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COMPARISON OF ^{14}C DATES AND OTHER AGE ESTIMATIONS BETWEEN 2000 BC AND AD 1000

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ABSTRACT. The ^{14}C age of charcoal and wood from Lebanon and central Europe is compared partly with the dendrochronologically determined age of the samples and partly with the archaeologically expected value. While the dendrologic values approximately confirm the correction curve of Ralph, Michael, and Han (1973), charcoal of burned layers seemes to be generally 2 to 3 centuries older than expected from contemporary archaeologically retrieved materials.

At excavations of a tell near the modern village of Kamid el-Loz, Lebanon (33° 37′ N, 35° 49′ E), Rolf Hachmann, Saarbrücken, collected charcoal from different layers, which he related to the Egyptian calendar on the basis of ceramic finds. The material belongs to three archaeologic stages (*cf* Hachmann, 1979):

Middle Bronze age	2200 to 1550 BC
Late Bronze age	1550 to 1200/1100 BC
Early Iron age	1200/1100 to 900 BC

The charcoal lay in calcareous soil, because buildings were constructed on foundations of limestone. All carbonates were removed by boiling with 1N HCl before preparing samples for ^{14}C and ^{13}C measurements.

Figure 1 compares archaeologic expectations and ^{14}C ages (corrected to $\delta^{13}C = -25‰$). The samples marked by laboratory number are arranged according to their stratigraphic position. The sequence is not perfectly exact, because the comparison of layers from different excavation areas has not yet been completed, but the attribution to different cultural stages is reliable. The bars are equal to $\pm 1\sigma$ of ^{14}C measurement. The upper, linear scale is the conventional ^{14}C age of the samples, corrected to $\delta^{13}C = -25‰$. To transform the ^{14}C ages into dendrochronologically corrected values according to the smoothed curve of Ralph and coworkers, the lower, nonlinear scale is given, which is shifted by 180 years (1000 BC) to 350 years (2200 BC) against the upper scale. Both scales contain the boundaries of cultural stages mentioned above.

Apparently, ^{14}C age and cultural stage correspond only for the conventional scale. The corrected age is about 200 years too old. Agrawal and Kusumgar (1974) came to a similar conclusion in a compilation of Egyptian dates from 2500 to 1900 BC, showing that ^{14}C dates ($T_{1/2} = 5730$ years) reproduce the archaeologic dates better than the corrected values.

In central Europe, Schwabedissen (1978) shows that the conventional ^{14}C age fits the archaeologic expectation for Neolithic and Bronze age samples (1800 to 1200 BC), while the MASCA correction would make them 3 to 4 centuries too old.

From excavations at a Slavonic fortification, Bischofswarder, at the Ploener See (54° 7′ N, 10° 26′ E) by Wilhelm Gebers, Kiel, we dated some 20 posts and wooden pieces not suited for dendrologic analysis (AD 615

to 840) (Willkomm, 1979). From the same layer, larger trunks yielded dendrochronologic ages ca 100 years younger. A series of tree rings from the first millennium dated dendrochronologically by Dieter Eckstein, Hamburg, was selected for measurement to test this difference (table 1). In addition, we measured two tree-ring samples from about 550 BC, dated dendrologically by Ernst Hollstein, Trier (Hollstein, 1977). Though differing somewhat from the smoothed curve of Ralph, Michael, and Han, all values roughly confirm the variations of recent activity derived from Rocky Mountain trees. In particular, the samples from AD 500 to AD 800 confirm the wiggles measured by Bruns, Münnich, and Becker (1980).

