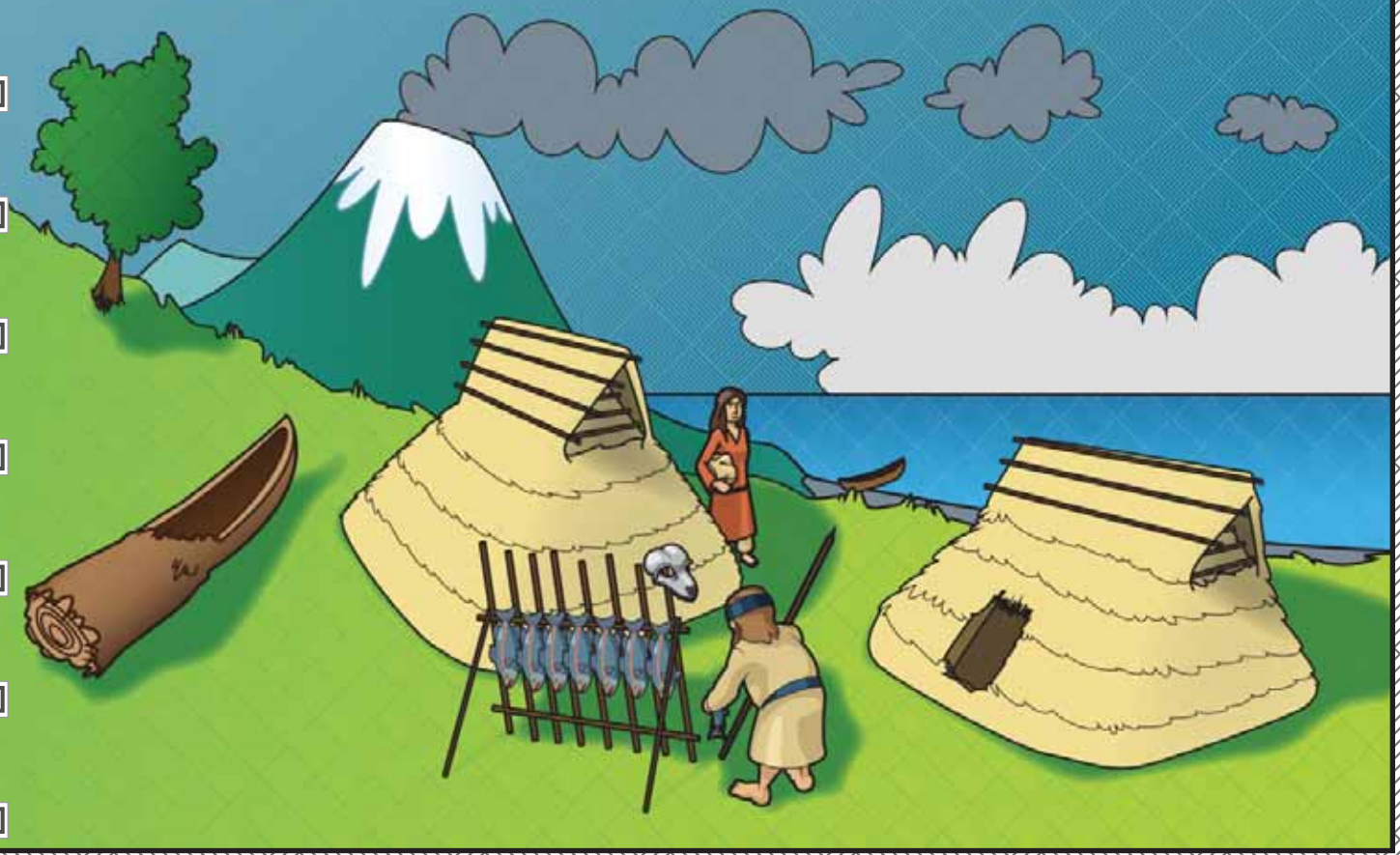
# SETTLEMENT

## Student exercises



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# Vocabulary

**Deposit:**

Sediment put down on the earth surface in the past either by natural or human action. An archaeological deposit was created by people in the past. It can include soil, artifacts, features, or other traces of human activity that signals anthropogenic (human) involvement in the deposition process. Deposits usually form layers or "strata" that stack up horizontally like a layer cake with the oldest at the bottom and the youngest at the top. As a result the oldest archaeological deposits (or geological deposits, such as volcanic ash layers) are found below younger ones, allowing us to develop histories of events by studying the stratigraphy. Even so, material within deposits can be out of place (for a number of reasons, like the action of burrowing animals) resulting in the possibility of misinterpretation of the stratigraphy of a site or excavation. (see Stratigraphy Module)

**Distribution:**

An arrangement of values according to some variable/s. For example, a geographical distribution may refer to locations of settlements according to their latitude and longitude coordinates (the variable). Or we could talk about the distribution of pottery, according to its style (the variables).

**Histogram:**

A graph visually representing the distribution of data points by showing how many data points lie within each range of two values. The distance between these two values is referred to as bin size; bins are usually of equal size.

**Landscape:**

In archaeological usage, a geographical space larger than a settlement that relates to the activities of people across space. This concept is usually used to discuss the ways past people interacted with the environment and each other in their regular movements between settlements, hunting grounds, agricultural fields, institutional facilities, monuments, resource extraction locations, etc. The area of a landscape, while left vague, typically covers areas larger than individual settlements, towns, or cities, to include multiple settlements, towns and/or cities as well as their hinterlands. Cultural landscapes like this changed through time in the past as human activities on them changed. It is an archaeological challenge to try and untangle the changing organization of human life on landscapes from the study of the archaeological sites that are found on them.

**Radiocarbon Date:**

A numerical date which approximates time of death of an organism (plant or animal) based on the amount of radioactive carbon (prone to decay) that remains in it. Radiocarbon dates are often used by earth scientists and archaeologists to understand the time lines of events, geological or cultural, respectively.

**Settlement:**

A location occupied by a group of people for some period of time. Settlements can be recognized by archaeologists by the cultural remains such as artifacts (stone tools, pottery, etc.) and features (remains of house structures or depressions, hearths, etc.) and by changes to local vegetation (human activities often enrich soils inviting lush vegetation).

**Settlement Pattern:**

A distribution of settlements during a specific time period. Settlement pattern studies reveal information about initial colonization of areas by people and eventual changes in their habitation and/or resource use.

