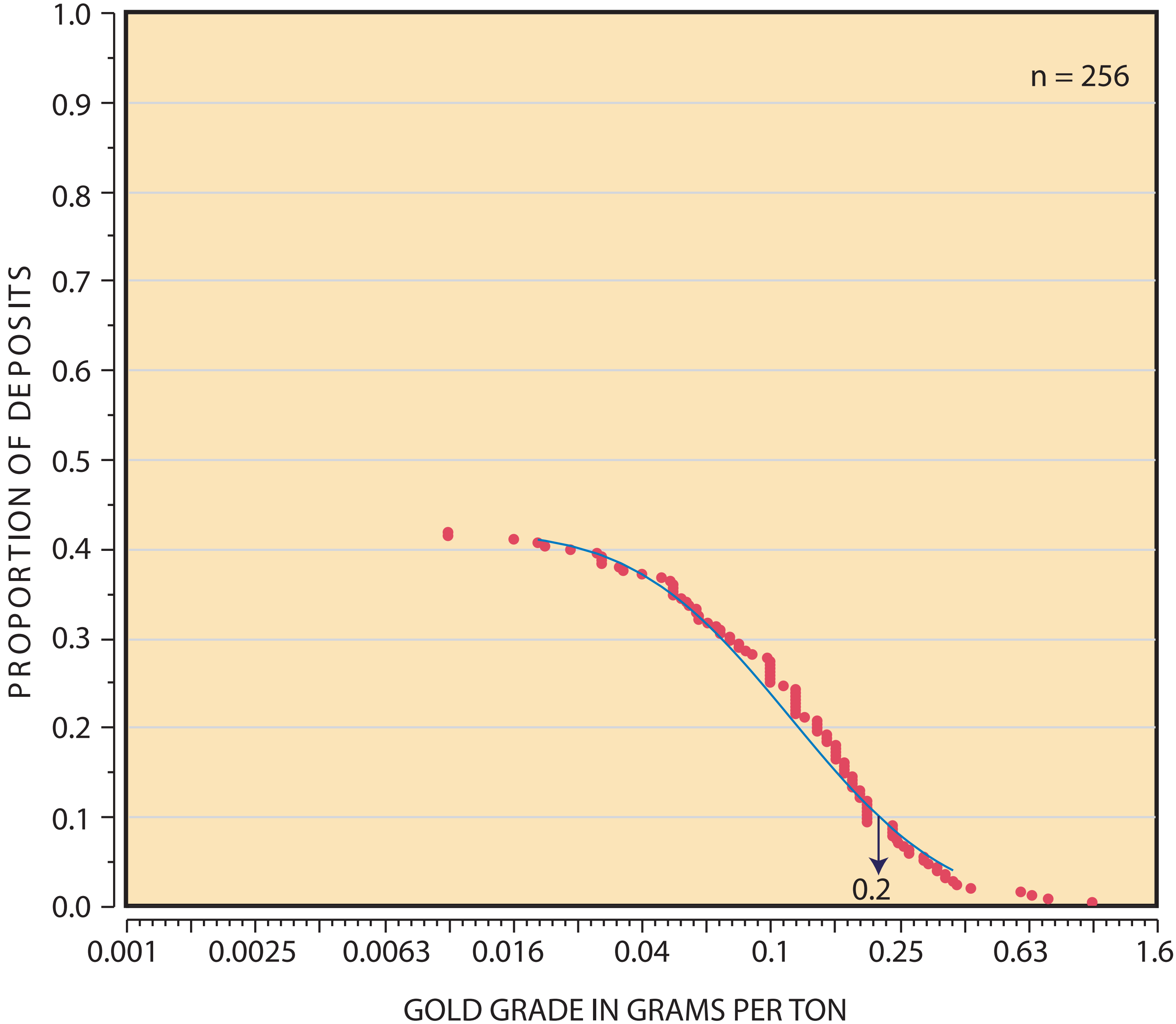

Fig. 15. Gold grade model for porphyry copper deposits (17)

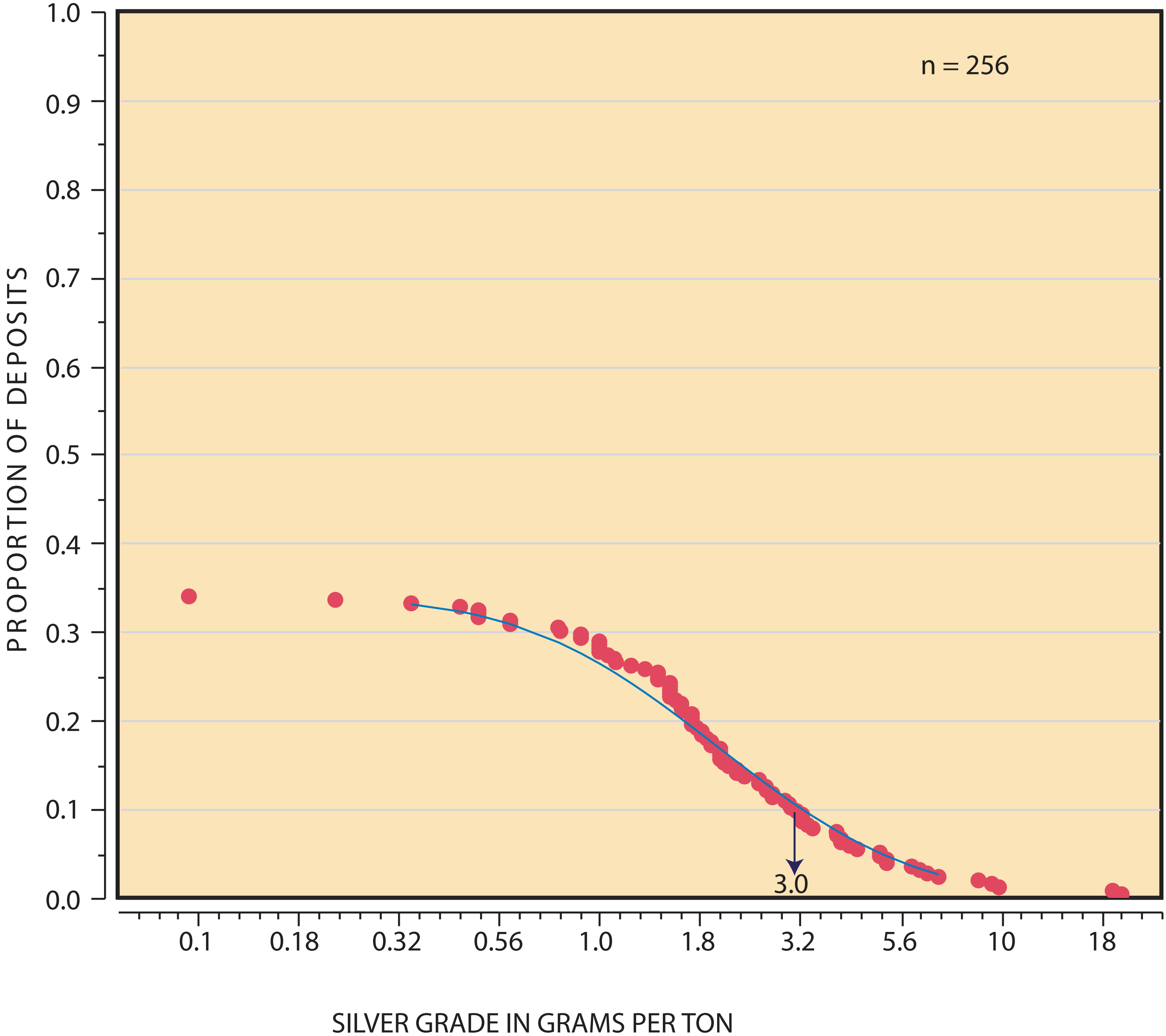

Fig. 16. Silver grade model for porphyry copper deposits.

