and mapping the tissue response to the administered radiation. Given the extreme sensitivity of the bone marrow to ionizing radiation, the promise of this technique for improving bone dosimetry (for beam therapy, as well as for bone-seeking radiopharmaceuticals) should be explored.

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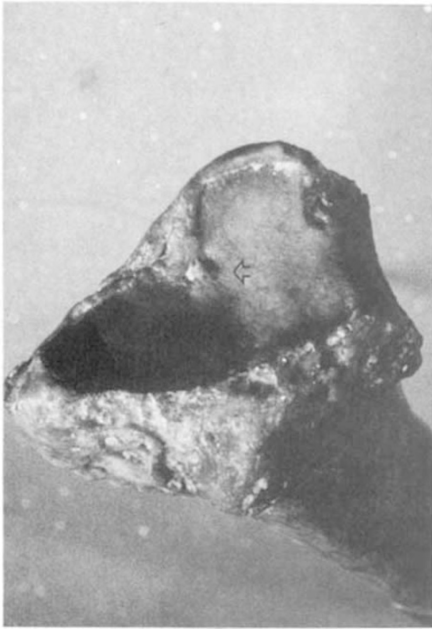
Oldest bone disease

SIR—We have identified calcium pyrophosphate deposition disease (CPPD) in Neanderthal skeletons from two widely separated sites. We found classic radiocarpal and tibiotarsal articular surface reflections on the bones of specimens from la Chapelle-aux-Saints (France) and Shanidar (Iraq), which to our knowledge is the earliest documentation of this disorder in humans. As CPPD may be a familial disease, populations from the two sites may be more closely related than has previously been suspected.

We assessed skeletal remains from la Chapelle-aux-Saints and la Ferrassie (le Museo de l'homme, Paris) and Upper Layer D of Shanidar Cave (Iraq), dated at 40,000 to 54,000 years before present[1,2], through the auspices of Professor J. K. Heim. One-third of individuals from la Chapelle-aux-Saints and 17% of individuals from Iraq (Shanidar) had CPPD. We found indentation of the distal radius (wrist) and tibia (ankle) with partial reflection onto the articular surfaces (see figure) in la Chapelle-aux-Saints and Shanidar I Neanderthals, respectively, as well as proximal humeral sub-chondral concretions in Shanidar I specimens and subtle proximal phalangeal smudged



Distal radius articular surface of la Chapelle-aux-Saints Neanderthal viewed with oblique lighting. Peripheral ridge and overhanging edge (partial reflection onto articular surface) are highlighted by their shadow (arrow).

marginal erosions in those from la Chapelle-aux-Saints.

These alterations in shoulder, wrist and ankle are characteristic of CPPD[3-5]. The 'smudged' appearance of the proximal interphalangeal joint is similar to that reported in contemporary humans[6]. The ill-defined boundaries of these erosions were easily distinguished from the sharply defined erosions characteristic of rheumatoid arthritis or those associated with reactive new bone formation characteristic of spondyloarthropathy[3-5].

The significance of our identification of these two groups of Neanderthals afflicted by the same disorder prompts some intriguing speculation. If the disease was famlial in Neanderthals (as indeed it often is in people today), Trinkaus' hypothesis[2] that the Shanidar remains were more closely related to "other Near Eastern Neanderthals and more distally related to the European Neanderthals" might be called into question.

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Scientific Correspondence

Scientific Correspondence is intended to provide a forum in which readers may raise points of a scientific character. They need not arise out of anything published in *Nature*. In any case, priority will be given to letters of fewer than 500 words and five references. □

Voronoi cosmology

SIR—I recently used[1] a simple argument based on analytical results drawn from a paper by Møller[2] to show that the surprising evidence for periodicity in the line-of-sight distributions from large-galaxy redshift surveys[3] is easily explained if the galaxy distribution forms a simple random cellular pattern called a Voronoi tesselation.

Unfortunately, one of the results (equation 7.15) in ref. 2 is not correct. This mistake leads to an error of a factor of 2 in equation (2) of my paper[1]. The correct expression should read:

$$\lambda_1 = (81/32n\pi)^{1/3}/\Gamma(2/3)$$

where n is the mean number density of Voronoi nuclei (this revised expression is consistent with the result of an alternative method of calculation[4]). For the preferred value of n, the mean spacing should thus be 69 h^{-1} Mpc, not 137 h^{-1} Mpc as I originally stated. One would therefore need a much lower value of n to reproduce the observed mean spacing of $\sim$ 128 h^{-1} Mpc (ref. 3) directly; and such a value of n would generate an unacceptably large cluster–cluster correlation length. There is no longer such a nice correspondence between the correlation function of rich clusters of galaxies and the scale of periodicity in the pencil-beam survey as I originally thought, so the motivation for a Voronoi explanation seems to be weakened.

On the other hand, Monte-Carlo simulations of Voronoi universes[5] show that about 15% of lines-of-sight (consistent with my estimate[1]) produce periodicity, but with a spacing of $\sim$ 107 h^{-1} Mpc for the favoured value of n. At first sight this does not look consistent with the revised calculation above, but in the light of my argument[1] that it is the larger Voronoi cells that look regular, selecting a periodic line-of-sight will necessarily select a set of above-average spacings. Taking into account this effect, there seems to be no problem in producing the correct periodicity with an acceptable value of n.

My estimates of the sizes of 'voids', 'great walls' and the estimated probability of observing periodicities are all unaffected, so the Voronoi model still provides a good explanation of how such features can arise from random initial data.

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