analysis of their complete detailed data by rigorous methods (*2*) may be able to show whether the data truly support this.

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Immunity in Cancer

Lacour *et al.* (*1*) demonstrated "a significant reduction in the occurrence of mammary tumors" in C3H/He female mice given injections of poly(A)·poly(U). Practically identical results were obtained in the same strain of mice by Riley (*2*) with living LDH-virus. Seibert *et al.* (*3*) also showed similar significant immune response against spontaneous C3H tumors with a heat-killed vaccine from a bacterium (C3H ♀ 27 Brtu) isolated from a C3H spontaneous mammary tumor and shown to be filterable through 0.1-μm Seitz filters. At the peak period of tumor reduction in all three sets of experiments there was an increment of survival of about 20 percent treated mice over control untreated mice.

The necessity, even though tedious, of continuing such experiments until death of mice, not done by Lacour *et al.* (*1*), was demonstrated by both Riley (*2*) and Seibert *et al.* (*3*), who found 90 to 100 percent tumor incidence in both control and treated mice after the 380-day period, probably due to loss of cellular immunity with age. However, since delay of spontaneous tumor development as affected by all of these agents is most desirable in middle age, such agents may be of immediate practical value.

The advantages of a sterile autogenous or homologous vaccine, as used by Seibert *et al.* (*3*), are evident from the problems with viral vaccines recently discussed by Kolata (*4*). Caution is indeed timely. Agents, whether chemicals, including that used by Lacour *et al.* (*1*), or tumor extracts, viral vaccines, and the like must, throughout their entire preparation, be made so as to avoid contamination with bacteria, alive or dead, even in their filterable forms, since bacterial products are potent immunogens (*5*). Tumors frequently used for extracts do harbor viable bacteria (*5*) and their products, and whether filterable forms or phages are also always present is not yet known.

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Dates for the Middle Stone Age of East Africa: A Discussion

Two new K-Ar dates from Ethiopia (*1*) augment a small, but growing, body of data implying that the beginnings of the African "middle Paleolithic" and of the associated "late Pleistocene" fauna are at least as early as 200,000 years ago. This recent acquisition is also an important one. It invites reexamination of relationships between the middle Paleolithic and late Pleistocene of Africa and presumably comparable successions in other parts of the world. We wish to comment on the authors' treatment of this aspect of their data.

In South Africa, as in Europe (*2*), late Pleistocene is commonly equated to Last Glaciation (Weichsel) plus Last Interglacial (Eem). Through this equation, the authors suggest that the new dates may also provide new minimum ages for the beginning of the Last Interglacial (Eem) in northwest Europe, as well as in South Africa. This extension, however, introduces "conflict with a series of K-Ar dates for Laacher See Volcanics (West Germany), which are incorporated in Rhine terraces ... [four of which] place the period between late and early Saale (Riss) at about 145,000 years ago ...." Further, "the most serious conflict ... [is with] dates obtained by analyses of ^{230}Th and ^{234}U in shells from Atlantic and Mediterranean beaches and raised coral reefs regarded as of Eem age ... [which] suggested a time range between 80,000 and 140,000 years ago."

The conflicts envisioned by Wendorf *et al.* (*1*) are not introduced by radiometric ages and their relationships to local stratigraphies (Fig. 1). Rather, they arise from an unwarranted use of the equation late Pleistocene = Last Glacial + Last Interglacial = Middle Stone Age in widely scattered areas. They require explication.

The Eem beds, in the type area, record a marine transgression directly overlying Saale till. In northwestern Europe, these and correlative deposits do represent the *last* interglacial. They have also been taken, arbitrarily, as the base of the late Pleistocene in that area. Their absolute age is not directly determinable. Extrapolation from ^{14}C dates of younger sediments (*3*) yields a minimum age of 75,000 years. On the other hand, the K-Ar age of 145,000 years for Laacher See Volcanics dates materials recognizable as detritus in the younger Middle Terrace of the Rhine (*4*) which downstream "at the Saale drift border, includes glacial-lake rhythmites and is overlain by Saale till" (*5*). Thus, both Saale (including Warthe) glaciation and Eem interglacial may be younger than 145,000 but older than 75,000 years.

