How Australia used Cannikin

WHATEVER one's views on the advisability of firing the five megaton explosion Cannikin on Amchitka, one cannot but acknowledge that the seismologist was handed a remarkable new source on a plate. In today's *Nature* (page 111), Cleary, Simpson and Muirhead describe an experiment of some importance that they performed with Cannikin.

It has been known for some time that the seismic velocity/depth curve within the Earth has some regional variations. Effects arising from underthrust slabs are well known and fairly local in extent, but there are broader regional trends which can only be as well documented as the distribution of seismic stations permits. A major contribution to understanding of the seismic velocity variation necessarily comes from travel time residuals (these are differences between observed arrival times of P-waves at seismometers and the theoretical arrival time from a standard set of tables). It is found that residuals vary from about −1.5 to +1.5 s (a negative residual implies a signal arriving earlier than predicted). There is a fairly good correlation between negative residuals and stable, very old continental regions called shields. Positive residuals tend to occur in regions of recent tectonic activity.

Information on residuals has usually had to be extracted from records of hundreds of earthquakes, and has had to be carefully sifted to ensure that all other sources of bias have been eliminated. Cleary *et al.*, however, have been able to circumvent this detailed analysis by using a source at an exactly known time and place. Just before Cannikin was fired they installed a set of temporary stations across about half of Australia. Arrival times at each station were measured and converted into residuals which are taken to be indicative of seismic velocity variation across the continent. They assume (with considerable justification) that near-source heterogeneity will not affect in any differential way the suite of rays departing steeply and southerly towards the network. They assume, also reasonably, that the deep part of each ray path is probably almost identical. Furthermore, by placing all the seismometers at almost the same distance from Cannikin they have eliminated any errors arising from inaccurate reference time tables. Thus they can conclude that the variation in residual of from −1.0 s to +0.5 s is most likely to be indicative of lateral variations in seismic velocity in the upper mantle underneath Australia. The variation is such that seismic velocities are higher in the west.

It is impossible from one number at each station to give anything more detailed than an integrated view of the seismic velocity profile. Nevertheless the integrated contrast is very striking and significant. If it were spread out over, say, the top 600 km it would correspond to a 2.5 per cent seismic velocity contrast. Confined to a narrower region the contrast, of course, goes up. Cleary *et al.* suggest that the lateral variation may be related to the disappearance of a low velocity layer. They are particularly impressed by a rapid velocity change over about 500 km in the centre of the profile and this region includes the eastern boundary of Precambrian rocks. It is thus geophysically plausible that the low velocity layer disappears here. If so, the contrast, presumed confined dominantly to the depths from 100 km to 300 km, would be about 6 per cent.

From this well controlled experiment has emerged a good first step towards understanding the structure deep beneath the Australian continent. The results are of importance, however, to the geophysics of continental regions in general.—D. D.

Viruses and Breast Cancer

A LITTLE more than a year ago Moore and Charney and their colleagues caused great excitement with their report that certain human milks contain particles which have a structure virtually identical to that of mouse mammary tumour virus. They wrote (*Nature*, **229**, 611 ; 1971), "We conclude that the similarities between adenocarcinoma of the breast in mice and women are too extensive to be coincidental and that human breast cancer may also be a viral disease." Since that was written, Moore's group in collaboration with Spiegelman's group have shown that there are particles in human milk which contain reverse transcriptase and a 70S single stranded RNA. Moreover, Spiegelman and his colleagues (*Nature*, **235**, 32 ; 1972) have, by nucleic acid hybridization experiments, shown that human cancerous breast cells but not healthy breast cells contain RNA molecules which are homologous to those of mouse mammary tumour virus RNA. Such findings, of course, have done much to strengthen the argument that an RNA tumour virus might be involved in the aetiology of human breast cancer, perhaps acting as a necessary, if not sufficient, aetiological agent. It is ironic, therefore, to read on page 103 of this issue of *Nature* that Moore and his colleagues have lately been having second thoughts about the various particles to be found in human milk and are now considerably more cautious about what significance might be attached to them.

Moore and his colleagues have done two things: first, they have now screened for viruses and other particulate matter 381 samples of milk from 263 American women, ninety of whom are from families with a history of breast cancer; second, they have paid greater attention to the structure, as revealed in the electron microscope, of the various milk particles, and have introduced a new nomenclature for these particles, which they believe will help avoid confusion although others may well argue that it is more likely to confound confusion.

In their earlier work and reports Moore *et al.* apparently classified any virus-like particle in human milk, which had regular spikes projecting from its surface, as a B-type particle and therefore similar to mouse mammary tumour virus. Now, however, they say that very few human milks (thirteen out of the total sample) contain particles which very closely resemble B-type particles of mouse mammary tumour virus and these particles in human milk should be called MS-1 particles. A larger proportion of the human milks contain spiked particles (MS-2 particles) not identical to the mouse virus but which may be partially degraded forms of MS-1 particles.