Name:_____

Lab Exercise 5 – Analysis of Lithic Assemblages from the Baker and Allen Sites

Objectives: To classify samples of debitage according to raw material type and cortical presence and test hypotheses about intra-assemblage (within assemblage) and inter-assemblage (between assemblages) variability.

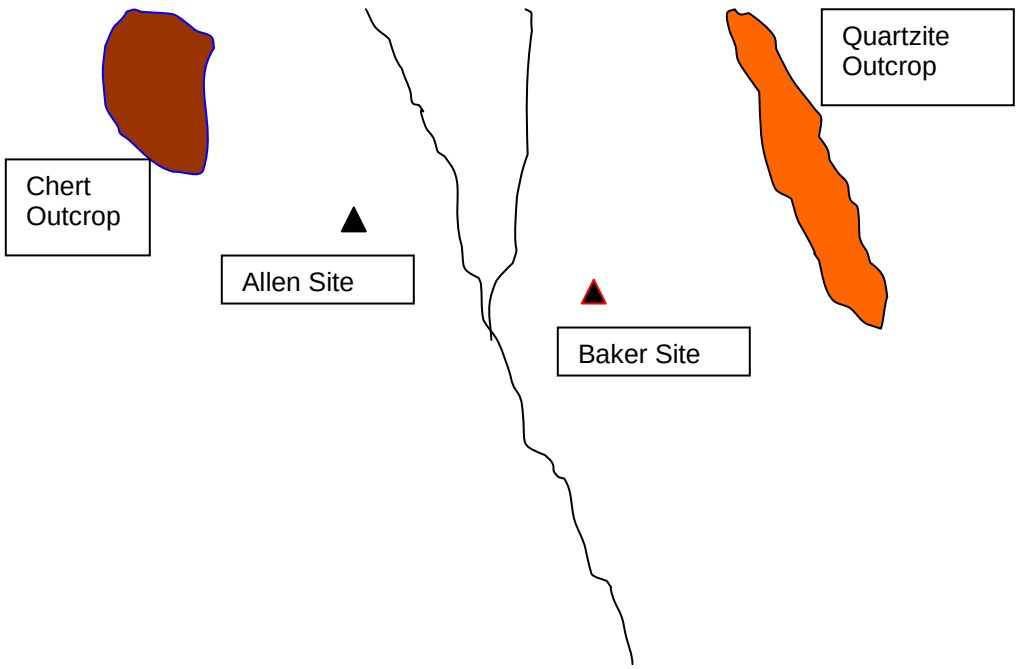
Points for this Exercise:

Completion of all analysis and tables:	25 points
Total of answers to questions	50 points

Materials: Debitage from the Allen and Baker Sites
This lab exercise
Hand calculator

The Research Objectives

For these analyses, we will consider debitage samples from the Allen and Baker Sites. These two Paleoindian sites are located in a valley that has outcrops of chert to the west and quartzite to the east, as shown in the map:



Our questions address the choices that the Allen and Baker folks made concerning their acquisition and use of stone raw materials for manufacturing their spear points. Did they practice strictly *economizing behavior* in this regard? If so, then we would expect that they would minimize their efforts and use raw materials that were closest at hand. If this were the case, then

what would you expect the frequencies of chert and quartzite to be in the two assemblages based on the locations relative to the raw material outcrops? How would you state this as a hypothesis, and how would you structure your test of that hypothesis?

While the economizing behavior idea is attractively plausible, are there any possible alternatives? What about the possibility that chert and quartzite are different with respect to properties that were important to the people who used them? These could include properties such as homogeneity that reduced the errors during biface manufacture. Also, chert and quartzite can exhibit differences in hardness that reduced the need for resharpening and increasing tool use life. Analyses of many Paleoindian assemblages have shown that in some cases they ignored local raw materials and instead either traveled to more distant sources of high quality stone, or acquired them by exchange with groups who lived closer to those sources.

These considerations suggest that while the economizing behavior hypothesis is indeed *plausible*, alternative factors exist, and we need to determine how *probable* it is that the economizing behavior hypothesis is correct.

In addition to raw material type, we will also study cortical presence in order to test the economizing behavior hypothesis. Why could this approach strengthen our analysis? The reason is based on what you have learned about making bifaces: cortical pieces are removed during the earlier stages of biface reduction. Therefore, their frequency within a given raw material category is an index of whether early or late stage reduction was executed at these sites.

Note that this aspect of the lithic reduction system also has behavioral options that could also influence our assemblage composition. This includes the possibility that the early stages of reduction were carried out near the raw material outcrops for additional economizing reasons: first, preforming and decortification can entail more errors than later stages of reduction, so it makes sense to get through those stages before transporting the stone over long distances. Second, successful pre-forming and decortification reduce the weight of materials carried to occupation sites. Thus, the data on cortical presence should play quite well in our analysis, giving us a better perspective on the raw material use practices of the Allen and Baker site Paleoindian folks.

These considerations should point out quite well that testing hypotheses about prehistoric behavior requires some thought about the alternatives we need to consider and the data we chose to test our hypotheses.

Work Groups:

You will divide into two work groups consisting of pairs of lithic analysts who will sort subsamples from each site. Each group will conduct intra-assemblage analyses for their site. After sorting your debitage samples, each group will also record their assemblage data on the board so the whole class can then conduct the inter-assemblage analyses.