As pointed out by Richmond (*6*), the implications of the Laacher See dates are consistent with a series of K-Ar dates from Yellowstone Park, where Bull Lake glaciation postdates a flow 150,000 years old and antedates a flow 70,000 years old. Additionally, an intra-Bull Lake interval of deglaciation may be 105,000 years old.

The ^{230}Th/^{234}U ages of molluscan shell from Mediterranean and Moroccan beaches do not suggest a time range for the Last Interglacial of 80,000 to 140,000 years. Rather, two intervals of (interglacial?) high sea level are indicated (*7*). The younger, Neotyrrhenian, yielded ages between 75,000 and 95,000 years. It is separated by strong regression (glacial?) from the older, Eutyrrhenian, which yielded ages between 115,000 and 220,000 years. The ^{230}Th/^{234}U ages of molluscan shell are ininherently unreliable (*8*), but ^{230}Th/^{234}U ages of coral from the Salentine peninsula confirm at least the age range of the Eutyrrhenian (120,000 to 220,000 years) (*9*).

Dated Eutyrrhenian deposits on Mallorca can be interpreted as belonging to two separate episodes of high sea level, separated by regression about 160,000 years ago (*10*). The same inference could be drawn from stratigraphic relations of Ravagnese and Cafari, Calabria [dates included in (*8*)] and near Cerveteri, Roma (*11*). A break in the series of dated reef-terraces in New Guinea (*12*) may record the same interval.

The classic littoral deposits of the Grotte du Prince (*13*) have traditionally been regarded as last interglacial (Riss-Würm) and late Pleistocene. They are older than

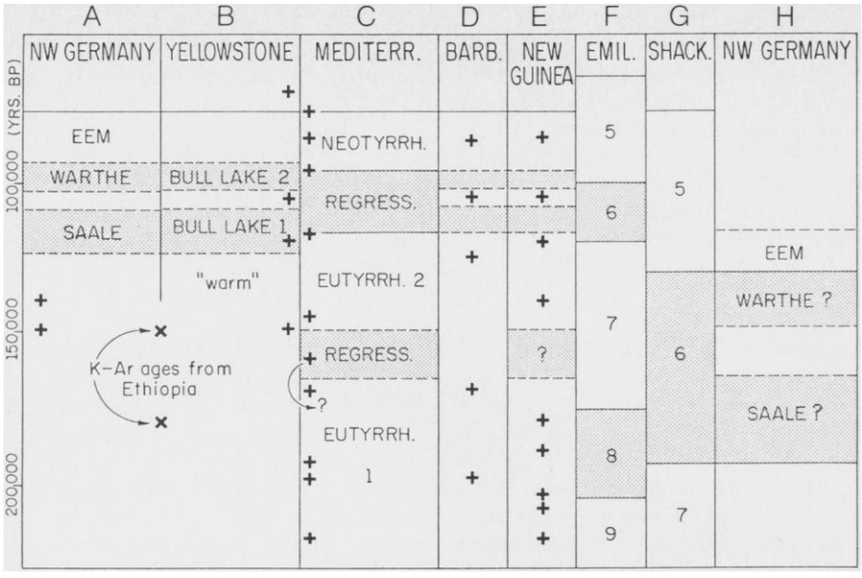

Fig. 1. Correlation diagram of radiometric ages related to local sequences (A to E) and two alternative chronologies of deep-sea core stages (F and G). New Ethiopian dates (*1*) are indicated by × below A and B. Other dates, from (A) northwest Germany (*4*), (B) Yellowstone Park (*6*), (C) Mediterranean littoral (*7*), (D) Barbados (*16*), and (E) New Guinea (*12*), are indicated by +. Alternative chronologies of deep-sea core stages are after (F) Emiliani and Rona (*20*) and (G) Opdyke and Shackleton (*17*). Alternative chronology of Saale, Warthe, and Eem (H) depends on alternative dating of deep-sea core stages (G) and discounts K-Ar ages (A).

