Distributions of soil chemistry test results by rock type

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Introduction

- Soil nutrient levels are primary determinants of forest productivity.
- An understanding of site soil nutrient environments is helpful in determining fertilizer prescriptions.
- Soil fertility management is key to long-term sustainable productivity of forest soils.

Introduction

- Comparing soil test values with empirical distribution allow site fertility ranking.

Materials and Methods

- Nutrients data from natural soils in Idaho, Montana, Oregon and Washington
- Douglas-fir Sites: 90 stands
- Forest Health Sites: 31 stands
- Seedling Sites: 10
- Umatilla Sites: 9
- Okanagon Sites: 8
- Click Sites: 6
- Total stands: 154

Materials and Methods

- Rock Type Distribution
  - Basalt: 54 stands
  - Granite: 31
  - Mixed: 33
  - Metasedimentary: 28
  - Sedimentary: 8
  - Total stands: 154

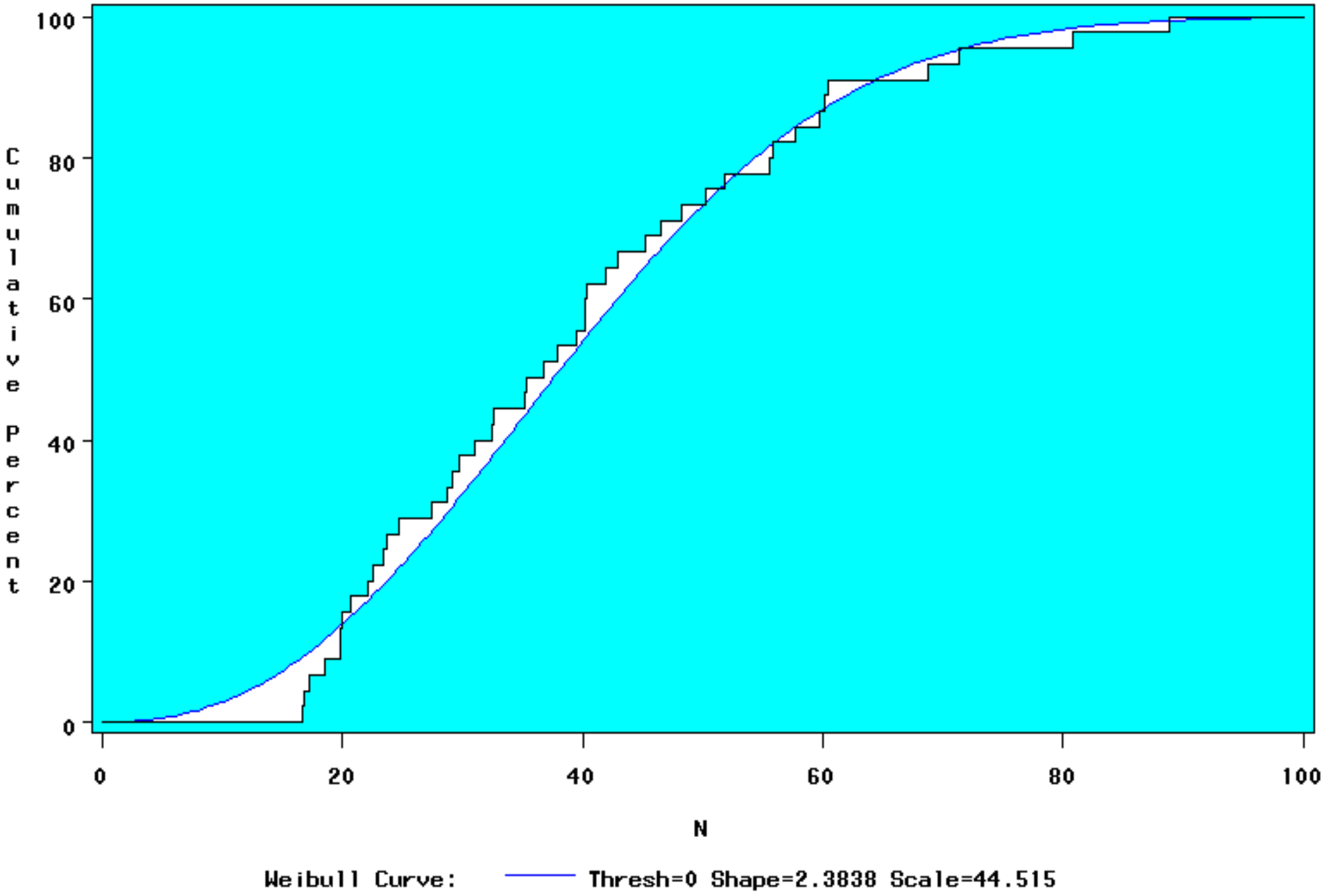
Materials and Methods

- Variables Analyzed:
  - Soil mineralizable N (ppm)
  - Available P, S, B and Cu (ppm)
  - Exchangable K, Mg and Ca (meq 100 g^{-1})
  - pH

  - Not every stand has all above variables

Materials and Methods

- ANOVA was used to test rock type differences in various nutrient variables
- Means were compared for nutrients that were significant among rock types
- SAS was used in statistical analyses
- Weibull function was used to smooth relative distribution of sites over a nutrient sample

