

AEGEAN DENDROCHRONOLOGY PROJECT 1995 PROGRESS REPORT

This year was one for records: over 2,000 measurable samples (totalling a quarter of a ton) from 45 sites; 10,000 miles of driving (no flat tires, one rebuilt clutch); 360 people-days in the field (two damsels hospitalized but no long-term ill effects as far as we know); one ferryboat strike on Crete (the delay allowed us to collect our first worthy Bronze Age material from that island--75 fragments from Phaistos (MMIIa/b)); our first Late Neolithic wood (222 pieces from Kösk Höyük near Nigde); our first burned wood from Troy VIIA (a big box of it from a destruction level in the area of the Sanctuary); our first serious collection of Hellenistic wood (55 bags of charcoal from a 10m x 10m collapsed and burned roof at Sos Tepe east of Erzurum); and our first significant collection of wood from Venice (52 pieces from San Lorenzo). Now that the Project has finished its 23rd consecutive summer in the field, here are some of 1995's dating highlights, scattered randomly over the last 9000 years, but tabulated in chronological order. Some of what you see below was collected years ago; some is hot off the microscope; but here is where we are as of December 1995. There are still holes in the long chronologies, darn it, especially in the 1st-4th centuries A.D., but we are working on them.

We now have our own World Wide Web page. Those of you with access to the Web can try <http://www.arts.cornell.edu/dendro/> where you will find the annual reports of the last five years (minus the graphics which we have not yet scanned in). More to follow.

Çatal Hüyük (cf. [1992 Annual Report](#)) 570 year chronology

Maryanne Newton is just about finished with Neolithic Çatal Hüyük (*old spelling*) after measuring and analyzing some five hundred very nasty charcoal fragments left over from the radiocarbon work at MASCA/University of Pennsylvania in the early 1960's. She expects to finish her M.A. thesis on "The Dendrochronology of Çatal Höyük" (*new spelling*) late this term or very early next term depending on when she gets the results of the last batch of accelerator dates and defends her thesis. She has built a 570 year tree-ring chronology with maybe a 60 year extension on the early end. The new excavations by Ian Hodder at Çatal Höyük should refine the phasing and add significantly to the sequence.

Since nobody has any idea of which rings were used for the original radiocarbon measurements at Çatal, the next step was to sacrifice some of the charcoal, cutting it into numbered ten-year segments. These fragments were too small for normal ¹⁴C dating, so they were sent to the Accelerator Mass Spectrometry (AMS) Laboratory at the University of Arizona for wiggle matching. Lots A and B from the extreme ends of the Çatal Höyük ring sequence fit roughly at 7020 B.C.±50 years and 6500 B.C.±100 years. Now Maryanne has selected eight more lots (C through J) to see whether the Arizona physicists can fit them to the morphology of the radiocarbon curve. If this works out as expected, we should be able to report in a month or two a wiggle-matched series that is pinned down to something like ±20 years. This will be the starting point for all Anatolian Neolithic dendrochronological dates from now on.

Malatya, Arslantepe, Level VIA, Temple B 298 year chronology with Bark

After years of trying to obtain long-lived specimens from the Late Uruk site of Arslantepe (Level VIA, late 4th millennium B.C.) and getting nothing more than a few decades of wood per sample, we were rewarded in 1994 by a splendid set of finds from Temple B, almost all of them carbonized fragments of juniper, totalling 298 years and ending in bark. The total number of fragments we had to measure in order to build this chronology was over 400. Our best guess is that a minimum of 10 to 12 trees are represented. Since we do not have comparative material from the late fourth millennium B.C. with which to try to crossdate the Arslantepe sequence, we have sent seven sets of specifically selected and

numbered decade-long samples to Arizona for AMS dating and subsequent wiggle-matching. The radiocarbon samples from Arslantepe Level VIA until now have ranged from around 3300 to 3000 B.C. By early Spring 1996 we hope to be able to provide a construction date for Temple B to within ten or twenty years. This in turn will form the foundation for any further fourth millennium B.C. crossdating.