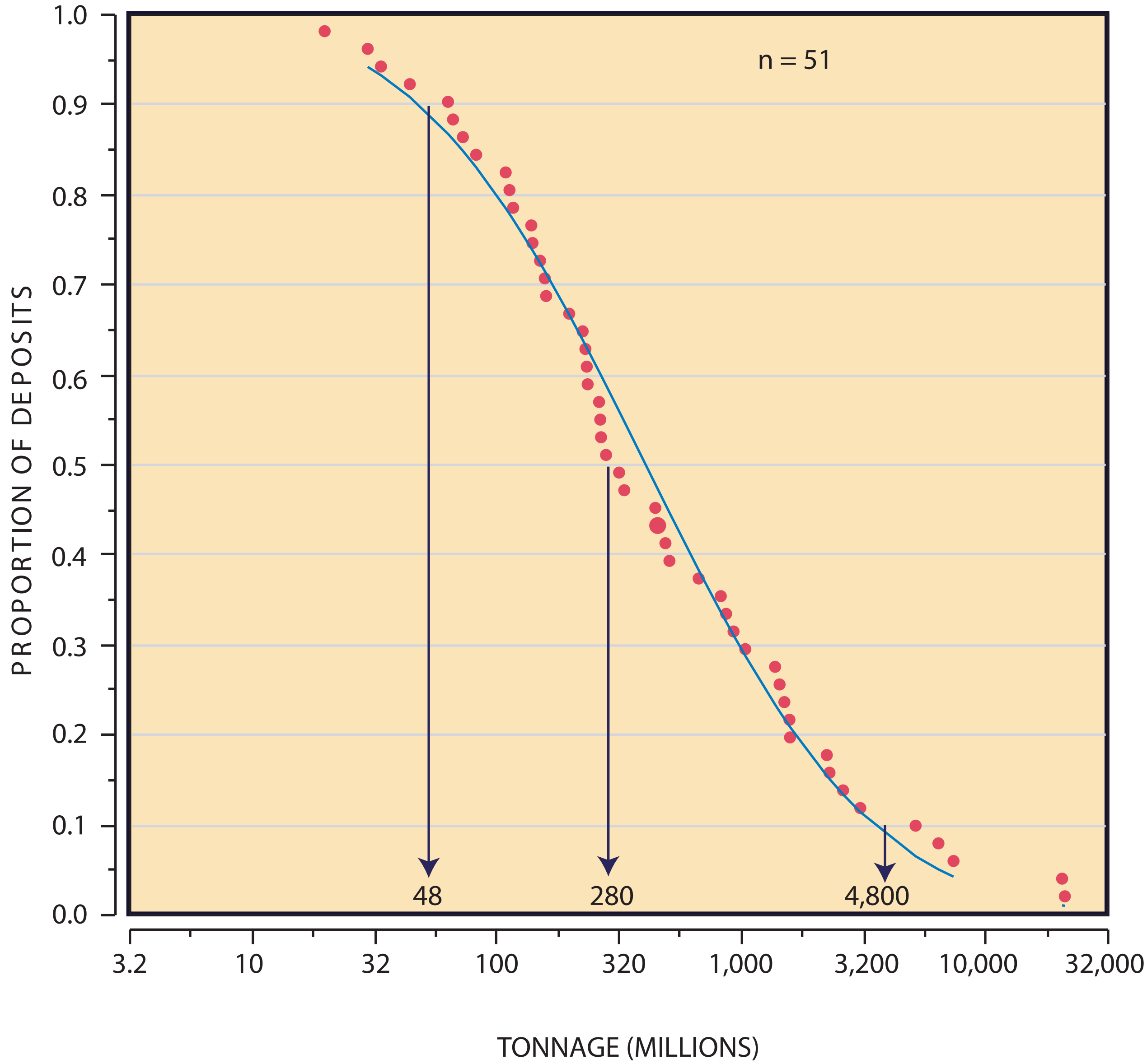

Fig. 17. Tonnage model for porphyry copper- molybdum deposits

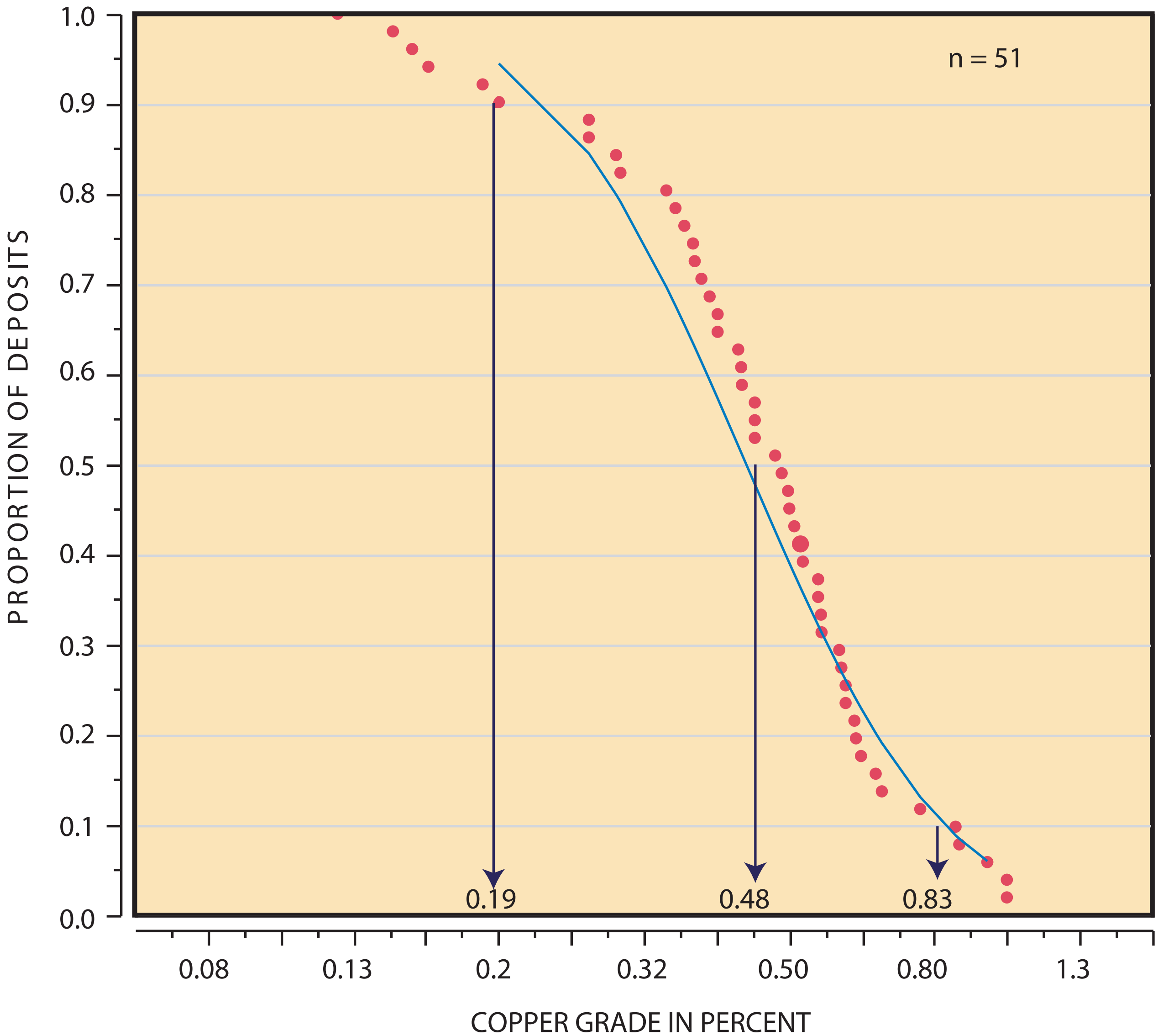

Fig. 18. Copper grade model for porphyry copper-molybdenum deposits