middle Paleolithic stone tools in overlying cave deposits, and younger than early Paleolithic stone tools in cave breccias preserved locally in peripheral locations. Were the two $^{230}Th/^{234}U$ ages [170,000 and 160,000 years (*7*)] only a little too young, they would support the general equivalence late Pleistocene = Middle Stone Age 180,000 years ago. The Eutyrrhenian littoral deposits, however, are not Last Interglacial. Neotyrrhenian is the last interglacial in the local stratigraphy. No direct evidence shows its relationship either to Riss-Würm or to the more distant Eem. Straightforward reading of available radiometric ages (Fig. 1) would say Neotyrrhenian = Eem. The hypothesis Eutyrrhenian = Eem requires discounting all available ages, by both K-Ar and uranium series methods.

There can be no doubt that our eventual synthesis of continental stratigraphies will depend on successful correlations with the more continuous climatic record obtained from deep-sea cores. Core stage 5 (the Last Interglacial) was dated directly by $^{231}Pa/^{230}Th$ ratios (*14*) to the interval 65,000 to 100,000 years. This time range would be consistent both with K-Ar ages related to the Saale (Bull Lake) and with $^{230}Th/^{234}U$ ages of the Neotyrrhenian (Fig. 1). Reliability of the method has been questioned (*15*), however. Considerable present opinion supports an alternative view, that core stage 5 began 130,000 years ago. Uranium series activity differences between separate, but "comparable" horizons in the same core (*16*), an assumption of constant sedimentation rate in a single Pacific core (*17*), and the inference that both the beginning of core stage 5 (core stage 5e) and coral reefs 122,000 years old ($^{230}Th/^{234}U$) record a brief interval of especially high sea level (*16*) all support the alternative view.

Even this alternative view (Fig. 1, G and H), however, places core stage 6 and a full glacial stage (= Saale + Warthe?) in the time range [128,000 to 195,000 years ago (*17*)] which Wendorf *et al.* would add to the Eem (*1*). It also leads to conflict between the implications that sea level was either generally low during this interval (if it be core stage 6) or generally high (if it includes the several Eutyrrhenian littoral deposits and New Guinea reef-terraces). Further conflict is introduced by the record of a low sea level (below −70 m) between 120,000 and 80,000 years ago on Barbados (*18*) and by regression between Eutyrrhenian and Neotyrrhenian deposits in the Mediterranean, not reflected in the isotopic record of core stage 5. Unambiguous correlation between deep-sea and continental chronologies has by no means been achieved. "The exact age of the peak of stage 5 has ceased . . . to be the cornerstone for absolute dating" (*19*), but 125,000 years is almost surely a maximum age.

The Ethiopian dates, from deposits which do not themselves reveal a glacial or interglacial character, will not resolve these conflicts. Nor will the correlation late Pleistocene in Africa = Last Interglacial (Eem) in northwest Europe, which is not supported by any independent data.

If these informal terms are not abandoned altogether, they should at least not be used as a basis for intercontinental correlation. Nor should the epithet Eem, which may still have significance in northwest Europe, be extended to other areas (including deep-sea cores) until either its age or its stratigraphic equivalences is more clearly established. As we try to reevaluate local stratigraphies in the light of the multiplicity of glacial-interglacial cycles recorded in the deep sea, it will confound what little security remains in local sequences to extend local terminologies to distant areas without unambiguous bases for correlation. The new K-Ar ages from Ethiopia are important. Their real significance should not be obscured by spinning a web of unsupported correlations around them. If the age of the Eem is eventually established, it will not be from Ethiopian data.

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