1993 wiggle-matching results for the Long Bronze Age/Iron Age Chronology

The first effect of applying the 1993 radiocarbon curve to our data from the Bronze Age and Iron Age was to move the chronology down (*i.e.*, make it more recent) by over three decades from where it had been pinned by the 1986 calibration (and which was duly announced in the Annual Report of 1990). We think we have evidence of the effect on our tree-ring record of the eruption of Thera/Santorini. With Bernd Kromer and Sturt Manning, we have a report on what this might mean for Bronze Age/Iron Age dates that I hope you will be able to see in print in the relatively near future. For those of you who are interested in specifics, all dates from the 23rd to the 8th century B.C. move down 39 years. For example, the date for the Midas Tomb at Gordion is 718 B.C.±1 rather than the previously estimated 757±37 B.C.

Gordion, Tumulus B

MMT Relative Date 1855v = 627vv B.C.±1

One of the very first tumuli excavated in 1950 at Gordion by Rodney Young and reported on by him in *Univ. Museum Bull.* 16:1 (1951), now published in detail in *Gordion II* by Ellen Kohler, was Tumulus B which included a cedar log sarcophagus. We have had pieces of this for years which were undatable, no thanks to an enormous knot which skewed the rings. Last summer we were able to retrieve a piece with 354 rings and no knots which fits on the end of the Gordion sequence, ending 91 years after the Midas Mound Tumulus. The last existing ring is thus 627 B.C.±1. Miss Kohler's estimate for the date is *circa* 630 B.C. We will have to ask her whether a three- year discrepancy is within the limits of "*circa*," but we trust she will approve.

Early Iron Age sequence attached to the above:

To the Tumulus B ring-sequence as pinned to the Midas Mound tree-ring sequence may now be attached several other Early Iron Age chronologies which have been hanging around for some years without much visible means of chronological support. Sos Höyük and Dilkaya could be any time in the first half of the first millennium B.C. The sites of Bastam and Ayanis are associated with the Urartian King Rusa II *ca.* 685-645 B.C. The building of the Colossal Lydian Structure (formerly the Monumental Mudbrick Structure or MMS) at Sardis could be any time from a very short time to long before its destruction *ca.* 547 B.C. The date shown below is 38 years before this destruction minus any exterior rings lost to fire. In 1991 we reported an estimated date of 531±37 B.C. for the painted tomb at Tatarli based on a very short overlap that we now see was clearly wrong. The revised date is closer to what Machteld Mellink estimated (and indeed she told us) its age to be. I would therefore prefer to treat the following list as tentative until we get a few more early Iron Age sequences to corroborate the fits. The Ayanis wood now being measured just might do it for us.

Van, Dilkaya, Iron Age	MMTRD 1716vv = 766 B.C.±1
Sos Höyük, Iron Age level(s)	MMTRD 1759vv = 723 B.C.±1
Bastam (Iran), palace of Rusa II	MMTRD 1788vv = 694 B.C.±1
Samos, Heraion, votive deposit	MMTRD 1789vv = 693 B.C.±1 more to be measured
Van, Ayanis, palace of Rusa II	MMTRD 1820vv = 662 B.C.±1 more to be measured
Sardis, MMS (City Wall)	MMTRD 1897vv = 585 B.C.±1
Afyon, Dinar, Tatarli Tumulus	MMTRD 1902Bark 580 B.C.±1

Early Byzantine Buildings *362p to 992B*

In the Spring of 1995 we were finally able to fit together a long sequence of oak chronologies, thereby deriving absolute dates for timbers in some nineteen monuments or parts of monuments from the first millennium A.D. Until March 1995 our earliest absolutely-dated tree-ring had been A.D. 927 on the inner end of a timber at Enez, Hg. Sophia. Now we can report an extension of this chronology 565 years back to A.D. 362 on the innermost ring at Amorium. Tree-ring dates for the following monuments or parts thereof are as follows. (Note: A number of these monuments were sampled years ago in a collaboration with C. L. Striker. He is not responsible for any of the observations in this report.)

Naturally, this summary list cannot convey the complexities of these monuments. Neither is it possible to go into the details of provenience or stratigraphy. However, dendrochronology has proven to be a useful technique for trying to sort out the history of the development of Byzantine architecture in the second millennium. Now that the dendrochronological framework has been built for the last two-thirds of the first millennium as well, the architectural historians are free to set about making sense of it. (There are two weak points in this 565 year graph where the overlaps are very short. However, the resulting dates are so much in accord with what we know about Byzantine history that I am confident that the placement of chronologies is correct.)