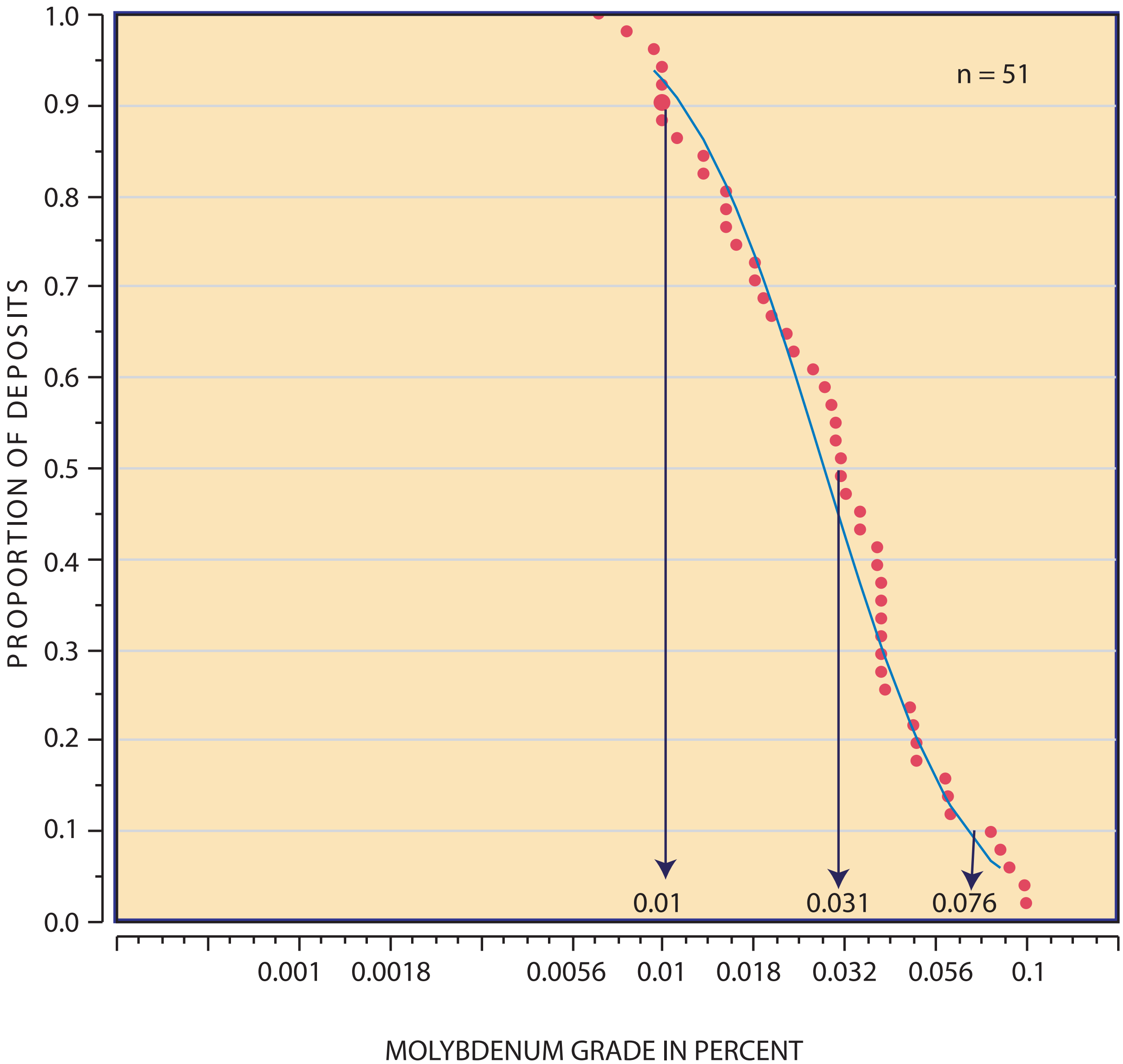

Fig. 19. Molybdenum grade model for porphyry copper-molybdenum deposits

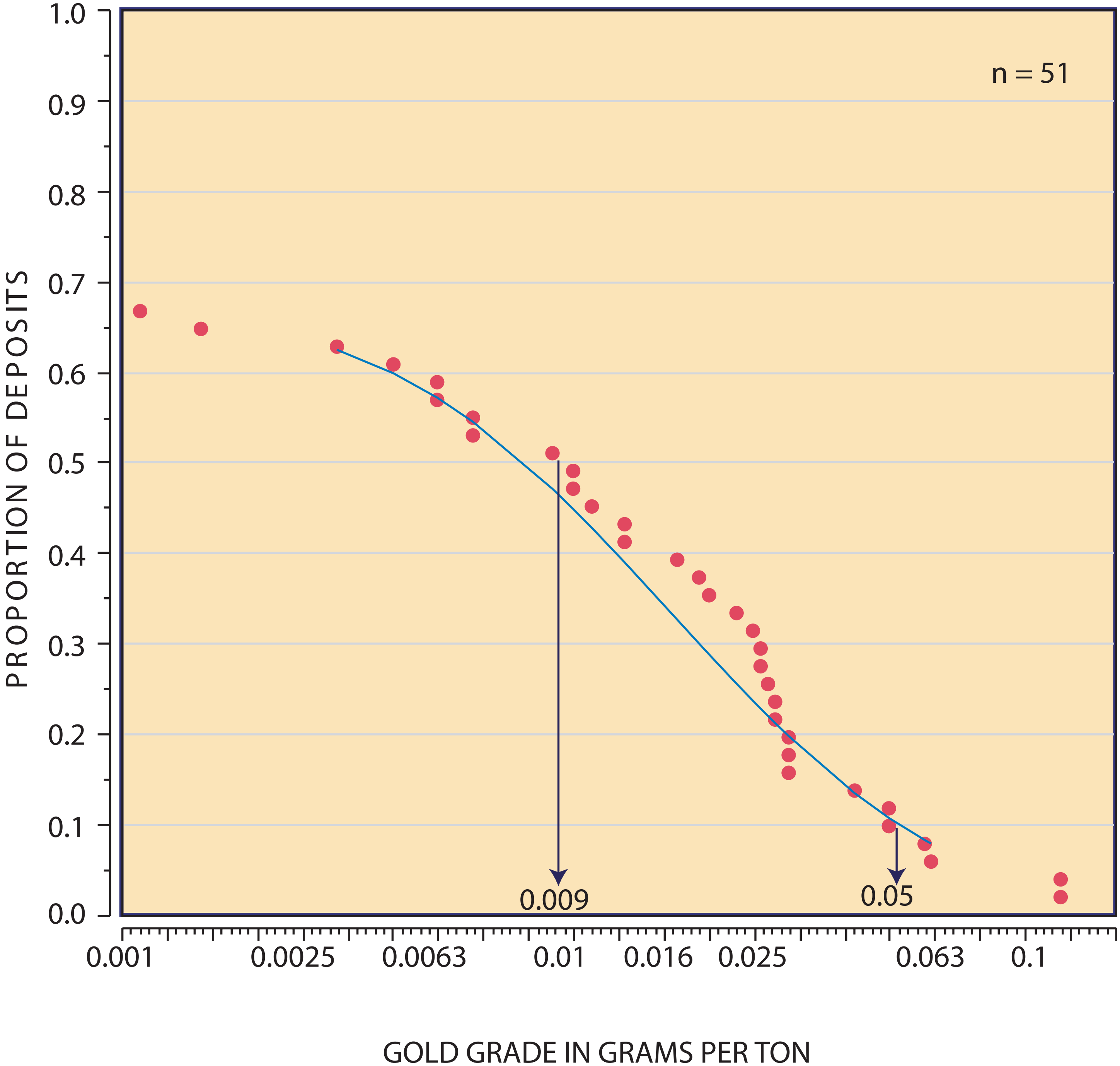

Fig. 20. Gold grade model for