A last group of ^{14}C measurements refers to charcoal samples from Oldenburg in Holstein (54° 18′ N, 10° 53′ E), the early Medieval capital Starigard of Slavonic Wagrian (now East-Holstein). During excavation, samples were collected by Ingo Gabriel, Schleswig, from different levels of a continuous 2.5m sequence of settlement layers ranging from AD 700 to AD 1150 (Gabriel, 1975). The site was abandoned for at least half a century and after German occupation during the 13th century, a castle

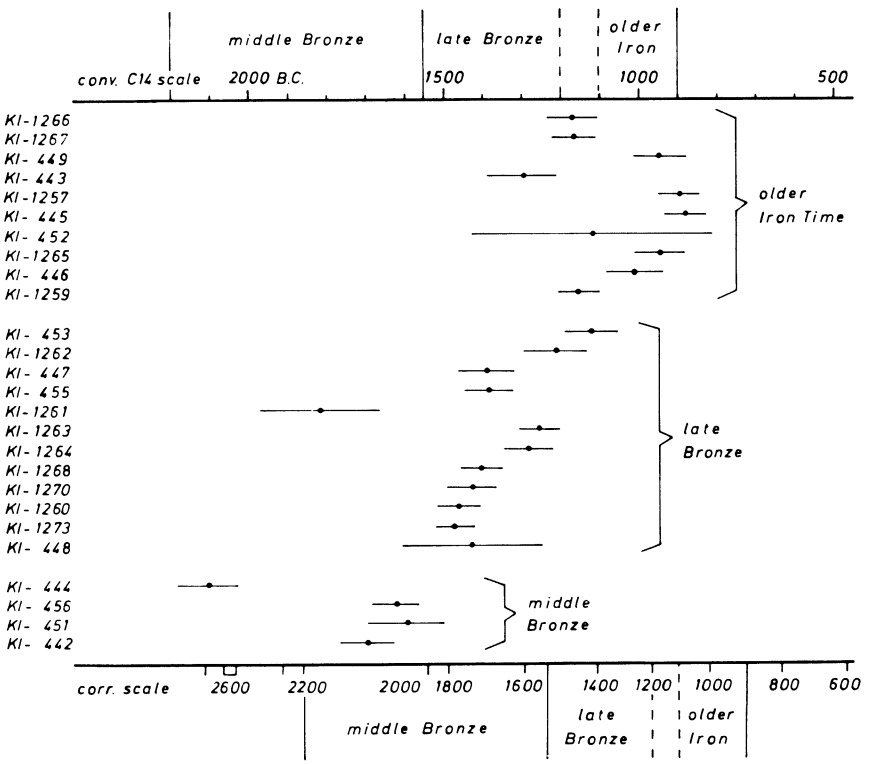

Fig 1. ^{14}C ages and archaeologic dates of charcoal samples from Kamid el-Loz, south Lebanon. Samples are arranged according to their stratigraphic position. For each sample, the ^{14}C age corrected for isotopic effects $\pm 1\sigma$ is given. The upper scale shows the conventional ^{14}C age, the lower one, the corrected age according to Ralph, Michael, and Han (1973).

was built within the former fortification. Some documentation exists for ancient Oldenburg since AD 967 (Widukind of Corvey, Adam of Bremen, Helmold of Bosau, Saxo Grammaticus, Knytlinga saga). The layers were dated mainly by quantitative analysis of ceramic style elements. According to the established typology outlined by Schuldt (1956; 1965), types such as Sukow, Feldberg, Menkendorf, and disc-made pottery with rotation grooves, including Bobzin, Teterow, Weisdin, Vipperow, and Garz (names associated with Mecklenburgian sites) are present in quantities varying with depth. Settlement layers of the 13th century contain German pottery—bluish-gray, hard, burned, globular jars. Ceramic dating is completed by studying the development of combs and horsemen's spurs throughout the stratigraphy. Some of the main strata can be correlated to known historic events.

