

Book Review

THE ANTHROPOLOGY OF MODERN HUMAN TEETH: DENTAL MORPHOLOGY AND ITS VARIATION IN RECENT HUMAN POPULATIONS. By G. Richard Scott and Christy G. Turner II. Cambridge: Cambridge University Press, Cambridge Studies in Biological Anthropology. 382 pp. ISBN 0 521 45508 1 (hardback)

Flaws and all, this is a splendid and admirable production. Basically it represents the methods and their application pioneered and pursued by its second author, Christy Turner, over the last thirty years. The only real regret one can have is that Christy's long-term partner, Jackie, is not here to savor its appearance in print. Her patient and enduring efforts played a major part in making its main contribution possible. Over two dozen tooth crown and root traits were graded, and their states were evaluated in more than 30,000 individuals. This is the kind of massive investment in time and effort that we are unlikely to see again, and it has produced a compilation that can be used with profit by anthropologists everywhere. It is a landmark demonstration of what dental anthropology can contribute, and the background flaws in conceptual orientation are completely unrelated to the marshaling and treatment of the data contained.

The enduring core of the volume is to be found in Chapter 5, "Geographic variation in tooth crown and root morphology," with mean and standard error bars for each of 20 different local human groups for each of 23 different crown and root features. That means 23 figures each with 20 bars. Even when their higher order attempts at generalization and group association are clearly wrong, the graphic means of presentation is as easy to read and use as one might wish. Appendix B lists the separate published sources used in compiling the data—that is, sources beyond the massive amounts of information accumulated principally by Christy Turner himself. The rest of the sources consulted are added in a bibliography extending another 33 pages.

Chapters 1 to 4 set the stage. The first chapter presents a succinct history of the study of dental morphology. The second describes in clear and straightforward fashion the crown and root traits assessed and presents the basis for their classification. It ends with a fine treatment of the degree of "error" that occurs with repeated assessments of the same specimens, and with the assessments by different observers of the same material. This makes a fine case for the reliability of the procedures they use.

Chapter 3 deals with "Biological considerations; ontogeny, asymmetry, sex dimorphism, and intertrait association." This includes a fine digest of dental embryology and post-natal growth and differentiation, although, since this is not meant as a text in dental development, it is more in the nature of showing roughly when and how the traits to be used actually develop than as a manual laying out that timing in detail. The references are there for those who might want them. The questions raised by the assessment of fluctuating asymmetry and how to handle it are thoughtfully treated and they state a preference for using individual count rather than side count for assessing trait status, showing that it really does not make any difference when treating a specific phenomenon such as the Carabelli trait.

In their treatment of intertrait association, the authors compare the various approaches used—presence/absence, ranked scales, and direct measurements—and show that they all produce the same results. They include tables of coefficients of correlation, but most interesting is the listing and discussion of the highest loadings of the first 12 principal components on an analysis of 14 morphological traits on 31 teeth. As they note, crown size and morphology "interact weakly, if at all" (P. 126), but that observation simply notes the hereditary ties between traits within the individual organisms and not the nature of the ties that are the result of a parallel trajectory through time as documented separately by Alexander Zubov and by John Frisch many years ago. This foretells one of the flaws that will be treated later.

The hereditary nature of the traits they use is expanded upon in Chapter 4: "Genetics of morphological trait expression." This unwittingly shows the frustrations felt by dental anthropologists starting with the expansion of the neo-Darwinian synthesis in the 1930's when hopes were raised that tooth crown and root details might be reflections of simple control. Vestiges of that "black box" faith in the nature of gene action are still obvious in their treatment, but the authors transcend this with a very valuable survey of the literature that shows that dental traits are legitimately inherited, even if not as the single-gene phenomena that serologists and others have regarded as the standards for treating population relationships and the basis of their scorn for those who have tried to deal with morphology. The authors' consideration of the often misunderstood concept of heritability is on solid grounds.