porphyry copper-molybdenum deposits

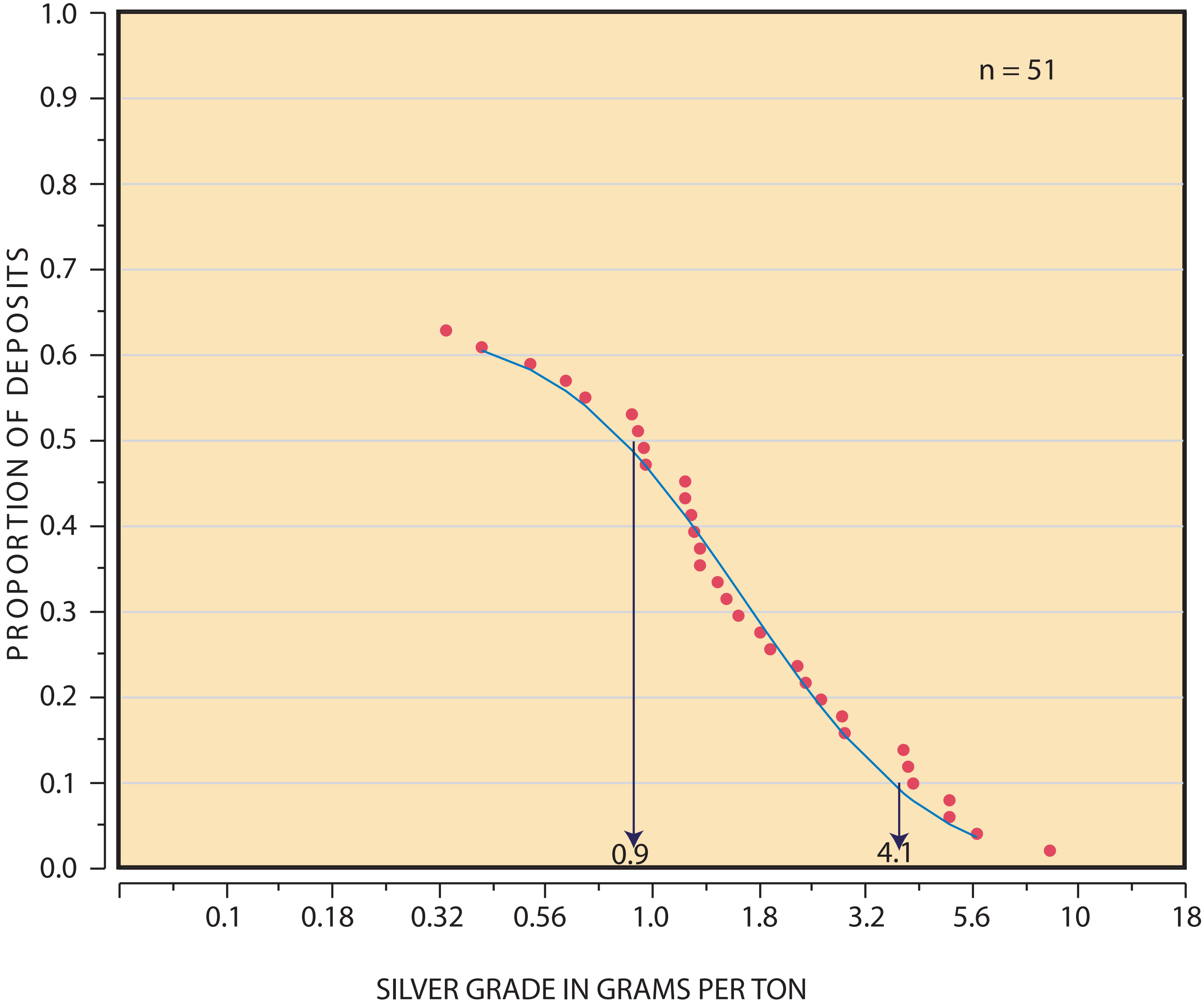

Fig. 21. Silver grade model for porphyry copper-molybdenum deposits

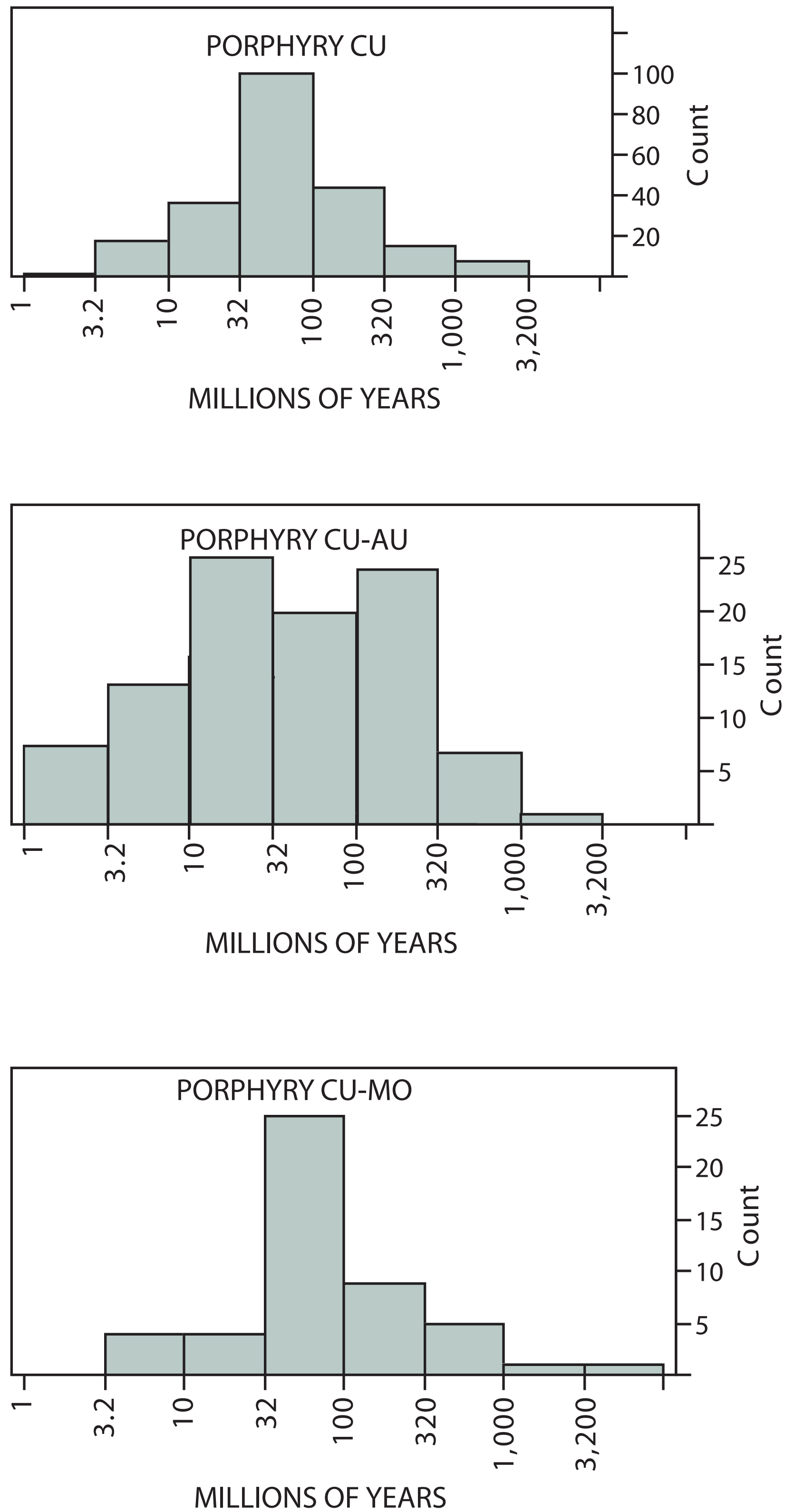

