# Weathering potential of rocks

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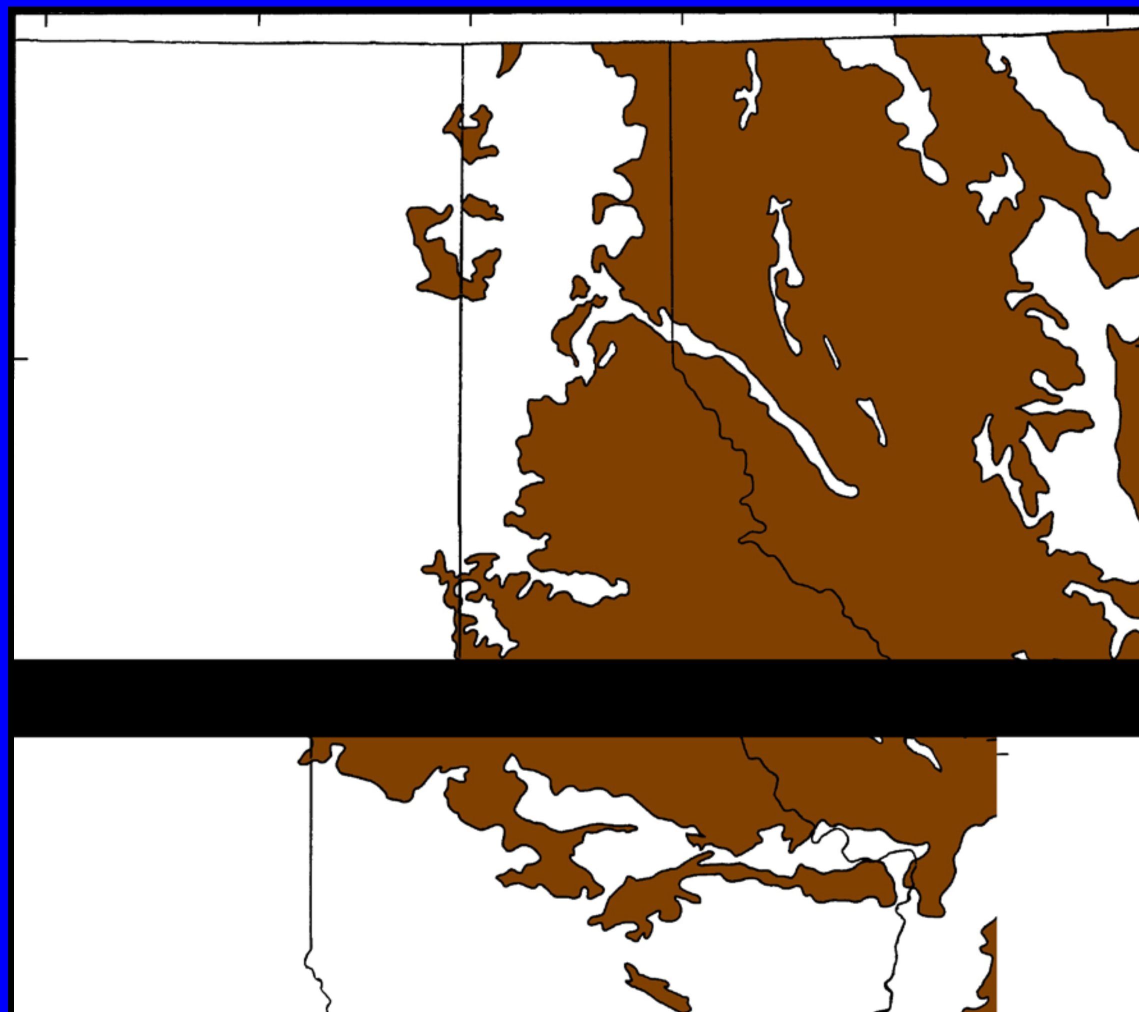
# The Good Rock-Bad Rock Story

- Early findings of square death were related to site K status (mid to late 1980’s)
- Implementation of Forest Health study, intended to incorporate both N and K, showed certain rock types as ‘bad rocks’ (mid-1990’s)
- First geological approach of the IFTNC was to identify K-status of rocks as the good rock-bad rock indicator
- Seedling establishment study devised to compare tree establishment on good rocks and bad rocks (late 1990’s)
- Geochemical analysis of seedling establishment rocks showed that K content was not a factor separating good from bad rocks (basalt=good rock but low K, quartzite=bad rock but high K)
- Good rocks and bad rocks are defined by the chemical and physical properties they impart to the soil, not by K status alone (today . . .)