Other Dated Medieval Monuments:

Konya, Selçuklu Sarayı, Primary *1174v*

In 1994 we collected four headers from the South face of the substructure of Sultan Kiliçarslan II's köşk in Konya. Since we have last-preserved rings of 1174 and 1173 on two of our three datable pieces, both untrimmed, and 1167 on the third with a few rings missing, we think the construction date must follow closely upon 1174, right in the middle of Sultan Kiliçarslan II's reign (1156-1192).

Konya, İnce Minareli Medrese, Primary *1259vv*

Konya, İnce Minareli Medrese, Secondary Substructure *1548vv*

Cores taken from the top of the unbonded E-W wall of poorly dressed masonry between medrese proper and minaret, which at the time of our visit we thought could have been a later insertion, crossdate well with other 13th century junipers. Just under the South wall of the Medrese is an E-W barrel vaulted, subterranean chamber about 3m. below grade. Six vertical shafts on the N side are now exposed about a meter S of the medrese's S wall. The chamber's existence was unsuspected until early in 1994 when it was broken into on the east end of the vault. Only then were the steps up on the S side discovered and most of the lintel beams discarded and replaced. We sawed an end off the (remaining) northernmost juniper lintel beam. The last preserved ring (no sapwood) is 1548 with an unknown number of rings missing from the exterior. The chamber then has nothing to do with the primary construction of the medrese although the N wall does line up with the S wall of the medrese.

Ordu, Ünye, İkizce, Eski Camii *1521vv*

The Eski Camii (Mosque) is an oaken box, rather humble in appearance. We noted at the time of collection that a number of timbers were reused, and we were prepared for a discrepancy in end dates. A 52 year old informant said that his 112 year old grandmother had told him the mosque was in its present form in her time. (The longevity of Black Sea grandmothers seems to be remarkable.) No sapwood was present on any of the samples. The end dates for the mosque timbers are spread out over 127 years as

follows: 1522, 1495, 1487, 1478, 1462, 1454, 1453, 1437, 1427, 1416, 1395 (almost as bewildering as Kaleburnu, below). With a full sapwood allowance a mid-16th century or slightly later date is reasonable. The mosque is indeed 'Eski' or old, and Grandmother was right.

Corinth, Acrocorinth *1443, 1508, 1715*

In 1995 a whirlwind visit to Medieval Acrocorinth with its excavators Richard Rothaus and Tim Gregory yielded a bag of samples, some of which have already been dated. For the oak lintel on Gate 3 we have 1715vv. For an unnamed and hitherto undated mosque we have 1508vv. For the fortification (Kastraki) at nearby Penteskouphi we have 1443v.

Foça, Kaleburnu Castle *1806 and earlier*

Kaleburnu Castle on the peninsula south of Foça is thought variously to be as early as Genoese or as late as Late Ottoman (Prof. Ömer Özyigit, the excavator of Phokaia, pers. comm.) At the tip of the point on the W, the rock of the promontory was trimmed down to make an almost vertical face N-S. Along and against this face is a N-S wall about 2 meters thick with a series of blind arches which end at the jagged, untrimmed rock. Projecting west from all of this are two E-W walls, about 4 meters thick which extend W about 10 meters before angling toward each other. The extreme W part of the construction is now gone, but a hexagonal or pentagonal construction seems reasonable. Almost at water level are a series (three and a half preserved on the N and two and a half preserved on the S) of irregularly placed arches of irregular width (approx. 2 to 4.5 meters W) and about 4 meters high. They could have been gunports, which does not make much sense since the guns would have been at sea level and could not have been trained with much latitude. A much better position for siting the guns would have been the top of the promontory. The arches make more sense as slipways through which small boats could have been dragged or winched. The floor of this area is made of large flat stone slabs, many of which might have come from the classical constructions of Phokaia. About a third of the floor on the E is preserved, the rest having been taken away by stone robbers.

We have now a series of 15 timbers with a variety of enddates ranging from 1516 to 1806. Many of the gun embrasures and/or boatslips appear to have been added piecemeal over a period of centuries from the 16th century onwards. If this had been the first medieval structure we had visited for dendrochronological sampling, we would have been very confused indeed. We plan to reexamine the structure in 1996 with our dendrochronological dates in hand to see whether we can find any clustering of dates for different parts of this fortification.