Fig. 22. Ages of porphyry copper deposits by subtype.

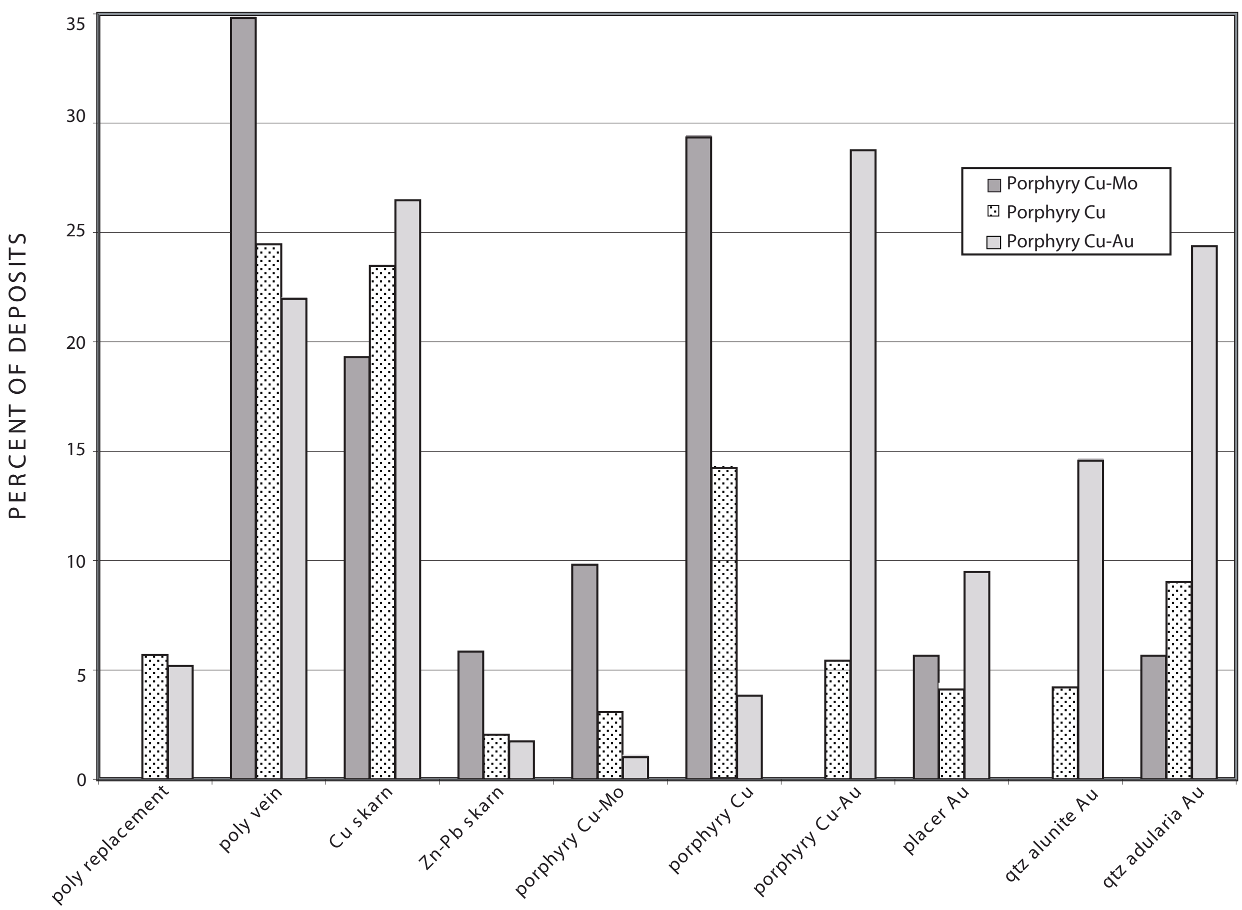

Fig. 23. Percent of selected deposit types observed within 10 kilometers of three subtypes of porphyry copper deposits.