**Site:**

A location in space. This term is used by researchers to refer to a location where data have been collected. In archaeology this term has a more specific meaning and refers to a location where archaeological materials/deposits are found in place on the landscape. The term has the implication of a concentration of archaeological material surrounded by little or no archaeological material. Archaeological sites are often the remains of settlements, though they could also have been created by any other kind of human activity in the past.

**yr BP (years before present):**

Date in the years before 1950 (e.g. 50 yr BP is the same as AD 1900).

# Background Information

Archaeologists seek to understand how people lived in the past based on the material remains people left behind, in the form of artifacts, features (e.g., house storage pits, house structures, and sometimes monumental buildings), and other traces of their activities (e.g., transformed soils, chemical stains). Some archaeological questions require the analysis of the distribution of artifacts, soil deposits, and features at specific locations called "sites," but an important part of archaeology also asks questions about changes at the broader scale of cultural landscapes. The analysis of settlement distributions across landscapes is called "settlement pattern analysis." Archaeologists use this approach to discover where people lived at different times in the past. Archaeologists generate this kind of understanding through survey, the process of looking for archaeological sites across vast areas of land.

The Kuril Biocomplexity Project surveyed the entire Kuril Archipelago between 2006 and 2008, finding a total of 68 different archaeological sites, distributed from the southern island of Kunashir to the northernmost island of Shumshu. These sites can be presented on a map showing their distribution throughout the islands. By itself this information indicates that people have lived throughout the island chain, but it does not tell us anything about how they came to live there or when, whether or not colonization occurred in a single event or multiple times, from which direction people came, or who they were.

To put archaeological settlement distributions into a historical framework, archaeologists need to assign ages to site occupations. One of the most common ways to do this today is to find organic material in the archaeological deposit (such as wood, charcoal, bone, seeds, or textiles) and submit this to a special laboratory for radiocarbon dating (see Chronology module). If the site has a deep archaeological deposit comprising multiple archaeological layers, it is important to collect several dates from different layers or depths. If the site covers a large area, it is also important to collect dates from across the site. These dates then help the archaeologist determine the history of occupation at the site and ultimately how the site formed. Combining dates from many sites provides critical information for building a picture of changes in the distribution of populations across space. This is often done by building histograms, which describe the changing frequency of settlements over time, per some standard interval (commonly labeled a "bin," e.g., per 200-year interval). As forms of statistical description, such histograms are convenient tools for looking at changes in the frequency of archaeological materials deposited over time. However, archaeologists also need to think carefully about a number of factors that can bias the pattern observed in such histograms. For example, we don't want our results to be influenced by the possibility that some sites or regions have been studied more intensively than others. To avoid these problems, we often decide to include only one date per site per histogram bin, or only one date per portion of a site per bin. Doing so minimizes the possibility that we are dating multiple samples deposited by the same group of people — in other words, double-counting them — while counting other groups only once.

# Introduction

Archaeologists sometimes estimate the history of human settlement across a region by comparing the relative proportions of **radiocarbon dates** from different site locations.

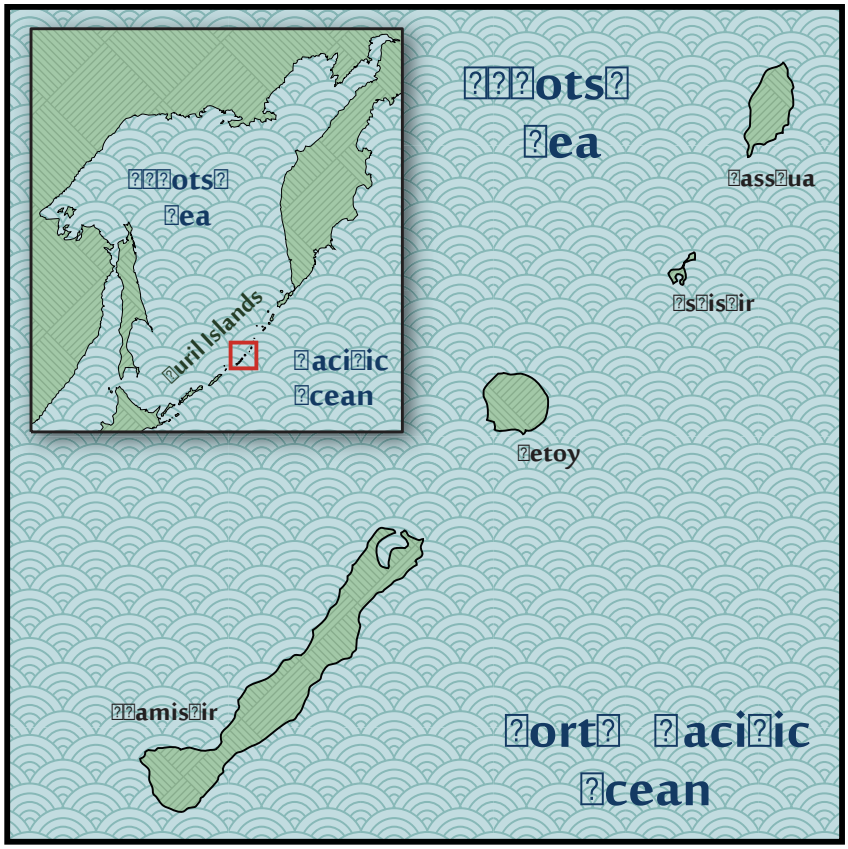
To do this, the first step is to generate a large set of **samples** for dating. That is done by finding sites through **survey**, excavating test pits and collecting charcoal, bone and other organic materials within the archaeological **strata** or **deposits**.

The next step is to submit as many of these samples as possible to a lab set up to determine the ages of the samples (for more detail on radiocarbon dating see the Chronology Module). While radiocarbon dating is expensive (between $300 and $600 per sample), having a large number of dates is important to get a clear picture of past history. The samples submitted should be randomly selected from the total to make sure that the results do not over-emphasize just one kind of site, or time period.

When the lab sends back the results, the third step is to count the number of dates per time period and to look at changes through time. A larger number of dates in one time period than another might tell us that more people were living in the region during that period compared to other times.

The fourth step is to try and explain the changes seen in the histograms. In this exercise, you will practice doing the third and fourth steps of this process using actual data from the Kuril Islands.

During the Kuril Biocomplexity Project, archaeologists worked in the segment of the island chain shown on this map.



## Introduction

Using survey techniques, archaeologists found prehistoric human settlements, which they tested to find datable materials. They then sent organics like wood and charcoal to be dated to find out when each island was occupied. The attached table of radiocarbon dates shows the results from these tests (Fig 1 & 2). To be able to tell whether there were significant changes in the populations of different islands (or even abandonments of some islands) your task is to compare the dates from each island. To do this, you will construct histograms from radiocarbon dates. Histograms are graphs plotting the frequency (quantity or number) of radiocarbon dates from each of a given interval or "bin" size (e.g., 100, 200, or 400 years per time step). A histogram is a convenient way to look at changes through time.