The two chapters after the succinct presentation of that mountain of valuable evidence in Chapter 5 are devoted to the effort to make some kind of sense out of their findings in world perspective. Certainly the effort is well worth

making, but the more they try the more messy things get. Actually, the efforts to put the New World into perspective in the light of the Old works quite well, but they have their problems with the Old World. Chapter 6: "Establishing method and theory for using tooth morphology in reconstruction of late Pleistocene and Holocene human population history," makes the case that dental traits can largely be treated as neutral and used without regard to the likelihood of change in the recent past. In their treatment of theory, the authors do not mention why this makes their approach so successful in dealing with the relationships that share a relatively recent common origin but so questionable when applied to those separated by relatively longer intervals of space and time.

Then Chapter 7: "Tooth morphology and population history," tries to apply the authors' approach to building a quantified picture of the relations of a set of populations representing the spectrum of geographic settings in which living humans are to be found and in the light of what we know of when the various parts of the earth were settled. This is followed by an "Epilogue" that makes brief bows to the deciduous dentition, the hominid fossil record, and the use of dental morphology for forensic purposes. The most useful part of the Epilogue is the discussion of dento-chronology. The application of this to the question of the timing, identity, and relationships of the first inhabitants of the New World is eminently satisfying as it has been over the years it has been developed by Christy Turner.

This application illustrates the main strength of the book, and remains true and unaffected by the flaws that need to be noted. There are two realms that suffer from limitations of perspective, and together they combine to cast major doubts on the use of the available material in eastern Asia to make sense out of population history in that part of the world and, to an even greater extent, elsewhere. On the one hand, there is a failure to consider the nature of the archaeological and historical evidence for the course of cultural developments in East Asia, and on the other hand there is a comparable failure to consider key aspects of the human biological evidence—including dental dimensions. Both of these bear on the framing and utility of the concept of "Sundadonty." The population history of eastern Asia over the last 7,000 plus years has all been of expansion southwards made possible by the population growth that followed the development of agriculture initiated in the Chinese Neolithic. There is virtually no archaeological support for a movement north from Sundaland to the Japanese archipelago, nor does the available evidence give any hint at a cultural dynamic that would make such a direction of movement plausible.

The evidence of human biology is also against it. The Ainu of Japan, putative representatives of Sundadonty at its northernmost extent, have less skin pigment than their Japanese neighbors, which could hardly be the case if their long-term original home was practically right on the equator. Conversely, the living people of peninsular and island Southeast Asia are all markedly lighter in color than the long-term dwellers at that latitude in New Guinea, southern India and Africa, although they are darker than their morphological relatives to the north of the tropics. This is not only consistent with the evidence for the spread southward starting with the Chinese Neolithic, but it is just what one would expect if temperate zone farmers had spread southwards absorbing a sparse indigenous sprinkling of heavily pigmented hunter/gatherers. Scott and Turner briefly try to dismiss the phenomenon of essentially temperate-zone levels of skin in the East Asian tropics as the consequences of sexual selection and genetic drift, but the effort is unconvincing. Then there is the genetic evidence recently summarized by Omoto and Saitou that the living Ainu are more closely tied to the populations of Northeast rather than Southeast Asia.

The final piece of evidence that weighs against a Sundaland origin for the Jomon and the Ainu of Japan is an aspect of dental variation that is completely left out of *The Anthropology of Modern Human Teeth*, and this is the basic matter of sheer tooth size. The Hoabinhian samples of Southeast Asia on which the concept of Sundadonty was based have teeth that are as much larger than the teeth of the Early Jomon of Japan as the teeth of the "classic" Neanderthals of Europe are larger than their earliest Upper Paleolithic successors, and yet the Hoabinhian and the Early Jomon are virtual contemporaries. Hoabinhian teeth are 20% larger on the average than Late Jomon teeth, and a reduction of that extent would have taken 20,000 years to have been accomplished at post-Pleistocene rates which have only been in effect for a maximum of 10,000 years. In fact, they take it as a given that there is little evidence for adaptive change during the past 20,000 years although they make no effort to document their assumption.

