Continuation
of . . . . .

THE NATS 101-GC TREE-RING EXTRAVAGANZA!!

Assignment I-4:

The Bristlecone Pine (BCP) Research Project

MAIN GOAL OF TODAY:

PART A: SITE DESCRIPTIONS

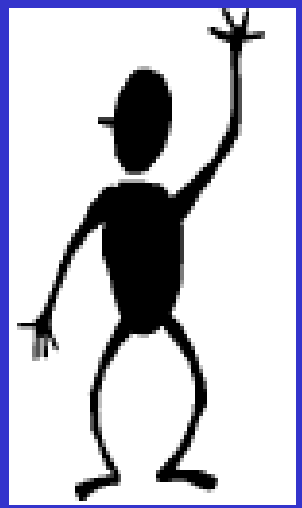
PART B: ANALYZING YOUR SITE

PART C: SITE-TO-SITE COMPARISONS

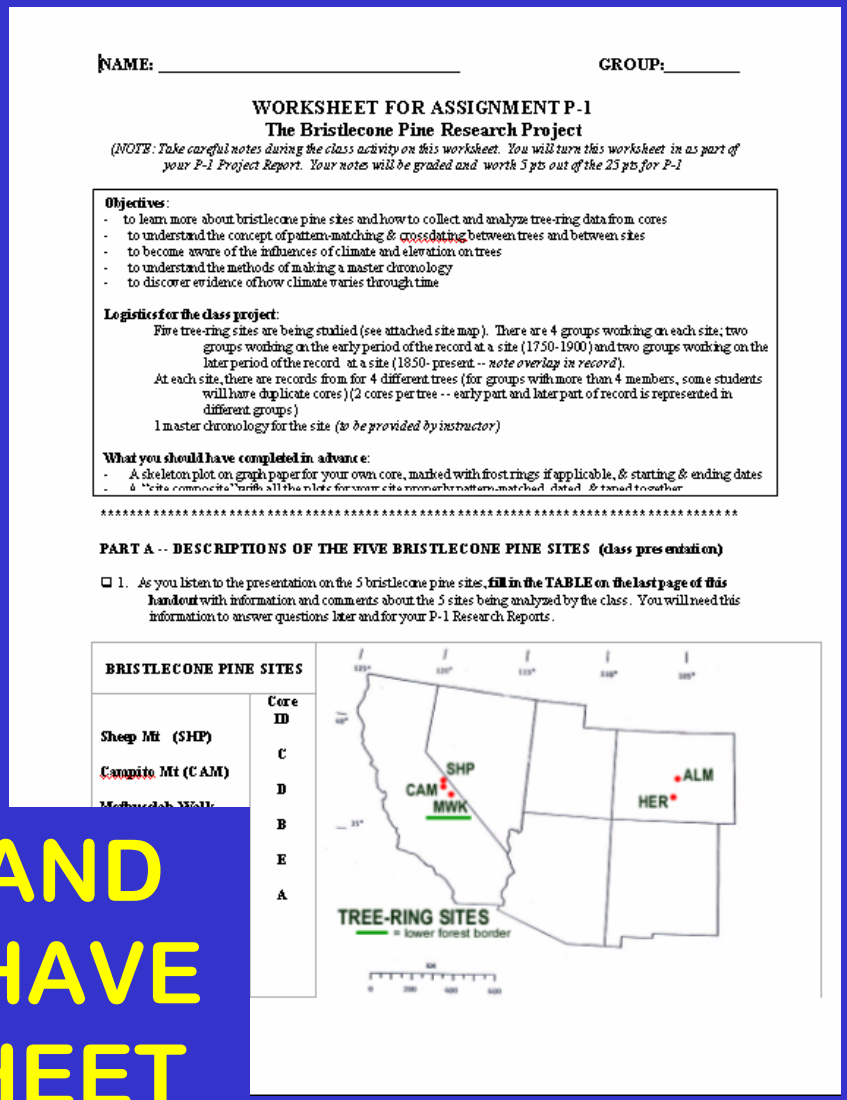
PART D: DEVELOPING & TESTING HYPOTHESES

TAKE YOUR OWN NOTES ON YOUR I-4 WORKSHEET

You'll turn it in for 10 of the 50 pts in your BCP RESEARCH REPORT



RAISE YOUR HAND IF YOU DON'T HAVE YOUR WORKSHEET WITH YOU!



NAME: _____ GROUP:_____

WORKSHEET FOR ASSIGNMENT P-1
The Bristlecone Pine Research Project

(NOTE: Take careful notes during the class activity on this worksheet. You will turn this worksheet in as part of your P-1 Project Report. Your notes will be graded and worth 5 pts out of the 25 pts for P-1

Objectives:
- to learn more about bristlecone pine sites and how to collect and analyze tree-ring data from cores
- to understand the concept of pattern-matching & crossdating between trees and between sites
- to become aware of the influences of climate and elevation on trees
- to understand the methods of making a master chronology
- to discover evidence of how climate varies through time

Logistics for the class project:
Five tree-ring sites are being studied (see attached site map). There are 4 groups working on each site; two groups working on the early period of the record at a site (1750-1900) and two groups working on the later period of the record at a site (1850- present -- *note overlap in record*).
At each site, there are records from for 4 different trees (for groups with more than 4 members, some students will have duplicate cores) (2 cores per tree -- early part and later part of record is represented in different groups)
1 master chronology for the site *(to be provided by instructor)*

What you should have completed in advance:
- A skeleton plot on graph paper for your own core, marked with frost rings if applicable, & starting & ending dates
- A "site composite" with all the plots for your site properly pattern-matched, dated, & taped together

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PART A -- DESCRIPTIONS OF THE FIVE BRISTLECONE PINE SITES (class presentation)

☐ 1. As you listen to the presentation on the 5 bristlecone pine sites, **fill in the TABLE on the last page of this handout** with information and comments about the 5 sites being analyzed by the class. You will need this information to answer questions later and for your P-1 Research Reports.