## Step 1 :

Plot the number of dates on the graphs provided, grouping them into sets per time interval (bin). Your teacher will indicate whether you will plot dates using the same interval on all three islands or take one island and use three different bin sizes for the dates from that island.

For example, if you are using bins having 100-year bin widths, you would count the number of dated samples that fall between 1,600 and 1,699 years BP (before present), then 1,700 to 1,799 years BP, and so on. If you have counted eight samples falling between 1,600 and 1,699 years BP, you would then shade in a bar that is eight units high in the column between 1,600 and 1,700 years BP. Follow the same procedure for all intervals.

## Step 1:

After drawing/completing the histograms, answer the following questions :

**Question 1:**

a. How similar are the occupation histories of the different regions?

b. Does it look like people live in all three regions at the same time?

c. Did they leave all three regions at the same time?

**Question 2:**

If the histograms differ by region, are the patterns complementary? That is, might people have abandoned one island in favor of one of the other two?

## Shimushir

| Sample Number | $^{14}$C Age (years BP) reported with error term |
|---|---|
| AA-44258 | 1003 ± 43 |
| AA-44259 | 1121 ± 38 |
| AA-44260 | 1164 ± 44 |
| AA-44261 | 1011 ± 40 |
| AA-44262 | 1818 ± 43 |
| AA-44263 | 935 ± 42 |
| AA-40944 | 1695 ± 36 |
| AA-44264 | 1732 ± 43 |
| AA-44265 | 897 ± 38 |
| OS-59199 | 1940 ± 40 |
| OS-59197 | 1600 ± 25 |
| OS-59381 | 1090 ± 25 |
| OS-59421 | 1300 ± 30 |
| OS-59346 | 1740 ± 30 |
| OS-59201 | 1650 ± 25 |
| OS-59202 | 1260 ± 30 |
| OS-59203 | 1700 ± 30 |
| OS-59204 | 1820 ± 30 |
| OS-67420 | 1800 ± 25 |
| OS-67269 | 1470 ± 30 |
| OS-67616 | 1100 ± 30 |
| OS-67586 | 1690 ± 30 |
| OS-67617 | 1570 ± 25 |
| OS-67470 | 1930 ± 35 |
| OS-67471 | 1280 ± 25 |
| OS-67587 | 1850 ± 30 |
| OS-67472 | 1930 ± 30 |
| OS-67492 | 1650 ± 30 |
| OS-67588 | 1100 ± 30 |

## Ushishir

| Sample Number | $^{14}$C Age (years BP) reported with error term |
|---|---|
| OS-59419 | 1130 ± 25 |
| OS-67329 | 1390 ± 30 |
| OS-59418 | 1090 ± 30 |
| OS-80150 | 430 ± 25 |
| OS-80149 | 615 ± 25 |
| OS-59420 | 100 ± 25 |

## Rasshua

| Sample Number | $^{14}$C Age (years BP) reported with error term |
|---|---|
| OS-67086 | 2430 ± 25 |
| OS-67143 | 3260 ± 30 |
| OS-67330 | 2570 ± 30 |
| OS-67130 | 30 ± 30 |
| OS-67131 | 1990 ± 30 |
| OS-79721 | 905 ± 25 |
| OS-79722 | 1000 ± 30 |
| OS-79861 | 1860 ± 30 |
| OS-79724 | 935 ± 25 |
| OS-79726 | 950 ± 25 |
| OS-79744 | 915 ± 30 |
| OS-79863 | 2250 ± 25 |
| OS-79864 | 2010 ± 30 |
| OS-79862 | 1920 ± 25 |
| OS-79727 | 245 ± 25 |
| OS-79725 | 1820 ± 25 |
| OS-79723 | 1100 ± 35 |
| OS-79865 | 2020 ± 30 |
| OS-79866 | 2040 ± 25 |
| OS-79867 | 2040 ± 30 |
| OS-79868 | 2160 ± 35 |
| OS-79741 | 1700 ± 35 |
| OS-79742 | 925 ± 30 |
| OS-79743 | 3280 ± 35 |
| OS-79728 | 315 ± 30 |
| OS-79731 | 215 ± 25 |
| OS-79730 | 205 ± 35 |
| OS-79729 | 225 ± 30 |
| OS-79896 | 2640 ± 30 |
| OS-79600 | 1930 ± 25 |
| OS-80139 | 1120 ± 50 |
| OS-79601 | 1000 ± 25 |
| OS-79602 | 3450 ± 30 |
| OS-79603 | 1940 ± 30 |
| OS-79594 | 1970 ± 30 |
| OS-79595 | 1280 ± 25 |
| OS-79596 | 905 ± 25 |
| OS-79597 | 1970 ± 25 |
| OS-79598 | 2260 ± 30 |
| OS-79599 | 835 ± 30 |
| OS-80015 | 1810 ± 25 |
| OS-80016 | 1920 ± 30 |
| OS-80017 | 2130 ± 25 |
| OS-80018 | 2080 ± 25 |
| OS-80019 | 1720 ± 25 |
| OS-80020 | 1670 ± 30 |
| OS-79668 | 1950 ± 25 |
| OS-79669 | 2080 ± 25 |
| OS-79670 | 2110 ± 25 |
| OS-79671 | 2210 ± 25 |

