length and body length in male competition for mates, and that this may have led to the evolution of higher allometric ratios in pupal mating species.

E. I. Deinert

J. T. Longino*

L. E. Gilbert

Department of Zoology,

University of Texas,

Austin, Texas 78712, USA

*Present address: Department of Biology, Evergreen State College, Olympia, Washington 98505, USA.

Organolead in wine

SIR — Reports on the use of the polar ice-cap archives to trace global atmospheric pollution by lead^{1,2} stimulated our interest in the use of old wine vintages for a similar purpose (but on a local scale). Toxic effects of lead in wine are well known³, but hardly any attention has hitherto been paid to organically bound lead, despite its far greater toxicity⁴. To distinguish between organolead species from automotive sources and from soil minerals added during the processing or storage of grapes, the use of species-selective and sensitive analytical techniques is essential.

We have analysed 19 vintages of a renowned French wine, *Château-neuf-du-Pape*, made of grapes collected in precisely the same area for 40 years. We used a custom-designed procedure to discriminate between Pb²⁺ and particular organolead (nonpolar and ionic) species⁵. The vineyard of origin is at the junction of two heavily-used French auto-routes (A7 and A9), and thus is subject to intensive automotive pollution. Variations of the two most abundant compounds, trimethyllead and triethyllead, the direct degradation products of tetramethyllead and tetraethyllead which are used as antiknock additives in petrol, are shown in the figure.

The concentration of organolead in the wines undergoes considerable variation with vintage. The values measured are 10–100 times higher than those in drinking water⁶; at the maximum they reach levels up to 0.5 µg l⁻¹, which is relevant to health concerns. The pattern of trimethyllead variation follows the consumption of leaded gasoline in western Europe (ref. 7 and R. Fiat, personal communication). No methyllead was found in the 1950 vintage, since this compound was first introduced only in 1960 (ref. 8); apparently no natural biomethylation of inorganic lead occurs in wine.

The introduction of regulatory measures to reduce the lead level in petrol at the beginning of the 1980s is reflected by a sharp decrease in the contamination of wine. On the other hand, triethyllead is

Changes in the concentration of a, trimethyllead; and b, triethyllead as a function of vintage.

already present in the oldest vintage investigated (1950). Its concentration triples in 1962, drops sharply in the mid-1960s as a consequence of a sudden increase in the fraction of methyllead used and then slowly decreases throughout the 1980s owing to the decrease of leaded petrol consumption.

R. Lobiński, C. Witte

F. C. Adams

Department of Chemistry,

University of Antwerp,

Universiteitsplein 1,

2610-Wilrijk (Antwerpen), Belgium

P. L. Teissedre

J. C. Cabanis

Université de Montpellier 1,

Centre de Formation et de Recherche en

Oenologie,

15, av. Charles Flahaut,

34060 Montpellier, France

C. F. Boutron

Laboratoire de Glaciologie et Géophysique

de l'Environnement du CNRS,

54 rue Molière,

Domaine Universitaire,

38402 St Martin d'Hères, France

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Global change detection

SIR — Considerable effort is being focused on the detection of an anthropogenic climatic change signal in short (10–15-year) satellite-derived datasets, such as lower tropospheric temperatures from the microwave sounding units (MSUs)¹ or sea-surface temperatures (SSTs) derived from the advanced very-high-resolution radiometers or the current and future along-track scanning radiometers (ATSRs).

J.R.C. and R.T.McN. reported an apparent warming trend in the MSU temperature record, after correcting for the effects of El Niño and volcanic aerosols². To place this result in perspective, we need to evaluate the probability that it occurred by chance. Applying ordinary least squares (o.l.s.) regression to the corrected MSU record from January 1979 to March 1994 (183 months), we find a warming trend of 0.069 °C per decade (the discrepancy with ref. 2 is due to the inclusion of additional data and an adjustment required for the NOAA-11 instrument). If we assume that the decadal trend measured by the MSUs represents the true trend to within ±0.03 °C per decade in 98% of cases³, o.l.s. regression indicates that this trend is significantly different from zero at the 99% level.

Significance estimates based on o.l.s. regression assume, however, that monthly global temperature anomalies, T' , after the effects of El Niño, volcanoes and any trend have been removed, are not self-correlated in time. This is unlikely, as T' is a naturally integrated quantity. Suppose we can identify a timescale, δt , beyond which heating anomalies, Q' , are not self-correlated. To first order, short-term fluctuations in T' may then be represented by the AR(1) model³:

$$T'(t + \delta t) = T'(t) e^{-\delta t/\tau} + \frac{Q'(t)\delta t}{c}$$

where τ is the characteristic relaxation timescale for temperature anomalies, and c is the heat capacity of the system. Provided $\tau \neq 0$, T' will be self-correlated. Thus, although the real climate clearly involves more than one heat capacity and relaxation timescale, the AR(1) model is a natural approximation which turns out to be a surprisingly good description of the behaviour of the global mean temperature on less than 40-year timescales⁴.

