
Aegean Dendrochronology Project December 2001 Progress Report

14,500 kilometers of driving in the summer of 2001 produced 395 sets of samples from 43 sites in Italy, Greece, and Turkey, with promises of more to come. Team-members were Defne Bozkurt, Kelly Jenks, and Dale Davis. In Turkey we were joined by colleague Aliye Aras from the Botany Department of Istanbul University and by Turkish Government representative Sena Mutlu. Sena Hanim, who in real life is a specialist in Byzantine numismatics at the Museum of Anatolian Civilizations, Ankara, discovered she had a hidden talent for coring very large trees. Work in the Taygetos Forest, Greece, in 2000 was supplemented by an Ithaca visit from Robert Brandes, Universität Erlangen, currently finishing his dissertation on the forest ecology of the Taygetos.



*On left, the **Presentation of the Virgin** on cedar panel from the Rhodes Museum. On right, Kelly Jenks records the icon's ring measurements (taken by PIK in background) in the Rhodes Museum.*

Among the more noteworthy pieces retrieved or measured during the summer was wood from the Roman ships in Pisa (more has been promised), charcoal from the so-called "Palace of Jason" at Iolkos, meta-Byzantine cedar icons in Rhodes (some of which we were able to measure in the museum's conservation room, and two of which are clearly cut from the same tree), and an entirely cedar roof from the Kubbeli Medrese (a/k/a the Hurmali Medrese) as well as the



gate to the Grand Master's Palace, both in Rhodes.

Defne Bozkurt collects cedar planks from the roof of the late Ottoman Kubbeli Medrese in the Old City, Rhodes

In Anatolia we have a core from the "700-Year-Old 'Bloody Oak'" in Aksaray (try something closer to 210 years), charcoal from Chalcolithic Güvercinkaya and Byzantine Amorium, timbers from Medieval Kastamonu castle, Sedd-ül Bahir at Çanakkale, and Stephan Blum's abandoned village at Isiklar near Troy. An illicit excavation by robbers near Tosya yielded wood that could date anywhere from Persian to Roman, and we thank the Lieutenant Governor for permission to try to date it. On our way home via Italy we collected another set of Early Bronze Age oak pilings from Lavagnone di Brescia.

More samples have come in during the autumn in the mail, and our first Greek Neolithic charcoal has been promised from Sesklo. We have, in other words, enough to keep us busy. More charcoal samples were collected from Aygül Süel's excavations at Hittite Ortaköy/Sapinuwa and Andreas Müller-Karpe's large buildings at Kusaklı/Sarissa, and Maryanne Newton, with the lab assistance of Pam Sullivan and Defne Bozkurt, is working on developing a regional chronology for Hittite Anatolia. Tentative dendro dates for the former in the 14th century BC and the latter in the 16th century BC are, in conjunction with radiocarbon work, contributing to a complete rethinking of Hittite chronology already being proposed by Jürgen Seeher, director of excavations at the Hittite capital at Bogazköy. Additional samples from Urartian Ayanis and Yukari Anzaf show promise for building a similar regional chronology for Urartian Anatolia.



North temenos wall at Ortaköy/Sapinuwa. A 14th century date is likely.

One interesting discovery on the Black Sea Coast was in the peat bog of Sürmene-Ağaçbasi (on top of a mountain, of all things) above Trabzon. There the villagers engaged in digging out the peat at an altitude of over 2033 meters are finding substantial spruce logs buried therein. The date range is between circa 4077 BC to 4470 BC. Today's upper timber line is at 1500 meters, or more than 500 meters below where we found the prehistoric wood. A topic currently engaging forest ecologists is the matter of

changing upper timberlines over time. Here is another small bit to add to the discussion.



What on earth is a bog full of subfossil trees doing on top of a mountain 500m above today's timberline? This house, at the bog near Sürmene/Agaçbasi (somewhere in the fog above), has a central joist (at floorline below the chimney) that was cut more than 6200 years ago.

Where does one begin with everything else that happened this year? Christine Groneman, after a valiant effort to get several more of our absolutely-dated chronologies added to the International Tree-Ring Data Bank server in Boulder, Colorado, left for Portuguese West Africa for a Peace Corps stint and was replaced by Jennifer Chiment as lab boss. Jennifer has been presiding over the activities of some 20 people this semester. Kenneth Harris and Muhammad Arif upgraded our data-handling system, replacing the 10 megabit network that links all our work-stations with a 100 megabit one. Ken plans to release the WINDOWS version of our measuring, cross-dating, and statistical analysis system (CORINA) about the turn of the year. Maryanne Newton and Carol Griggs cleaned up a lot of old business. They also shared publication responsibilities, and together with Mary Jaye Bruce and Jennifer prepared and presented several posters for international meetings. Maryanne also gave her maiden speech at the Fifth International Iron Age Congress in Van, Turkey.