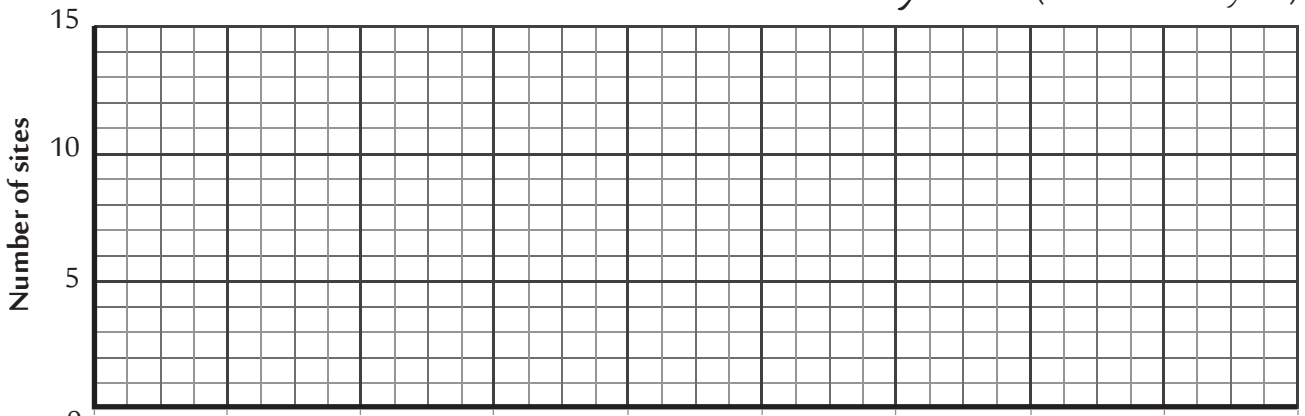
| Sample Number | $^{14}$C Age (years BP) reported with error term |
|---|---|
| OS-79720 | 2430 ± 25 |
| OS-79665 | 2860 ± 25 |
| OS-79666 | 2480 ± 35 |
| OS-79667 | 2660 ± 25 |
| OS-79604 | 2490 ± 25 |
| OS-79664 | 170 ± 30 |
| OS-79859 | 2230 ± 30 |
| OS-79860 | 830 ± 25 |
| OS-67133 | 130 ± 25 |
| OS-67134 | 1720 ± 30 |
| OS-67135 | 1100 ± 35 |
| OS-67136 | 1190 ± 35 |

Name: _____

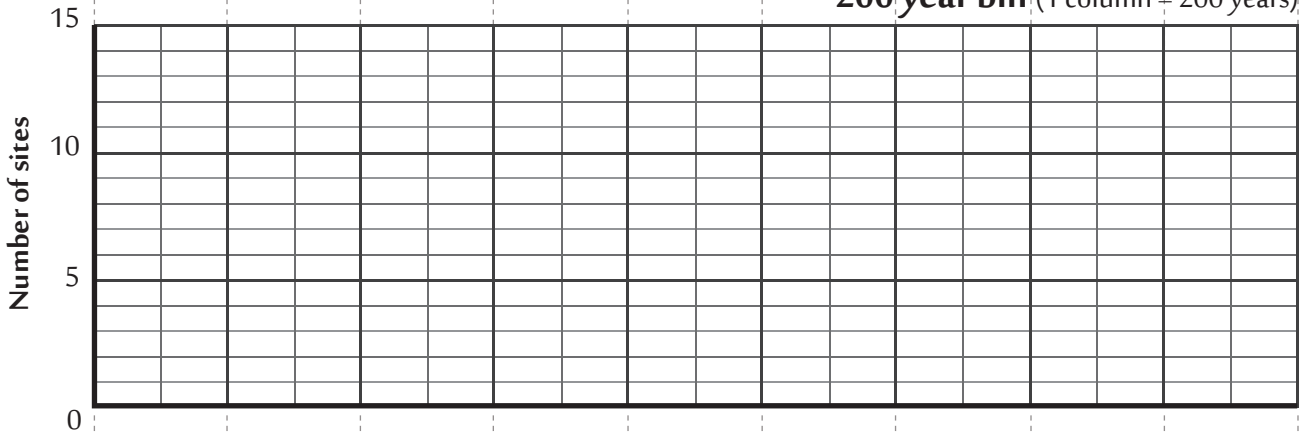
## Step 1:

Question 1 - Simushir

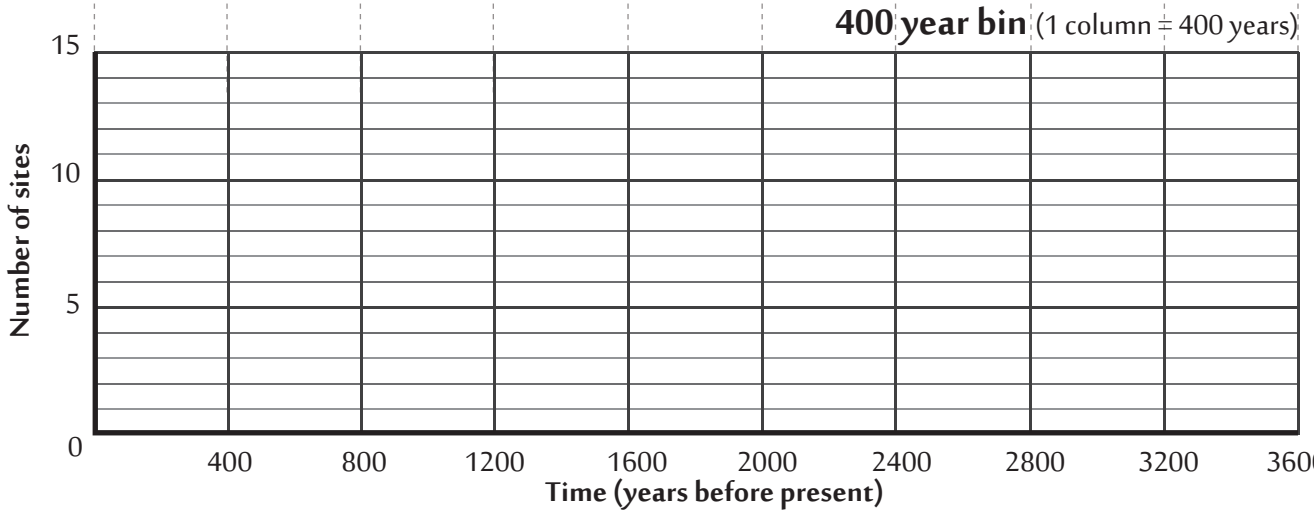
**100 year bin** (1 column = 100 years)