The standard Durbin-Watson test⁵ indicates that the o.l.s. residuals from the corrected MSU record are indeed self-correlated at a very high confidence level. We therefore have both theoretical and empirical reasons to distrust o.l.s. results. We can take this self-correlation into

account by applying estimated generalized least-squares (e.g.l.s.) regression^{3,6} to the corrected MSU record with an AR(1) model for the residuals. This gives a warming rate and standard error of 0.063 ± 0.047 °C per decade: the null hypothesis of no warming cannot be excluded even at the 85% level. With this revised estimate of the error in the trend from the MSU data, a warming rate of 0.15 °C per decade (the lowest rate pro-

range 0–0.5 °C per decade, to simulate the possible effect of greenhouse-gas-induced warming over the coming decades (predictions range over 0.15–0.4 °C per decade⁷, but these do not take into account the possible cooling effects of sulphate aerosols and century-timescale climate fluctuations). We then tested for a warming trend in short segments of these artificial series, using e.g.l.s. regression with an AR(1) model for the residuals (see figure). If we are confident that the long-term drift in our observing system is zero, a 15-year dataset appears to give us an 80–95% chance of detecting a warming trend if the true trend is 0.25 °C per decade (point *a* in the figure).

Estimated probability of detecting a warming trend in global monthly mean SST (e.g.l.s. regression with AR(1) model; see text). For all true-trend (minus possible observing system drift) and segment-length combinations above the solid/dashed/dotted line there is a > 50/80/95% chance of detection at the 97.5% confidence level ($\sim 2\sigma$ for a one-tailed *t*-test).

posed by ref. 7 on the basis of model predictions) also lies just within the conventional $\pm 2\sigma$ range.

Given this failure to detect a significant warming trend in the corrected MSU data, what is the probability of detecting a warming trend of the magnitude predicted by climate models in any 10–15-year dataset, given the level of natural climate variability? As a proxy for natural variability on the relevant timescales, we use monthly global mean SSTs from historical ship observations⁸, with the residual annual cycle and all variability on timescales greater than 60 years removed using a nonlinear-trend reconstruction algorithm⁹. Varying this cut-off time over 40–80 years has little impact on the results. Global SST was chosen because the level of 'noise' is likely to be no higher in this parameter than in any other¹. We use these detrended SSTs to represent the interannual to interdecadal variability which will be present in any global temperature series, however observed. To minimize the short-term effects of sampling and observation errors, we use only post-1900 data (spurious long-term drifts will have been removed by the detrending). Some such variability will remain, so our estimated detection times will be slightly conservative, but only for a completely noise-free observing system.

We added linear trends to the 1901–90 detrended SSTs, with gradients in the

If, however, we can only guarantee that the observing system has drifted by ≤ 0.15 °C per decade, we might then require a trend > 0.15 °C per decade before claiming unambiguous detection. The probability of detection in a 15-year dataset then drops to $\sim 50\%$ (point *b* in the figure). This highlights the importance of strict control of observing system drift, which can be achieved only

continuous cross-instrument validation. Removing the El Niño signal (by regression on a lagged, low-pass filtered Southern Oscillation index¹⁰) may reduce these detection times by 1–2 years. The use of seasonal in place of monthly SSTs increases typical detection times by about 2 years, indicating that the noise-reducing effect of taking a 3-month average is more than compensated for by the increased sampling interval.

Thus, 10–15 years represents the shortest length of dataset in which we should expect to be able to detect a warming trend of 0.25 °C per decade. Our failure to detect a significant trend in the MSU dataset may allow us to exclude warming rates at the upper end of the current uncertainty range, but it should not be regarded as conclusive

evidence that no warming is taking place, particularly if there is still any doubt about the stability of the observing system.

M. R. Allen*

C. T. Mutlow

Rutherford Appleton Laboratory,
Chilton OX11 0QX, UK

G. M. C. Blumberg

Department of Geography,
University of Oxford,
Oxford OX1 3TB, UK

J. R. Christy

R. T. McNider

Earth System Science Laboratory,
University of Alabama in Huntsville,
Alabama 35899, USA

D. T. Llewellyn-Jones

Department of Physics and Astronomy,
University of Leicester,
Leicester LE1 7RH, UK

*Also at Department of Physics, University of Oxford, Oxford OX1 3PU, UK.

Intrinsic source of stomach NO

SIR — Benjamin *et al.* have discussed the interesting possibility that swallowed salivary and food-derived nitrate may give rise to nitric oxide (NO) generated in the stomach, where it might be a defence mechanism against swallowed pathogenic microorganisms¹. As well as this effect, NO has previously been reported² to protect the gastric mucosa from acid-induced lesions.

But NO in the stomach may not be delivered only by extrinsic sources but may also be generated by an intrinsic epithelial cell type of the gastric surface epithelium long known under the names brush cell, tufted cell or caveolated cell³. This particular cell type is scattered throughout the surface epithelium in the stomach of humans and probably all other mammals⁴. In the rat, brush cells are particularly abundant in the cardiac region of the gastric mucosa⁵.

Our belief that brush cells provide an intrinsic source of NO is based on the following observations of brush cells in the rat stomach:

(1) All brush cells display strong immunoreactivity with an antibody specific for the brain type of NO synthase⁶ (*a* in the figure). Immunostaining is abolished by absorption of the antibody with purified NO synthase from rat cerebellum.

(2) In immunoblots of electrophoretically separated proteins of the cardiac epithelium, the NO synthase antibody detected a M_r 160,000 polypeptide band displaying the same electrophoretic mobility as neuronal NO synthase from rat brain (*d* in the figure). In the oxyntic mucosa, which contains only relatively few brush cells, NO synthase is not

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