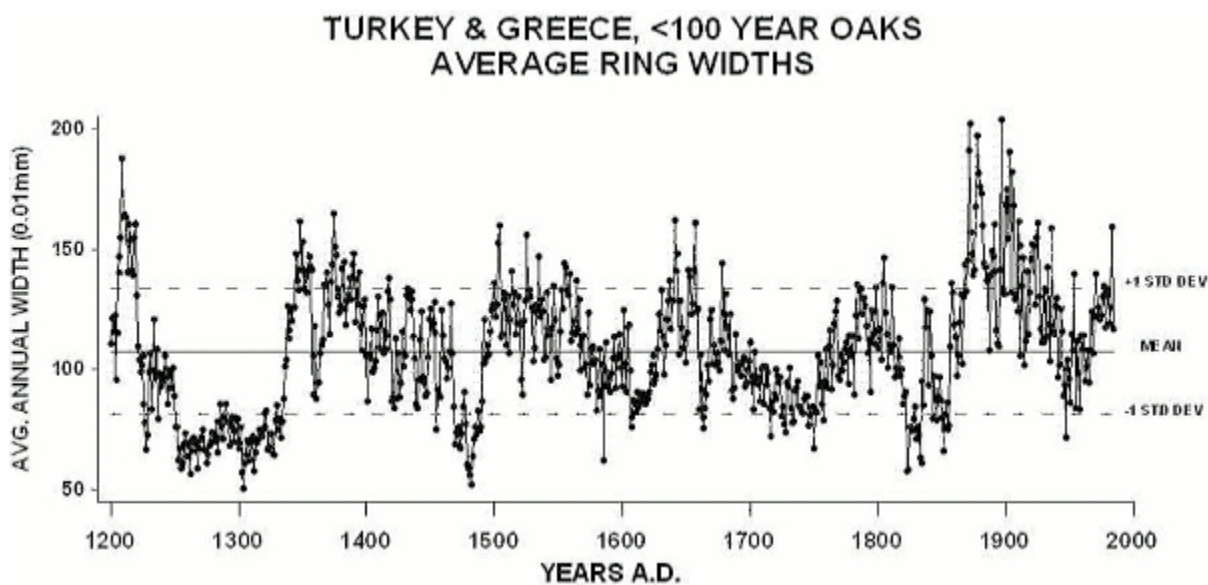
In September Maryanne, Carol, and I participated in a "Tree Rings and People" symposium in Davos, Switzerland, in honor of Fritz Schweingruber's retirement. Some 240 tree-ring workers from all over the

world were there to discuss where we are as of 2001 and where we all ought to be going over the next 25 years. The theme that was on everybody's tongue was 'networking,' not only among laboratories but among regions. Now that multi-millennial tree-ring scales exist in all hemispheres, looking for and finding resemblances is no longer the random pie-in-the-sky exercise that it used to be. Data exchange is easier than ever, thanks to the Internet, and a number of agreements for data-sharing were made.

One oddity was immediately apparent at Davos. Work that is sponsored by the Federal (U.S.) Government is intended to be made available, after publication, for the public's benefit. Some of our European collaborators claim that their governments consider information sponsored by public funds to be proprietary property. Thus they are prohibited from sharing their data. They can receive data but not send it out. We pointed out that this is not how one makes progress. Several mistakes made in the past by one lab or another have been identified and corrected only after comparison exercises with foreign labs. The matter is under continued discussion.

Kurt Nicolussi, University of Innsbruck, not only met us at Lermoos just west of the Zugspitze to show us his wooden Roman road, the Via Claudia Augusta, but also shared his sequence of *Abies alba* therefrom, against which we have dated our Ercolano and Pompeii *Abies*. Our report on this Roman wood in W.F. Jashemski's *The Natural History of Pompeii* has been announced for March, 2002, by Cambridge University Press. We have radiocarbon dates for 2nd century Ravenna fir collected several years ago, and a first century date for fir from San Francesco del Deserto in the Venetian lagoon. Both these chronologies also crossdate with Nicolussi's *Abies* chronology with further implications for the importation of Alpine wood for Roman building projects. We may fill that Roman gap yet. Some of this was reported earlier this semester at Albert Ammerman's Colgate University Symposium on Venice Before San Marco and will appear in print in due course.