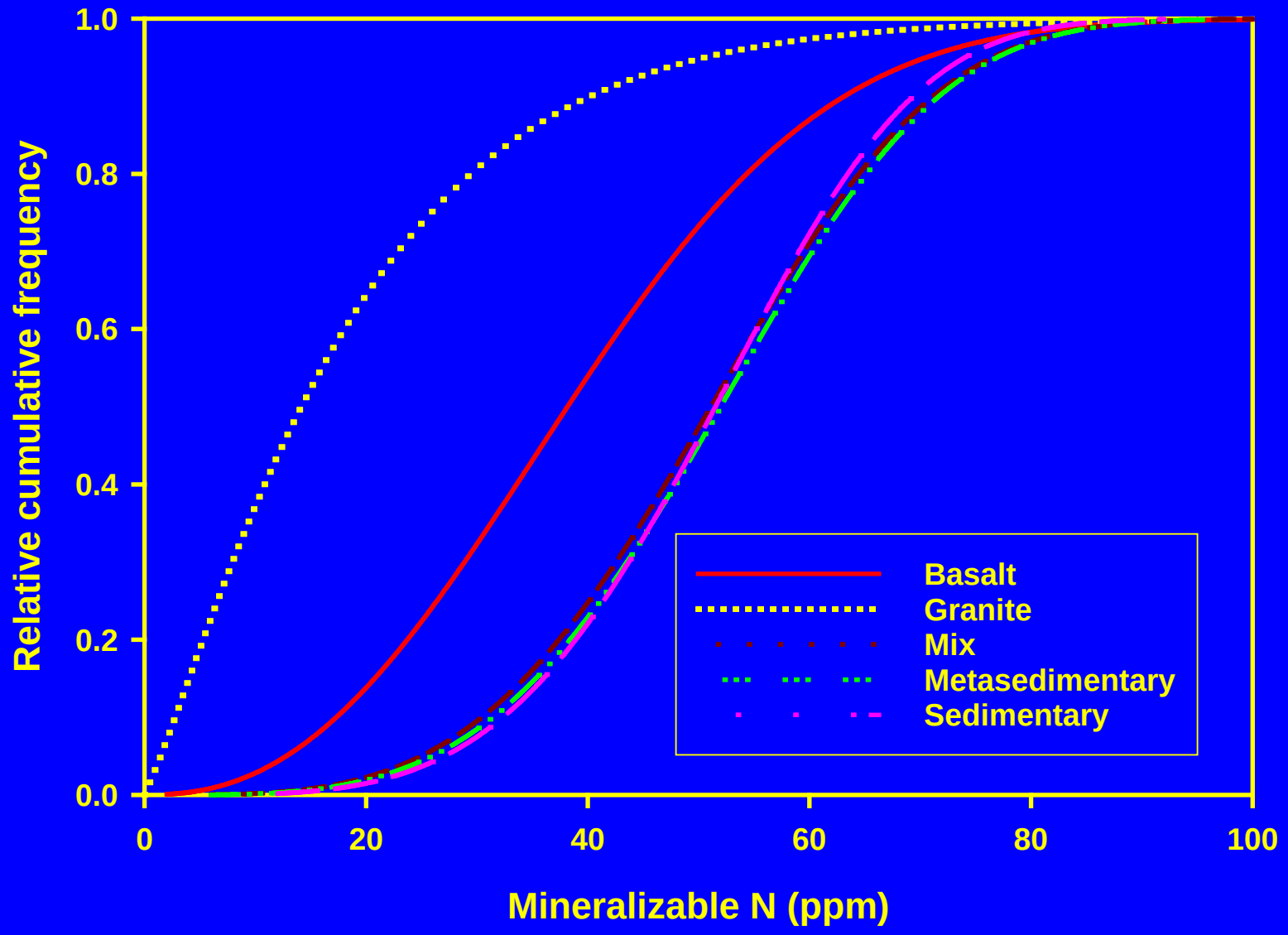

100
80
60
40
20
0
Cumulative Percent
0
20
40
60
80
100
N
Weibull Curve:
Thresh=0 Shape=2.3838 Scale=44.515