# Precambrian Belt Rocks



# Metaseds: Bad Rocks?

- Metasedimentary rocks have been broadly categorized as ‘bad rocks’
- Some of our least productive sites are on Belt metasedimentary rocks (eg Striped Peak quartzite)
- Some of our most productive sites are on Belt metasedimentary rocks (eg lower and middle Wallace)
- Productivity seems to be related to rock weathering characteristics
- How can we sort out the good from the bad within the metasedimentary rocks?

# Weathering Potential Index

A geologist named Reiche developed a weathering potential index in the early 1940's. We applied a modification of his index to 446 geochemical analyses of rock samples collected in north Idaho by IGS and USGS personnel between 1990 and 2002.

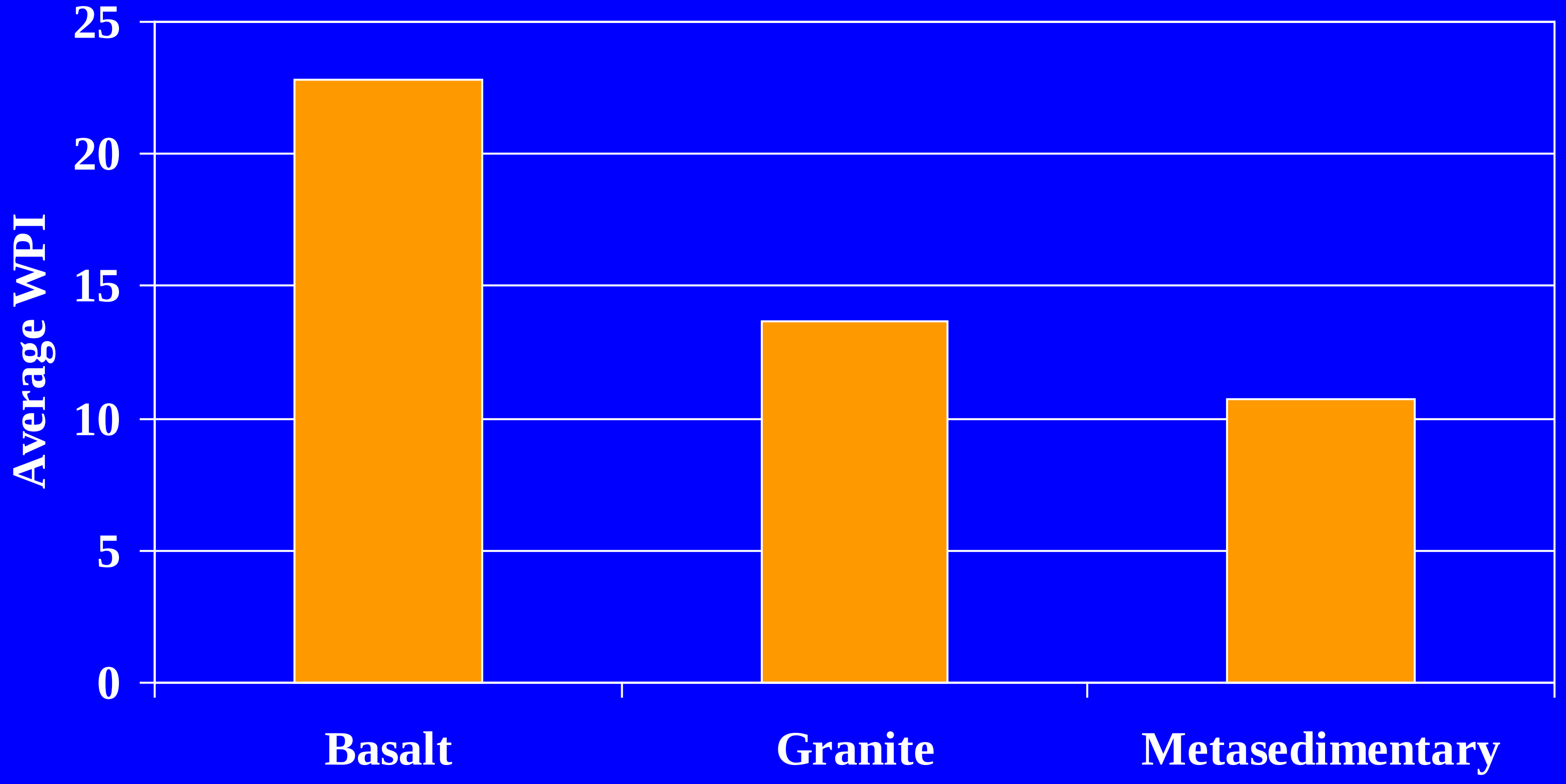
$$WPI = \frac{100 \cdot moles(Na_2O+K_2O+MgO+CaO)}{moles(Na_2O+K_2O+MgO+CaO+SiO_2+Al_2O_3+Fe_2O_3)}$$

This is simply representing the cations as a proportion of all the common rock-forming elements in the rock.

