

The past as the key to the present

from D. H. Tarling

DURING the last month 69 papers and a similar number of discussion contributions have been presented at two meetings concerned with the early history of the Earth and Proterozoic tectonics. Many significant and often apparently contradictory views were expressed about this period that covers the first 4,000 million years of the Earth's existence.

One of the main items of agreement seems to have come from the dating of lunar rocks and fly-by studies of the terrestrial planets, as it was generally

agreed that the Earth experienced a very rapid segregation of its core during a near-molten phase within some 50–100 Myr of its accretion. There was also general but not unanimous agreement that the cessation of major planetesimal infall some 3,900 million years ago means that only localised tectonic features are like to have resulted from impact phenomena so that the apparent similarity between the lunar mare basalts, all younger than 3,100 Myr, and the terrestrial Archaean greenstone belts, some 2,700 Myr old, is fortuitous.

But points of significant dispute immediately arose even from consideration of the accretion process. If the accretion was of an essentially homogeneous mixture, then the earliest

core–mantle–crust composition would be geochemically controlled, but inhomogeneous accretion, with predominantly iron-rich material at first, followed by more chondritic materials, could mean that the composition of the upper mantle was modified after the primary segregation had taken place. From there on the story gets even more interwoven with the inevitable problems of isolating geological facts from interpretations, sorting out semantic problems such as what is understood by plate tectonic processes, and the lack of understanding between different specialisations even when tackling similar problems. These are, of course, the main reasons for meetings such as the very successful NATO Advanced Study Institute at Leicester (April 5–11) and the discussion meeting at the Royal Society (March 13 and 14).

One of the most critical papers for understanding Archaean tectonic processes (before 2,500 million years) was by S. Moorbath (University of Oxford) who demonstrated, in his usual thorough manner, that a very large proportion of strontium and lead isotopes in both granite and volcanic rocks of this age could not have originated by the reworking or partial melting of significantly older sialic crust but must have been derived from the upper mantle. Thus Archaean greenstones and granitic gneisses must have been derived by at least a two-stage process from mantle sources and the metamorphism of the gneisses must have occurred during their emplacement or certainly not more than 50–100 million years later. This evidence will take some time to evaluate, but it clearly means that the Archaean crusts must have been at least comparable in thickness to the present continental crust and that some tectonic process similar to modern plate tectonics probably existed at this time.

The possibility of applying plate tectonic models during this early period was mentioned by several speakers, some for and some against, but the inevitably higher heat flow due to radiogenic heat production must have strongly enhanced convective motions at this time and the higher thermal gradients would also mean that subduction zones, although more active, would be shallow, possibly accounting for the absence, compared with Phanerozoic times, of andesites (other than those that now seem to be mechanical mixtures of basalts and andacites rather than geochemical differentiates). Nonetheless, there are many features that seem difficult to reconcile with current plate tectonic models; for instance the greenstone belts comprise some 7–10 km of volcanics, usually with interbedded sediments and divided in some areas into two distinct suites. Such belts, each originally covering some 1,500 km,

Elusive hepatitis A virus identified

from Arie J. Zuckerman

THE discovery of a specific antigen associated with hepatitis B virus infection has heralded an era of unprecedented progress in our knowledge of this type of infection and in the pathogenesis of liver disease in general. Recent advances with epidemic hepatitis (Nature, 252, 193; 1974), now referred to as hepatitis A, indicate that there may soon be an answer to this hitherto insoluble problem.

The pioneering work of Deinhardt and his colleagues on the transmission of human hepatitis A to species of marmosets (*J. exp. Med.*, 125, 673; 1967 and *Nature*, 243, 419; 1973) were confirmed by painstaking experiments conducted over a period of five years by Mascoli *et al.* (*Proc. Soc. exp. Biol. Med.*, 142, 276; 1973). An agent designated as CR 326 was isolated in Costa Rica from the serum of a child with classical hepatitis A. This virus was passaged serially in marmosets and it was concluded that certain species of marmosets, particularly *Saguinus mystax*, are highly reliable for detecting and propagating human hepatitis A virus. This work was extended by Provost *et al.* (*Proc. Soc. exp. Biol. Med.*, 142, 1257; 1973) who found that all patients with hepatitis A infection developed antibody which neutralised the CR 326 enterovirus-like agent, but there was no such antibody response in patients with hepatitis B.

In the same year, Feinstone and colleagues (*Science*, 182, 1026; 1973) demonstrated by immune electron microscopy virus-like particles measuring 27 nm in diameter in faecal extracts obtained from two out of four adult volunteers who were in-

fectured with the MS-1 strain of hepatitis A virus (see also *Nature*, 252, 193; 1974). Similar observations have now been reported on natural hepatitis A by other groups from Australia (Locarnini *et al.*, *Intervirology*, 4, 110; 1974) and from Arizona (Gravelle *et al.*, *J. infect. Dis.*, 131, 167; 1975). But perhaps the most exciting reports have emanated from the laboratories of Hilleman and colleagues who developed specific serological tests for hepatitis A antibody using the CR 326 virus antigen. Hilleman presented data at symposia held recently in Milan and in Washington on complement fixation and immune adherence tests. Patients with hepatitis A developed complement fixing and immune adherence antibody soon after the onset of the acute illness and the antibody persisted thereafter. Limited seroepidemiological studies have shown that most individuals of a low socio-economic level had hepatitis antibodies and these antibodies were detectable for at least seven years after infection. In contrast, most persons of high socio-economic status in an area of low hepatitis A incidence may proceed to adulthood without infection with hepatitis A.

The availability of serological tests for hepatitis A will provide a valuable tool for diagnosis, for epidemiological studies for detection of hepatitis A virus in attempts to propagate the virus in cell cultures, for the identification of susceptible and immune persons, for assay of hepatitis A antibody in batches of human immunoglobulin and ultimately for vaccine development. A new era in hepatitis research has just begun.