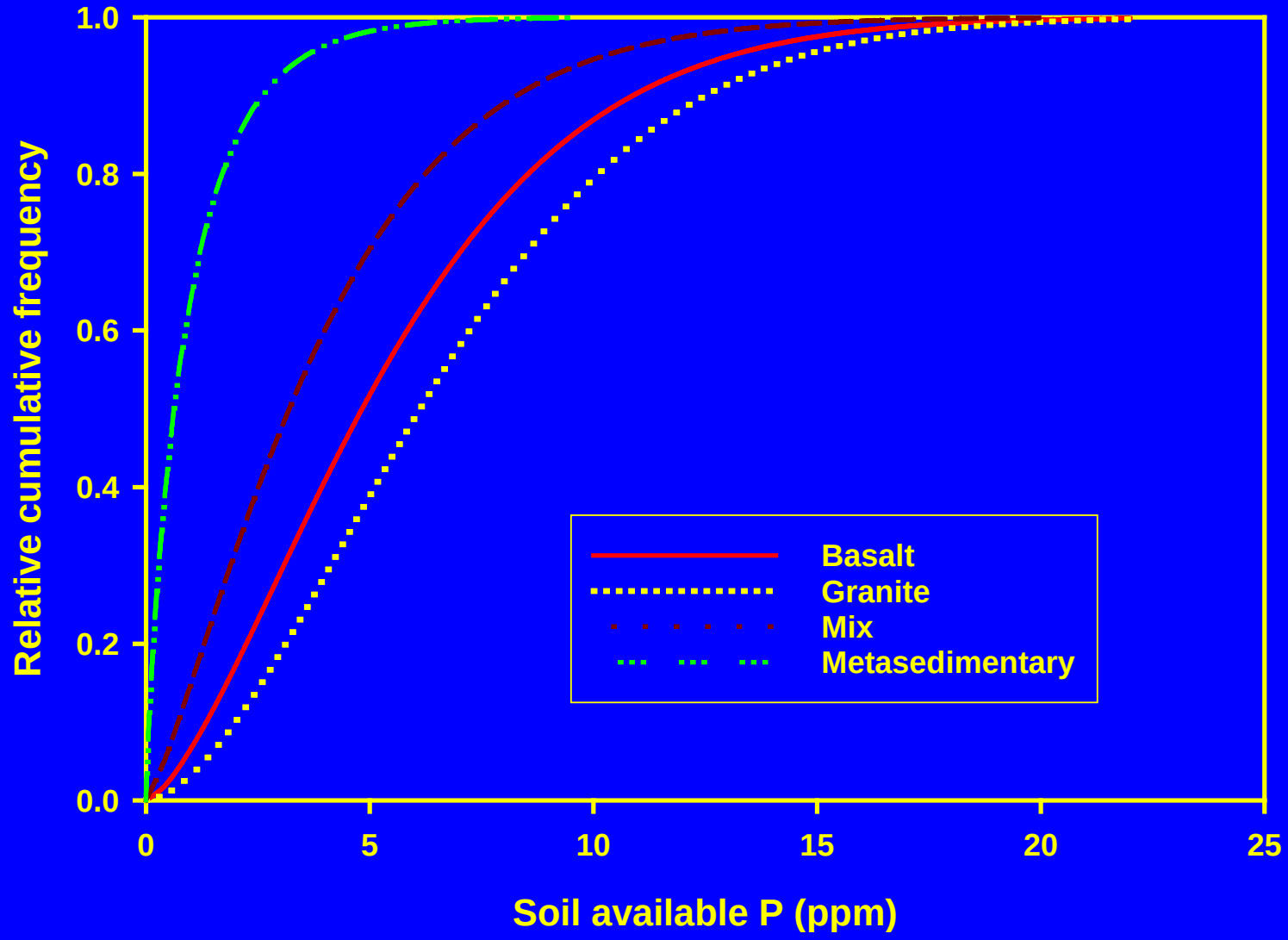
Results

- Mineralizable N, available P, exchangeable K and Ca are significantly different among rock types at 90% level
- No clear differences in exchangeable Mg, available S, B and Cu among rock types

Comparison of means among rock types

Rock type	Min_N	Av_P	Ex_K	Ex_Mg	Ex_Ca
Basalt	39.3b	3.68ab	1.38a	1.93a	9.76ab
Granite	32.7b	6.80a	0.74b	0.81c	6.51d
Sedimentary	51.2a	3.02ab	0.94b	2.10a	10.89a
Metasedimentary	51.7a	2.13b	0.93b	1.40b	9.22bc
Mixed	51.1a	3.97ab	0.84b	1.14bc	8.20c


1.0
0.8
0.6
0.4
0.2
0.0
Relative cumulative frequency
0
20
40
60
80
100
Mineralizable N (ppm)
Basalt
Granite
Mix
Metasedimentary
Sedimentary


