CALIBRATION OF THE TIME HORIZONS STATED IN RADIOCARBON AGE FOR THE WESTERN CARPATHIANS ISOPOLLEN MAPS

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The problem

Following the decision, motivated by analogy with the older isopollen project for the whole of Poland (Ralska-Jasiewiczowa et al., eds 2004), that a radiocarbon time axis, i.e. one stated in conv. BP years, is to be employed in the Western Carpathian Isopollen Project, the need has arisen to calibrate the time horizons. The task is no in the simple calibration of "dates" like 500 BP, 1000 BP, and so on, since the arbitral values of boundaries are not radiocarbon dates themselves. These are arbitral values, at least in sense that they are not attributed with any measurement error because they are by definition error-free. Similar situation has been considered by the authors in the paper considering the Mangerud chronozone boundaries (Mangerud et al. 1974, Walanus & Nalepka 2010). Due to the appearance of this paper, it is no longer possible to apply a resolution analogous to that from the isopollen for Poland to the problem (Walanus & Nalepka 2004a).

Proposed solution

The proposed method for "calibrating" dates arbitrarily stated in radiocarbon years (BP) is similar to the older proposition (Walanus & Nalepka 2004a) in the sense that the result is also not unequivocal. However, the final result is given as a single value rather than a time span (years AD/BC, or b2k – the terminology is still under discussion and it seems to be "never ending story" as the new data at so on has been arrived day by day. One of the summarizing proposals are discusses/included in Owen 2009). The simpler form of the final result comes at the cost of including a certain amount of arbitral decisions, which influence its accuracy. There is some relatively objective parameter in this case, which, when minimalized, gives the unequivocal "calibration", i.e. transformation of BP into AD/BC. However, such an approach depends on the measurement error (σ) of the dates involved in the pollen profile dating. Moreover, the mentioned errors are to be treated as true imprecisions, not only "one sigma" physical errors connected with the ^{14}C concentration measurement. It is essentially impossible to assume one value here, for example 40 or 100 yr. The only option here is to present a plot of the relation of BP versus σ, for different AD/BC. Such plots create a basis for choosing the final calendar age for each conv. BP time horizon (Fig. 10). The plot gives an idea of how diffused the final result in fact is.

Results

The *post factum* calibration of boundaries, while profiles are dated in radiocarbon age, cannot be a good resolution, however it is all that can be done.

In the case of the "calibration" of Mangerud's chronozones (Walnus & Nalepka 2010), the idea that the calendar age should also be expressed in round numbers that were not too precise was important. The same seems to be valid now. Time horizons are definitely "round" numbers. So the idea of not being too precise played some role in the decision over which AD/BC curve to choose (Fig. 10). The final result is presented in Table 3. The "precision" is down to 50 yr at most.

Figure 11 presents the sinusoid of the Earth's magnetic field oscillation, extremely familiar in radiocarbon research. However, it is obtained here as the deviation of the numbers from Table 1 from the linear model. Since the plot (Fig. 11) seems to be relatively smooth, with no outliers, the presented "calibration" does not seem to display any significant errors.

The analogy of the Western Carpathians Isopollen Project to that covering the whole of Poland (Ralska-Jasiewiczowa et al., eds 2004) differs in another point. Almost 10 years ago it was decided to use precisely cut time spans from the pollen profiles. This was somewhat of an oversimplification, since the precision of the dating of pollen samples was poor. Today the precision of the dating of individual samples is not much better, since the

