A NOTE CONCERNING "LOCATION-DEPENDENT DIFFERENCES IN THE ^{14}C CONTENT OF WOOD" BY McCORMAC *ET AL.*

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I have read with interest the detailed paper by McCormac *et al.* (1995) in which they suggest that the shift in the Belfast calibration data of *ca.* 18 yr toward older dates may not be valid (Pearson and Qua 1993). They also document "evidence for small location-dependent ^{14}C differences". In the process, they also rediscover a North American marine west coast effect that, as a reviewer of their first draft, I had pointed out to them but that they chose not to acknowledge. Specifically, we find no difference between our measurements on west coast samples (sequoia and bristlecone pine) and Seattle measurements on west coast Douglas-fir and bristlecone pine (Kalin *et al.* 1995; Linick *et al.* 1986). However, we found a significant time-dependent difference between our data (Damon, Cheng and Linick 1989) for Douglas-fir from the Santa Catalina Mountains near Tucson (32°26′N, 110°47′W; elev. 2740 m) and Douglas-fir from the Olympic Peninsula reported by Stuiver and Quay (1981). Since their 1981 paper, Stuiver and Becker (1993) have reported the necessity of correcting the Seattle data measured between 1976 and 1990 for an error due to radon contamination. I considered that the necessity for this correction might have been the reason for the failure of McCormac *et al.* (1995) to acknowledge our 1986 paper.

Consequently, I replotted the Arizona data *versus* the slightly revised Seattle data (Stuiver and Braziunas 1993: Fig. 1). Except for a shift of 1.7‰ of the Seattle data toward lower values (older apparent age of 17 yr) and a shift of the formerly anomalous 1947 measurement to exact agreement between Seattle and Tucson, the new Figure 1 given here is identical to Figure 7 of Damon, Cheng and Linick (1989). As before, two modes of depleted ^{14}C fall with high correlation on two lines, one at 3‰ ^{14}C depletion and the other at 6.2‰ depletion. These differences could be explained by the addition of 2% and 4% of 15% ^{14}C-depleted ^{14}C from the deep sea derived by upwelling and mixed with the prevailing undepleted air mass. Mode 1 represents a shift of *ca.* +25 yr and mode 2 represents a shift of *ca.* +51 yr. The 17-yr average change from the uncorrected data is equivalent to the *ca.* 18-yr shift toward older dates so thoroughly discussed by McCormac *et al.* (1995). The shift caused by upwelling would result in a bias in decadal samples of *ca.* 35 yr between the Santa Catalina Mountains and Seattle and a shift of *ca.* 55 yr between the Santa Catalina Mountains and the Arctic Circle in the Mackenzie Valley cited by McCormac *et al.* from the measurements of Damon *et al.* (1992). The latter, we suggest, is the result of the release of depleted ^{14}C from the thawing of frozen earth during the growing season.

CONCLUSION

McCormac *et al.* have confirmed the existence of regional differences in the ^{14}C content of wood that we have previously documented. The age bias caused by this regional effect is not trivial and must be taken into consideration in ^{14}C calibration studies. Further, the effect is not constant, so that secular variation (though not as great for decadal and bidecadal samples) must also be taken into consideration. Finally, I find no significant correlation with El Niño or La Niña events.

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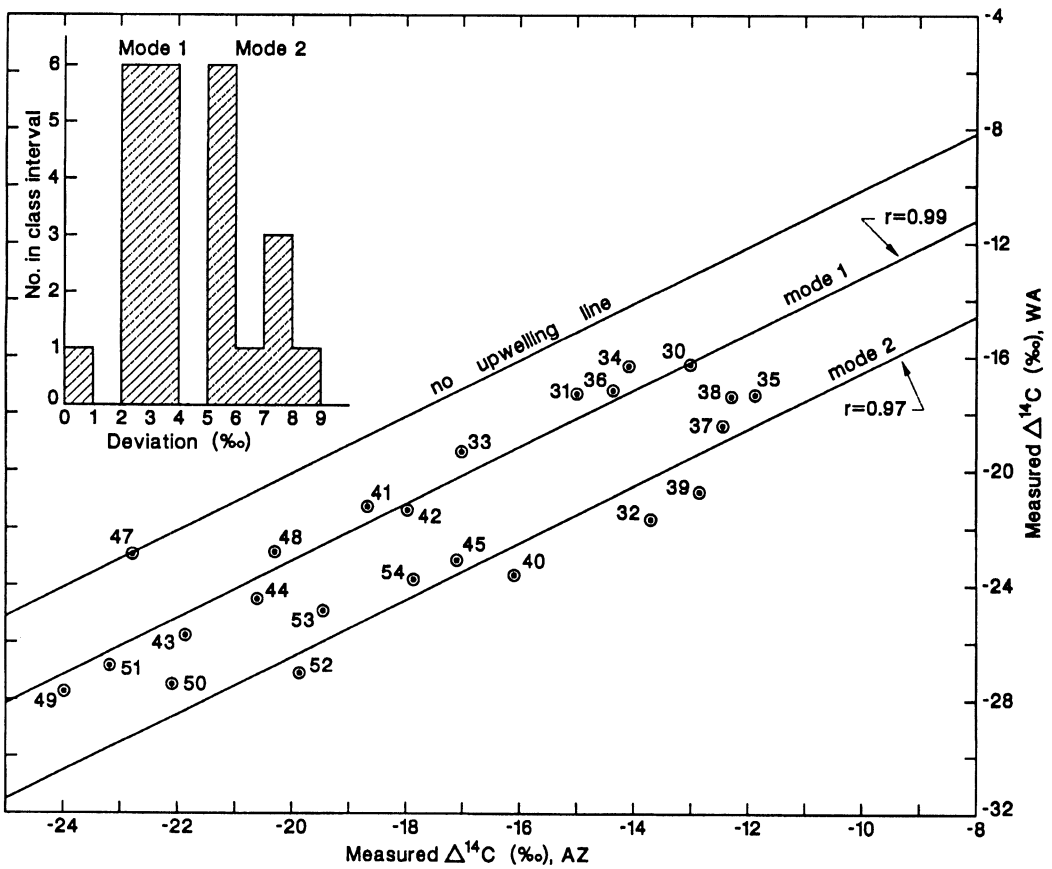

Fig. 1. $\Delta^{14}C$ data of Stuiver and Braziunas (1993) for Douglas-fir from the Olympic Peninsula *vs.* $\Delta^{14}C$ data from Damon, Cheng and Linick (1989) for Douglas-fir from the Santa Catalina Mts. near Tucson. Note the three lines with high correlation coefficients that we postulate are the result of different modes of oceanic upwelling introducing ^{14}C-depleted CO_2 into the prevailing airmass over the Pacific Ocean. The inset shows that the modes of upwelling represent discrete events.

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