In figure 2, the ^{14}C age corrected to $\delta^{13}C = -25‰$ is given as a function of the archaeologic age estimate. The left scale gives the conventional ^{14}C age. In the right scale, the dendrologic correction according

TABLE 1

Dendrochronologic and radiocarbon ages for tree rings from northwest Germany

Lab no.	Location	Range of tree rings T_D (AD)	Conventional ^{14}C age $\pm 1\sigma$ T_L (AD)	$\Delta^{14}C$ ‰
KI-242	Haithabu, near Schleswig (54°30'N, 9°34'E)	520±5	350±40	−26 ±5
KI-542/43	Haithabu	588±14	460±40	−21 ±5
KI-731	Wittmoor, bog N of Hamburg (53°42'N, 10°4'E)	618±16	600±50	−11 ±6
KI-1293	Scharstorf, near Preetz (54°14'N, 10°20'E)	689±15	675±55	− 6 ±7
KI-1296	"	"	655±90	− 9 ±11
KI-1297	"	"	627±50	−12 ±6
KI-1293/97	" mean value	"	650±35	− 9.5±4.2
KI-241	Haithabu	800±5	680±40	−19 ±5
KI-1298	Scharstorf	800±20	690±55	−18 ±7
KI-1300	"	"	790±55	− 5 ±6
KI-1302	"	"	720±50	−14 ±6
KI-1303	"	"	770±60	− 8 ±7
KI-241/1303	Haithabu, Scharstorf, mean value	"	721±22	−14.0±2.7
KI-240	Wienhausen, monastery near Celle (52°35'N, 10°11'E)	1100±5	980±35	−18 ±4
KI-239	Wienhausen	1270±5	1220±30	− 9 ±4
KI-238	"	1280±5	1260±35	− 5 ±4
KI-1484	Magdalenenberg near Villingen (Black Forest, 48°4'N, 8°27'E)	563±11 BC	574±40 BC	− 6 ±5
KI-1485	Magdalenenberg	557±5 BC	533±42 BC	−10 ±5

$\Delta^{14}C$ is calculated for $T_{1/2} = 5730$ years according to

$$\Delta‰ = \frac{T_L\ (AD)}{8.033} - \frac{T_D\ (AD)}{8.270} - 7.0$$

$$\text{with } 7.0 = \frac{1950}{8.033} - \frac{1950}{8.27}$$

The ^{14}C age is corrected to $\delta^{13}C = -25‰$ execept samples KI-238 through KI-242.

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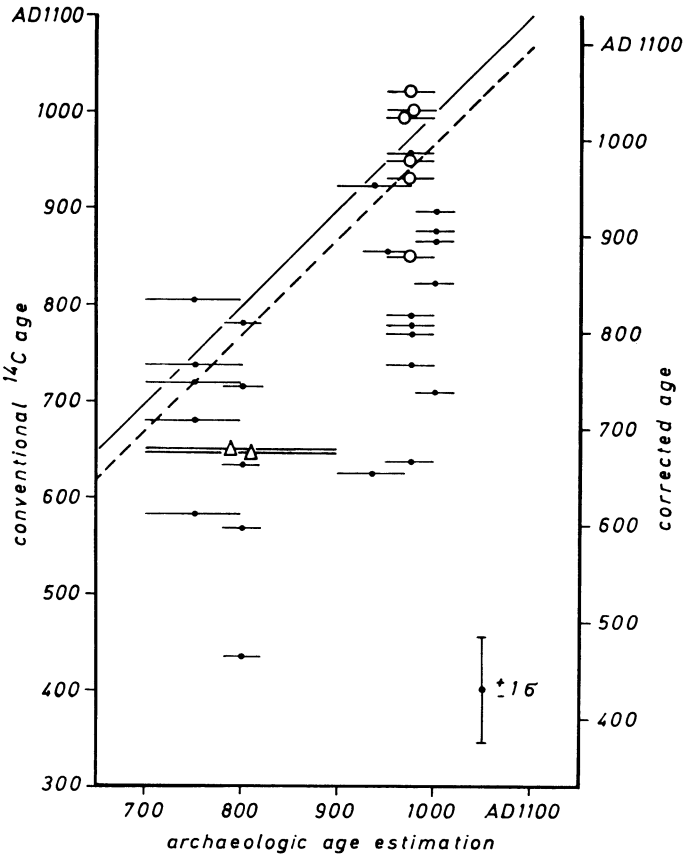