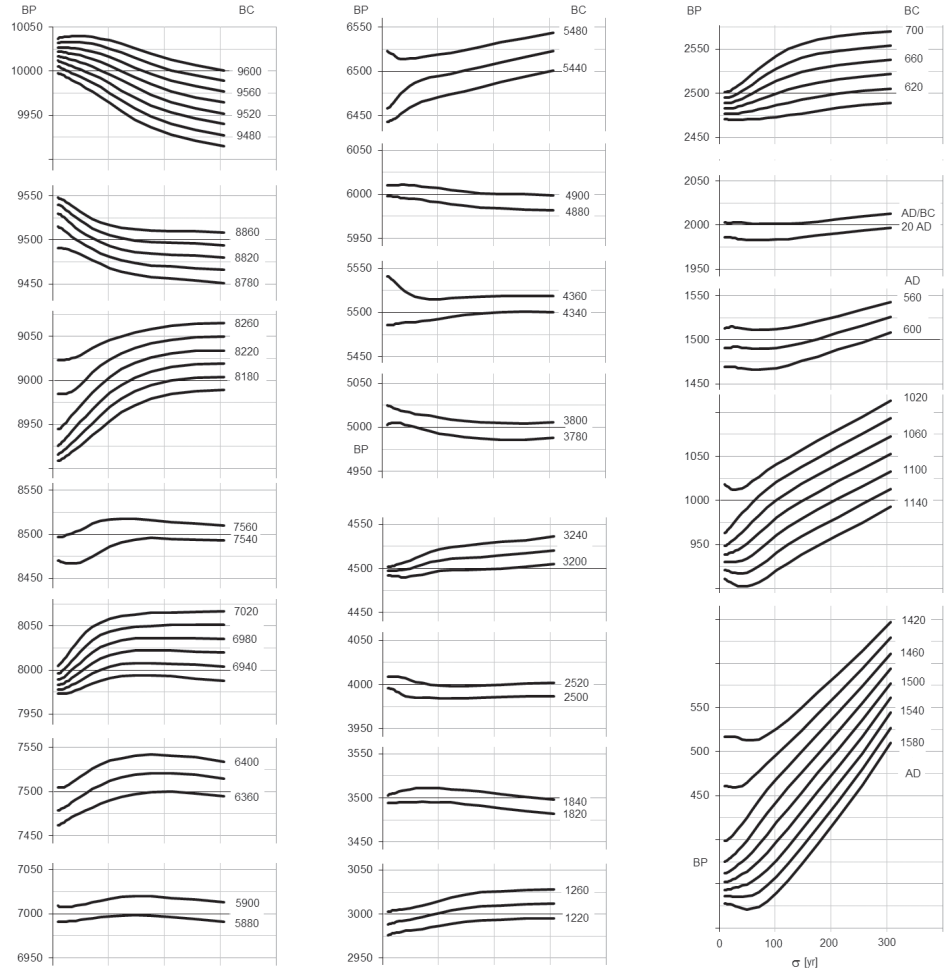

Fig. 10. "Calibration" of time horizons: 500, 1000, … 10 000 conv. BP. The vertical axis (broken many times) depicts radiocarbon age. The horizontal axis represents the measurement error. Curves presented for each time horizon of interest are parameterized by the AD/BC calendar age (the step is 20 yrs)

Table 3. Correspondence of the conventional radiocarbon age of time horizons to the calendar age

^{14}C BP	AD/BC
0	2000
500	1450
1000	1050
1500	600
2000	0
2500	−600
3000	−1250
3500	−1850
4000	−2500
4500	−3200
5000	−3800
5500	−4350
6000	−4900
6500	−5450
7000	−5900
7500	−6400
8000	−7000
8500	−7550
9000	−8200
9500	−8800
10000	−9500

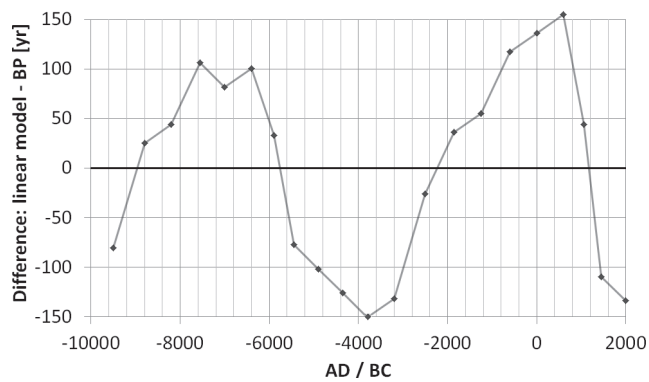

Fig. 11. Deviation of ^{14}C BP values (Tab. 3) from the linear model BP = a* AD/BC + b

old profiles continue to be used. However, in the Carpathian Project, the samples were Gaussially weighted, so there are no strict boundaries to be dated. Samples dated as being close to the exact time horizon are included in the map with higher weights than those which have some probability of belonging to the neighboring time horizon instead.