Carol Griggs has been doing a survey of oak tree-growth over the last millennium. Her graph shows raw ring-width measurements from over 500 oak samples which she averaged to find out when major regional climate changes might have occurred. Several of the anomalies appear to be contemporary with well-known deviations like the Medieval Warm Period or the Little Ice Age. One thing that the tree-rings tell us is that the present global warming is no warmer than the Medieval Warm Period. This kind of major fluctuation is present in many of the long tree-ring chronologies, and Mike Baillie's paper on this subject in the next issue of *Dendrochronologia* should be well worth reading.



The trees say it is no warmer today than it was 650 years ago.

For the past ten years we have seen the fitful emergence of a coherent plan to run an oil pipeline from Baku on the Caspian, via Tbilisi in Georgia, to Ceyhan on the Mediterranean. The footings for this above-ground pipeline will rest in 17,000 trenches, each the size of a large house, to be dug to bedrock, 10 trenches per kilometer, over 1700 kms. We have offered to provide dendrochronological dating and analysis for any wood and charcoal that the Silk Road Project finds in this gigantic enterprise. See http://www.igcc.ucsd.edu/regions/middle_east/silk_road/.

Our dendrochemical work at the Ward Center (Neutron Activation Analysis) and the Cornell High Energy Synchrotron Source (X-Ray Fluorescence) continues as we look for plant evidence for volcanic activity over the centuries. Four centuries of dated wood cut up into single-year slices have already been activated and counted at Ward in that carousel contraption I showed you in last year's report. Six centuries more are waiting activation as of the end of November 2001, and more wood is being dissected daily. We are already cutting apart the last 500 years from California sequoias and we have promises of material from Germany, Poland, and Argentina so that we can expand the geographical scope of this work into the western and southern hemispheres. Our chief woodcutters were Michael West (now in graduate school at Texas A&M), Amanda Erwin (hoping to be in graduate school this autumn), Meg Underwood, Pam Sullivan, and Karola Kirsanow.

Our own website, maintained by Mary Jaye, continued to be highly successful. In the calendar year 2000 we had 77,700+ hits from 51 countries, an average of 210 hits a day all year long. 1.7Mb of publications and other information were downloaded daily. Year 2001 hits (low estimate based on incomplete log files) are 110,000 from 72 countries, with an average of over 300 per day. Downloads (e.g. copies of various articles) went up to 7Mb daily, probably the graphic material which takes up more space than pure text.

2001 was a publication year, with a number of papers finally seeing daylight. Enclosed with this report for active Patrons of the Project (and until we run out of offprints) is a summary paper on "Dendrochronology and Other Applications of Tree-ring Studies in Archaeology" from Brothwell and Pollard's Handbook of Archaeological Sciences, and a report: "Aegean Tree-Ring Signature Years Explained" by M.K. Hughes, P.I. Kuniholm, J.K. Eischeid, G. Garfin, C.B. Griggs, and C.E. Latini in the newly-renamed journal Tree-Ring Research 57:1 on a climatic explanation for why we get crossdating across such a wide expanse of real estate as Italy, Greece, Turkey, and Cyprus. Ayanis I, ed. A. Çilingiroglu and M. Salvini, appeared last summer with a piece by me and Maryanne Newton on the tree-ring dates. Maryanne and I also have a short report on Iron Age Kaman Kalehöyük, now in page proof, to appear momentarily in Anatolian Archaeological Studies X (2001) published by the Middle Eastern Culture Center in Japan.

On December 6th, 2001, in Science Express (www.sciencexpress.org) the following articles will have been posted. I cannot send you a photocopy now because *Science* has placed an embargo on advance dissemination.

- Manuscript 1066114, B. Kromer, S.W. Manning, P.I. Kuniholm, M.W. Newton, M. Spurk, I. Levin, "Regional $^{14}\text{CO}_2$ offsets in the troposphere: magnitude, mechanisms, and consequences"
- Manuscript 1066112, S.W. Manning, B. Kromer, P.I. Kuniholm, M.W. Newton, "Anatolian tree-rings and a new chronology for the east Mediterranean Bronze-Iron Ages"
- There will also be an opinion piece by Paula Reimer, one of the authors of the calibration curves, on what she sees as the significance of these two papers. (I have not seen this as I write this paragraph, but I do hope she likes them.) Both articles and the commentary will be published in *Science* at a date to be determined. If you are a Patron of the Project, you will get offprints immediately thereafter. Meanwhile, Patience.