Relative cumulative frequency
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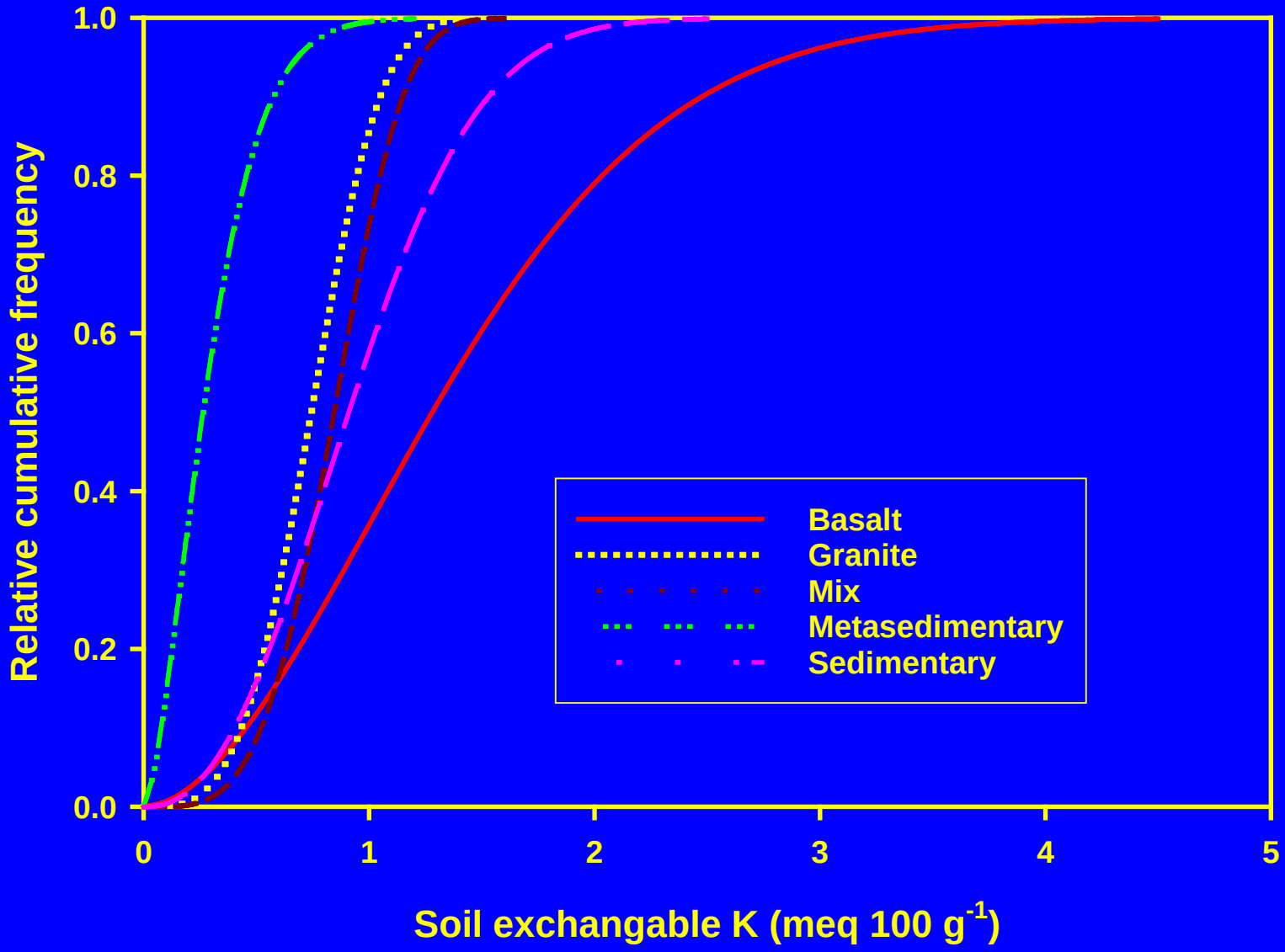
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
Soil available P (ppm)
Basalt
Granite
Mix
Metasedimentary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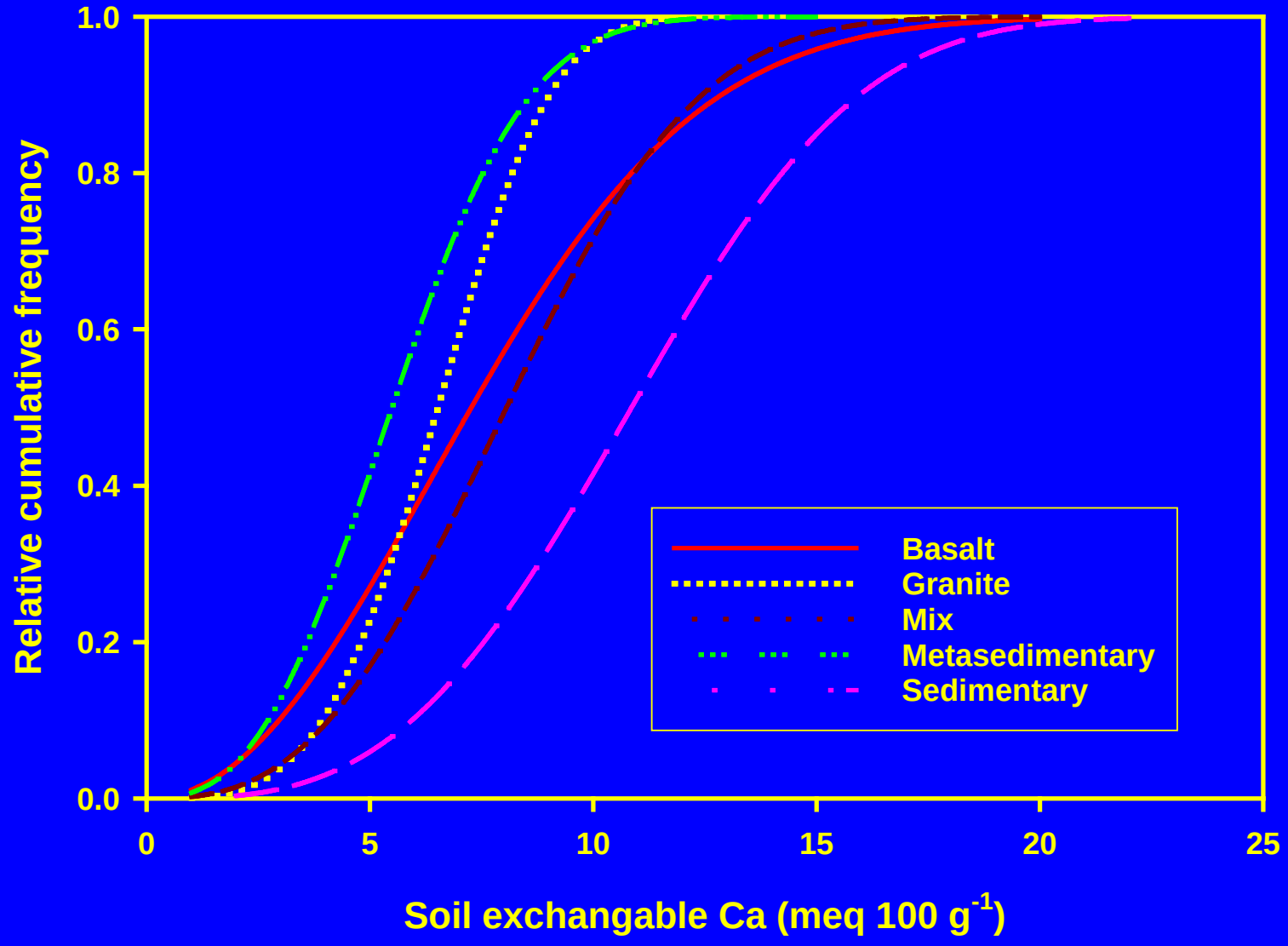
0.6
0.4
0.2
0.0
Relative cumulative frequency
0
1
2
3
4
5
Soil exchangable K (meq 100 g-1)
Basalt
Granite
Mix
Metasedimentary
Sedimentary


