

# URANIUM EXPLORATION

Observe (fact)

Record (fact)

Interpret (fiction?)

# FIRST CONSIDERATION IS BUDGET

- 1 maximize available \$
- 2 transport \$
- 3 field sampling \$
- 4 analysis \$

# FIELD PROCEDURES

- **PLANNING** – Check all old records for evidence of anomalous U values
- **TECHNIQUES** –
  - » Samples
  - » Radiometric measurements
  - » On-site analysis
  - » Ground geophysics

# SAMPLES

- Field work is expensive so collect as many samples as possible
- Make sure the samples are large enough for various types of processing later
- Locate sample site as accurately as possible

# RADIOMETRIC MEASUREMENTS

- Scintillometers \$
  - » inexpensive
- Spectrometers \$\$
  - » require careful calibration

# ON-SITE ANALYSIS

- Chemical analysis
  - » operating field laboratories is difficult
- XRF analysis
  - » expensive equipment and poor detection limit

# Ground Geophysics

- Many techniques available
  - » Magnetic
  - » Electromagnetic
  - » Electric
  - » Gravity
  - » Seismic

# FIELD PROCEDURES CONCLUSIONS

- Initially keep it simple
  - » collect lots of samples
  - » use basic scintillometers and/or spectrometers

# LABORATORY WORK

- Essentially this means chemical analysis
- Analyse for labile and stabile U
- Analyse for as many other elements as the budget will allow for

From these data estimates of leachable U, of disequilibrium (U vs eU), and of multielement haloes are possible

# INTERPRETATION

- This is the most difficult but the most important aspect of exploration
  - » Use statistics with care
  - » Use basic statistics

# DID YOU KNOW?

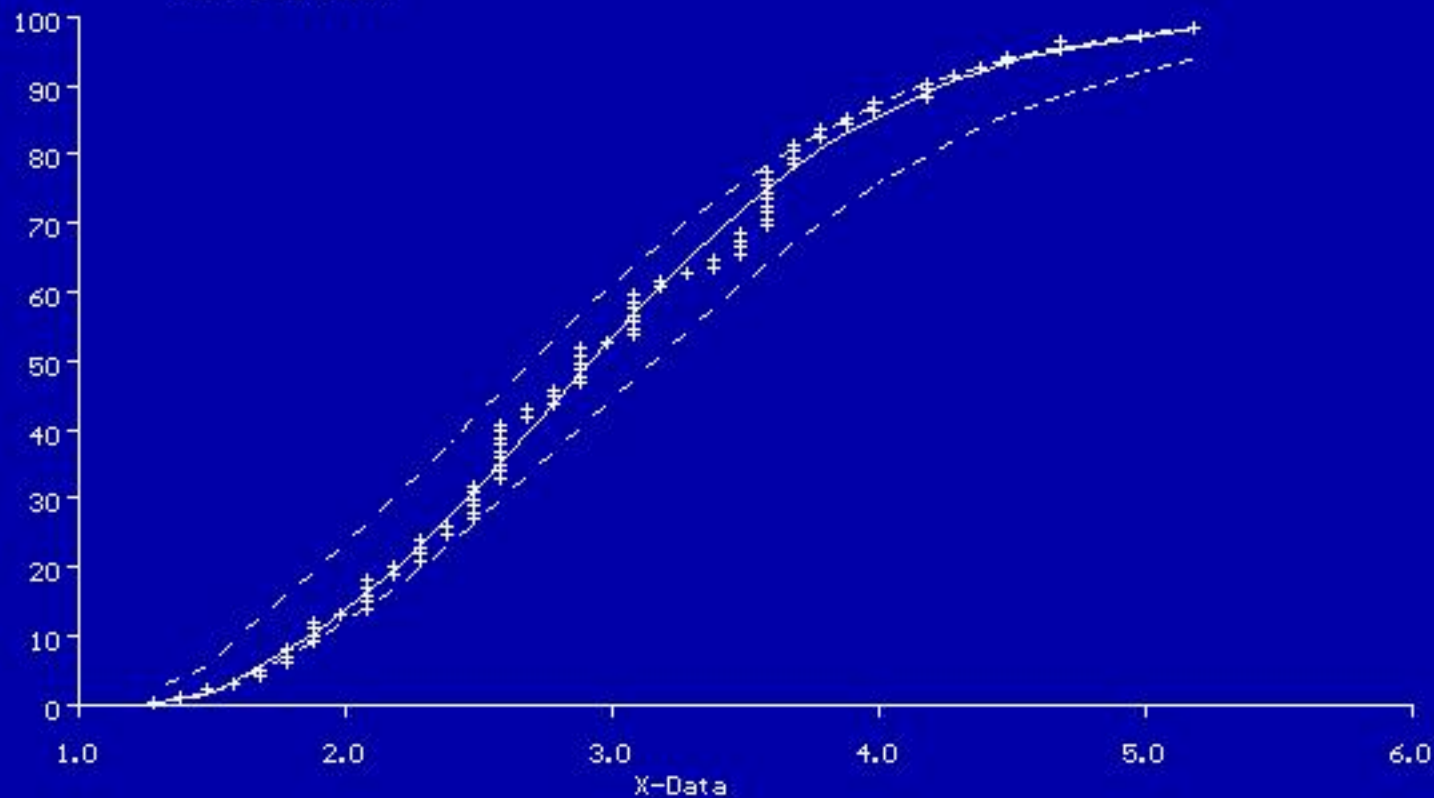
- If you do linear, quadratic, and cubic regressions using random numbers you get fits of 1.6%, 10%, and 30% respectively.

