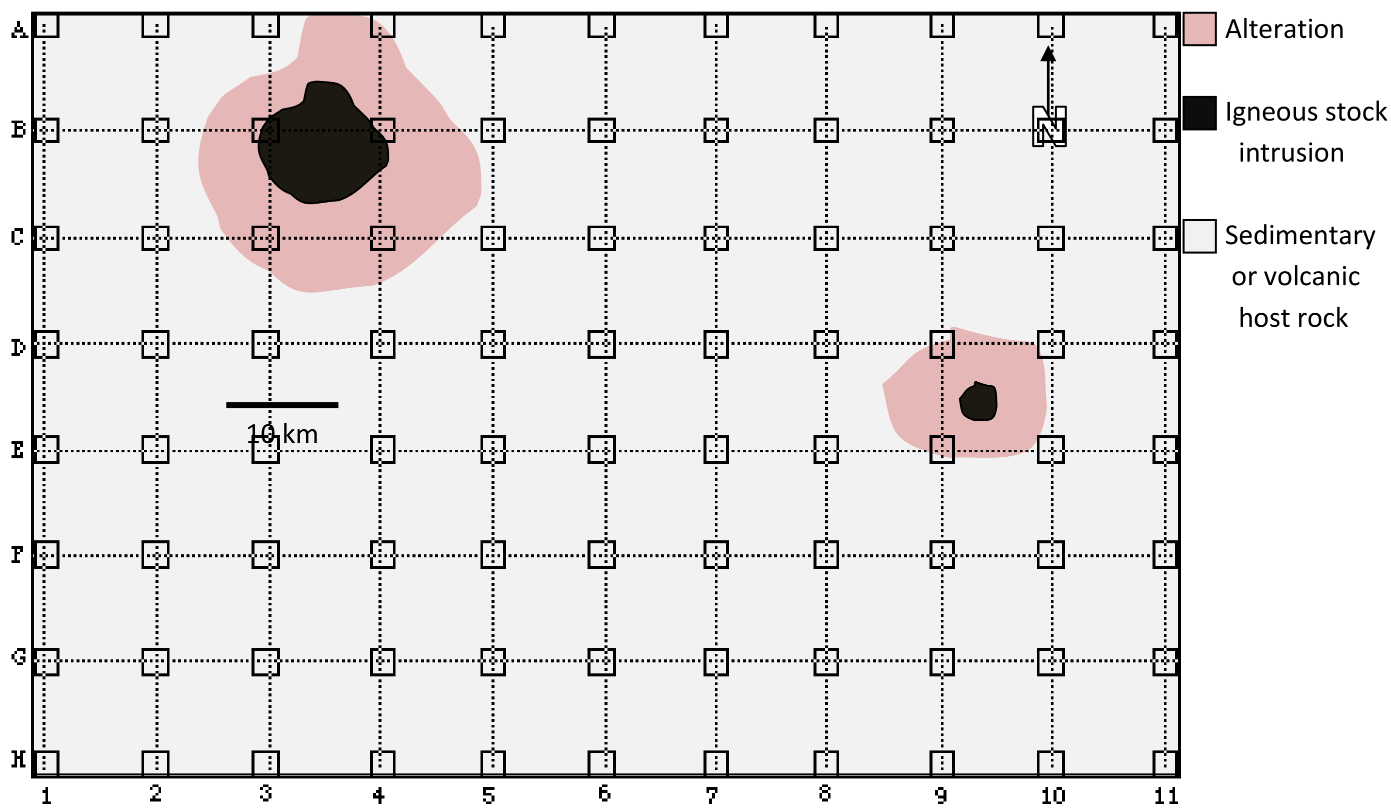
Learning Goals:
-What is an ore deposit?
-What is a porphyry copper deposit?
-Plot data from table to map.
-Calculate ore grade of selected area and determine if it is economic.

Background knowledge needed for activity:
-3 rock types
-understanding of how to read a map.

Activity:

Copper Longhorn Exploration Company is searching for the next big copper deposit in the southern Arizona area. The company geologists have already spent time in the field creating a geologic map of the area. Here is a simplified version of their map.

