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Source: *Current Anthropology*, Vol. 8, No. 4 (Oct., 1967), pp. 353-354

Published by: The University of Chicago Press on behalf of Wenner-Gren Foundation for Anthropological Research

Stable URL: <http://www.jstor.org/stable/2740159>

Accessed: 18-07-2017 14:04 UTC

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On Late Pleistocene Chronology

by GARY A. WRIGHT

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The CA★ reviews of Karl Butzer's fine book, *Environment and Archeology* (CA 7:501-12), have interesting features which require further comment:

1) The average on the C¹⁴ dates for the early worked copper from Çayönü given by Braidwood (p. 504) appears to be misprinted. They average out to 7,000 B.C. and not 7,000 B.P. as listed. This would thus be the earliest known worked copper in the world.

2) Balout (p. 502) says of Butzer's approach:

The prehistorian will be perplexed at the preference for an economic classification of prehistoric civilizations over one based on industries and typology-stratigraphy.

In contrast, I find this type of approach quite useful. Better understanding of hominid adaptation cannot come from tool descriptions alone, no matter how exhaustive and exact they may one day become. Discussions based on the various "activities" of prehistoric hunters-and-gatherers are already producing valuable insights (see, for example, Binford and Binford 1966, Fitting 1966).

3) The recent Th²³⁰-U²³⁴ dates on Late Pleistocene beaches from the Mediterranean littoral cited by Biberon have great implications for the cultural sequence in the Levant. There seems to be no good evidence for the appearance of the Mousterian of Levallois facies in the Levant prior to the lowering of the sea from the + 6 m. beach (e.g., Ras el-Kelb, Garrod and Henri-Martin 1961). If, as seems likely, the + 6 m. beach correlates with the Neotyrrenian stage of Bonifay (1962) and also with the Ouljian (e.g., see Choubert 1962), it would thus date to about 90,000-75,000 B.P. according to the Th²³⁰-U²³⁴ determinations (Stearns and Thurber 1965). The Mousterian of Levallois facies could then be said to begin about 75,000 years ago in the Levant. Of course, absolute dates from the Levantine beaches are badly needed to support these correlations.

The enigmatic Pre-Aurignacian is well-dated stratigraphically below the Mousterian of Levallois facies industries at Jabrud (Rust 1950) and possibly also occurs at Tabūn (Garrod 1956). The Pre-Aurignacian appears to date later than the + 15 m. beach at Abri Zumoffen (Garrod and Kirkbride 1961) and may then correlate with the Eutyrrhenian Regression (but see van Liere 1961). This regression is now dated between 115,000 and 90,000 years ago. If the correlations

suggested by Butzer are correct in reference to the European glacial stages and the geology at Abri Zumoffen is interpreted correctly (Zeuner 1961), the Pre-Aurignacian would correlate with the Warthe Stadial. This is far earlier in relation to the glacial chronology than anyone has yet maintained and would pose an interesting set of new problems.

Bonifay has consistently maintained in a number of papers (e.g., 1962) that the Neotyrrenian belongs to the Würm I/II Interstadial and not to the Riss/Würm Interglacial (= Eemian Interglacial). Butzer (p. 512) apparently still feels the beginning of the last glaciation may be dated at about 75,000 B.P. Thus, the Neotyrrenian and the + 6 m. beaches would certainly date to the Eemian Interglacial. I realize that Butzer was limited in space in his reply, but one wonders exactly what evidence he and many others are using to derive this absolute date. At present I can find no concrete evidence (this includes the papers of Rosholt *et al.* 1961, Andersen *et al.* 1960, and Ericson *et al.* 1964) which would allow us to fix an absolute date for the initial advance of the last glaciation. I would tend to prefer Bonifay's correlation for the Neotyrrenian as Würm I/II and thus a similar correlation for the + 6 m. beach in the Levant.

Butzer's comments on the problem of relating Late Pleistocene high sea stands to the glacial chronology would be highly informative.