BRISTLECONE PINE SITES

	Core ID
Sheep Mt (SHP)	C
Campito Mt (CAM)	D
[illegible]	B
	E
	A

Take your OWN notes on the WORKSHEET

It will be evidence that YOU did the research & writing for your OWN report

PART B -- ANALYZING YOUR SITE

☐ Your Preceptor will gather together the 2 teams that analyzed the same site (the early part of the record & the later part of the record) into a **SITE GROUP**. Your Preceptor will present and explain the full chronology of the measured **ring-width indices** for your site and point out key things to notice. **Discuss** what you discovered about your site (e.g., variations, frost rings, and trends -- Are there differences between pre-1900 ring widths and post-1900 ring widths and frost ring frequency?)

✍ Enter the name of your site:

Data collection & Observations from your site's **SKELETON PLOT MASTER:**

✍ Enter the **years** during which **frost rings** formed at your site:

✍ Describe the relationship between **frost ring years** and **narrow ring years** (if any):

✍ Describe **differences (if any) between pre-1900 & post-1900 frequency of frost rings**:

Data collection & Observations from your site's **RING WIDTH INDICES PLOT :**

✍ Describe the **variation** in the time series of the **ring width indices** at your site (e.g., *increasing trend, no trend, step change beginning at 1900, etc. etc.)*

OBSERVATION TABLE (last page of WORKSHEET)

VARIABLES *(NOTE: A variable is something that varies from site to site or from time to time at one or more sites)*	OBSERVATION TABLE: SITE-to-SITE COMPARISONS				
	Sheep Mt Core ID = C	Campito Mt Core ID = D	Methuselah Walk Core ID = B	Almagre Mt Core ID = E	Hermit Lake Core ID = A
Geographic Location					
Elevation					
Upper or Lower Forest Border?					
Moisture- or Temperature- sensitive?					
Rock / soil type					
# of frost rings in entire record Any differences in # of frost rings over time?					
Trends in the time series of the ring width indices?					
Pre- & post 1900 differences?					
Other observations or things you noticed at each site?					

I-4 BCP Report Directions are posted in D2L

DIRECTIONS: P-1 The Bristlecone Pine Tree-Ring Research Project Report

DUE DATE: **Tue Oct 26** at the start of class (or earlier if you wish)
GRADING: **Worth 30 points assigned according to the GRADING RUBRIC on back →**
FORMAT: **4-5 pages of typed, double-spaced text** (based on 12 pt font; 1-inch margin).
STRUCTURE: *(Write your report as follows, using the bolded* **Headings** *to separate each section.)*

I. **Introduction (1 pt)**
A short (1-paragraph) introduction to your report, telling the reader what is to follow. (1 pt)

II. **Methods (3 pts)**
Brief description of methods you used in the class research project (i.e. counting rings on core, skeleton plotting, crossdating with master, comparing skeleton plot masters and ring-width indices from site to site, etc.) Specifics for this section: Define crossdating, state why sensitivity is important, make sure to mention that the cores/trees are based on *bristlecone pines*, discuss the usefulness of extreme narrow rings and frost rings for crossdating.

III. **Study Sites (2 pt)**
Description of the site you worked on, its key frost ring years (if any), and a brief description of the other sites in comparison to yours (higher or lower elevation, geographic location, etc.)

IV. **Observations (2 pt)**
Describe and discuss the observations and trends you observed at your site and the 4 other sites (based on both the skeleton plot masters and the ring-width indices)

V. **Analysis, Results, & Discussion (total of 10 pts)**
A discussion of the hypotheses you tested (#1, #2, & #4) and the conclusions you drew based on the results of testing these hypotheses **(5 pts)** A description of how the portion of the chronologies at all 5 sites prior to 1900 differed from the portion after 1900 and a discussion of some possible explanations for any observed trends. **(5 pts)**

VI **Conclusions (1 pt)**
A closing paragraph that includes conclusions on what you learned in this activity about *bristlecone pine tree rings* and about *dendrochronology* as a tool for global change research.

VII. **References (1 pt)**
Include a list of references with page numbers and/or webpage URL's that you consulted to write the report (in addition to the P-1 materials provided to you in class & the P-1 Worksheet).
Example:
NATS 101, Lec 17 Class Notes Packet, (Fall 2004), p 151
Tree Ring Basics: http://www.ltrr.arizona.edu/dendrochronology.html
Sensitive vs. Complacent Tree Growth: http://www.ltrr.arizona.edu/skeletonplot/sensitivitycomplacency.htm

VIII. **Appendix (optional)**
You may include sketches, images, drawings, maps, etc. in an appendix to illustrate your report as needed. These additions should not be merely "decorative," they *should serve a purpose* for your report by illustrating a concept or providing supporting evidence for a statement you make in the text. **Do not include a figure or table without describing or discussing it somewhere in the text part of your report.** Give each figure and/or table in the Appendix a number and refer to it as "Figure 1," "Table 2," etc. when you discuss it in the text. Include a SOURCE reference for each figure or table you do not create yourself.

IX. **P-I WORKSHEET (5 pts) Attach your P-1 Worksheet to your written report!**
You will receive up to 5 pts for participating in the P-1 class activity and taking notes on the Worksheet. Your grade will be based on: (1) whether *your own notes* contain sufficient information to support *your* written report, and (2) how well your notes show evidence of careful listening, observing, and critical thinking during the class discussion.