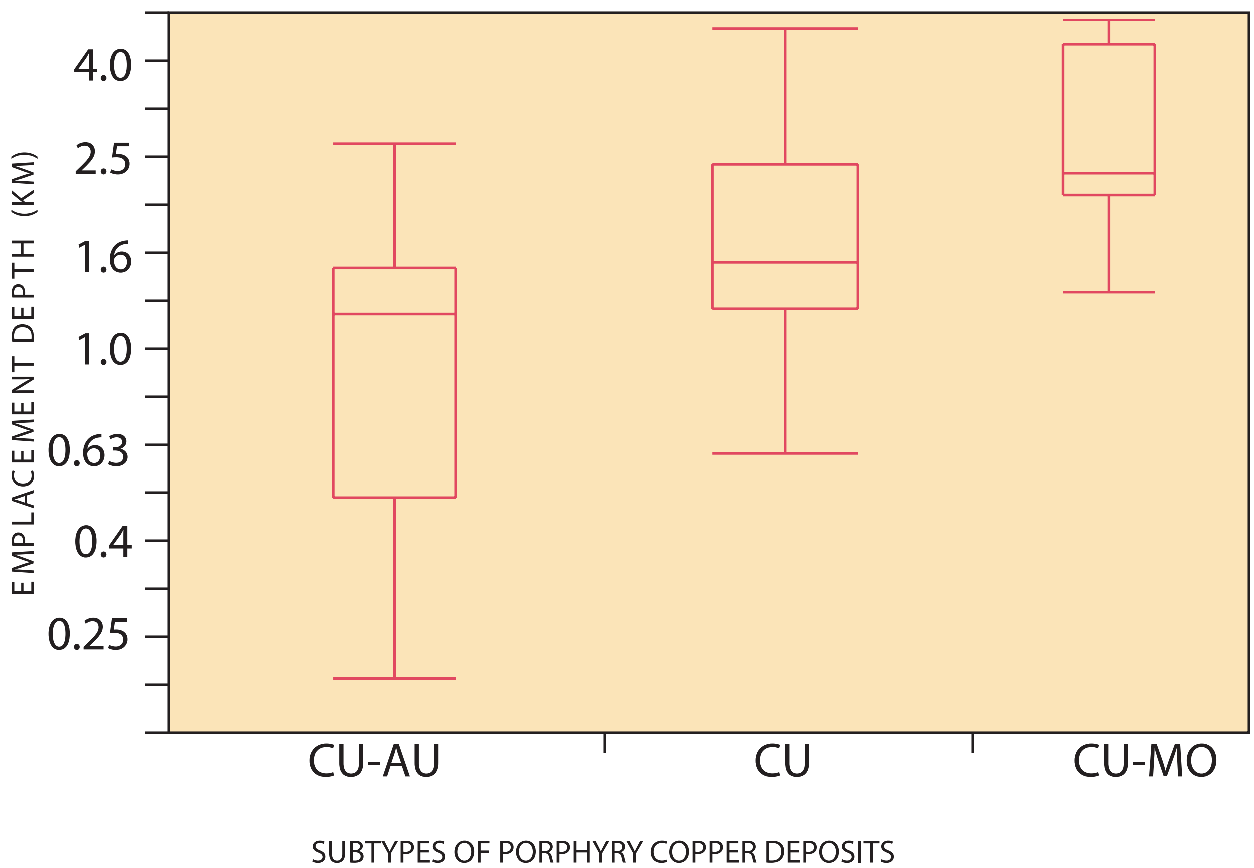

Fig. 24. Box plots of depth of emplacement from paleosurface of porphry copper deposits by subtype.

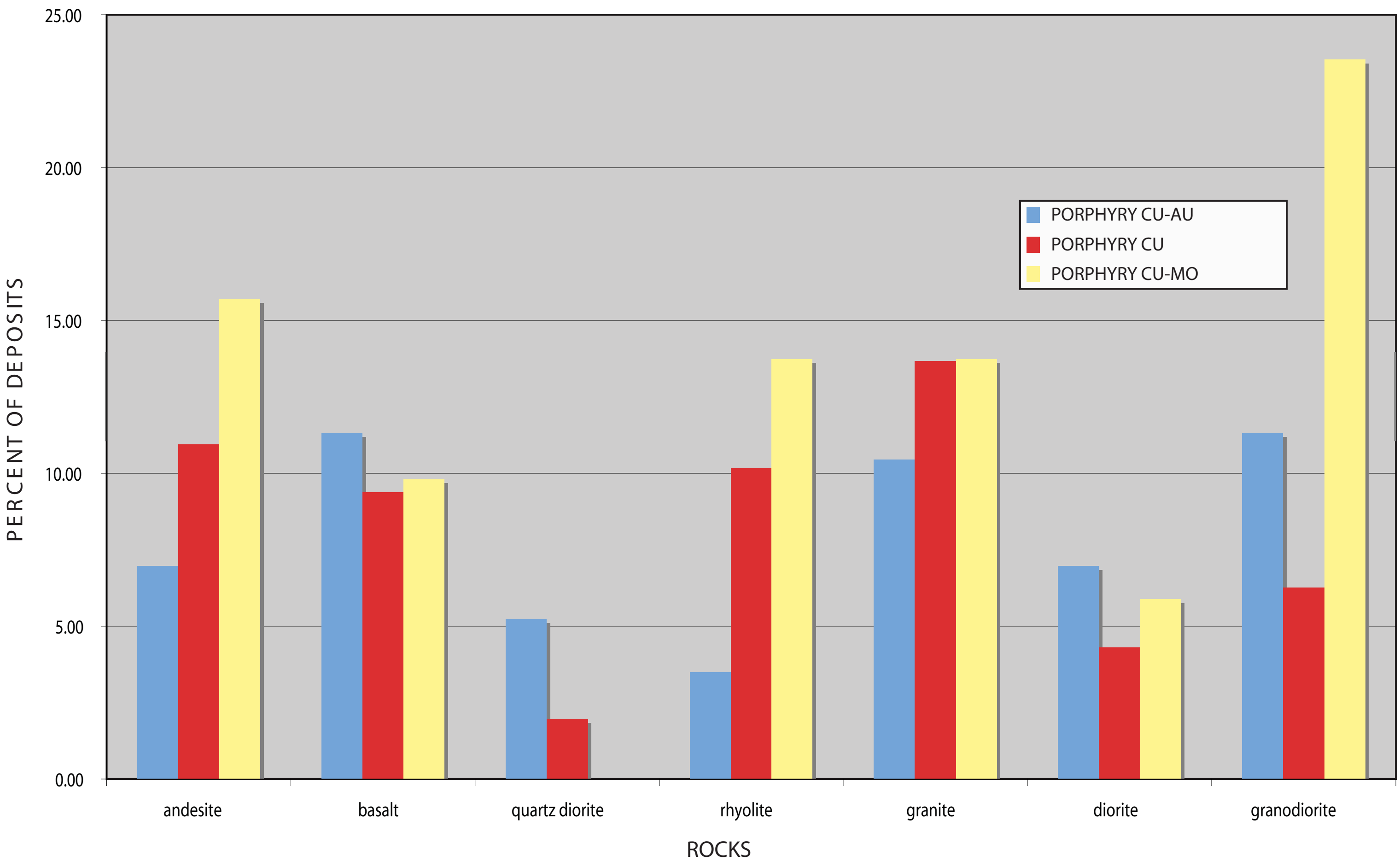

Fig. 25. Histogram of frequency of some igneous rocks observed on regional maps near subtypes of porphyry copper deposits.

