

COMPUTERIZED GRAY-SCALE ANALYSIS

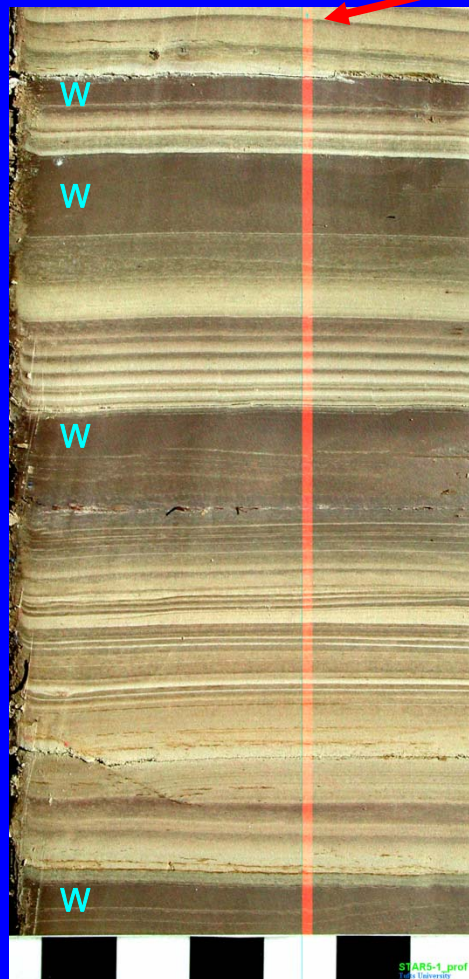
Measuring a varve record from a core involves measuring the thicknesses of summer and winter layers in successive couplets from bottom to top in the core. Digital gray-scale analysis can assist in making decisions about summer/winter layer boundaries as well as pulling out some of the details of bedding in the summer layer. The gray-scale analysis is a less biased way of looking at varve images.

At Tufts University, varve gray-scale data is assembled with a script program written for **UTHSCSA Image Tool 3.0**. Image Tool is a free image processing and analysis program developed for medical applications in the Department of Dental Diagnostic Science at The University of Texas Health Science Center, San Antonio, Texas (Wilcox and others, 2002). The script program, **Varveprofile100.itm**, creates a gray-scale data file for pixels along a strip of specified pixel width and takes advantage of utilities built into Image Tool.

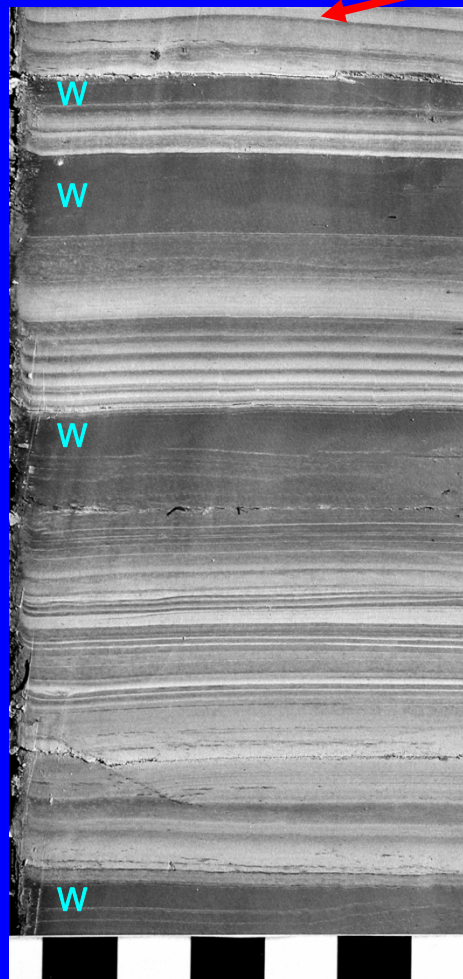
The program shown in this section is available in the supplemental materials. Unfortunately we do not have Mac versions of the programs available.

COMPUTERIZED GRAY SCALE ANALYSIS - UTHSCSA Image Tool 3.0 + Varveprofile100.itm

High resolution color (RGB) image of dried varve core with image sampling profile line that is 20 pixels wide. (W = winter layers)



Gray scale version (total RGB values) of high resolution image.