Grading Rubric for Evaluation of P-1 Tree-Ring Research Report

TOTAL = 30 pts (Written Report is worth 25 pts & Worksheet is worth 5 pts)

CONTENT: 20 pts
I. Introduction (1 pt)
II. Methods (3 pts)
III. Study Sites (2 pt)
IV. Observations (2 pt)
V. Analysis, Results, & Discussion (10 pts)
VI. Conclusions (1 pt)
VII. References (1 pt)
VIII. Appendix *(optional)*

EXPRESSION & FORMAT: 3 pts
MECHANICS: 2 pts

WORKSHEET: 5 pts

Comments:

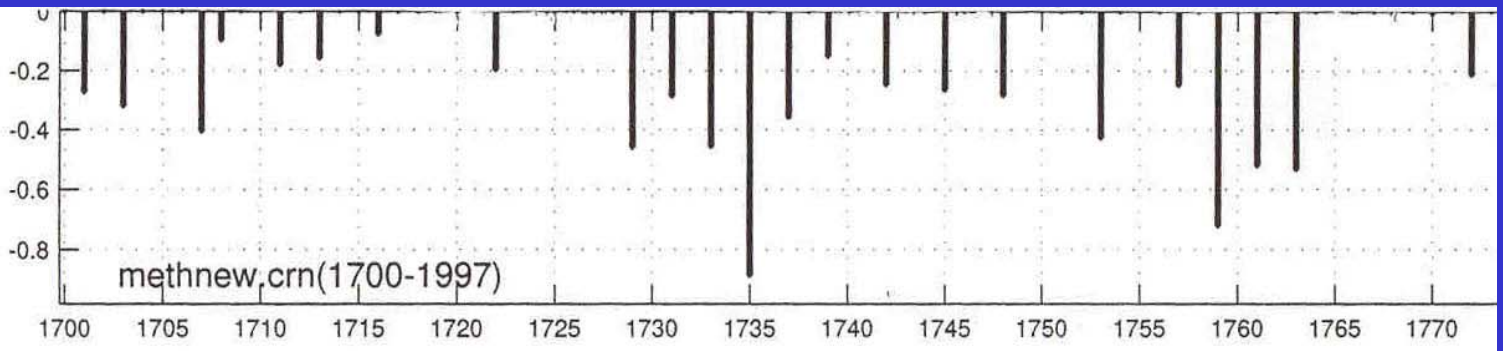
Grading Rubric

	Excellent	Satisfactory	Needs improvement
Content *(20 pts possible)*	*15- 20 pts based on how well the report:* Addresses I through VII above clearly, thoroughly, accurately, & articulately. Demonstrates a high level of independent critical thinking about the assignment beyond the classroom; effectively ties together the observations, hypotheses, class discussion, and conclusions into a well-constructed synthesis of the entire activity.	*8-15 pts based on how well the report:* Addresses I through VII above clearly, thoroughly, and accurately. Demonstrates some independent thinking and synthesis; does not just "parrot" phrases from the in-class discussion, but shows evidence of thinking and making connections beyond the classroom about the material in the assignment.	*1-8 pts based on a report that:* Addresses I through VII, but not clearly, thoroughly or accurately on every point. Demonstrates some follow-up thinking about the assignment but mostly repeats what was said in the class discussion and doesn't go beyond this by thinking on one's own.
Expression and format *(3 pts possible)*	*2.5 -3 pts based on whether:* Paper has effective sentence and paragraph structure. Content is well-organized and argument flows well from the organization and format of essay. Writing is concise; effective introduction and conclusion to the essay is provided.	*1.5 - 2.5 pts based on whether:* Most sentences are concise and show good word choice and arrangement. Paragraphs are well-organized. Content is sufficiently organized and argument is easily understandable from the organization and format of essay. Adequate introduction and conclusion is provided.	*0-1.5 pts based on whether:* Paper is excessively wordy with many poorly structured sentences and poorly organized paragraphs. Content is poorly organized and argument doesn't hold together in the essay's format and organization. Introduction and conclusion are absent or ineffective.
Mechanics *(2 pts possible)*	*1.5 -2 pts based on:* No major spelling, punctuation, or grammatical errors. (This includes typos, so be sure to spell-check and then to edit.)	*1 - 1.5 pts based on:* Few spelling, punctuation, or grammar errors, and none that detract from the essay's effectiveness & meaning.	*0 - 1 pts based on:* Many spelling, punctuation or grammar errors that detract significantly from the essay's effectiveness & meaning.
Worksheet *(5 pts possible)*	*3-5 pts based on:* Worksheet is attached and sufficiently complete to serve as the basis for the report		*0 - 3 pts based on:* Worksheet is not included *(0 pts)* Worksheet is included but is incomplete and inadequate to serve as the basis for the report *(1- 3 pts)*
Bonus Pts	*(awarded for truly exceptional effort on one or more sections involving: critical thinking, creative presentation, clarity of reasoning, substantiation of statements, etc.)*		

Two sources of data:

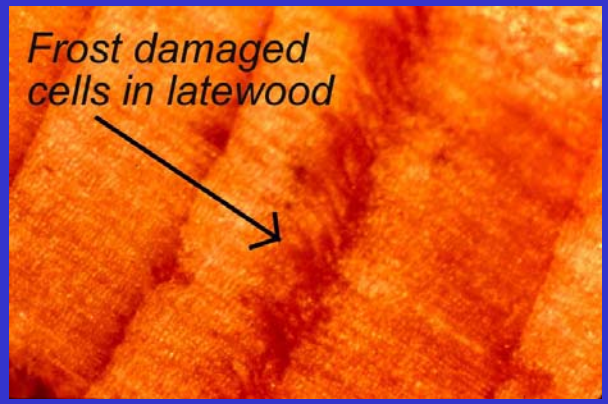
(1) Site Skeleton Plot Masters (with dates & FROST RINGS marked)

