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Racemization: still some kind of joke?

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Amino acid racemization has been considered âEURŸsome kind of jokeâEURŹ for perhaps too long. Recent studies suggest that the method works in Quaternary sediments with increasing reliability. How is it possible to reconcile the widely held view that the method is unreliable or of limited usefulness with recent successes? This presentation will try to solve this apparent conundrum by revisiting some of the classic examples cited as failures of the method and examine possible reasons for each.

The presentation will first consider the case of racemization in archaeological bone and will conclude that this has essentially no utility as a Quaternary dating tool. The reasons for this are intriguing, reflecting upon not only the organization of the biomineral but also the quaternary structure of the main bone protein collagen.

Next the controversy surrounding the dating of terrestrial Quaternary sequences in the UK will be considered. Acknowledging some limitations of the dataset, caused by the use of different biominerals and despite the controversial dating of a number of key sites, in fact a surprisingly large number of sites dated two decades ago remain in agreement with the emerging consensus.

Finally controversies surrounding the dating of marine sequences will be explored. Full data sets of amino acid data from marine terraces does not display clustering as would be anticipated if different terraces represented different marine isotope stages. Examining this data more closely suggests considerable noise caused by the nature of protein decomposition in these shells. Using models of racemization rates and assumptions regarding levels of uncertainty in the data analysis, we will explore what âEURŸgoodâEURŹ data which does cluster in distinct marine isotope stages does look like and compare this with results from our research.

Having considered the problems inherent with previous approaches, we conclude that racemization is no more than a series of chemical reactions whose rates vary as a con-

sequence of protein structure, sequence and temperature and the chemical environment in which they decomposed. If the chemical environment is stable and closed, the extent of racemization measures the âEURŸthermal ageâEURŹ of a sample. Racemization appears to be a useful method which may have a greater role to play in Quaternary geochronology in the future.