Procedure for Sorting the Debitage

The assemblages from the Allen and Baker Sites consist of debitage that includes raw materials you are now familiar with: chert and quartzite, some of which are cortical and some interior. Each group will divide into work pairs that will open the bags of artifacts, sort their debitage samples, and add them to the sorting template on the table so that final counts can be determined.

Site: _____ Bag #: _____

	Cortical	**Interior**	**Total**
Chert			
Quartzite			
Total			

Sort the debitage on the sorting template into the following 2 x 2 classification:

Lithic Data from the _____ Site (Your Site)

	Cortical	**Interior**	**Total**
Chert			
Quartzite			
Total			

Have a team member go to the board and fill in your data so that both teams have the data from both sites. Copy the data from the board for the other site here, but be careful to use YOUR data for the Intra-Assemblage analysis below:

Lithic Data from the _____ Site (Their Site)

	Cortical	Interior	Total
Chert			
Quartzite			
Total			

Procedure for Intra-Assemblage Analysis

Within each assemblage, we want to see if lithic reduction at your site was accomplished in the same way for both raw material types. Our test of this is based on the frequencies of cortical and interior pieces. The frequency of cortical pieces is taken as evidence of whether initial core reduction took place on the site, and our expectation is that if this is the case then the frequency of cortical pieces will be high. But because both raw materials have some cortical debitage, our conclusion will be based on the relative frequencies of cortical pieces between the two raw material types.

The null hypothesis you are testing is:

H_o: Any differences between cortical presence and raw material type in this assemblage are due to chance.

Your procedure will be the same as was illustrated in the lab introduction, as follows:

Record the counts for the four categories of debitage in the form.

To calculate the theoretical values for your X^2 analysis, use the following formula:

$$(R_i \times C_i)/T$$

where R_i is the row total (1 for chert and 2 for quartzite), C_i is the column total (1 for cortical and 2 for interior) , and T is the total of all artifacts.

In the table below, calculate the Theoretical Frequencies using the formula shown above and put them in the their respective cells:

Theoretical Frequencies

	Cortical	**Interior**	**Total**
Chert			
Quartzite			
Total			

Now calculate the four components of the X^2 equation (for each cell), using the formula:

$$(O-T)^2 / T$$

where O= Observed and T=Theoretical

The sum of these four numbers will be your X^2.

	Cortical	**Interior**	**Total**
Chert			
Quartzite			
Total			X^2 =

The degrees of freedom as you recall is (r-1) x (c-1) = 1.

We will use the P_{95} probability for testing our hypothesis, and from the X^2 Table note that the cut-off value of X^2 is 3.84.

Question 1. (***10 points***)

Describe the result of your X^2 analysis. This is to say did you accept or reject your null hypothesis?

Inter-Assemblage Analysis of Raw Material Acquisition

Now let's compare the assemblages from the two sites, and test hypotheses about the acquisition and use of lithic raw materials by their inhabitants.

First, let's look at the raw material data from both sites that have been put up on the board. Copy those data into this table and calculate the percentages as shown:

Raw Material Frequencies

	Allen Site		Baker Site		
	N	**%**	**n**	**%**	**Total (N+n)**
Chert					
Quartzite					
Total					

Based on your observation of these data, do you think there is a significant difference in raw material frequencies between the two sites?

Your null hypothesis is:

Ho: Any differences in raw material frequencies between the Allen and Baker sites are due to chance.

Let's test that hypothesis using the X^2 statistic. We'll use the same procedure as we did for the intra-assemblage analysis above.

Calculate the Theoretical Frequencies with the formula used above, and add them to the table.

Theoretical Frequencies

	Allen Site	**Baker Site**	**Total**
Chert			
Quartzite			
Total			

As you did for the intra-assemblage analysis, calculate the four components of the X^2 equation (for each cell), using the formula:

$$(O-T)^2 / T$$

where O= Observed and T=Theoretical.

The sum of these four numbers will be your X^2

	Allen Site	Baker Site	Total
Chert			
Quartzite			
Total			X^2 =

The degrees of freedom as you recall is (r-1) x (c-1) = 1

We will again use the P_{95} probability for testing our hypothesis, and from the X^2 Table note that the cut-off value of X^2 is **3.84**.

Question 2 (***10 Points)***

What is the result of your X^2 analysis? This is to say did you accept or reject the null hypothesis?

Locational Analysis of Lithic Reduction

Now let's go back to the issue of cortical presence as an indicator of where the stages of reduction took place. For these considerations we will not use statistical analysis, but just observations of the data.

We'll compare cortical frequencies among raw material types for the two sites. Using the frequencies for the two sites you filled in earlier, complete the following tables and calculate the percentages as indicated:

CHERT CORTICAL FREQUENCIES

	Cortical (C) #	Interior #	Total (N) #	% Cortical (C/N)x100
Allen Site				
Baker Site				

QUARTZITE CORTICAL FREQUENCIES

	Cortical (C) #	Interior #	Total (N) #	% Cortical (C/N)x100
Allen Site				
Baker Site				

Critical Thinking Questions:

Question 3 (***10 Points***)

Overall, what is the relationship between site location, raw material outcrops and raw material frequencies in the Allen and Baker site assemblages?

Question 4 (***10 Points***)

Assuming that the frequency of cortical pieces is an index of early stage reduction location, how do the sites compare in terms of where chert and cortex were initially reduced?

Question 5 (***10 Points***)

Given the raw material analysis you've completed, did the Allen and Baker site groups strictly practice economizing behavior, or did they appear to have considered factors other than distance to raw material in their acquisition and reduction of stone for their bifacial tools?