Mecki's CORINA

Robert "Mecki" Pohl spent last year completely rewriting all our computer programs in C++ and linking them in a more rational fashion than hitherto. They had been compiled over two decades in a variety of computer languages, and much of their running was based on quirks or limitations of machines that are now obsolete and have been discarded. Mecki finished his one-year stint as Programmer/Systems Analyst and has returned to Berlin to complete his Diplom in Computer Science. His academic supervisors in Berlin have agreed that he may use CORINA (Cornell Ring Analysis Program) for his thesis. Miles McCredie, who built much of our system in the first place, is back in the fold as computer consultant.

Publications pending:

Offprints forthcoming at unspecified times in the next twelve months: "An Early Bronze Age Settlement at Kiten" in the James Harvey Gaul Memorial volume, Studia Praehistorica (Sofia) (with B. Kromer, S. Tarter, and C. Griggs); "A 513-Year *Buxus* Dendrochronology for the Roman Ship at Comacchio (Ferrara)" in the Bollettino di Archeologia (with C. Griggs, S. Tarter, and H. Kuniholm); "Long

Tree-Ring Chronologies for the Eastern Mediterranean" in the Archaeometry 1994 Symposium; "Dendrochronology (Tree-Ring Dating) of Panel Paintings" in S. Taft and J. Mayer, eds., The Science of Oil Paintings (Academic Press); "Forests" and "Climatology" in the Encyclopedia of Near Eastern Archaeology (Oxford); "Scientific Chronology" and "Forestation" in Archaeology of Anatolia (Garland); and "Anatolian Tree-Rings, Santorini, and Old World Chronology" in Nature (with B. Kromer, S. Manning, M. Newton, C. Latini, and M.J. Bruce). Mary Jaye Bruce continues as Editrix and Chief Trouble-Shooter and is partly responsible for seeing that these reports go to the printer in a timely fashion.

Summer 1995 Aegean Dendrochronology Project Sample Collection:

ITALY

Venice, San Lorenzo, 9th and 12th centuries	52
Venice, San Francesco del Deserto, poss. 5th century	2

GREECE

Kastoria, Dispilio, Late Neolithic	1
Meteora, Moni Barlaam, medieval (BAR-28-29)	2
Corinth, Acrocorinth, medieval (ACR-1-16)	16
Crete, Samaria Gorge, (<u>P. brutia</u>) modern (CSG-16-21)	6
Crete, Khania, Kastelli, LMIIa2 (CAS-1-7)(still in Rethymnon)	7
Crete, Khania, Splantzia Xanion, MMIIb/LMIIa-b	28
Crete, Rethymnon, Amari, Pantanassa, Eremokliseis, LG I	8
Crete, Mochlos, Bronze Age	6
Crete, Palaikastro, LM Ib	5
Crete, Monastiraki (Rethymnon), MM II	3
Crete, Phaistos, MMIIa and b	3
Crete, Hg. Triadha, MM IIb?, IIIa	3

TURKEY

Aydin, Madran Dagi (<u>P. nigra</u>) modern	10
Aphrodisias, Theater (APH-5-20), late antique?	16
Usak, Banaz, Kozviran Tumulus, Roman?	38
Usak, Güre, İkiztepe Tumulus, Archaic	21
Usak, Güre, Kayaagil Köyü Necropolis, 1st Millennium B.C.	42
Kütahya, Seyitömer Höyük (KSO-70-73), EB II	4
Bursa, Kursunlu, Hg. Albercios (KUR-6), Byzantine	1
Gordion, Tumulus B (GOR-173-178), Archaic (<u>ca.</u> 630 B.C.)	6
Kilis, Oylum Höyük (OYL-2-3), Bronze Age	2
Gaziantep, Zeugma (Belkis), Roman?	1
Çorum, Bogazköy (1994: BOG-12, 13, 14), Phrygian	3
Çorum, Bogazköy, Büyükkaya (1995/BOG-6-11), Phrygian	6
Giresun, Sebin-Karahisar, Kale, medieval	1
Erzurum, Pasinli, Sos Tepe, Hellenistic (SOS-5-59)	55
Erzurum, Pasinli, Sos Tepe, Iron Age (SOS-60-66)	7
Erzurum, Pasinli, Sos Tepe, EBA (SOS-67-68)	2
Erzurum, Pasinli, Sos Tepe, Medieval, etc. (SOS-69-75)	7
Erzurum, Pasinli, Sos Tepe, (SOS-76-77)	2
Van, Ayanis, Urartian (AYA-338-376)	28