# WPI Analyses

1. Broad IFTNC rock categories (basalt, granite, metasedimentary)
2. Lithology: siltite, quartzite, basalt, etc. (32 groups)
3. Formal Nomenclature: Wallace, Prichard, Grande Ronde, etc. (16 groups)

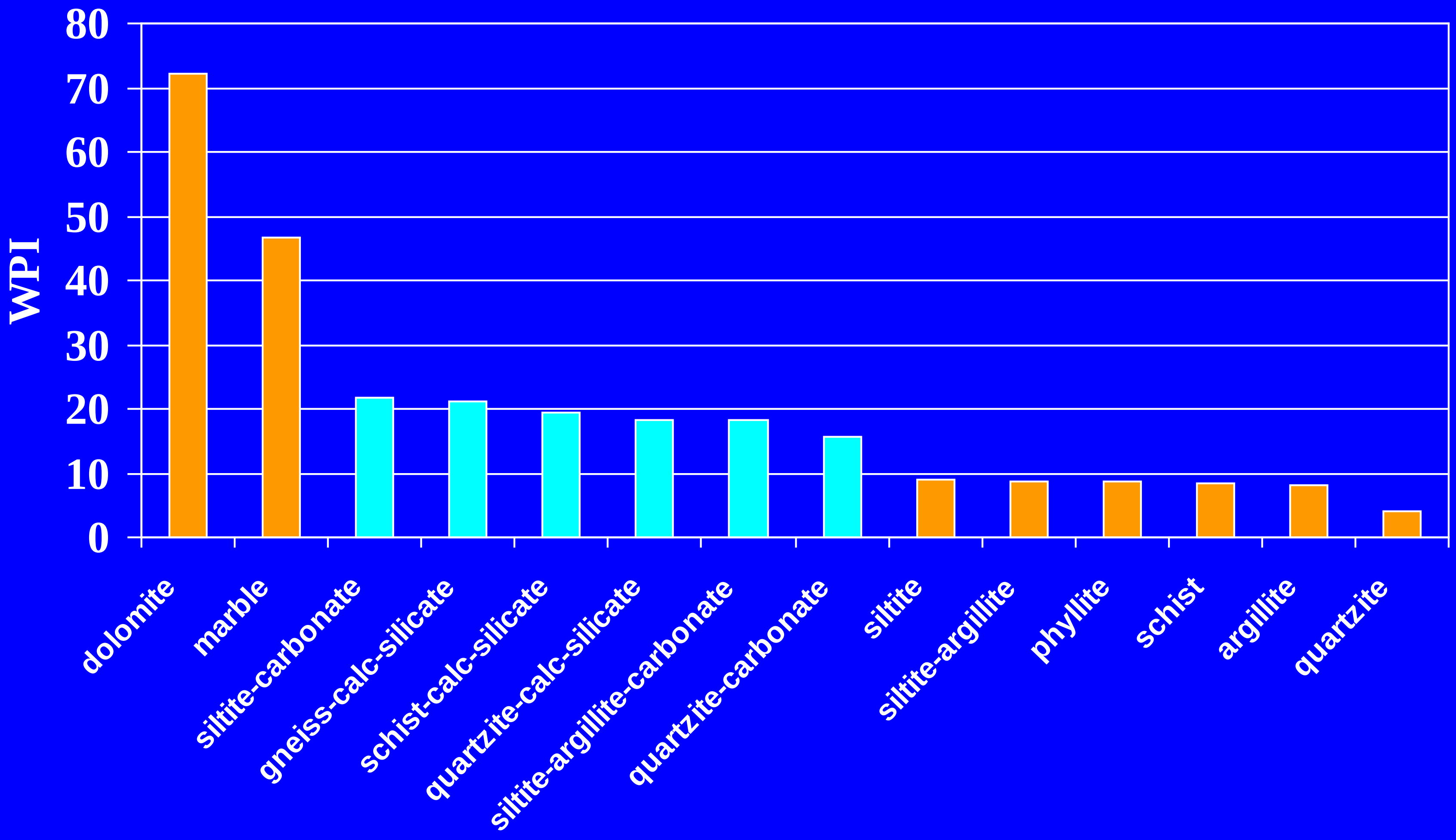