DATA FROM FARMERS' FIELDS, GOHANA, HARYANA, INDIA

X = yield of wheat (t/ha)

Cumulative frequency (%)

- + observed
- calculated
- - 90% conf.limit

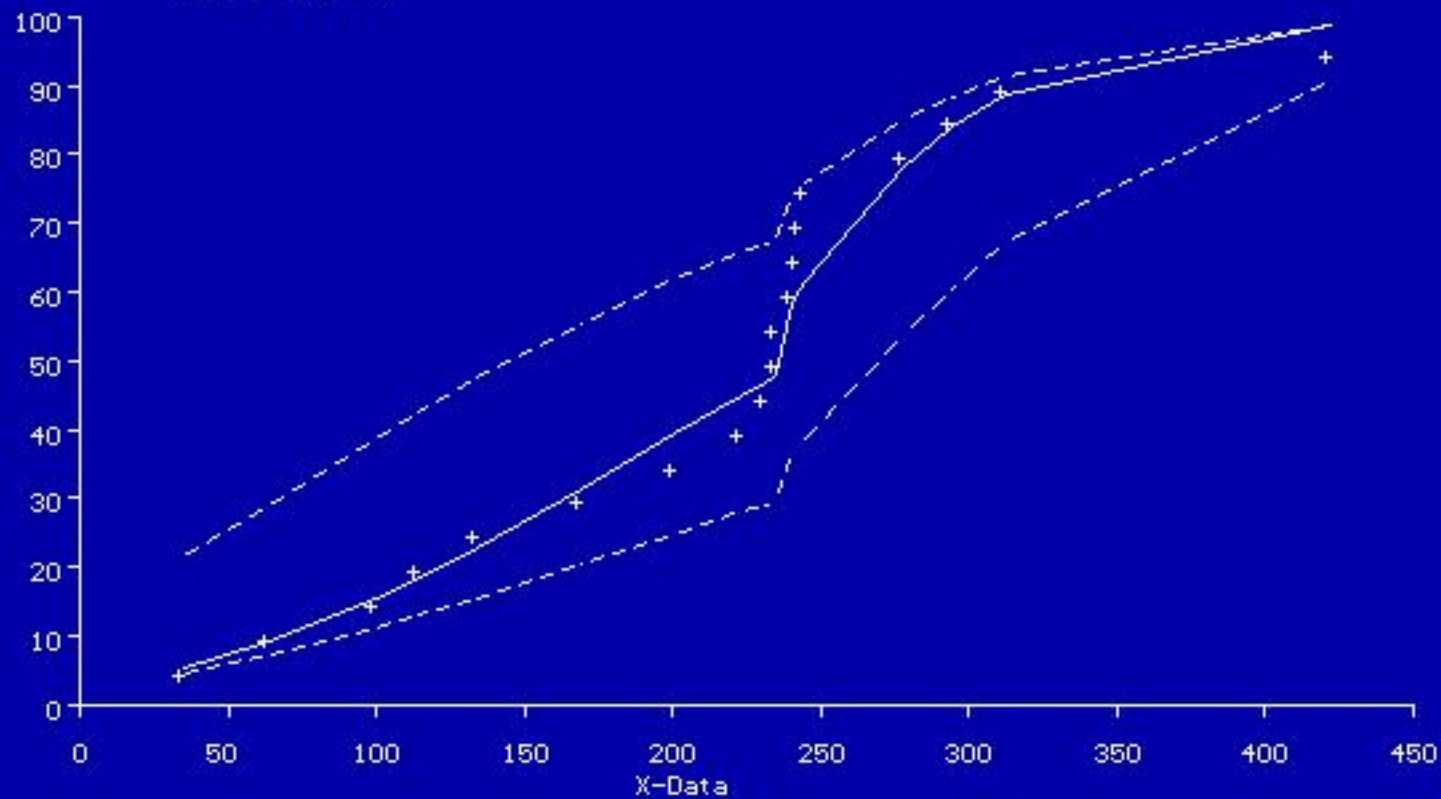


CumFreq: GOHACUM

Northern Peru

Cumulative frequency (%)

- + observed
- calculated
- - 90% conf.limit



# SIMPLE INITIAL PROCEDURES

- Mean – Median comparisons
- Probit calculation

| <i>U TD (AF)</i> |             | <i>kaolin (Al)</i> |             |
|------------------|-------------|--------------------|-------------|
| Mean             | 0.386435935 | Mean               | 19.25737408 |
| Standard Error   | 0.006285952 | Standard Error     | 0.688041576 |
| Median           | 0.36        | Median             | 15.197      |
| Mode             | 0.36        | Mode               | 0           |
| Standard Devia   | 0.163797013 | Standard Devia     | 17.92873174 |
| Sample Variance  | 0.026829462 | Sample Variance    | 321.4394219 |
| Kurtosis         | 88.17680407 | Kurtosis           | 2.953938977 |
| Skewness         | 7.35035621  | Skewness           | 1.704398553 |
| Range            | 2.73        | Range              | 93.69       |
| Minimum          | 0.09        | Minimum            | 0           |
| Maximum          | 2.82        | Maximum            | 93.69       |
| Sum              | 262.39      | Sum                | 13075.757   |
| Count            | 679         | Count              | 679         |