Relative cumulative frequency
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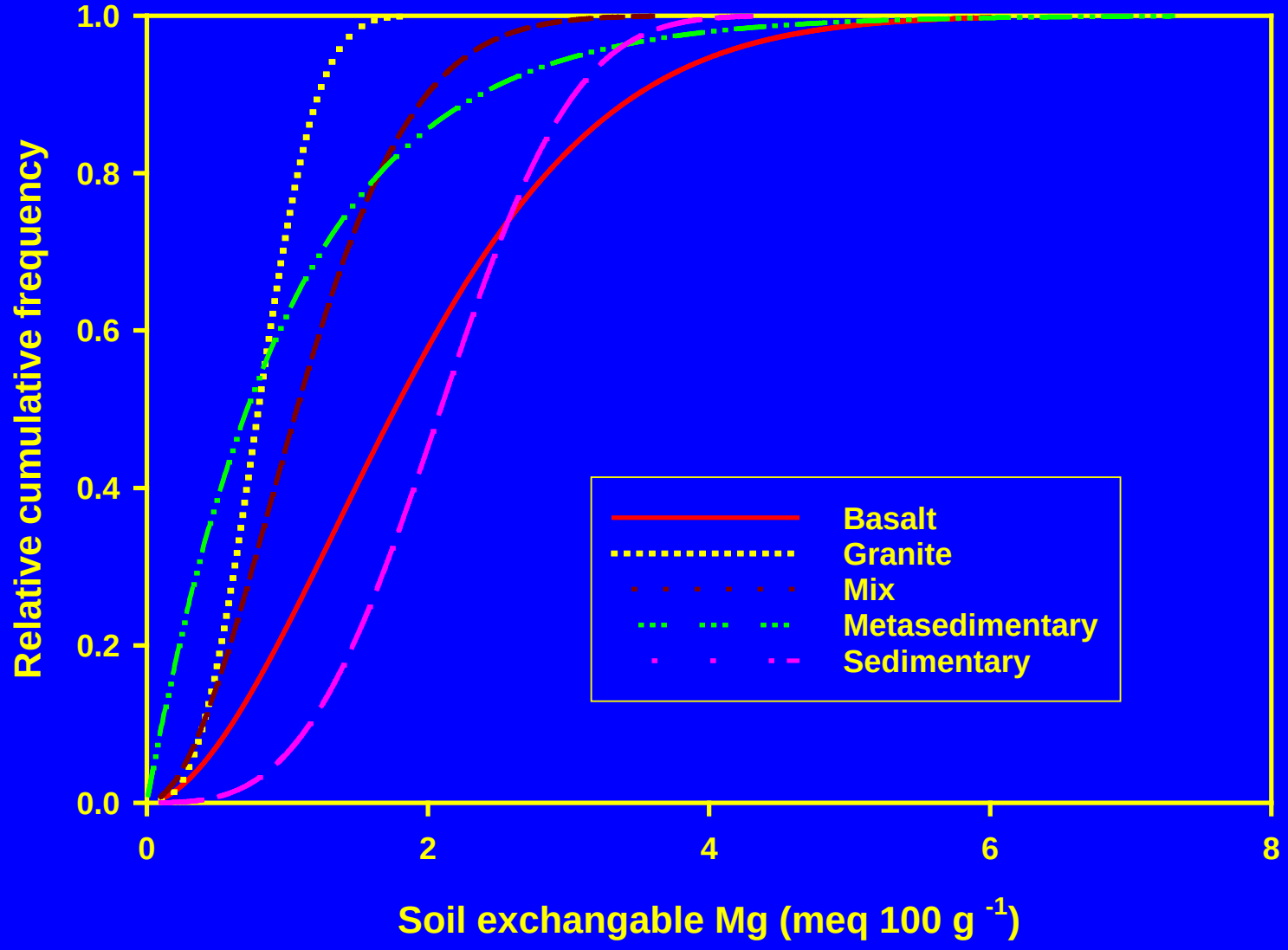
0.6
0.4
0.2
0.0
0
5
10
15
20
25
Soil exchangable Ca (meq 100 g-1)
Basalt
Granite
Mix
Metasedimentary
Sedimentary