1. Where would you expect copper to be found based on what you just discussed in class? Draw on the map below. Why? **Igneous intrusion with surrounding alteration.**



It is now your turn to use geochemical information to help locate the deposit. Geologists have collected soil samples from across the prospective area. These samples provide us with copper concentrations which will help you to decide where to drill. Copper grade is the concentration of copper in the ore rock. To calculate the grade of copper for the sample, geologists use the equation**:**

(amount of copper metal/amount of copper ore rock)*100

2. If a deposit area has 200lbs of copper in 10,000lbs of ore rock, what is the grade?
   200/10000*100=2%
3. If a deposit area has 6 tons of copper in 1,000 tons of ore rock, what is the grade?
   6/1000*100=0.6%

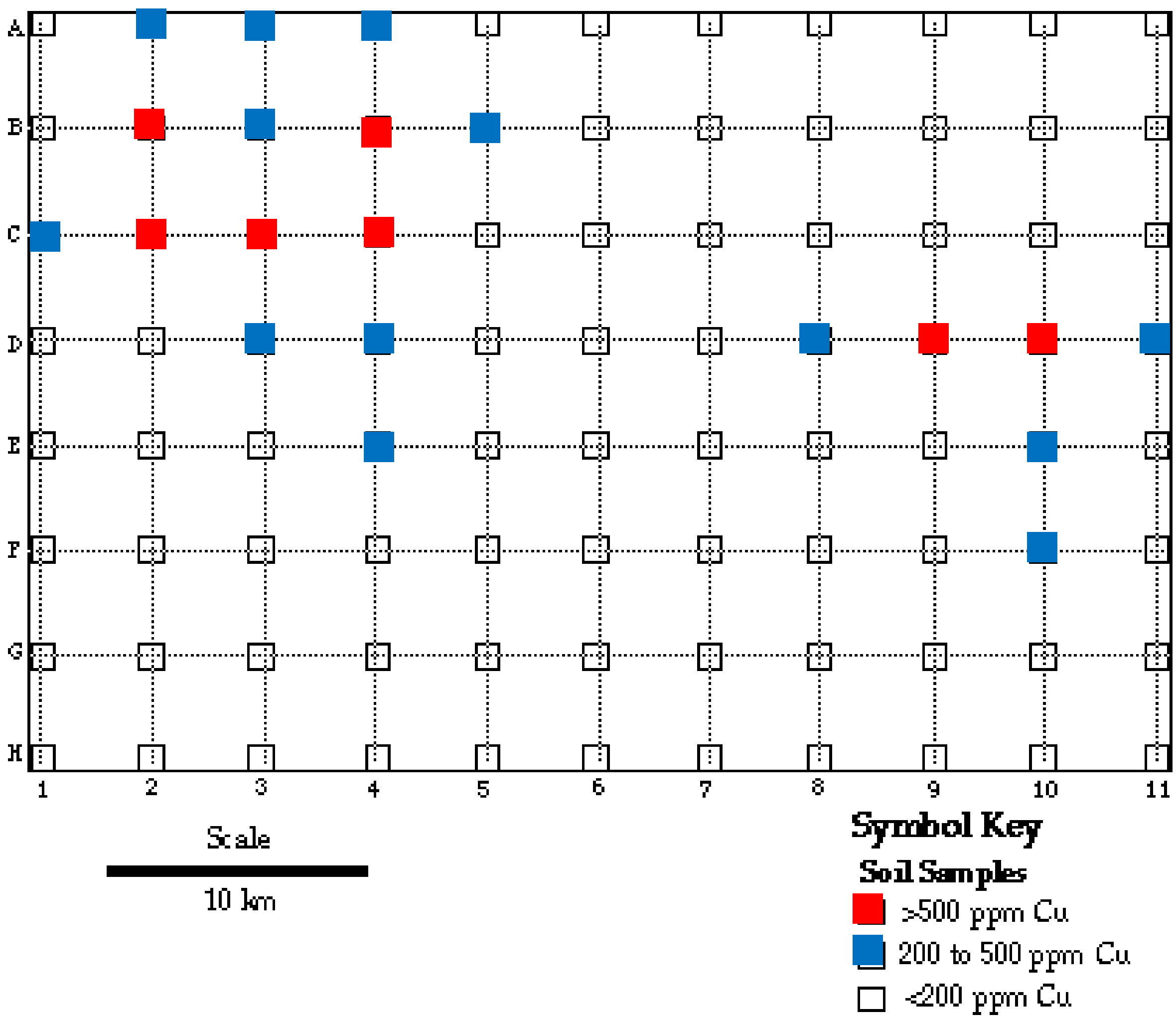
Typical mines today have ore grades of only 0.6 percent copper. Since metal concentrations occur at much lower grades, the copper concentrations are measured in parts per million (ppm). If a sample has 1ppm copper, this means that in 1 million lbs of rock, there is 1 lb of copper.