Fig 2. ^{14}C ages vs archaeologic age estimates for the Slavonic capital of Oldenburg, northwest Germany. Left scale: conventional ^{14}C age (AD). Right scale: dendrochronologically corrected age (AD) according to Ralph and coworkers. For clarity, the uncertainty of ^{14}C values has been omitted. In most cases, the standard deviation lies in the range of 50 to 60 years according to the bar in the right corner of the figure. ● ● ● = charcoal and carbonized wood, ○ ○ ○ = carbonized cereals, △ △ △ = charcoal from Scharstorf (northwest Germany).

to Ralph, Michael, and Han is taken into account for these centuries merely by a uniform shift of 35 years[1]. Only a part of the samples lies near the diagonal lines which indicate the coincidence of archaeologic expectation and conventional ^{14}C age (straight line) or corrected age (dashed line). Carbonized cereals, in particular, fit these lines better than wood or charcoal. In most cases, however, the expected age is one or more centuries younger than the ^{14}C age.

The ^{14}C values of dendrologically dated trees clearly show the validity of the *Pinus aristata* calibration also for European samples. Therefore,

[1] The tables and diagrams of Ralph contain other numerical values because they are calculated for $\tau = 8270$ years.

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we must try to explain the comparatively high ^{14}C ages of burned layers from archaeologic sites with reasons other than in the radiocarbon method itself. A small difference could be explained if the charcoal were formed only from hardwood which is, at least, 20 to 30 years older than the date of felling the tree. The most probable reason, however, may be that, in the case of destruction of the whole village by fire, only those pieces of wood are preserved as charcoal which were orginally protected by up to several hundreds of younger tree rings. In addition, in some cases, stratigraphic layers may be disturbed, moving charcoal up from deeper parts into higher layers or, on the contrary, ceramics downward from above. Another possibility is that some archaeologic time boundaries may have to be slightly changed.

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REFERENCES

Agrawal, D P and Kusumgar, Sheela, 1974, On the calibration of C^{14} dates: Puratattva, v 7, p 70-73.

Bruns, Michael, Münnich, K O, and Becker, Bernd, 1980, Natural radiocarbon variations from AD 200 to 800, *in* Stuiver, Minze and Kra, Renee, eds, Internatl radiocarbon conf, 10th, Proc: Radiocarbon, v 22, no. 2, p 273-278.

Gabriel, Ingo, 1975, Burg, Siedlung und Gräberfeld im früh-mittel-alterlichen "Starigard" (Oldenburg in Holstein): Archäol Korrespondenzblatt, v 5, p 225-230.

Hachmann, Rolf, ed, 1980, Bericht über die Ergebnisse der Ausgrabungen in Kāmid el-Lōz in den Jahren 1968-1970: Saarbrücker Beiträge zur Altertumskunde, v 22.

Hollstein, Ernst, 1977, Eisenchronologie Westdeutschlands und der Schweiz aus römischer und vorrömischer Zeit: Erdwissenschaftl Forsch, v 13, p 16-24.

Ralph, E K, Michael, H N, and Han, M C, 1973, Radiocarbon dates and reality: MASCA Newsletter, v 9, p 1-20.

Schuldt, E, 1956, Die slawische Keramik in Mecklenburg: Berlin, Deutsche Akad Wissenschaften, p 5-74.

———— 1965, Slawische Töpferei in Mecklenburg: Schwerin, Mus f Ur- u Frühgeschichte Schwerin, p 5-89.

Schwabedissen, Hermann, 1978, Konventionelle oder kalibrierte C^{14}-Daten?: Archäol Informationen, v 4, p 110-117.

Willkomm, Horst, in press, Radiokohlenstoffdatierungen und Untersuchungen an den stabilen Kohlenstoffisotopen im Bereich Bosau-Bischofswarder, *in* Hermann Hinz, ed, Bosau, Untersuchung einer Siedlungskammer in Ostholstein, vol IV: Naturwissenschaftliche Untersuchungen, Neumünster, in press.