Relative cumulative frequency
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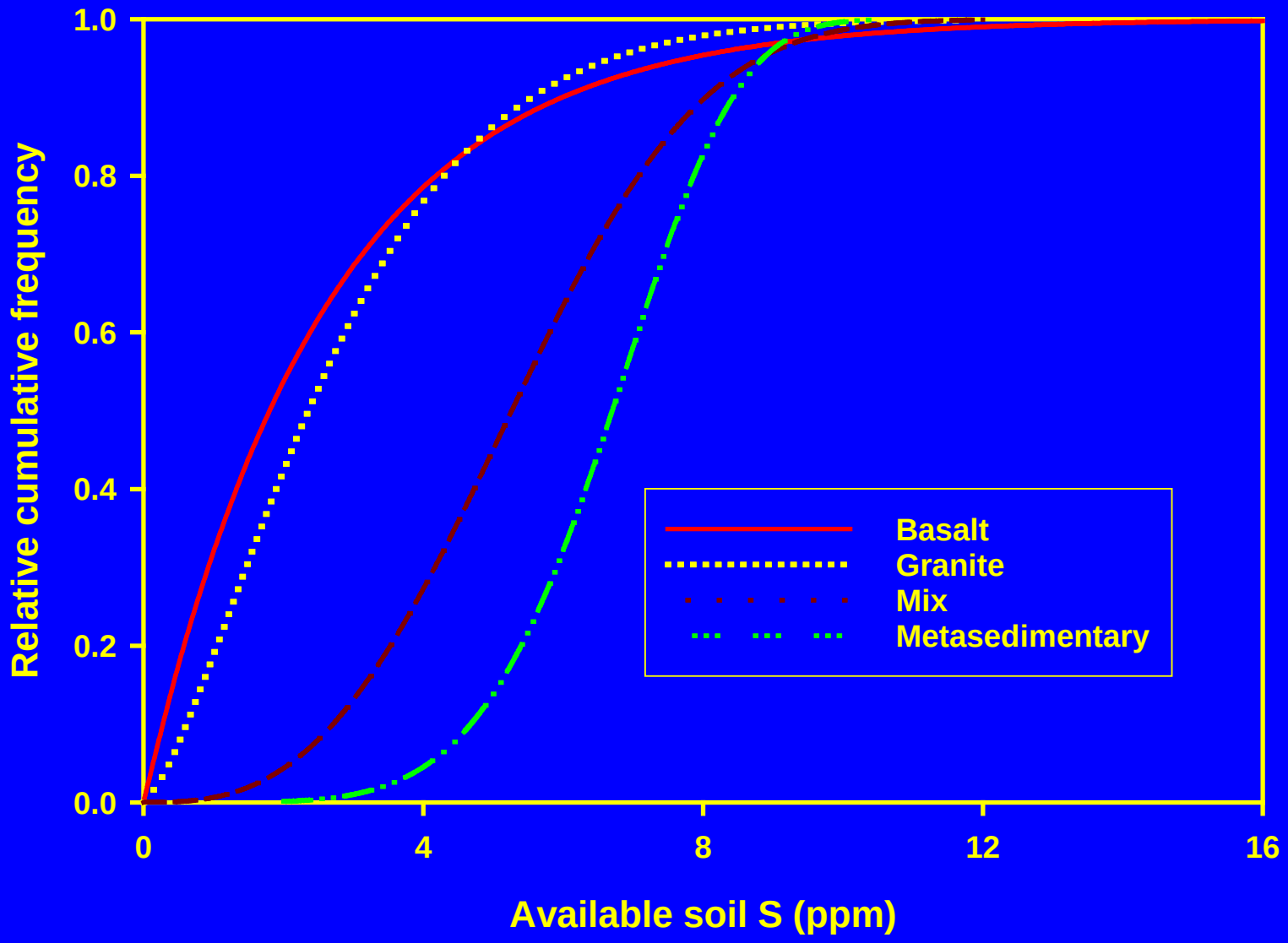
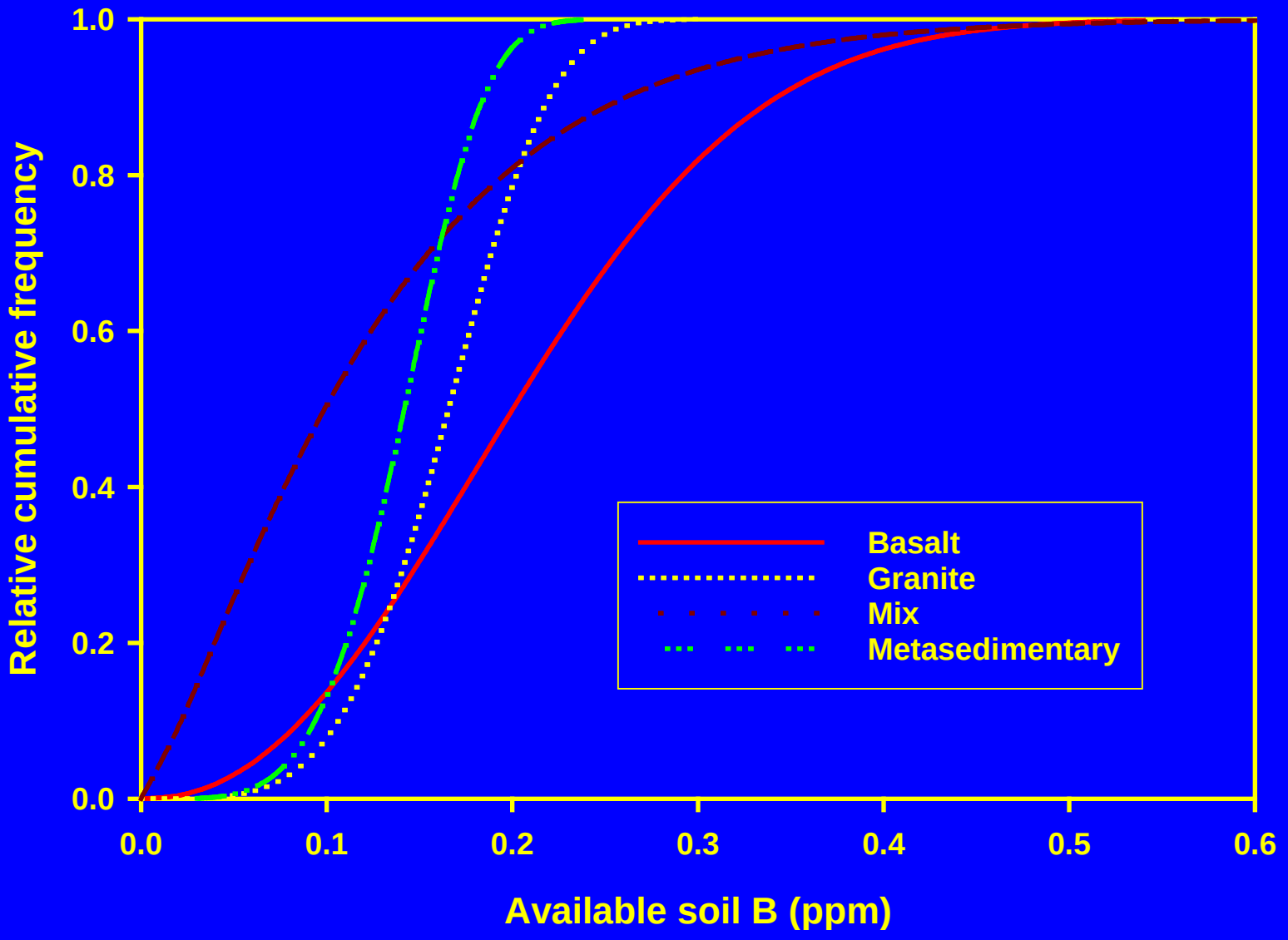