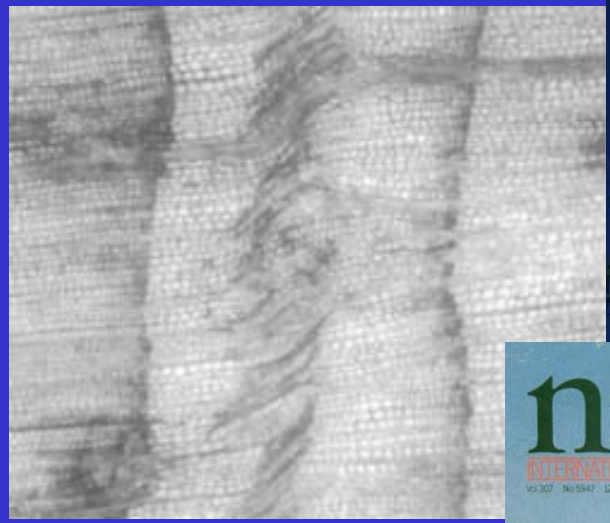
Methuselah Walk



FR = frost ring year

WHAT YOU NEED TO KNOW ABOUT FROST RINGS:





From a severe freeze occurring DURING the tree's growing season → "frost rings"

2 nights < - 5° C
intervening day 0° C

Growing season for high elevation bristlecone pines = June – Aug, continues into September during cooler years (growth is slower during cool summers) and makes them more susceptible to an early frost

Linked to global cooling after major volcanic eruptions !!

SOME MAJOR VOLCANIC ERUPTIONS OF THE PAST 250 YEARS:

Laki (Iceland)	1783
El Chichon? (Mexico)	1809
Tambora (Indonesia)	1815
Cosiguina (Nicaragua)	1835
Krakatau (Indonesia)	1883
Agung (Indonesia)	1963
El Chichon (Mexico)	1982
Mt Pinatubo (Philippines)	1991

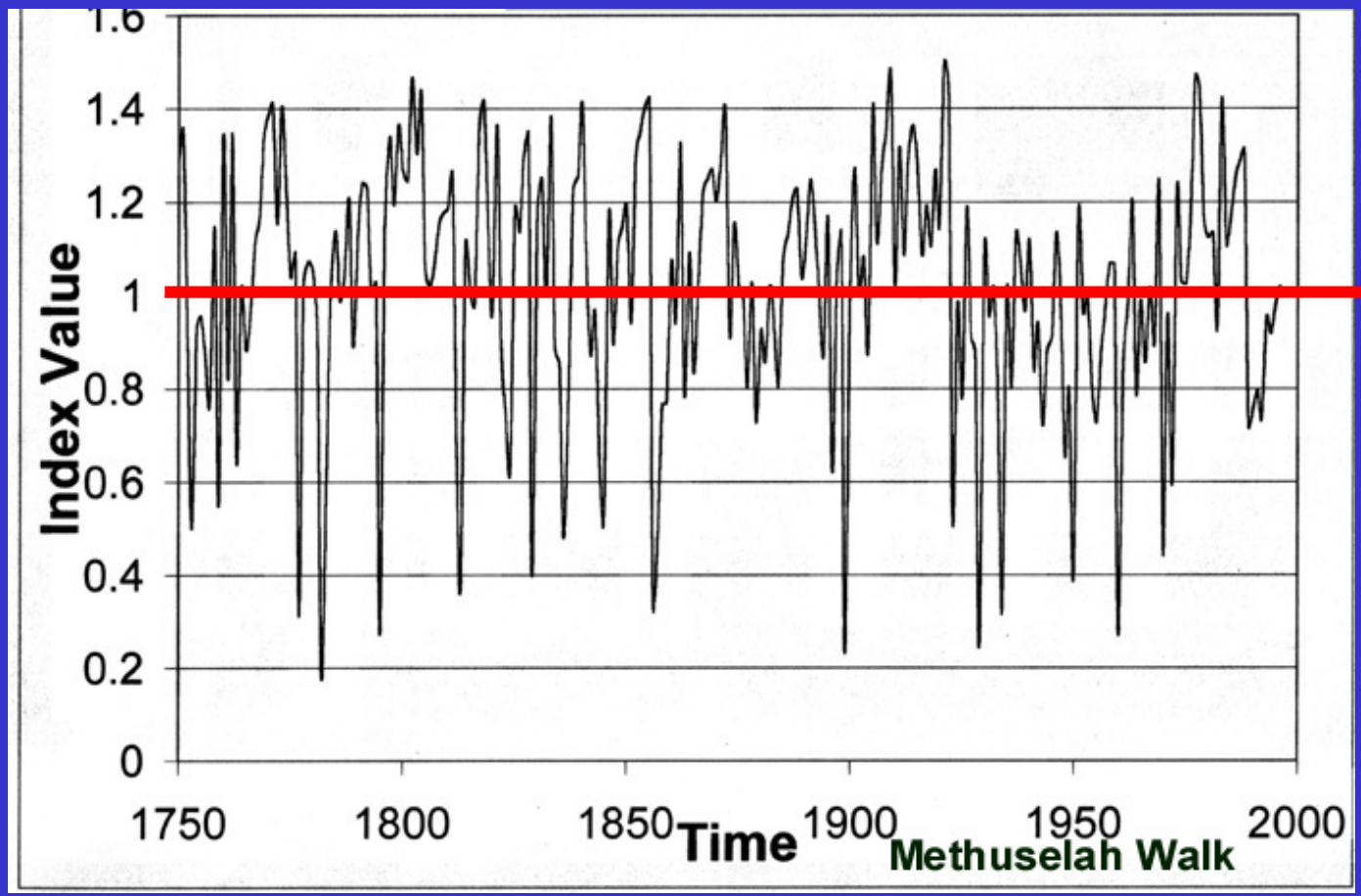
Global cooling can occur for up to 3 years after the eruption!

(2) Ring-Width Indices

(will be provided for your site)

Ring width indices = represent departures of growth for any one year compared to average growth.

Index of 1.0 = average or normal growth.