Reply

by KARL W. BUTZER

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Several lines of information are currently helpful for tentative delimitation of the Eem-Würm boundary: (a) pollen zones and weathering profiles of very early Würm interstadials in continental Europe (Amersfoort-Rodebaek and Brørup), with Groningen C¹⁴ dates in the 50,000-60,000 year time range (see Vogel and Waterbolk 1963, 1964, 1967), implying that the onset of the Würm dates ca. 70,000 B.P.; (b) the Atlantic deep-sea palaeotemperature curves (Emiliani 1964, 1966; Ericson *et al.* 1964), which by extrapolation or interpolation of C¹⁴ and Pa/Th dates show a non-glacial interval of 20,000 years or more duration, terminating about 65,000 or 70,000 B.P.; and (c) the Th/U dating of the last Pleistocene high sea-level stand as ca. 90,000-70,000 B.P. (Stearns and Thurber 1965; Thurber *et al.* 1965; Broecker and Thurber 1965), which stage includes the sedimento-

logically and palaeontologically distinctive Tyrrhenian III of the Balearic Islands, a transgression followed by a major complex of regressional eolianites (Butzer and Cuerda 1962a, 1962b). Assuming that the dating methods are internally consistent, a long non-glacial period, comparable to the longest in the Pleistocene deep-sea cores, terminated about 70,000 B.P. At that point the question becomes one of nomenclature: do we call the non-glacial period ca. 90,000-70,000 B.P. (by Th/U, or, alternatively, 100,000-65,000 B.P., by Pa/Th) an interglacial or an interstadial? The latter designation would seem unreasonable to me. Further, K/Ar dating (Frechen and Lippolt 1965) of the Rhine terraces and the superposed Drenthe-Saale moraines places the Drenthe or early Riss somewhat younger than 150,000 B.P. It would seem reasonable, therefore, that the Eem pollen spectra and palaeosols of central Europe occupy part or all of the warm "zone" ca. 90,000-70,000 B.P.

Turning now to Wright's important queries of the Mediterranean stratigraphic sequence: Bonifay's belief that the Neo-Tyrrhenian (generally = Tyrrhenian III) is Würm I/II would make Würm I = Saale (Riss). The age of the + 6 m. beach of Lebanon might be ca. 80,000 years or it might be ca. "120,000-plus" years. Altimetric correlations are hardly permissible in view of the multiplicity of sea-level stages at similar levels (see also Flint 1966). Archaeological stratigraphy in the Middle and early Late Pleistocene time range is in a state of flux at the moment, no less so than geological stratigraphy.

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Conferences

■ **The Interrelation of Biological and Cultural Adaptation.** July 22-30, 1966, at Burg Warthenstein, Austria.

Sponsored by the Wenner-Gren Foundation for Anthropological Research.

Organized by PAUL T. BAKER, Pennsylvania State University, University Park, Pa., U.S.A., and JOSEPH S. WEINER, London School of Hygiene, London, England.

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Background and Discussion:

As the Human Adaptability Project of the International Biological Programme has developed, the requirement of broad cross-disciplinary participation in the study of human adaptation has become increasingly apparent. At a 1964 conference entitled "The Biology of Populations of Anthropological Importance," biological scientists from different disciplines, by long-term discussions and exchange of written material, found they had common goals and comparable methodology for studying human adaptability despite a difference in original goals. It then became equally apparent that the social and biological scientists also needed to meet and discuss their respective goals and methods if the anthropological concepts of adaptation were to develop into a coherent theoretical and methodological tool of science.

The general aim of the 1966 conference was the development of theories and methods for examining the total adaptational pattern of simple communities living under conditions of environmental stress. Three groups of participants were concerned with the following sub-aspects of the problem: (a) Genetic and physiological aspects—adaptation to environmental stress (with emphasis on altitude, climate, disease, nutrition, and reproductive aspects; theory of adaptation). (b) Physio-psychological and psychomotor development aspects

—the relationship between physiological states during stress and performance, and the sensory and motor capabilities of primitive populations particularly in relation to the adaptational requirements of the groups. (c) Cultural and enculturation aspects

—the adaptive aspects of material culture, specific behavioral adaptations in relation to an environmental stress and the cultural aspects of demography in relation to community survival. The enculturative development of these behavioral patterns was also dealt with by members of the other groups.

The first few days of the conference were spent establishing common definitions and theoretical goals. The conferees agreed that the principle contribution of such an interdisciplinary conference at this time should be the development of methodological tools. Five subgroups then prepared brief statements on: (1) Components of interaction between genetics, population and culture, (2) Population control processes and the methods of studying these processes; (3) The development of adaptive behavior in the infant and young child (methods of study); (4) The problems of cross cultural testing for perceptual motor skills; (5) The assessment of arousability (methods for measuring the role of emotional arousal on the physiological and psychological responses to tests and measurements).

Publication:

Present plans call for the publication of a monograph containing the five papers in expanded form accompanied by a contextual paper by the organizers of the conference.

Reported by PAUL T. BAKER