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MIDDLE EAST TECHNICAL UNIVERSITY (METU) RADIOCARBON DATES I

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The Radiocarbon Dating Laboratory was established at the Middle East Technical University in the Physics Department with the equipment provided by the British Government through former CENTO auspices and financial support by the Ford Foundation. This list reports on ^{14}C dates measured up to July 1987.

The laboratory is built in the basement of a three-story building and uses CO_2 gas for proportional counting. The system is equipped with three high-purity copper proportional counters (Twentieth Century Electronics). Each counter has an active volume of ca 2L.

The proportional counters are protected against cosmic ray and surrounding ionizing radiation by a passive 10cm-thick shield made of old lead (James Girdler & Co, Ltd) and an active cylindrical plastic scintillator anticoincidence ring (Nuclear Enterprise NE 102A). Each copper proportional counter is separately placed inside a horizontal cylindrical cavity in the plastic scintillator which is viewed from both ends by two 30cm photomultipliers (EMI 945B) to detect any external radiation passing through the system. In between the passive and active shields there is a neutron moderator in the form of small pellets made of 70% paraffin wax, 20% boric acid, and 10% polythene. The signals from both photomultipliers are first fed into individual preamplifiers and then added in a mixing unit before going to the amplifier. Output signals from the proportional counters are fed into separate signal processing channels through charge-sensitive preamplifiers built into the counters. Anticoincident ^{14}C signals from the counter are also fed into a 256-channel pulse height analyzer (Tracor Northern NS633) to obtain beta spectrum of each sample counted.

Only one of the counters is used for dating purposes. The usual operating pressure of the counter is 120cmHg. Two other pressures, 100cmHg, and 80cmHg, are also used for smaller-sized samples. Counter plateaus are ca 700V long with slopes $<1\%/100V$ for cosmic rays at the operating pressure of 120cmHg. The operating voltage at this pressure is ca 4750V. Modern standard CO_2 is prepared by wet oxidation of NBS oxalic acid and background CO_2 is prepared by combustion of anthracite. At the operating pressure of 120cmHg, the background is 9.74 ± 0.06cpm and net modern (95% of NBS oxalic acid) corresponding to AD 1950 ^{14}C count rate is 15.92 ± 0.10cpm. Every sample is counted for >48 hours with 200 minute repeating periods. The background and the NBS oxalic acid standard are counted at least twice a month.

Samples are examined for contamination and a physical cleaning is followed by a standard acid-alkali-acid treatment. After each treatment the sample is rinsed with distilled water until neutralization is achieved, and is made slightly acidic before it is dried overnight at 100°C. Charcoal, wood,

charred grains, and anthracite for background are converted to CO_2 by controlled combustion in a quartz tube with a stream of commercial oxygen gas coming through washed bottles containing 1% NaOH solution. The combustion products of the sample are initially purified by passing over several $KMnO_4$ solutions and water traps cooled at −78°C. The CO_2 is collected with liquid nitrogen and further purification is achieved by circulating the CO_2 over 450°C hot CuO. The purified CO_2 is stored for about four weeks to ensure radon decay. Prior to each counter filling, the CuO furnace is reduced to Cu by passing hydrogen gas at 450°C and the CO_2 is routinely circulated several times over 450°C hot Cu and is vacuum distilled at −78°C. After this procedure, CO_2 quality is satisfactory for proportional counting and, therefore, the CaO purification furnace present in the system is not used.

Dates are expressed in years BP (AD 1950) using the half-life for ^{14}C of 5568 years (Stuiver & Polach, 1977). Errors quoted with dates are based only on counting statistics and correspond to $\pm 1\sigma$ of sample, background, and modern standard. No $\delta^{13}C$ values were measured and dates have not been corrected for isotopic fractionation. No corrections were made for natural ^{14}C variations.

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ARCHAEOLOGIC SAMPLES

Turkey

Phrygian series

Wooden beam from Gordion (39° 45′ N, 31° 55′ E), ca 110km SW of Ankara, in very good state of preservation. Beam was taken from tomb in Great Tumulus. NaOH pretreatment. *Comment:* series of dates for same site was pub previously (P-127, -128, -133 to -137: R, 1959, v 1, p 45–58). Another wooden sample from Great Tumulus, Phrygian site, Bahçelievler, Ankara. It contains too much humic acid. NaOH and HCl treatment.