**200 year bin** (1 column = 200 years)




**400 year bin** (1 column = 400 years)

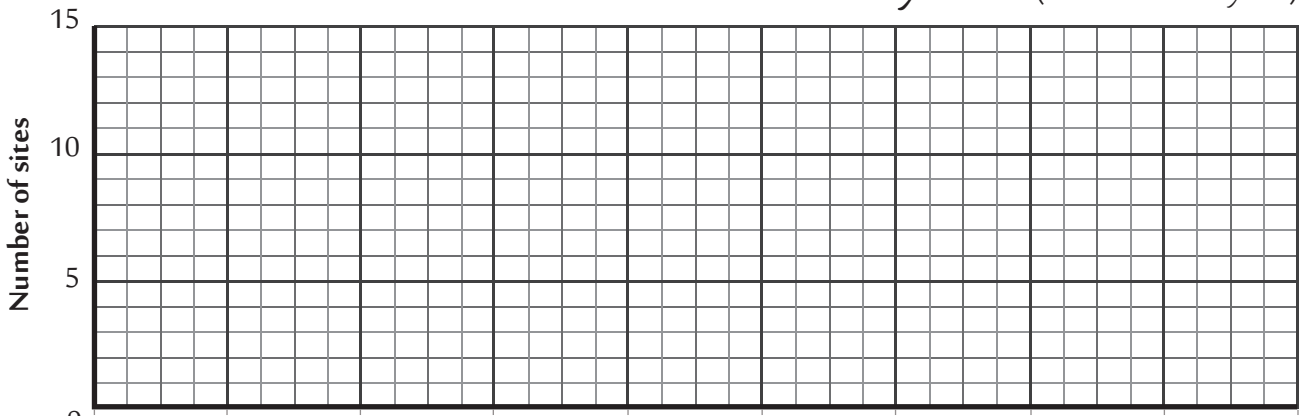


Name: _____

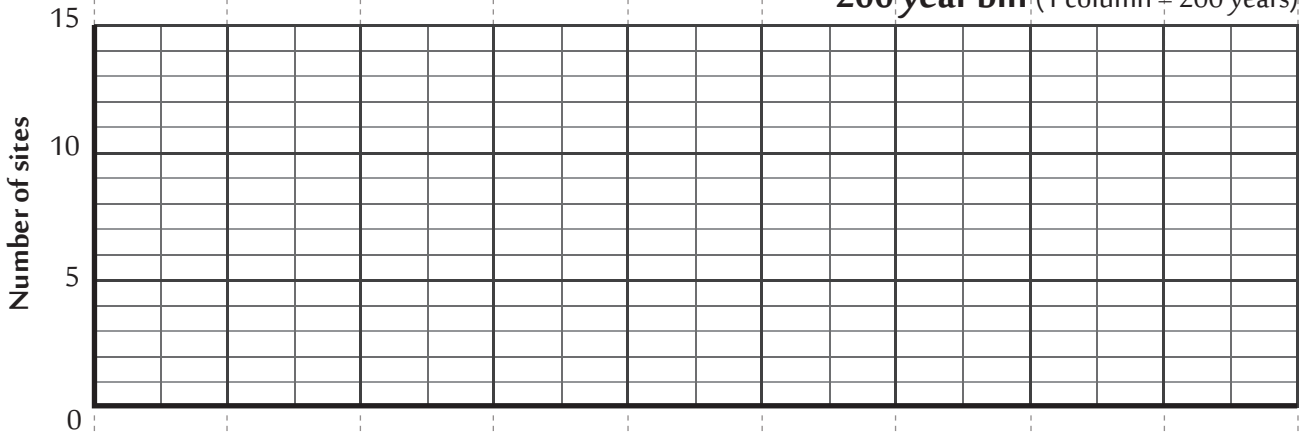
## Step 1:

Question 1 - Ushishir

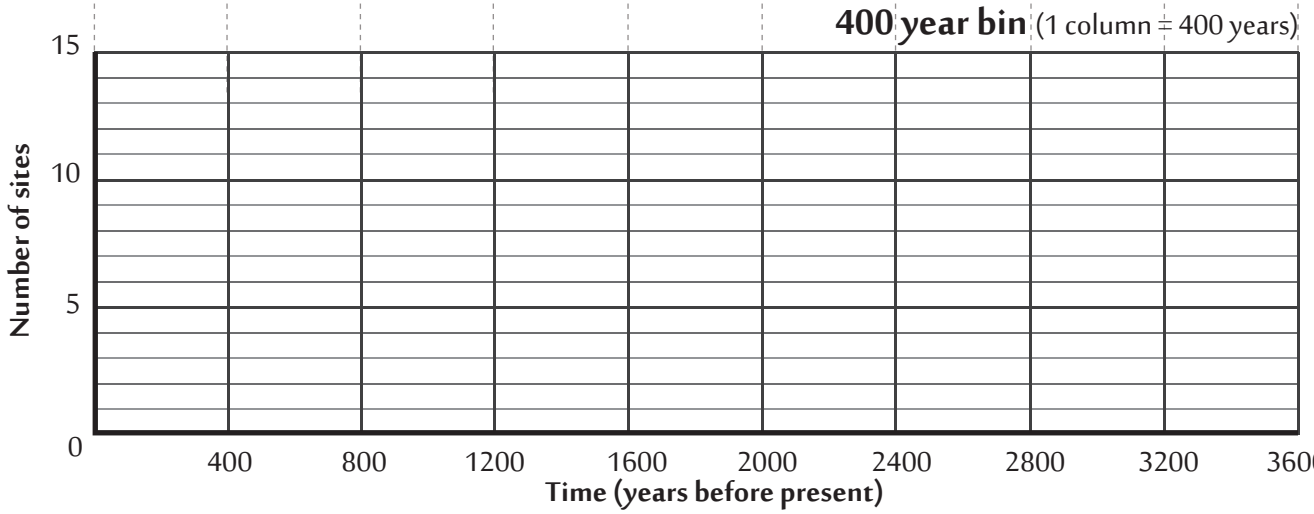
**100 year bin** (1 column = 100 years)