4. If a copper concentration comes back from the lab as 100ppm of copper, how many lbs of rock must be mined to have 100lbs of copper?
   100lbs Cu/x=100/1,000,000ppm= 1,000,000lbs

To determine if these concentrations are economic for Copper Longhorn to begin mining, they must look at the size of the deposit, the grade or concentration, mining costs and clean up/environmental costs. That is a lot to think about before they even start mining! We must overcome the production costs for the mine to be profitable.

This is your section map with locations of all the soil samples. Use the copper concentration table to determine where you would like to drill for exploration.

5. Color in the squares to indicate the copper concentration. Use red for any sample location >500ppm and blue for anything >200 but <500. Do not color in any location which has copper concentrations <200ppm.



Sample	Copper Concentration (ppm)	Sample	Copper Concentration (ppm)	Sample	Copper Concentration (ppm)	Sample	Copper Concentration (ppm)
A1	143	B1	188	C1	278	D1	120
A2	245	B2	780	C2	680	D2	160
A3	267	B3	344	C3	677	D3	276
A4	288	B4	570	C4	532	D4	300
A5	217	B5	322	C5	199	D5	120
A6	67	B6	156	C6	188	D6	88
A7	94	B7	98	C7	125	D7	92
A8	65	B8	56	C8	105	D8	290
A9	31	B9	103	C9	244	D9	570
A10	106	B10	144	C10	237	D10	600
A11	154	B11	128	C11	187	D11	254

Sample	Copper Concentration (ppm)	Sample	Copper Concentration (ppm)	Sample	Copper Concentration (ppm)	Sample	Copper Concentration (ppm)
E1	125	F1	160	G1	113	H1	43
E2	188	F2	154	G2	125	H2	28
E3	200	F3	189	G3	141	H3	101
E4	202	F4	120	G4	105	H4	108
E5	183	F5	108	G5	117	H5	98
E6	105	F6	111	G6	125	H6	92
E7	126	F7	105	G7	165	H7	82
E8	155	F8	58	G8	105	H8	77
E9	105	F9	85	G9	102	H9	75
E10	227	F10	215	G10	172	H10	73
E11	105	F11	100	G11	299	H11	71

6. Do your 2 maps correlate with where the copper could be located? Are the deposits where you predicted them to be?
   Yes, around the intrusions.

7. What is the cause/source of these copper deposits?
   Igneous intrusion

8. The cost of producing the ore (mining, refining and reclaimation) will be $25/ton. The eastern deposit contains 20 million tons of potential ore. The western copper deposit contains 80 million tons of potential ore but would be producing near the migratory path and breeding area of the mule deer. Environmental protection of the area surrounding the pit will add $50,000 to the final total production costs. What will be the total production costs for each deposit? Show your work. *(Remember total production costs= cost of producing the ore/ton *tons of potential ore)*
   E- $25*20,000,000=$500,000,000
   W-$25*80,000,000=$2,000,000,000+$50,000=$2,000,050,000

9. Which would you mine?

10. If the east deposit has an average grade of 2 percent copper and the west deposit has a grade of 0.6 percent copper, how many tons of copper will be produced? *(Check back to 2 and 3 if you forget how to calculate grade.)*
    E- x/20,000,000*100=2 x=400,000 tons
    W- x/80,000,000*100=0.6 x=480,000 tons

11. How many lbs of copper could be produced from each deposit? *(Remember 2000lbs=1 ton.)*
    E- 400,000 tons * 2000lbs/1 ton=800,000,000 lbs
    W- 480,000 tons * 2000lbs/1 ton= 960,000,000 lbs

12. The average price of copper in March 2012 was $3.60 per lb. Will the deposits be profitable? To be profitable, they must make more money than the total production cost.
    E- 800,000,000 lbs *$3.60/lb=$2,880,000,000
    W-960,000,000 lbs *$3.60/lb=$3,456,000,000

13. How much would each deposit gross? *(Remember to figure out how much the company will make, you must subtract how much they must spend on production.)*
    E- $2,880,000,000-$500,000,000=$2,380,000,000
    W-$3,456,000,000-$2,000,050,000=$1,455,950,000

14. If you could only mine one deposit, which would you choose? Why?
    West deposit

15. What if the price of copper dropped to $2.00? Would it be profitable to mine both deposits?
    E- 80,000,000 lbs *$2.00= $1,600,000,000
    $1,600,000,000-$500,000,000= $1.1 billion
    W-960,000,000 lbs * $2.00=$1,920,000,000
    $1,920,000,000-$2,000,050,000= -$80,050,000 in the RED