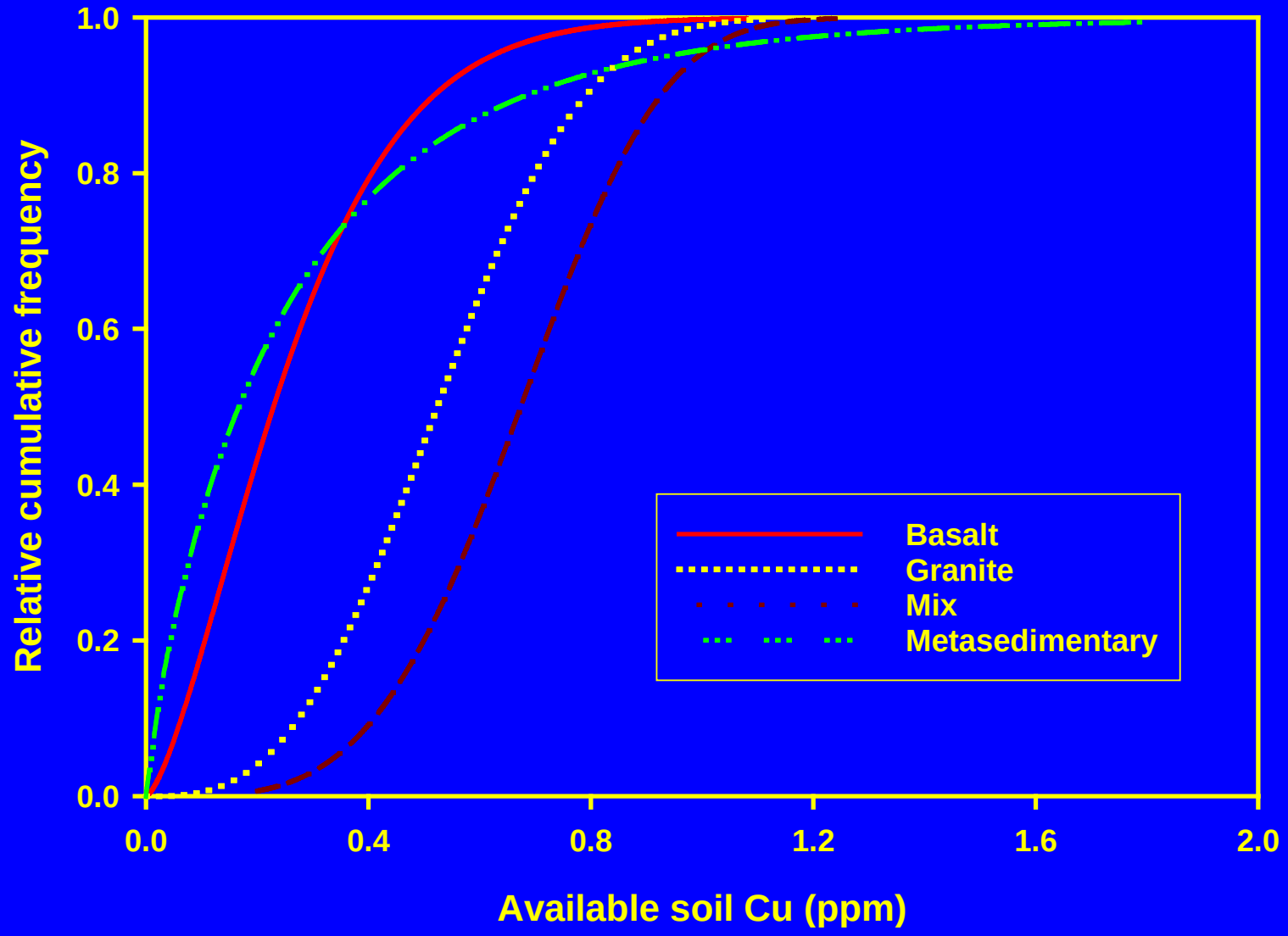
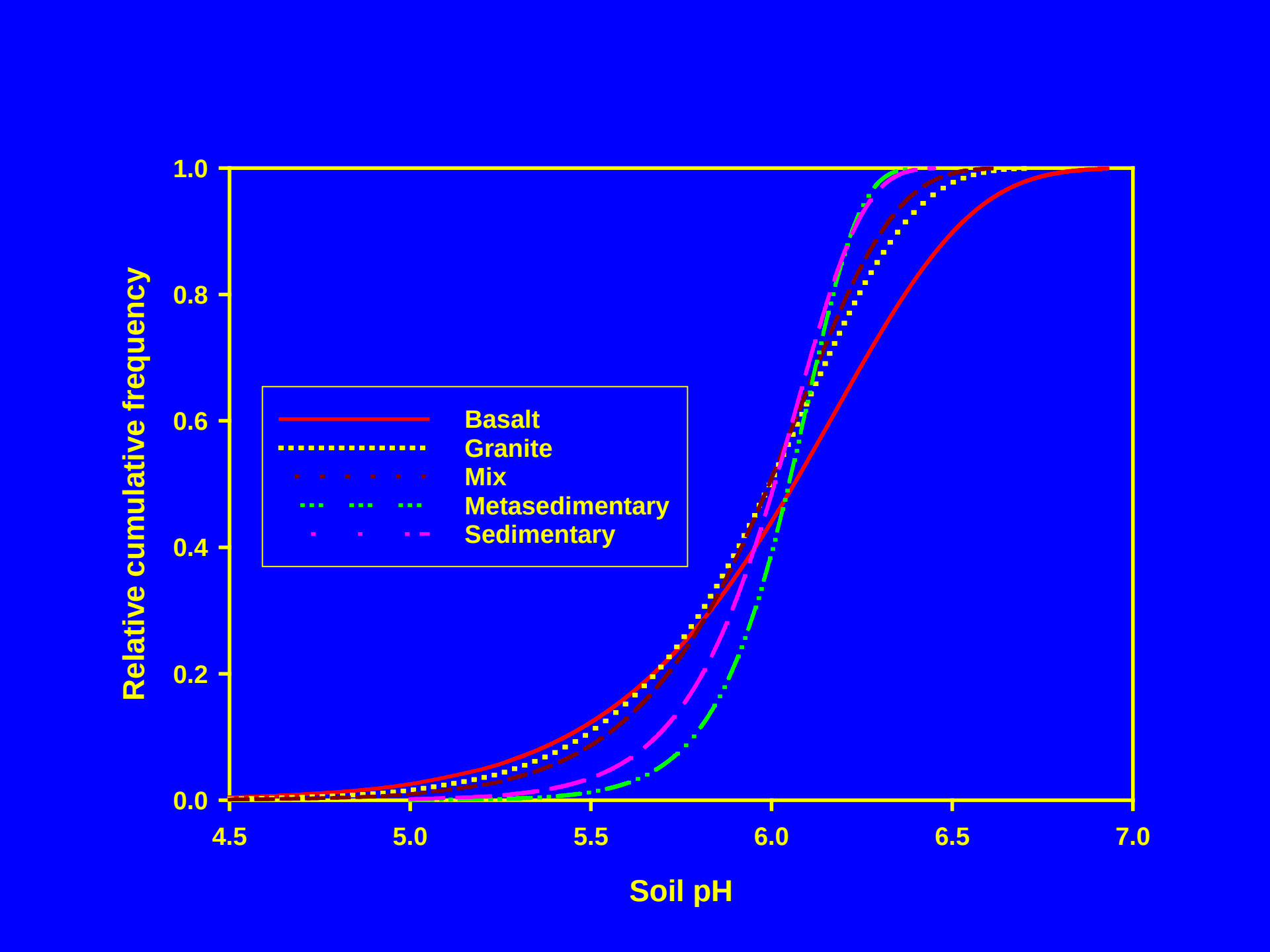
0.8
0.6
0.4
0.2
0.0
0
2
4
6
8
Soil exchangable Mg (meq 100 g -1)
Basalt
Granite
Mix
Metasedimentary
Sedimentary