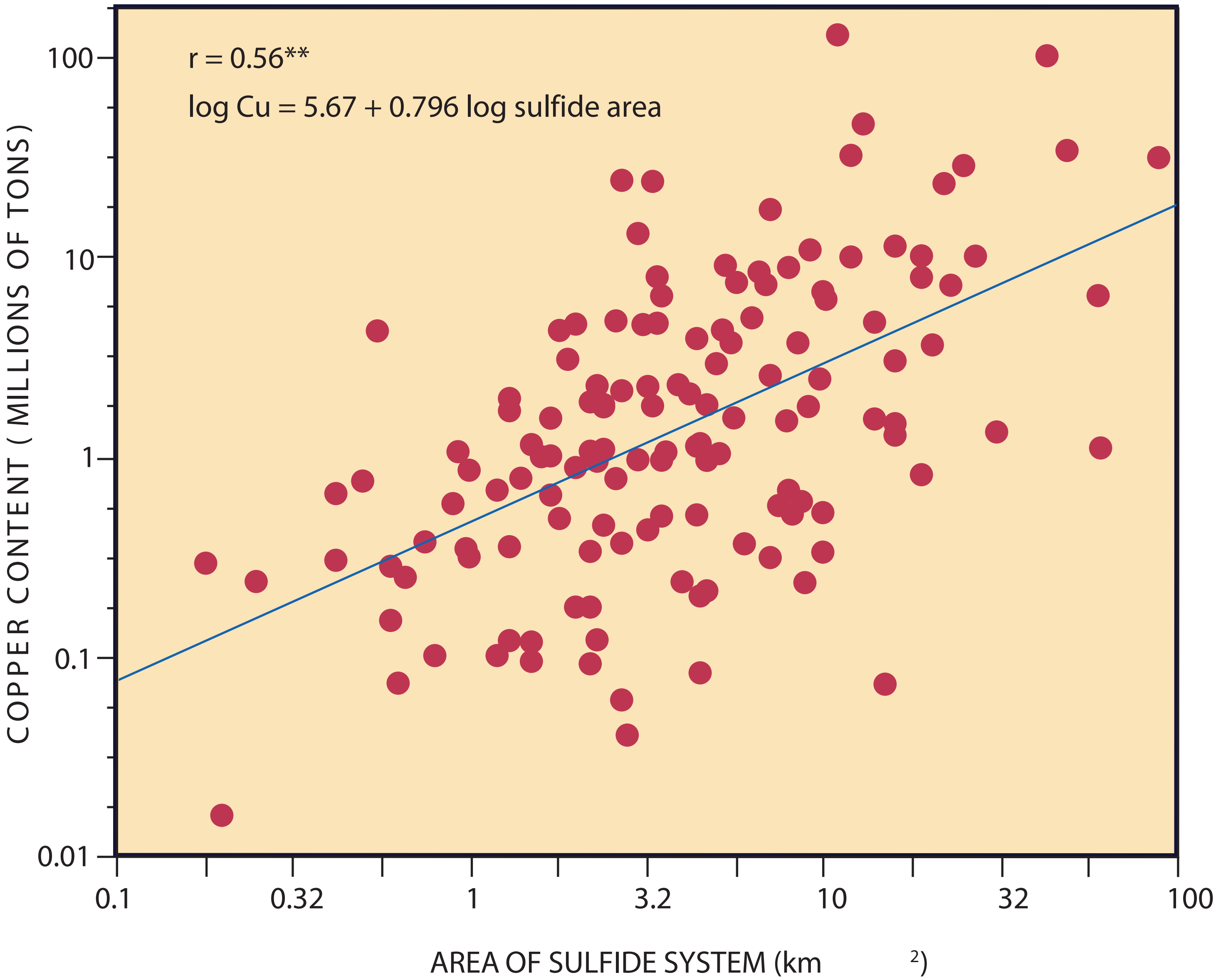

Fig. 26. Area of sulfide system associated with porphyry copper deposits versus copper content of deposits.

DEPOSIT MODEL COUNTRY CODE	COUNTRY NAME
AFGH	AFGHANISTAN
AGTN	ARGENTINA
ALBN	ALBANIA
ALGR	ALGERIA
AMSM	AMERICAN SAMOA
ANDR	ANDORRA
ANGL	ANGOLA
ANGU	ANGUILLA
ANTG	ANTIGUA
ASTR	AUSTRIA
AUNS	AUSTRALIA, NEW SOUTH WALES
AUNT	AUSTRALIA, NORTHERN TERRITORY
AUQL	AUSTRALIA, QUEENSLAND
AUSA	AUSTRALIA, SOUTH AUSTRALIA
AUTS	AUSTRALIA, TASMANIA
AUVT	AUSTRALIA, VICTORIA
AUWA	AUSTRALIA, WESTERN AUSTRALIA
BANG	BANGLADESH
BARB	BARBADOS
BELZ	BELIZE
BENN	BENIN
BHMS	BAHAMAS
BHRN	BAHRAIN
BHTN	BHUTAN
BLGM	BELGIUM
BLVA	BOLIVIA
BOTS	BOTSWANA
BRMA	Myanmar/BURMA
BRMD	BERMUDA
BRND	BURUNDI
BRNI	BRUNEI
BRZL	BRAZIL
BULG	BULGARIA
CAFR	CENTRAL AFRICAN REPUBLIC
CARL	CAROLINE ISLANDS
CHAD	CHAD
CILE	CHILE
CINA	CHINA
CLBA	COLOMBIA
CMRN	CAMEROON
CMRS	COMOROS
CNAL	CANADA, ALBERTA
CNBC	CANADA, BRITISH COLUMBIA
CNGO	CONGO
CNMN	CANADA, MANITOBA
CNNB	CANADA, NEW BRUNSWICK
CNNF	CANADA, NEWFOUNDLAND
CNNS	CANADA, NOVA SCOTIA
CNNT	CANADA, NORTHWEST TERRITORIES
CNON	CANADA, ONTARIO
CNQU	CANADA, QUEBEC
CNSK	CANADA, SASKATCHEWAN

CNYT	CANADA, YUKON TERRITORY
COOK	COOK ISLAND
CORI	COSTA RICA
CPVD	CAPE VERDE
CUBA	CUBA
CYMN	CAYMAN ISLAND
CYPS	CYPRUS
CZCL	CZECHOSLOVAKIA
DHMY	DAHOMEY
DJBT	DJIBOUTI
DMNC	DOMINICA
DMRP	DOMINCAN REPUBLIC
DNMK	DENMARK
ECDR	ECUADOR
EGPT	EGYPT
ELSA	EL SALVADOR
EQGU	EQUATORIAL GUINEA
ETHP	ETHIOPIA
FAER	FAEROE ISLAND
FALK	FALKLAND ISLAND
FIJI	FIJI
FNLD	FINLAND
FRNC	FRANCE
FRPL	FRENCH POLYNESIA
GABN	GABON
GAMB	GAMBIA
GAZA	GAZA STRIP
GBLT	GIBRALTAR
GHNA	GHANA
GNBS	GUINEA-BISSAU
GNEA	GUINEA
GRBR	GREAT BRITAIN
GREC	GREECE
GRLD	GREENLAND
GRME	GERMANY, EAST
GRMW	GERMANY, WEST
GRMY	GERMANY
GRND	GRENADA
GRSY	GUERNSEY
GUAD	GUADELOUPE
GUAM	GUAM
GUAT	GUATEMALA
GUYN	GUYANA
HATI	HAITI
HNDR	HONDURAS
HONG	HONG KONG
HUNG	HUNGARY
ICLD	ICELAND
INDA	INDIA
INDS	INDONESIA
IRAN	IRAN
IRAQ	IRAQ
IRLD	IRELAND