# 1. WPI by Broad Rock Category



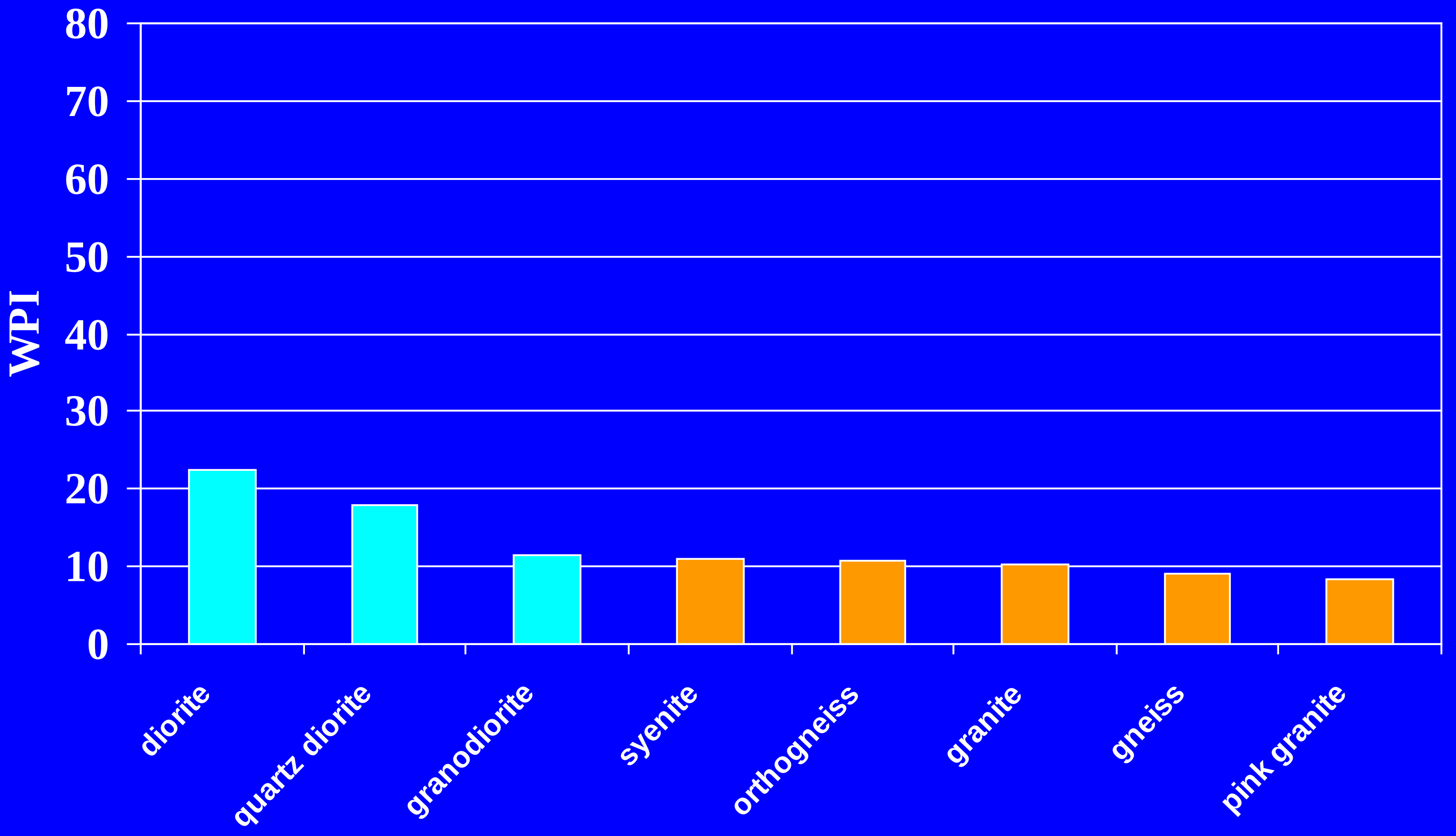

Range 16-29 Range 7-35 Range 1-75

In the WPI analysis, this classification scheme was poor, because of the high variability within the granitic and especially metasedimentary rocks

