previously envisaged. For one thing, a worldwide system of hotspots is now envisaged as distinct from ridge activity, unifying conceptually sources of volcanic islands (and even continental volcanic centres) and aseismic ridges. Thus Iceland, situated on an oceanic ridge, is thought to be the result of a hotspot no less than the Hawaiian chain, which lies far from a ridge. Second, Morgan has proposed that hotspots are the surface manifestations of deep mantle plumes which bring up heat and "relatively primordial" material to replenish the asthenosphere, although it is not entirely clear yet whether this can be regarded as the sole source of the viscous asthenospheric material ultimately returned to the deeper mantle. But Morgan's most far-reaching suggestion is that plumes/hotspots provide the principal driving force for plate motions. Upwelling material along oceanic ridges and downwelling material along trenches, by contrast, represent near-passive processes contingent on the effects of the plumes. In other words, the primary manifestation of sub-lithospheric convection is the localized plume-hotspot rather than the large-scale cell mirroring the rise-trench system.

These are radical suggestions indeed; and although it is more than two years since Morgan made them, it is doubtful whether many geophysicists have yet fully appreciated just how fundamental is the implied impact on concepts relating to the Earth's global behaviour. To be sure, there has recently been a flurry of activity in which thermal plumes and hotspots have been invoked to prove or disprove the existence of unrelated phenomena such as polar wandering; but such studies have been hardly more than extensions in the use of Tuzo Wilson's original chain concept with the added assumption that hotspots are fixed relative to the mantle. The problem in assessing the validity of hotspots is, of course, that so little direct information about them is available. On page 565 of this issue of *Nature*, however, Schilling reports the results of a detailed geochemical investigation into the spatial and temporal characteristics of the supposed Iceland plume. In view of the potential significance of the plume concept, Schilling's important article deserves to be studied by all Earth scientists whatever their particular specialisms might be.

P. J. S.

Microarchaeology

ARCHAEOLOGICAL excavators are now experiencing advances in technique more radical than any since the 1920s and 1930s. Traditionally the role of the excavator has been to seek significant artefacts and the buried traces of former structures with which they are associated, enclosed and contained within the debris and earth of the archaeological site. Today, however, the recovery of such artefacts has become rather routine, and it is the information afforded by this debris and by the earth itself which is becoming a new focus of interest. A battery of techniques now being developed makes the processing of this material quite as informative as the study of the artefacts themselves. Equipment for flotation and sieving is taking its place beside the trowel and the spade in the indispensable armoury of the digger.

It is now some fifty years since Sir Mortimer Wheeler established definitively the principles of controlled stratigraphic excavation, admirably set out in his *Archaeology*

Works of Man

MORE than half a century ago, in 1921, the Swedish geologist Dr J. G. Andersson, noticed small fragments of white vein quartz among material that had fallen from an exposure of a fissure deposit into a quarry at Choukoutien in the region of Peking. The significance of the occurrence was immediately obvious to him: quartz was "exotic" at this locality. He turned to his companions and explained dramatically: "Here is primitive man, now all we have to do is to find him." (One of Andersson's companions on this occasion was Dr O. Zdansky, who discovered the first fossil human teeth at this site, which later became famous as the type locality of Peking Man, *Sinanthropus pekinensis*, now known as *Homo erectus pekinensis*, of Middle Pleistocene antiquity.)

It is not without interest that the milky white vein quartz which was worked by primitive man in the Omo Valley, Ethiopia, about 1.5 million years earlier in time than the material at Choukoutien (which is between 400,000 and 200,000 years old) is also "exotic". At Omo, as at East Rudolf in Kenya (the site of an even older culture, see Isaac, *Science*, **173**, 1129; 1971), man by good fortune has been found before or concurrently with his tools. Remains of hominids were recovered from the Omo Valley in the late 1960s, and now Merrick, and his colleagues, De Heinzelin, Haesaerts and Howell, record, on page 572 of this issue of *Nature*, their discoveries in 1971 and 1972 of artefacts *in situ* in the upper members of the Shungura Formation. Only the activity of man, 2.0 million years ago, as Merrick *et al.* point out, can feasibly account for the localized concentrations of the quartz tools in the fine clay sediments. Indeed the quartz would have had to be transported from sources several kilometres distant.

These artefacts from Omo are about 0.6 million years younger than the pebble tools and flakes uncovered in 1969 and 1970 *in situ* at East Rudolf. These two primitive cultures, and that found in Bed I, Olduvai Gorge (known as Oldowan), together with their associated hominids and fauna, now provide opportunities for a comparative study of early palaeolithic man and his habits in East Africa during a span of several hundreds of thousands of years.

From a Correspondent

from the Earth (Clarendon, Oxford, 1954) and more than thirty years since Bersu demonstrated in Britain the techniques of area excavation (*Proc. Prehist. Soc.*, **7**, 30; 1940), where large expanses of the site are cleared, without intervening baulks, to reveal the entirety of whatever structures may be indicated by postholes or other scanty traces. In such excavations, and indeed since the work of Schliemann a century ago, it was normal to collect the animal bones unearthed, or any obvious accumulations of carbonized grain, and submit them for specialist study. Such materials did not, however, become a principal preoccupation until twenty years ago, when the objective of much