**200 year bin** (1 column = 200 years)




**400 year bin** (1 column = 400 years)



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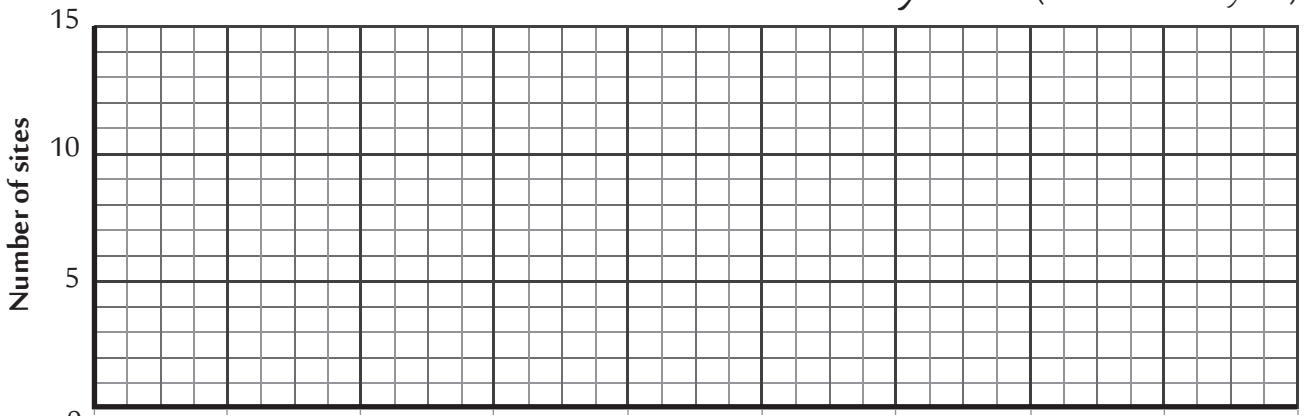
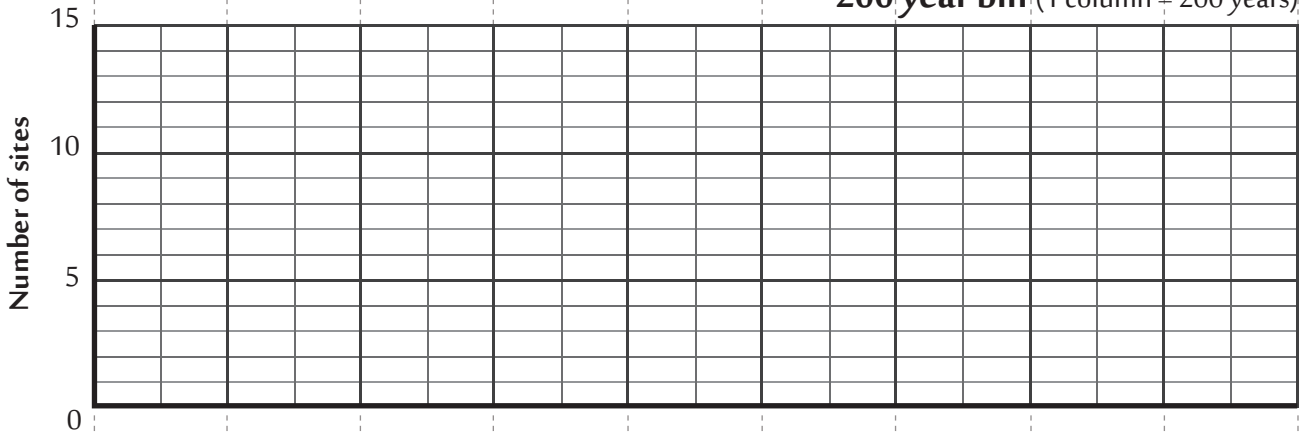
## Step 1:

Question 1 - Rasshua

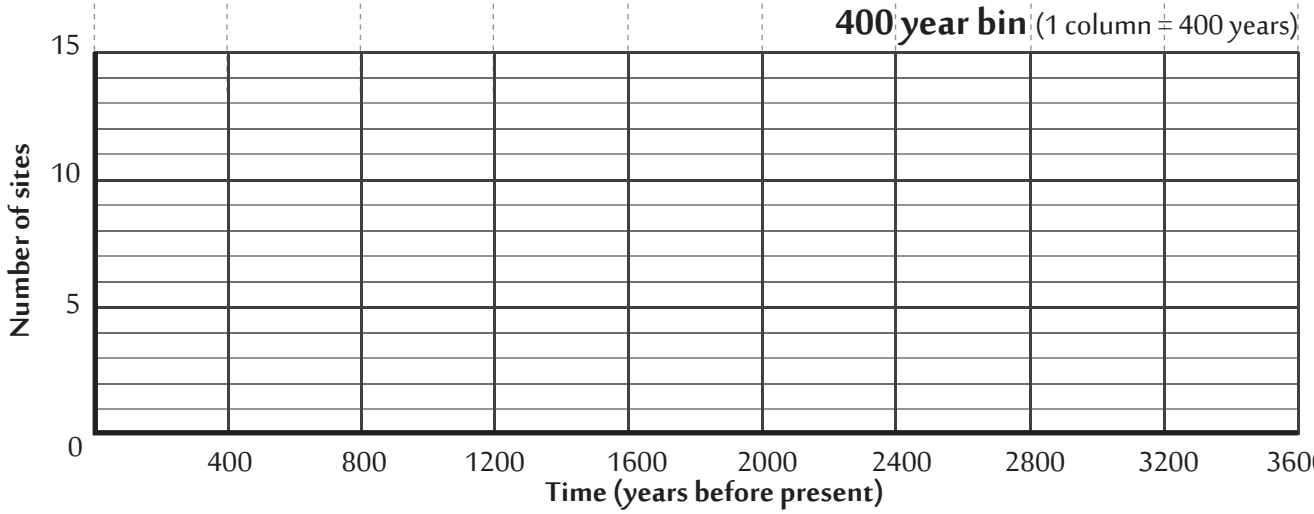
**100 year bin** (1 column = 100 years)