The calibrated radiocarbon curves have been built up over the years by several high-precision labs working in concert. The 1998 curve, which represents the latest and best attempt at quantifying what we know about the radioactivity in the north temperate zone, was done on dendrochronologically dated German and Irish oak, and the results are pretty much in accord with the bristlecone pine calibration

curve built decades ago with what now seems antiquated equipment and procedures.

But there have always been grumbles from some of the "users" of radiocarbon to the effect that something was not quite right with the radiocarbon method. The biggest grumblers were the archaeologists who had alternative forms of dating. Obviously when one is working on a culture with zero historical record, radiocarbon is all there is on which to rely. But for Egypt, Mesopotamia, and the Aegean, radiocarbon is relatively "new" and not always understood, much less accepted, especially by workers accustomed to traditional forms of dating-ceramic chronologies, king-lists, and the historical record. So, to demonstrate that the calibration curves built from material north of the Alps were relevant for dating material south of the Alps, several years ago our colleague Sturt Manning at the University of Reading dreamed up the East Mediterranean Radiocarbon Intercomparison Project (EMRCP) in which selected decades of German oak and Anatolian conifer would be compared by Bernd Kromer's high-precision radiocarbon laboratory in Heidelberg. By conventional assumptions, the EMRCP would obtain identical radiocarbon results for contemporary samples, despite the difference in the wood's place of origin.

But this is not what we observed. Thus, the results reported in the first *Science* paper are that although radiocarbon uptake by trees from the temperate zones are more or less identical through time (a difference of 1.4 radiocarbon years between Germany and Anatolia over 500 years), there are specific periods, say centuries or parts of centuries, when there are "offsets" between one region and the other. For example, during the "Little Ice Age," the period of global cooling in the 1500s and 1600s (think of Brueghels's snow-covered landscapes at that time), Anatolian tree-rings have demonstrably more radiocarbon in them and therefore appear to be younger, in radiocarbon age by as much as 17 years or so, than tree-rings from identical decades in Germany. Why? you might well ask. We suggest the answer lay in the longer growing season at lower latitudes of the temperate zone, and that the difference in radiocarbon uptake appears significant only when growing periods are shortened, principally by cooling. The same kind of offset (in fact, an even greater one) is visible in the 8th and 9th centuries BC. We hope to identify other problem periods like this in future work.

The gist of the second *Science* paper is that we must push back our floating (but wiggle-matched) Bronze Age/Iron Age tree-ring chronology some 22 years. ("Floating" means that the chronology is not anchored to living trees of today because of a shortage of available samples in the Roman period.) The whole chronology must move as a block, not just selected parts of it. Thus we believe the "Midas Mound" Tumulus at Gordion was built around 740 BC rather than 718 BC as we reported six years ago in *Nature*. Similar shifts are required for the rest of the monuments on the date list. The Warsama Palace at Kültepe was built close to 1832 BC and burned down some time after about 1771 BC. The Sarikaya Palace and Hatipler Tepesi at Acemhöyük were built around 1774 BC. You can read the rest of the details, including which of the Mesopotamian historical chronologies now make sense, in *Science* very soon.

This year the French Institute of Anatolian Studies in Istanbul organized a Central Anatolian Neolithic e-Workshop (CANeW), culminating in a two-day round-table in Istanbul last week, in which a number of us discussed terminologies and definitions, re-worked and re-calibrated the entire suite of known Anatolian Neolithic radiocarbon dates (to the 1998 calibration curve) from circa 10,200+ BC to 5,000 BC (with more dates still coming in). Getting archaeologists to think in terms of calibrated BC dates is a major accomplishment on the part of our French colleagues. The chronological spread of the dates shows that the Neolithic was a relatively extended period, several thousand years longer than originally thought, and I suspect we will find that it begins even earlier than 10,200 cal. BC, possibly by as much as a couple of thousand years. We contributed several dendrochronologically wiggle-matched sequences to this enterprise and are honored to be playing a part in it. The web-site, including the ranges of dates from specific sites, is <http://chez.com/canew/>

Finally, one administrative detail: note that this year's letterhead indicates our new autonomous status. You can find us in the Cornell telephone directory under A for Aegean, D for Dendrochronology, and W for Wiener. Whether this represents progress or not, only time will tell. Meanwhile, write us directly

at the dendro lab in B-48 Goldwin Smith Hall.



Ancient and modern plumbing at Pompeii. Fill in your own caption....

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