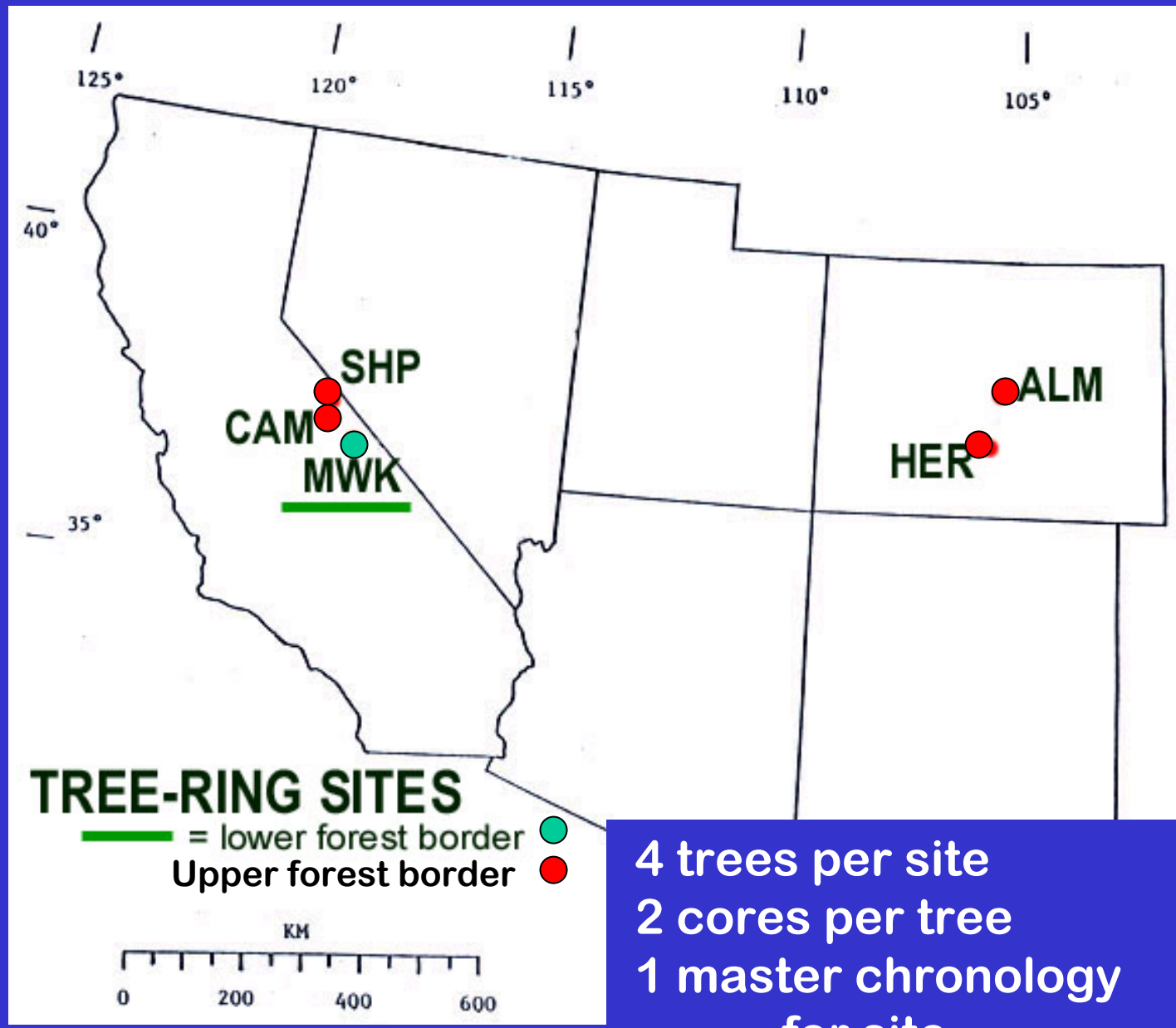
WIDE RINGS

NARROW RINGS

Recall: 5 SITES IN WESTERN U.S.

All are bristlecone pine sites

- 2 teams will work on a site together, assisted by TA/preceptor
- 1 team has early part of record
- other team has later part of record



4 trees per site
2 cores per tree
1 master chronology for site

SKELETON PLOTTING YOUR OWN CORE

WHAT YOU NEED TO KNOW:

- How to skeleton plot, pattern match, & crossdate

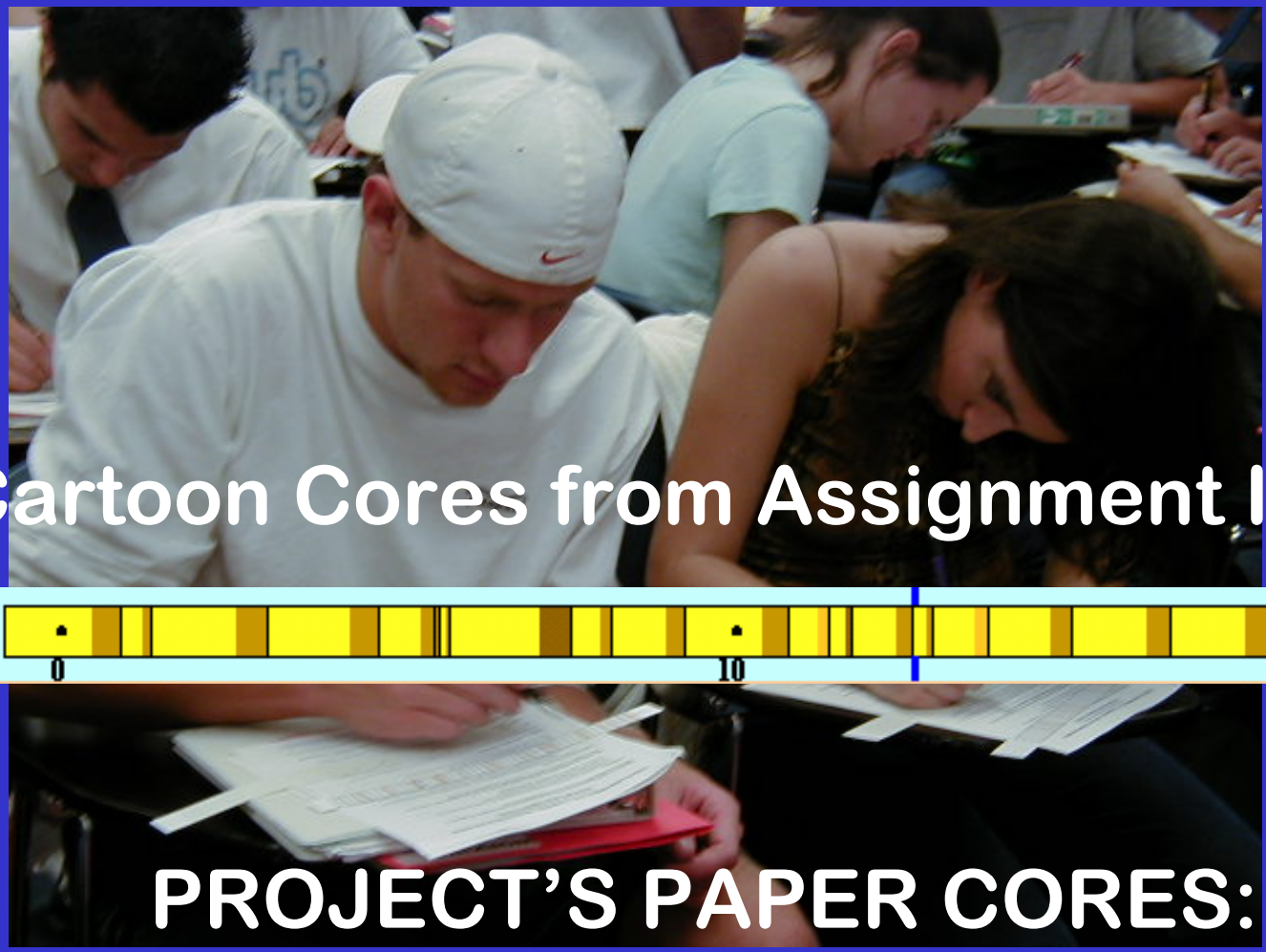
(you learned this in the I-3 assignment) ✓

- How to make a skeleton plot by hand.

- What a frost ring is ✓
& how to put a frost ring notation on your plot

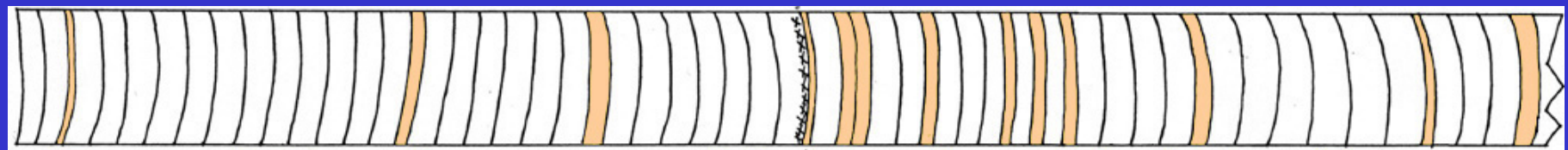
- How to pattern-match (you learned this in the I-3 assignment) ✓

SKELETON PLOTTING YOUR OWN CORE



Cartoon Cores from Assignment I-3:

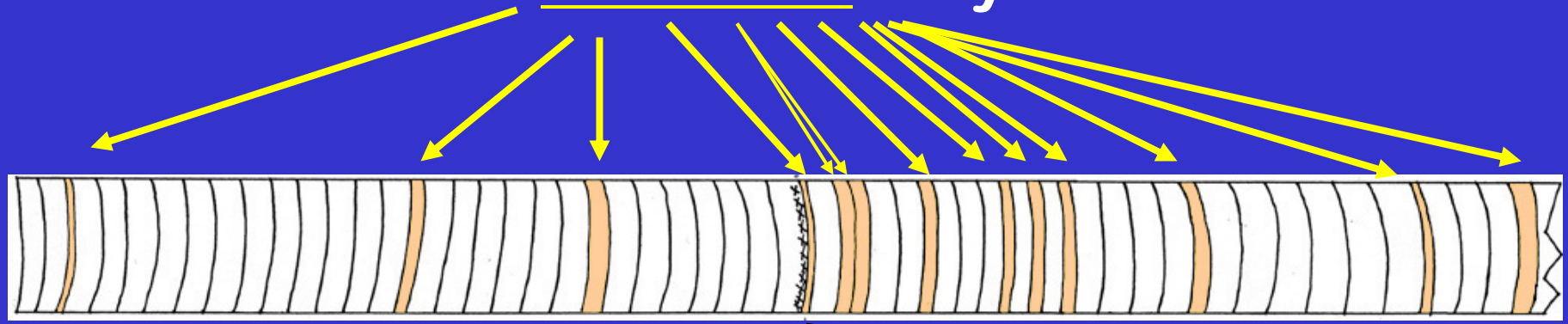
PROJECT'S PAPER CORES:

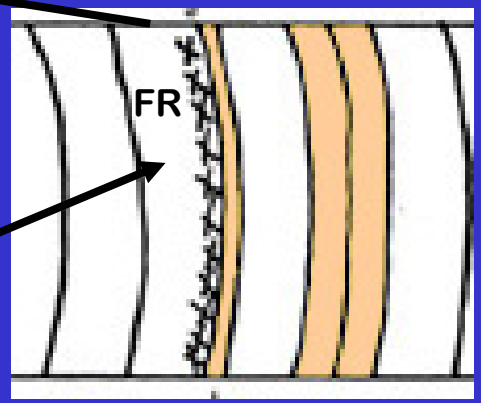


PROJECT'S PAPER CORES:

Earlywood & latewood NOT shown

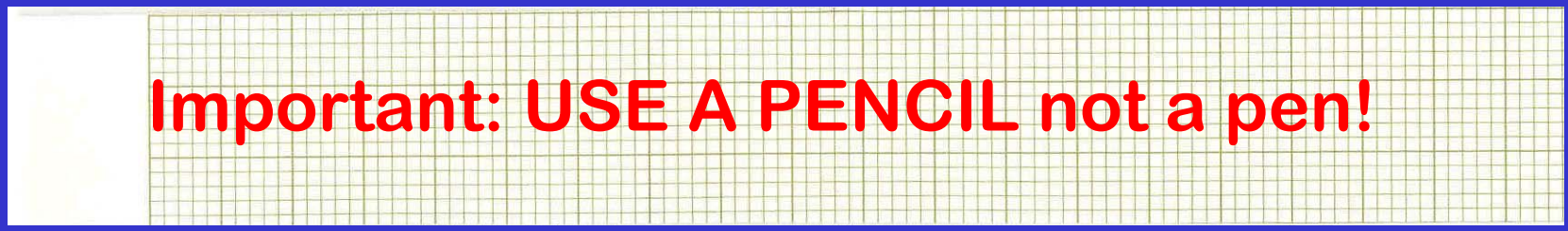
INSTEAD: each narrow ring you should plot is colored in for you





Frost ring = marked by xxxxx

SETTING UP YOUR SKELETON PLOT GRAPH PAPER:



Core ID #
Your NAME

LABEL intervals of 10

Starting Flag for Ring 0 (first ring)

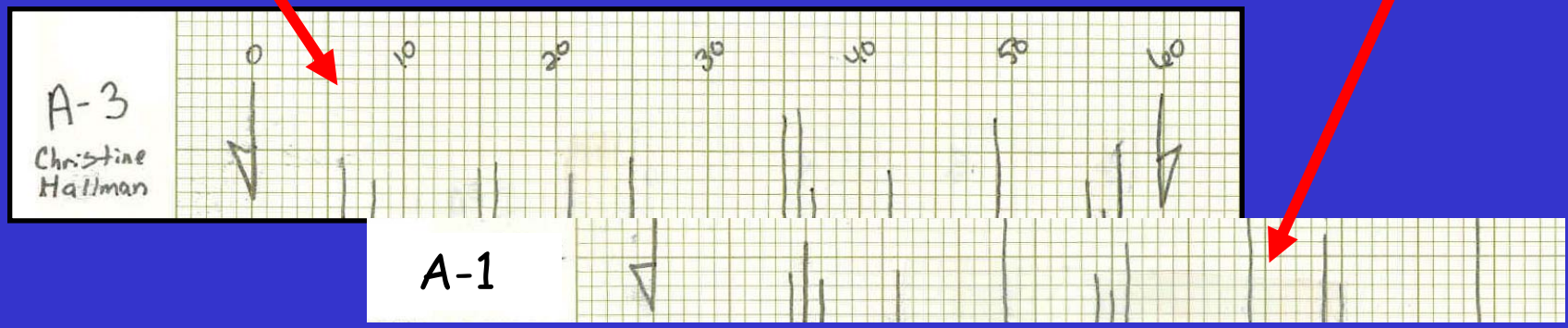
Ending Flag for LAST *complete* (not jagged) RING in core -- plot arrow when <u>finished</u>, not all cores have 60 rings