METU-3. Gordion **2650 ± 200**

METU-4. Bahçelievler **2550 ± 200**

Ikiztepe series

Charcoal and charred grains from Ikiztepe Mound, ca 7km NW of Bafra, Samsun at Black Sea Coast. There are four distinct tumuli at site;

only Tumulus I and Tumulus II were excavated. Three main periods, Chalcolithic, Early Bronze Age, and Early Hittite (or Transition), were assigned to site on archaeol grounds. Six phases of Early Hittite period are present in Tumulus I, at 6m depth from surface. Upper levels of Tumulus II were eroded and seven phases of Early Bronze Age occur at 5m depth. Seven phases of Chalcolithic period occur at 5.5m depth. All samples coll and subm by late U Bahadir Alkim, Istanbul Univ. NaOH and HCl pretreatment.

METU-5. Ikiztepe 6 **5170 ± 170**

Tumulus II, charcoal mixed with soil, Loc b 517, D-13/II-19.

METU-6. Ikiztepe 8 **3690 ± 160**

Tumulus I, charred grains mixed with soil, Loc b 421, D-4/IV-11.

METU-7. Ikiztepe 15 **4270 ± 100**

Tumulus I, charred grains mixed with soil, Loc b 422, D-4/IV-12.

METU-8. Ikiztepe 18 **5550 ± 120**

Tumulus II, charcoal mixed with soil, Loc b 116, D-11/II-19.

METU-9. Ikiztepe 22 **4030 ± 100**

Tumulus II, charcoal mixed with charred grains and soil, Loc b 506, D-13/II-1.

Çayönü series

Charcoal from Çayönü Tumulus (38° 16′ N, 39° 43′ E), Diyarbakir in Turkey (Braidwood, Çambel & Shirmer, 1981; Çambel, 1981, p 151). Samples are mixed with soil. NaOH and HCl pretreatment. Samples coll and subm by Halet Çambel, Istanbul Univ. *Comment:* series of 20 dates for same site was pub previously (GrN-4458, -4459: R, 1967, v 9, p 107–155; GrN-5827, -5952 to -5954, -6241 to -6244, -8078, -8079, -8103, -8819 to -8821, -10358 to -10361: Çambel, 1984, p 20). GrN-8079, 9250 BP or GrN-8821, 9175 BP date beginning of site.

METU-10. Çayönü 2 **9510 ± 100**

Charcoal mixed with soil. Excavation R-3/4-0.51.

METU-11. Çayönü 3 **10,480 ± 220**

Charcoal mixed with soil. Excavation R-5/11/1.10.

METU-12. Çayönü 4 **10,820 ± 220**

Charcoal mixed with soil. Excavation R-5/13-7.08 Tr-1.13.

METU-13. Çayönü 5 **5940 ± 150**

Charcoal mixed with soil. Excavation R-4/10-0.74 Tr-0.82.

Keban series

Charcoal and charred grains coll from Tepecik Tumulus (38° 39′ N, 39° 26′ E) and Tülintepe Tumulus (38° 38′ N, 39° 24′ E) Altinova, Elaziğ, ca 30km E of Elaziğ. Both tumuli are now flooded as result of Keban Dam built in region. Tepecik Tumulus was assigned on archaeol grounds to beginning of Late Neolithic. Early and Late Chalcolithic, Early, Middle, and Late Bronze Ages, Iron Age, and Middle Ages cultural levels are present in Tepecik. Upper levels of Tülintepe Tumulus were destroyed and only Early and Late Chalcolithic cultural levels were excavated (Esin, 1982, p 95; Esin & Arsebük, 1982, p 127). All samples coll and subm by Ufuk Esin, Istanbul Univ.

METU-14. Tepecik (K-15B) **4000 ± 60**
Charcoal, Loc K, 74, 12K, 4.

METU-15. Tepecik (K-19) **4790 ± 60**
Charcoal, Loc A, 16A, 3, BT2.

METU-16. Tepecik (K-22A) **2890 ± 60**
Charcoal mixed with soil, Loc K, 70, 7K, 4,29.

METU-17. Tülintepe (K-4) **6160 ± 150**
Charred grains, Loc I, 531, 1, B, 10.

METU-18. Tülintepe (K-6) **5360 ± 180**
Charred grains, Loc L, 54L, 18.

METU-19. Tülintepe (K-7) **5730 ± 190**
Charred grains, Loc I, 71, 481, 2,2.

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