What this points up is that a consideration of the effects of evolution are largely absent from *The Anthropology of Modern Human Teeth*. Scott and Turner do consider the possibility that reductions in cusp number may be related to reductions in jaw and tooth size but only in a speculative sense without any effort to check actual instances where this can be tested. There is no attempt to review the available evidence from the human fossil record. Their characterization of European tooth form as displaying hypocone and hypoconulid reduction in distal molars and an

absence of shoveling on incisors would be quite different if they had included the perspective of Early Upper Paleolithic European teeth. Nor do they consider the fact that the Sinodont pattern, presumably a derivative of a southern Sundadont predecessor, is evident in the Zhoukoudian *erectus* material of at least 400,000 years ago and for the North Chinese Neanderthal, Jinniushan, of about half that age. There are many more gaps in the picture of the Far East, but the coordination of cusp reduction, lingual tubercle (*tuberculum dentale*) disappearance, and measurable crown size reduction is parallel to that demonstrated by the more extensive record available in the West. If one can get a modern European dentition out of an Upper Paleolithic predecessor 30,000 years ago with shovel-shaped incisors, four cusps on all upper and five on all lower molars, then there should be no problem getting a Jomon or an Ainu pattern out of something like the Sinodont pattern attributed to the Upper Cave at Zhoukoudian, also about 30,000 years ago. And the Upper Cave at Zhoukoudian has a craniofacial configuration that is metrically indistinguishable from the Minatogawa specimens in Okinawa, the Jomon and Ainu of Japan, and the Polynesians of Oceania, but not the living inhabitants of Southeast Asia. Even if the authors did not have the time or the opportunity to check the relevant specimens first hand, the information is all available in print.

By and large, the absence of a concern for evolution does not hinder their ability to assess the relationships of populations that have only been separated since the end of the Pleistocene 12,000 years ago—their own date for establishing the dentochronology they present. This works just fine for testing the divergence of Amerinds from their putative Asian relatives, but when it dates the Europe/Sri Lanka split to the Bronze Age, something is wildly out of whack. Equally bizarre is the conclusion that the split between the European and the Amerind condition dates to 50,000 and that the African/Amerind split was only 60,000 years ago.

In summary, this book is a masterly presentation of the spectrum of dental morphology displayed in the living human populations of the world, and an awesome compilation of the available information. Readers can use this on their own with great profit, and the techniques by which the assessments were made are so clearly laid out that anyone could follow them and make their own additions should they so wish. The application to an understanding of the relationships of the aboriginal inhabitants of the Western Hemisphere is sound and plausible and fits comfortably with what we know from archaeology and linguistics. However, the attempt at an application to understand the relationships and history of the peoples of Asia and the Pacific is at odds with what we know from genetics, craniofacial morphology, culture history and archaeology. Finally, the attempt to deal with European and African manifestations produces results that threaten to make the whole approach seem ludicrous. The problem, however, is not in the assessment of dental morphology which is as sound as it can be. The problem stems from an inadequate control of the archaeological and paleoanthropological data and a complete absence of the perspective of evolutionary biology. In spite of these flaws, the book can stand as a landmark in dental anthropology.

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DENTAL ANTHROPOLOGY ASSOCIATION SECTION

Recent Books by Dental Anthropology Association Members

Compiled by A.M. Haeussler

INTRODUCTION TO THE PRIMATES by Daris Swindler and illustrated by Linda E. Curtis chronicles our continuing interest in our closest nonhuman relatives and our growing understanding of them. After establishing the principals of taxonomy and the requirements for classification as a primate, Swindler provides a detailed description of the major primate groups and their environments, from the smallest lemurs of Madagascar to the gorillas of Central Africa. He compares and contrasts the primate species, looking at each with a specific anatomical focus: blood groups; the skull; teeth; diet and digestion; the brain and the senses; the skeleton and locomotion; and growth and development. Swindler also considers primate behavior and its close connections with environment and evolutionary differences as well as the fossil record as traced through dental evidence.

The book is an introductory text that is readable and accessible for dental anthropologists as well as beginning students of primates. It will be published in June, 1988, by the University of Washington Press, P.O. Box 50096, Seattle, Washington, 98145-5096, U.S.A.