ISMN	ISLE OF MAN
ISRL	ISRAEL
ITLY	ITALY
IVCO	IVORY COAST
JAPN	JAPAN
JMCA	JAMAICA
JRDN	JORDAN
JRSY	JERSEY ISLAND
KAMP	KAMPUCHEA
KNYA	KENYA
KUWT	KUWAIT
LAOS	LAOS
LCSN	LIECHTENSTEIN
LEBN	LEBANON
LIBR	LIBERIA
LIBY	LIBYA
LSTH	LESOTHO
LXBG	LUXEMBOURG
MACU	MACAU
MALI	MALI
MAUR	MAURITANIA
MDGS	MADAGASCAR
MLDV	MALDIVES
MLTA	MALTA
MLWI	MALAWI
MLYA	MALAYSIA
MNCO	MONACO
MNGL	MONGOLIA
MRCO	MOROCCO
MRTQ	MARTINIQUE
MRTS	MAURITIUS
MTSR	MONTSERRAT
MXCO	MEXICO
MZMB	MOZAMBIQUE
NCAL	NEW CALEDONIA
NCRG	NICARAGUA
NEPL	NEPAL
NGRA	NIGERIA
NIGR	NIGER
NKOR	KOREA NORTH
NAMB	NAMIBIA
NRAN	NETHERLANDS ANTILLES
NRLD	NETHERLANDS
NRWY	NORWAY
NZLD	NEW ZEALAND
OMAN	OMAN
PANA	PANAMA
PDRY	PEOPLE'S DEMOCRATIC REPUBLIC OF YEMEN
PERU	PERU
PKTN	PAKISTAN
PLND	POLAND
PLPN	PHILIPPINES
PORT	PORTUGAL

PPNG	PAPUA NEW GUINEA
PRGY	PARAGUAY
PTRC	PUERTO RICO
QATR	QATAR
REUN	REUNION
RMNA	ROMANIA
RWND	RWANDA
SAAR	SAUDI ARABIA
SAFR	SOUTH AFRICA
SING	SINGAPORE
SKOR	KOREA SOUTH
SLMN	SOLOMAN ISLAND
SLNK	SRI LANKA
SMLA	SOMALIA
SNAF	SPANISH NORTH AFRICA
SNGL	SENEGAL
SNMR	SAN MARINO
SPAN	SPAIN
SRLN	SIERRA LEONE
SRNM	SURINAM
STHL	ST. HELENA
STKN	ST. KITTS-NEVIS
STLC	ST. LUCIA
STPM	ST. PIERRE AND MIQUELON
STPR	SAO TOME AND PRINCIPE
STVN	ST. VINCENT
SUDN	SUDAN
SWAZ	SWAZILAND
SWDN	SWEDEN
SWTZ	SWITZERLAND
SYCL	SEYCHELLES
SYRA	SYRIA
THLD	THAILAND
TIWN	TAIWAN
TKCS	TURKS AND CAICOS ISLAND
TNGA	TONGA
TNZN	TANZANIA
TOGO	TOGO
TRKY	TURKEY
TRTO	TRINIDAD AND TOBAGO
TUNS	TUNISIA
UAEM	UNITED ARAB EMIRATES
UGND	UGANDA
UKEN	UNITED KINGDOM, ENGLAND
UKSC	UNITED KINGDOM, SCOTLAND
URAM	ARMENIA
URAZ	AZERBAJDZANSKAJA
URBE	BELORUSSKAJA
URES	ESTONIA
URGR	GRUZINSKAJA
URGY	URUGUAY
URKG	KIRGIZSKAJA
URKZ	KAZAKHSTAN

URLA	LATVIA
URLI	LITHUANIA
URMD	MOLDAVIAN
URRO	ROSSIJSKAJA
URRS	RUSSIA
URTD	TADZHIKISTAN
URTK	TURKESTAN
URUK	UKRAINIA
URUZ	UZBEKISTAN
USAK	UNITED STATES, ALASKA
USAL	UNITED STATES, ALABAMA
USAR	UNITED STATES, ARKANSAS
USAZ	UNITED STATES, ARIZONA
USCA	UNITED STATES, CALIFORNIA
USCO	UNITED STATES, COLORADO
USCT	UNITED STATES, CONNECTICUT
USDE	UNITED STATES, DELAWARE
USFL	UNITED STATES, FLORIDA
USGA	UNITED STATES, GEORGIA
USHI	UNITED STATES, HAWAII
USIA	UNITED STATES, IOWA
USID	UNITED STATES, IDAHO
USIL	UNITED STATES, ILLINOIS
USIN	UNITED STATES, INDIANA
USKS	UNITED STATES, KANSAS
USKY	UNITED STATES, KENTUCKY
USLA	UNITED STATES, LOUISIANA
USMA	UNITED STATES, MASSACHUSETTS
USMD	UNITED STATES, MARYLAND
USME	UNITED STATES, MAINE
USMI	UNITED STATES, MICHIGAN
USMN	UNITED STATES, MINNESOTA
USMO	UNITED STATES, MISSOURI
USMS	UNITED STATES, MISSISSIPPI
USMT	UNITED STATES, MONTANA
USNC	UNITED STATES, NORTH CAROLINA
USND	UNITED STATES, NORTH DAKOTA
USNE	UNITED STATES, NEBRASKA
USNH	UNITED STATES, NEW HAMPSHIRE
USNJ	UNITED STATES, NEW JERSEY
USNM	UNITED STATES, NEW MEXICO
USNV	UNITED STATES, NEVADA
USNY	UNITED STATES, NEW YORK
USOH	UNITED STATES, OHIO
USOK	UNITED STATES, OKLAHOMA
USOR	UNITED STATES, OREGON
USPA	UNITED STATES, PENNSYLVANIA
USRI	UNITED STATES, RHODE ISLAND
USSC	UNITED STATES, SOUTH CAROLINA
USSD	UNITED STATES, SOUTH DAKOTA
USTN	UNITED STATES, TENNESSEE
USTX	UNITED STATES, TEXAS
USUT	UNITED STATES, UTAH

USVA	UNITED STATES, VIRGINIA
USVI	VIRGIN ISLAND (U.S.)
USVT	UNITED STATES, VERMONT
USWA	UNITED STATES, WASHINGTON
USWI	UNITED STATES, WISCONSIN
USWV	UNITED STATES, WEST VIRGINIA
USWY	UNITED STATES, WYOMING
UVOL	UPPER VOLTA
VNTU	VANUATU
VNZL	VENEZUELA
VRGN	VIRGIN ISLAND (BRITISH)
VTCN	VATICAN CITY
VTMN	VIETNAM NORTH
VTMS	VIETNAM SOUTH
VTNM	VIETNAM
WLFT	WALLIS AND FUTUNA
WSAM	WESTERN SAMOA
WSHR	WESTERN SAHARA
YEMN	YEMEN
YUGO	YUGOSLAVIA
ZIMB	ZIMBABWE
ZIRE	ZAIRE
ZMBA	ZAMBIA