Pattern Matching

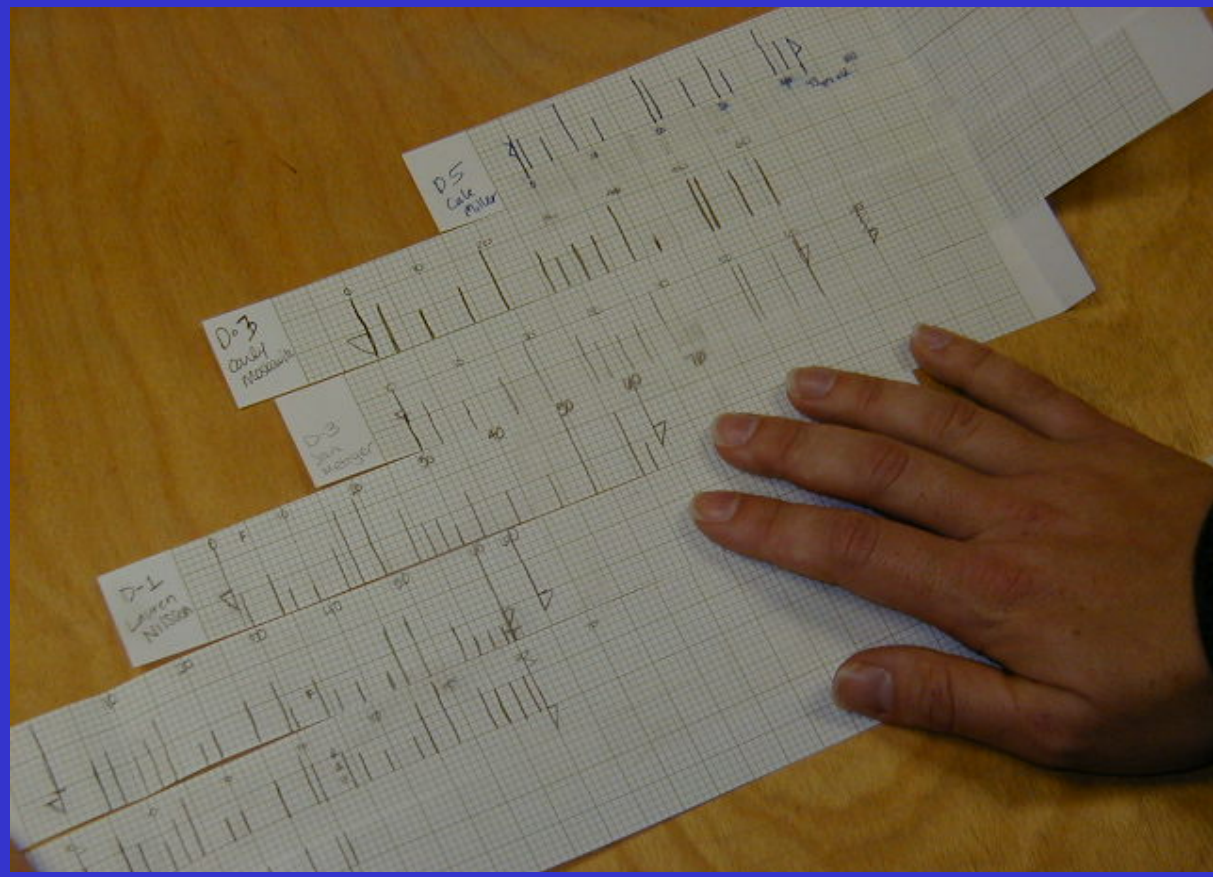
Pattern Matching

Student A's plot

Student B's plot



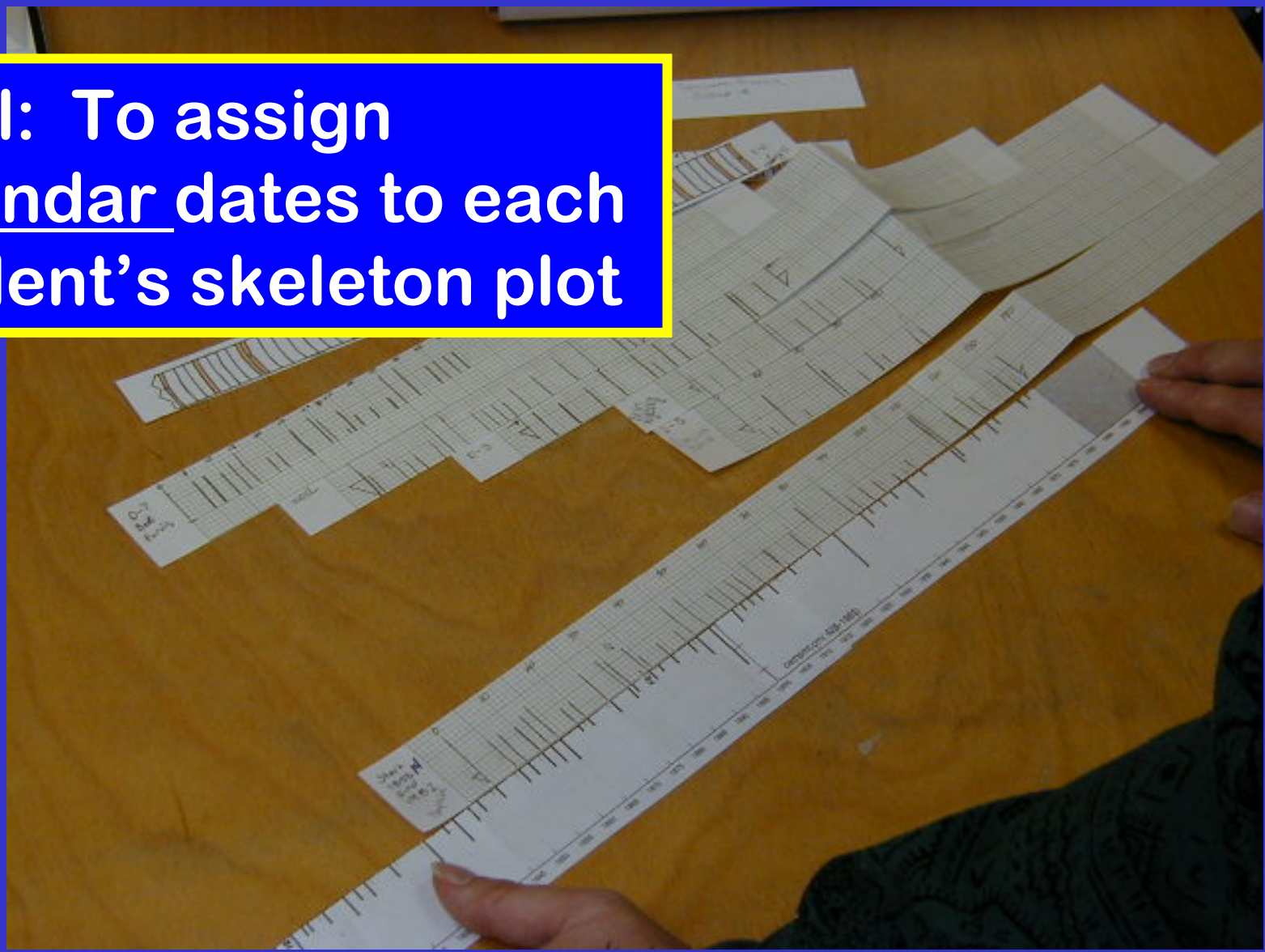
Making a Site Composite



SITE COMPOSITE = all individual plots from your site pattern-matched & taped together

Crossdating with the Master

Goal: To assign calendar dates to each student's skeleton plot



NOTE: This presentation, some hints to help you write your report, and copies of:

- All 5 Skeleton Plot Masters
- All 5 Ring-Width Index Plots

Are available ONLINE in D2L under ASSIGNMENTS – click on the BCP (I-4) assignment link:

http://fpnew.ccit.arizona.edu/kkh/nats101gc/bcp_report_dir.htm

IF YOUR GROUP DID NOT FINISH, THERE WILL BE MORE TIME IN CLASS NEXT TUESDAY.

DON'T FORGET TO BRING YOUR WORKSHEET BACK TO CLASS WITH YOU!!

Have a great weekend . . . but

DON'T FORGET THAT
RQ-4 is due on
Monday at NOON!!!