1.0
0.8
0.6
0.4
0.2
0.0
Relative cumulative frequency
0
4
8
12
16
Available soil S (ppm)
Basalt
Granite
Mix
Metasedimentary


1.0
0.8
0.6
0.4
0.2
0.0
Relative cumulative frequency
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Available soil B (ppm)
Basalt
Granite
Mix
Metasedimentary


1.0
0.8
0.6
0.4
0.2
0.0
Relative cumulative frequency
0.0
0.4
0.8
1.2
1.6
2.0
Available soil Cu (ppm)
Basalt
Granite
Mix
Metasedimentary


Relative cumulative frequency
1.0
0.8
0.6
0.4
0.2
0.0
4.5
5.0
5.5
6.0
6.5
7.0
Soil pH
Basalt
Granite
Mix
Metasedimentary
Sedimentary

Conclusions

- Rock type contributes significant differences to soil nutrient levels.
- Sites on basalt are rich in K, Mg and B, but generally poor in N, S and Cu
- Soils on granite are most abundant in P, but poor in N, Mg and S
- Some soils from mixed category are only poor in B, but most are relatively rich in other nutrients

Conclusions

- Soils on metasedimentary rocks are rich in S, but poor in P, K, Mg, Ca and Cu
- Soil pHs are similar across rock types and may not be a major factor in determining soil nutrient levels.