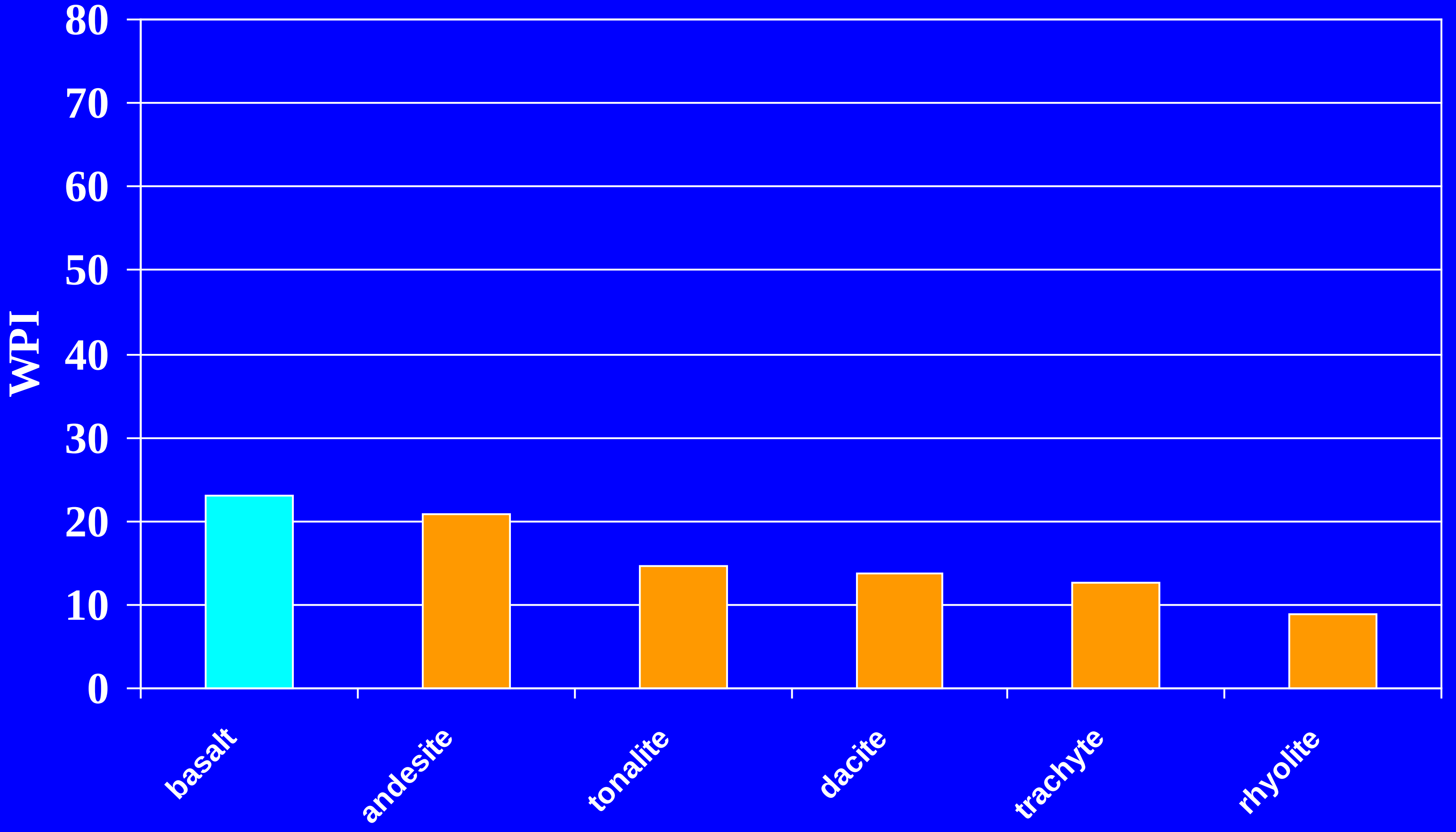
# 2. WPI by Lithology: Metaseds



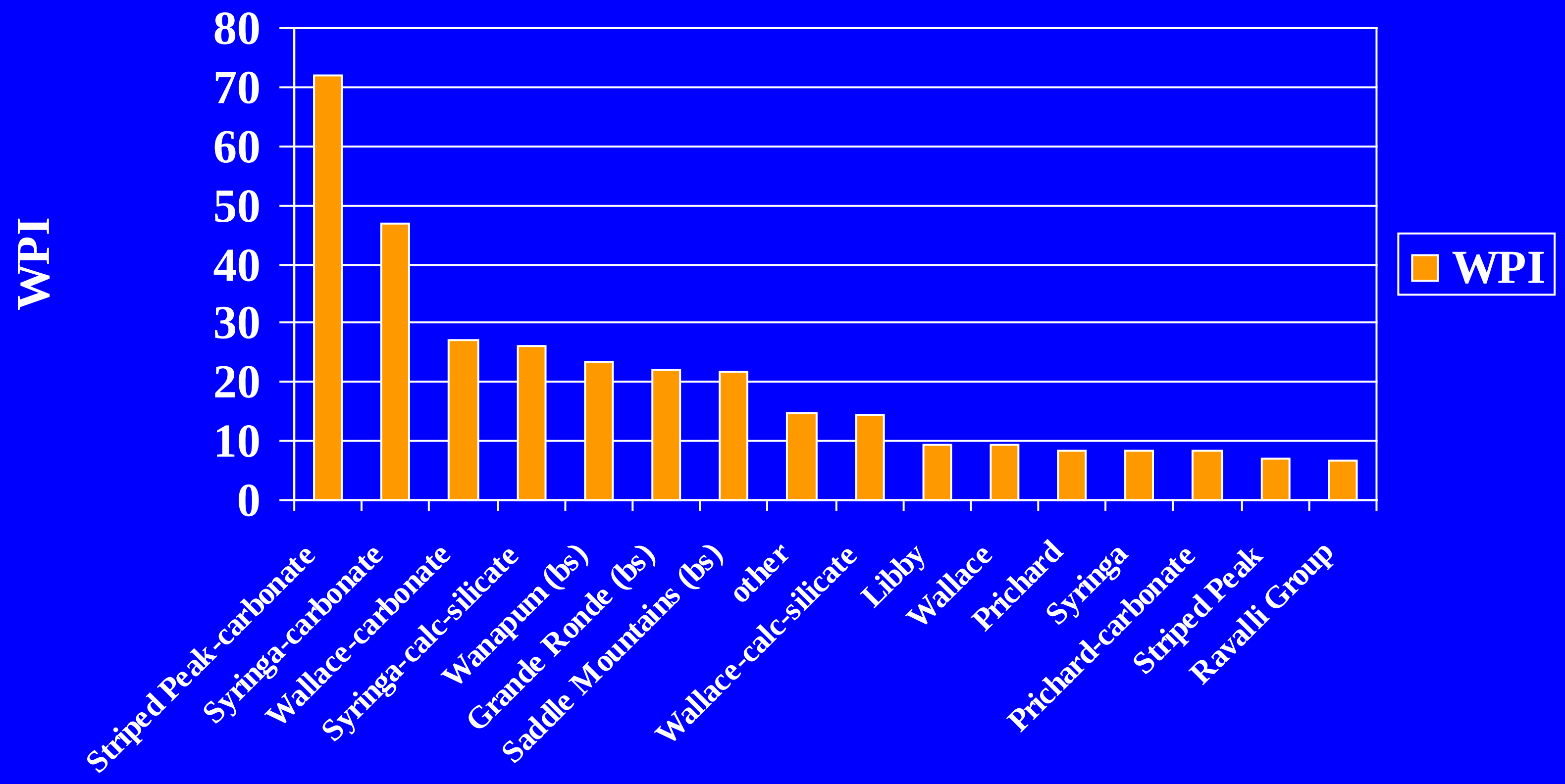
# 2. WPI by Lithology: Granites



# 2. WPI by Lithology: Basalts



# 3. WPI by Formal Nomenclature




This classification scheme worked OK as long as the carbonate members could be identified, but was still not as strong as lithology.

# Summary

1. Broad categorization scheme
    1. WPI: $R^2$=0.31
    2. $SiO_2$ : $R^2$=0.42
2. Lithology categorization scheme
    1. WPI: $R^2$=0.85
    2. $SiO_2$ : $R^2$=0.80
3. Formal nomenclature categorization
    1. WPI: $R^2$=0.60
    2. $SiO_2$: $R^2$ =0.53

# Conclusions

- Differences in stand productivity among various metasedimentary rocks are observable
- Potassium alone does not differentiate ‘good’ from ‘bad’
- Weathering potential index (WPI) may provide a means of quantifying the ‘good’ and the ‘bad’ in rocks
- Lithology was the best descriptor of the variability in WPI values among 446 samples
- By associating site-specific IFTNC response data with WPI values, we can perform a correlation analysis to determine how well WPI describes productivity
- By associating WPI values with digital geologic map units, we may be able to assess stand productivity potential at a landscape level