**200 year bin** (1 column = 200 years)




**400 year bin** (1 column = 400 years)

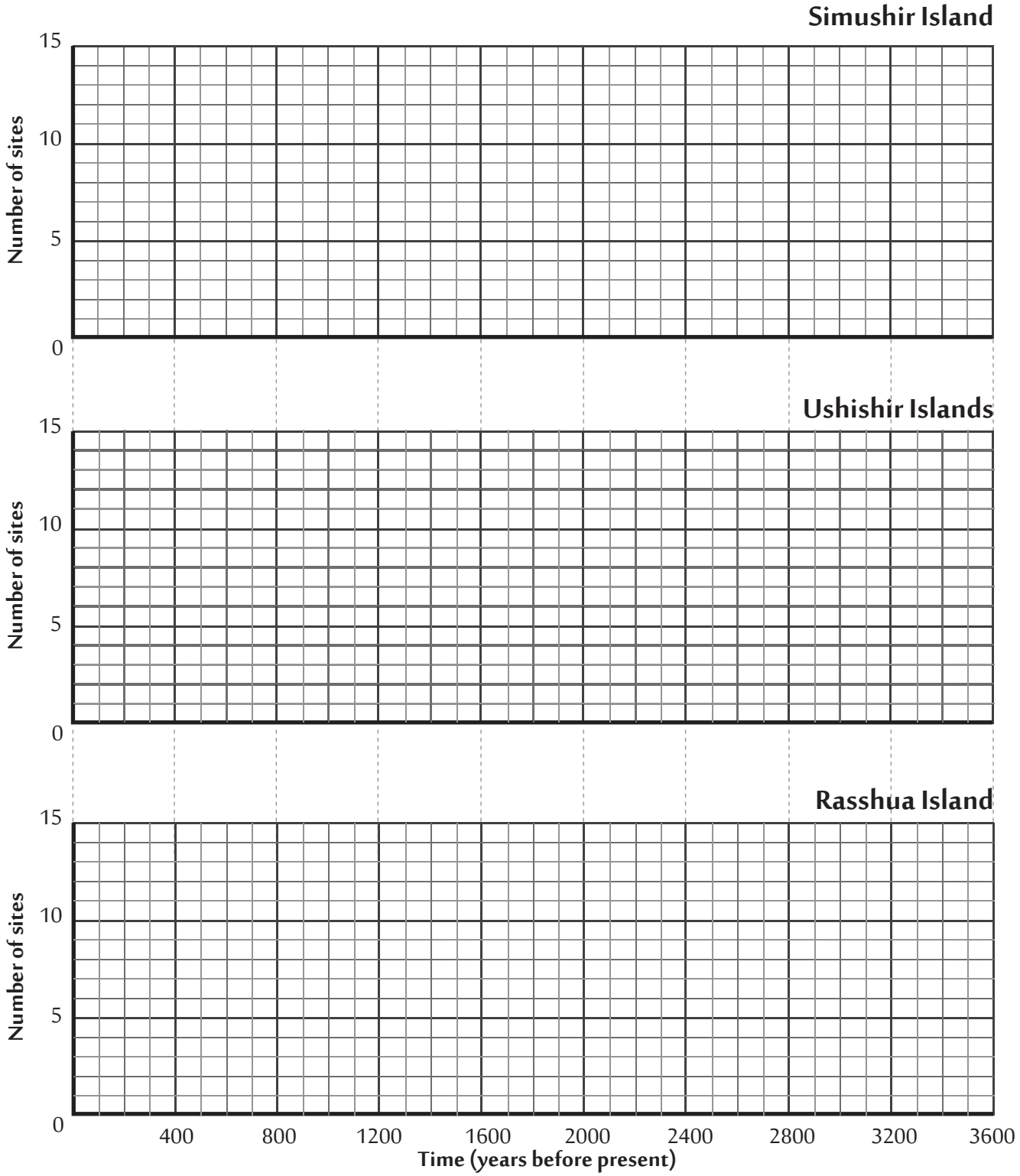


Name: _____

## Step 1:

100 year Bin

(1 column = 100 years)

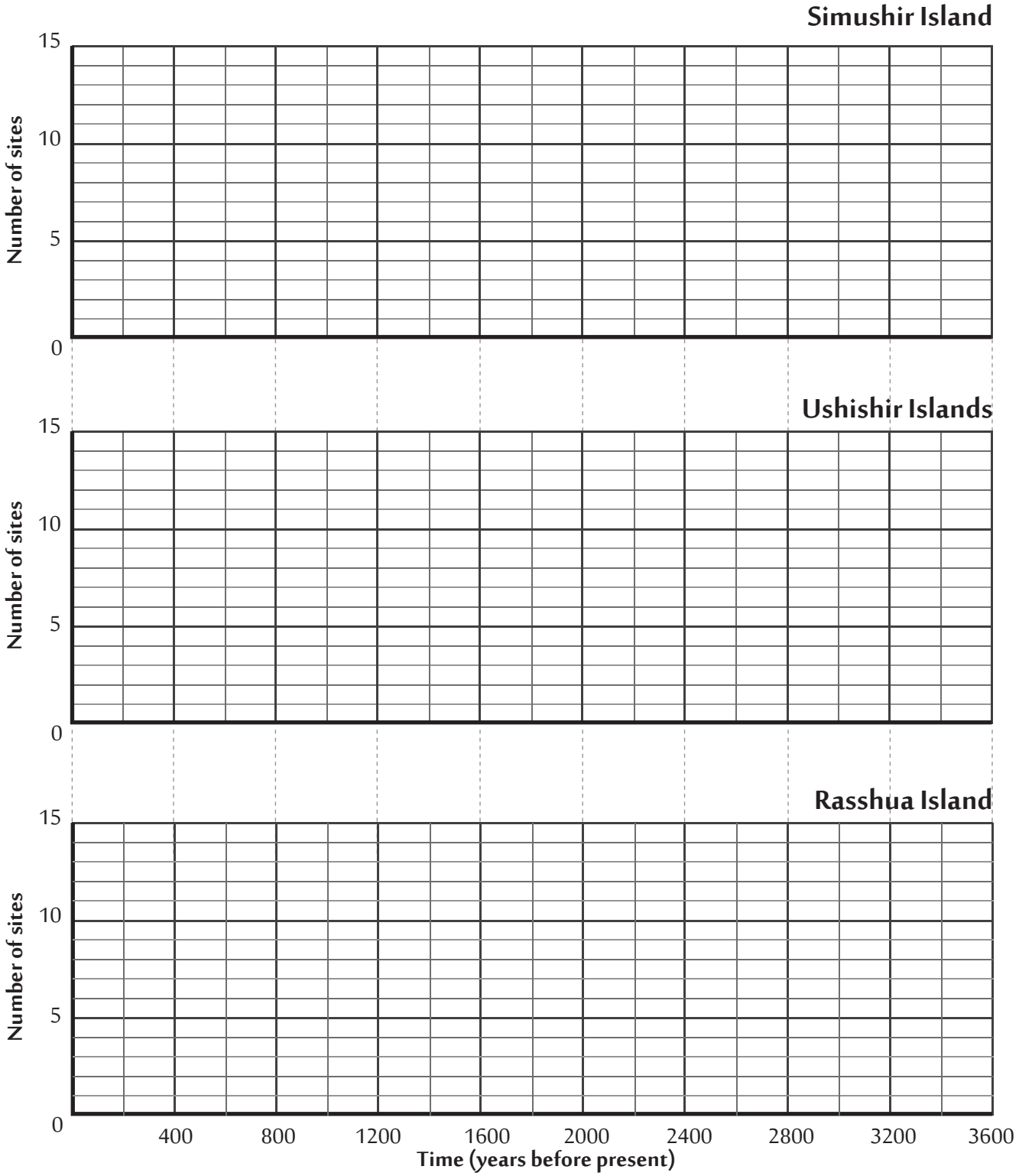


Name: _____

## Step 1:

200 year Bin

(1 column = 200 years)