Agri, Dogubeyazit, İshakpaşa Sarayı, late medieval (1 bag)	1
Van, Çavustepe, Urartian (CAV-5AB)	1
Sivas, Kusaklı Höyük, Late Hittite	8
Nigde, Köşk Höyük, Late Neolithic (KOS-28-249)	222
Nigde, Porsuk Höyük, Hittite (POR-133-141)	9
Mersin, Silifke, Kelenderis (KEL-3), Archaic	1
Konya, Sirçalı Medrese Substructure, Early Christian?	6
Burdur, Sagalassos, Roman (SAG-30-36)	7
Afyon, Emirdağ, Amorium, medieval (AMO-66-73)	8
Denizli, Çardak, Kale, Byzantine?	4
Denizli, Pamukkale, Roman Bath	2
Manisa, Salihli, Sardis, Archaic Wall (MMS-15-31)	17
Çanakkale, Troy, Bronze Age and Classical (TRO-153-156)	4
Çanakkale, Troy, Bronze Age (Troy VIIA)	15
Aksaray, Asikli Höyük (ASH-9-13)	5
Aksaray, Acemhöyük, Aribas Mezarlığı	8
Kirsehir, Kaman, Kalehöyük	4
Çorum, Ortaköy	1

NOTE: In this tabulation a bag of charcoal lumps has been counted as one sample. Thus approximately 75 fragments of charcoal from Phaistos are listed as a single sample. We do not yet know how many beams are represented thereby.

45 sites as of November 1995 totaling 689 samples (about 2000 measurable pieces)

Other Personnel: Jennifer Fine has succeeded Christine Latini (now in the publishing business) as Laboratory Supervisor. Laura Steele, delayed by serious illness, is working part-time as she finishes her Undergraduate Honors thesis on "Superstructure, Space, and Society: the Architecture of the Aceramic Neolithic Antitaurus" and will switch to full-time as soon as she is done. Chris Roosevelt, Isabel Tovar-Castro, Robert Hooker, Dominique Lazanski, and Michael McGrann are the old-timers who are staffing the lab this term. Jennifer, Mary Jaye, Dominique, and Maryanne (also on loan to both Asikli Höyük and Çatal Höyük) made up the summer field team while Isabel and Robert worked in the lab. Chris was loaned to Sardis, and Michael excavated at the Athenian Agora.

So there you have it as of December 1995. The Bar Graph on the next page, a composite of some eight million measurements, inches along, bit by bit. Of course, not all of our lives are characterized by **HIGH MORAL PURPOSE** and **SERIOUSNESS**. Some of the more ridiculous items of this past year, as many as can be squeezed into the remaining space on the last page, are appended.

Selected Idiocias of 1994-1995:

- The **EROS REGENCY HOTEL** in Denizli and the **NO PROBLEM PANSIYON** (Pension) in Tekirdağ, Turkey.
- Our stay in **KAVSIT VILLAGE** above Aydın (s-> in Turkish is pronounced sh).
- The **BIMBO BUS** on the Autostrada west of Venice where I was dissuaded from taking incriminating photographs of the ladies.
- **HAILSTORMS** in Venice in **JUNE** and in Turkey in **JULY** (including ten straight days of rain on the Black Sea Coast).

- The **HOTEL KARAGOL** on a 2100m. high mountain above Giresun where we sat gratefully in front of a **ROARING WOOD FIRE ON JULY 17TH** and tried to guess where summer had gone.
- The **COMMANDO POST** where they tried to give us their **NINE SHEEPDOG PUPPIES**.
- **MOBY DICK BURGERS** in Kayseri, **TITANIC JEANS** in Samsun, **SAVE THE WALES TEE-SHIRTS** in Erzurum.
- Tee-Shirts from **DETROIT, KANSAS** -- and **KANSAS CIGARETTES** to smoke while wearing them.
- My generic **AMERICAN MAN** softball cap from Karaman, priced at 75 cents and worth every penny.
- Wondering which of 2000 skeletons in S.Lorenzo in Venice might have been that of **MARCO POLO**.
- Finally, **AN ENTIRE BATHROOM** (you can imagine what the Australian excavator called it) filled to the top of the washbowl with several hundred plastic bags of Hellenistic charcoal at Sos Hüyük,....you think I am kidding?

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