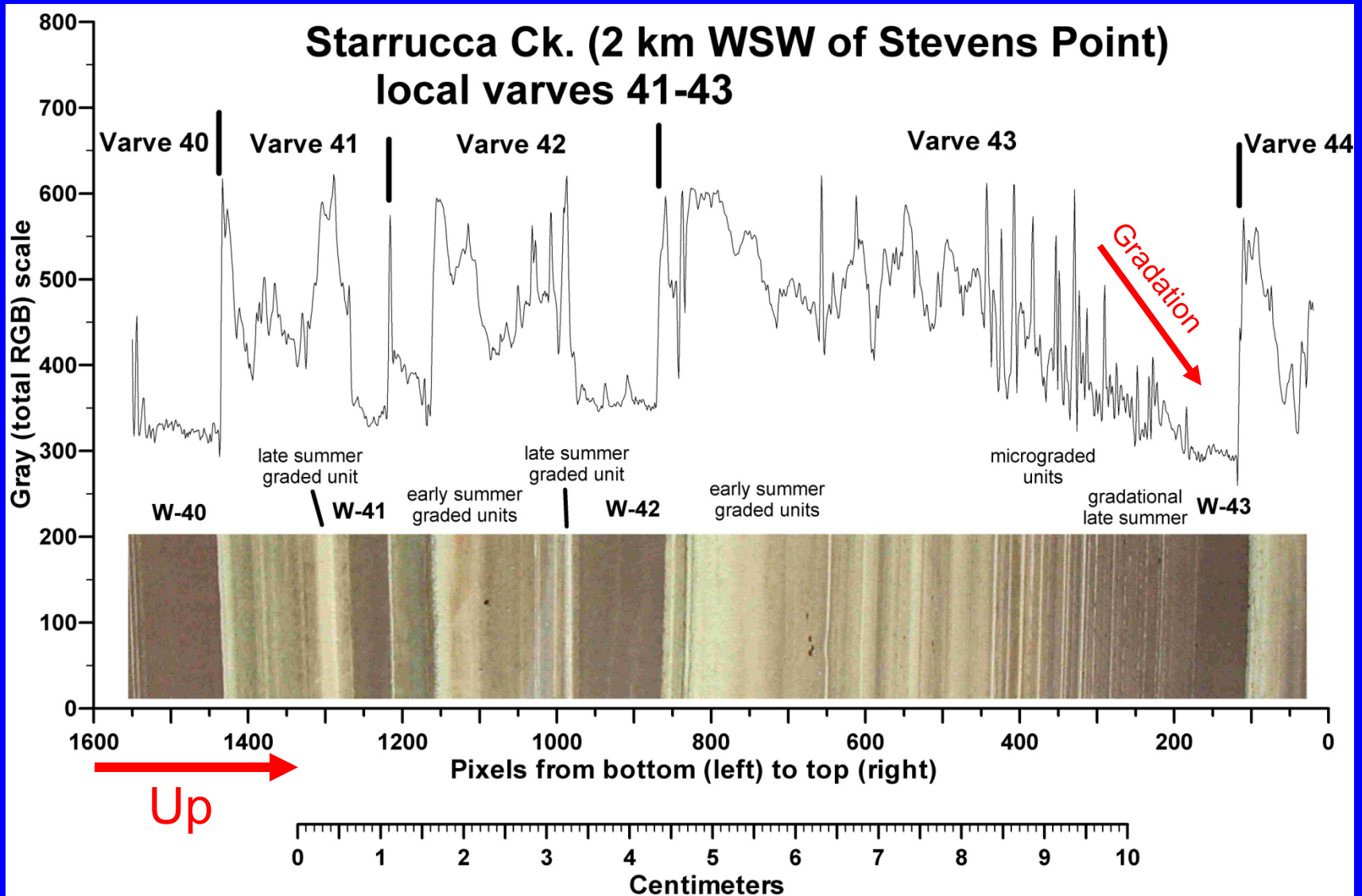
```
Star5-1_prfl_1.txt
Profile Data for core: STAR5 images 1- 1
Line_width: 20 number of prof: 1
Unit for Z-value:cm Scale for Z-value:0.0066
Profile 1 position: 745
Z-value Profile
1 576.50
2 595.70
3 602.30
4 609.00
5 618.90
6 610.20
7 588.20
8 574.80
9 566.00
10 572.20
11 580.00
12 579.10
13 569.20
14 567.70
15 581.50
16 592.60
17 599.60
18 581.70
19 562.90
20 572.70
21 595.20
22 588.30
23 557.50
24 511.20
25 426.10
26 402.80
27 391.70
28 390.20
29 390.50
30 413.40
31 440.30
32 442.00
33 466.60
34 488.20
35 501.80
36 509.10
37 513.60
38 516.60
39 508.90
40 506.90
41 508.80
42 504.40
43 510.90
44 521.90
45 528.90
46 534.20
47 533.10
48 525.80
49 522.70
50 523.50
51 513.70
52 510.40
53 526.90
```

DATA FILE

The top of the gray scale data file from the profile line shown on the RGB image. Data are average total RGB values from 0 (black) to 768 (white) for each 20 pixel row on the profile. The whole profile is 2008 pixels long with data from only the top 53 rows of the image shown here. The highlighted data is for the top-most dark lamination on the images (red arrow) that has lower RGB values than the surrounding sediment. Plotting the gray scale data gives a graphical representation of the thicknesses and gray scale contrasts of the layering in each varve.

Reddish brown varves from Starrucca Creek near Stevens Point, Pennsylvania.

GRAY SCALE ANALYSIS – Shown below is a plot of gray scale (total RGB) data of a high resolution image of varves from Starrucca Creek, near Stevens Point, Pennsylvania. Gray scale profiles of high resolution images of thick varves display the details of summer layers. The micro-graded units in the summer layer may represent diurnal layers (especially in the gradational top of Varve 43) opening the possibility of making minimum estimates of the number of days in the melting season.



REFERENCES

Wilcox, C.D., Dove, S.B., McDavid, W.D., and Greer, D.B., 2002, UTHSCSA Image Tool Version 3.0: Freeware software available from the Department of Dental Diagnostic Science at the University of Texas Health Science Center at San Antonio:
<http://compdent.uthscsa.edu/dig/itdesc.html> or search for “Image Tool 3.0”