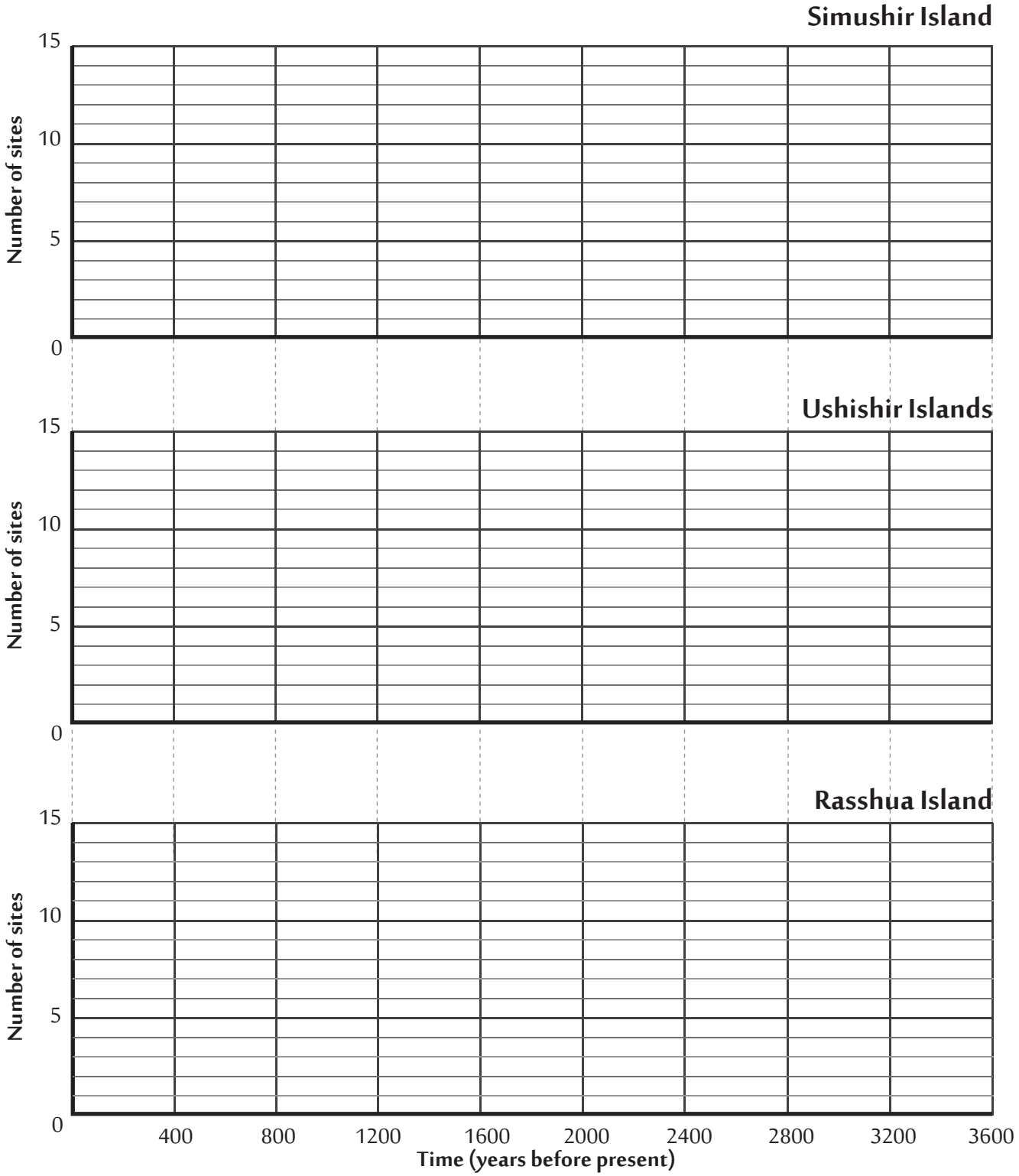


Name: _____

## Step 1:

400 year Bin

(1 column = 400 years)



## Step 2 - Introduction:

Now you are going to compare your population histories with information about environmental impacts and changes, to see if you can explain why settlement patterns changed over time.

When archaeologists were looking for the settlements left behind by the prehistoric inhabitants of the Kurils, geologists were researching the geological history of the islands, using radiocarbon dating and other methods to determined when the largest volcanic eruptions and tsunamis in the area occurred. Meanwhile, paleoclimatologists studied lake cores and other evidence to determine when the climate was wetter or drier, cooler or warmer, in the region.

Examine the results of their studies. Compare these results to the histograms you created. You might want to indicate on your histograms when these environmental events or changes occurred. This will help you to see the relationships between human populations and natural conditions. Then answer the following questions.

### Question 3:

a. Do the patterns of movement correspond to **catastrophic events** recorded for the region? (see tables on next page). For example, can you justify an argument that volcanic eruptions or tsunamis, or climate changes forced island abandonment or movement of population from one island to another?

b. How convincing are your conclusions to you (how well do the patterns match up?)

Name: _____

Step 2

## Question 4:

Step back and look critically at the analyses you conducted. Do you think there may be problems with the way this analysis was done?

a. Are there problems with the data sets and what would be needed to reduce those problems, if any?

b. What assumptions do you think go into doing this analysis (list several)? For example what has to be assumed to treat a single radiocarbon date as an indication of a unit of population (number of people)?

c. Are there problems with these assumptions?

d. How convincing are the correlations between settlement changes and environmental effects?

Name: _____

**Part 2:**
Natural Events Data

## Climate:

| Age of Event | Notes |
|---|---|
| 0-200 years BP | warm |
| 200-700 years BP | cold/dry |
| 700 - 1,100 years BP | warm |
| 1,100-2,000 years BP | cold/dry |
| 2,000-2,400 years BP | cooling |

Climatic conditions were determined using proxies such as lake cores

## Eruptions:

| Volcano | Island | Age of the Event |
|---|---|---|
| Zavaritsky 1 | Simushir | 1,000 years BP |
| Us-Kr | Ushishir | 2,000 years BP |
| CKr | Iturup* | 2,400 years BP |
| Sarychev | Matua ** | 2,600 years BP |

Volcanic eruption ages were determined by dating tephras left from each eruption.

**Notes:**

*Iturup Island is over 200 km south of Simushir Island

**Matua Island is ~40 km north of Rasshua Island

**Years BP:** years before present (before 1950)

## Tsunami:

| Number | Age if the Event | Notes |
|---|---|---|
| 1 | 100 years BP | |
| 2 | 400 years BP | |
| 3 | 700 years BP | |
| 4 | 800 years BP | |
| 5 | 900 years BP | |
| 6 | 1,250 years BP | |
| 7 | 1,500 years BP | |
| 8 | 1,600 years BP | |
| 9 | 2,750 years BP | (possibly) |
| 10 | 2,900 years BP | (possibly) |

Tsunami ages were determined by dating layers of beach sand deposited by the large waves on the affected islands.