| <i>illite (AJ)</i> |              | <i>chlor (AL)</i> |             |
|--------------------|--------------|-------------------|-------------|
| Mean               | 76.68699705  | Mean              | 4.055630339 |
| Standard Error     | 0.824211521  | Standard Error    | 0.62606701  |
| Median             | 82.469       | Median            | 0           |
| Mode               | 100          | Mode              | 0           |
| Standard Devia     | 21.47699757  | Standard Devia    | 16.31382154 |
| Sample Variance    | 461.2614247  | Sample Variance   | 266.1407731 |
| Kurtosis           | 3.00296282   | Kurtosis          | 25.07943036 |
| Skewness           | -1.775111569 | Skewness          | 4.978257205 |
| Range              | 100          | Range             | 100         |
| Minimum            | 0            | Minimum           | 0           |
| Maximum            | 100          | Maximum           | 100         |
| Sum                | 52070.471    | Sum               | 2753.773    |
| Count              | 679          | Count             | 679         |

# The Probit

- Probit =  $((\text{value} - \text{mean}) / \text{std dev}) + 5$

The above gives results from 0 -10

Ignore the +5 and the results are from -5 to +5

# FINALLY, REMEMBER

- THE REASON WE NEED A LOT OF EXPLORATION GEOLOGISTS IS BECAUSE ORE DEPOSITS ARE DIFFICULT TO FIND