LETTERS TO THE EDITOR

PHYSICS

Detection of Fresh Fission Products in Sydney from the 1962 Christmas Island Nuclear Test Series

FISSION products arising from the American nuclear weapons test series at Christmas Island in the Pacific (April 25–July 11, 1962) have been detected in Sydney (lat. 34° S.) in both air and rain-water within a period of 3 weeks.

Air was filtered through a 'Forestone' filter paper at a rate of 6.6×10^4 kg/day, with an average sampling period of 3 days/week. Rain-water was collected until a sufficient volume (approximately 10 l.) was obtained; over the period of interest this restricted the collections to only 6, owing to unseasonably low rainfall. The rain-water was passed through a mixed-bed exchange resin. The compressed 'Forestone' filter paper and the exchange resin were counted in calibrated geometries using a 5 in. $\times$ 4 in. sodium iodide crystal feeding into a 512-channel pulse-height analyser.

Cerium-141, zirconium-95 – niobium-95 and barium-140 – lanthanum-140 were identified from the γ -ray energies and by half-life determinations. A peak at 0.48 MeV was also obtained and checks on the decay rate indicated the presence not only of beryllium-7 (half-life = 53 days, 0.48 MeV) and lanthanum-140 (half-life (eff) = 12.8 days, 0.48 MeV) but also of some other emitter. This component is probably ruthenium-103, and half-life and ratio studies support this view, but no attempt has been made to obtain a positive identification. The results are shown in Tables 1 and 2.

Since sampling of the air was not commenced until May 18, 1962, at which time the fission products were

Table 1. FALL-OUT LEVELS IN AIR
 $\mu\text{mc./kg air} \times 10^4$

Sampling period	^{95}Zr and ^{95}Nb	^{141}Ce	^{140}La	0.48 MeV peak— ^{140}La contribution*
25–28/5/62	28	—	80	4
8–11/6/62	139	93	55	60
15–18/6/62	153	85	45	68
22–25/6/62	47	31	17	36
29/6–2/7/62	49	28	15	33
6–8/7/62	75	22	9	24
13–15/7/62	170	75	32	62
20–22/7/62	765	270	118	194
27–29/7/62	650	102	54	99
3/8–9/8/62	114	45	17	39
10–16/8/62	143	42	18	44
17–26/8/62	89	20	4	20
27/8–2/9/62	174	36	2	34
3–9/9/62	155	34	—	28
10–16/9/62	143	31	—	27
17/9–1/10/62	119	24	—	—
2/10–7/10/62	167	26	—	—
8–14/10/62	175	41	—	—
15–21/10/62	163	35	—	—
22–28/10/62	105	24	—	—
29/10–4/11/62	92	19	—	—
5/11–11/11/62	163	29	—	—

* The figures given in this column are based purely on the γ -activity.

Table 2. FALL-OUT LEVELS IN RAIN-WATER

Collection period	Rainfall during period (in.)	^{95}Zr and ^{95}Nb	$\mu\text{mc./l. rain}$ ^{141}Ce ^{140}La	0.48-MeV peak— ^{140}La contribution*
14/4–14/5/62	9.9	—	—	69
14/5–28/5/62	0.6	252	—	288
28/5–11/7/62	1.2	138	162	122
11/7–16/7/62	1.2	66	70	35
16/7–15/8/62	3.1	208	267	93
15/8–19/9/62	3.2	269	394	—
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NOTE: Dates of announced test explosions were:—

25/4, 27/4, 2/5†, 4/5, 7/5, 8/5, 9/5, 14/5, 25/5, 28/5, 8/6, 9/6, 10/6†, 12/6, 15/6, 18/6, 19/6, 22/6, 10/7, 11/7†.

* The figures given in this column are based purely on the γ -activity.

† These were explosions in the megaton range.

already present, a direct value for the transport period was not obtained, but it was less than 3 weeks. The ratios in zirconium/cerium and zirconium/lanthanum in the earlier part of this sampling period also suggest a transport time of this order.

A histogram of the specific activities shows a marked peak for all isotopes over the sampling period July 10–21, 1962, at which time an intense anticyclone passed over Sydney. Minor peaks were also observed under similar meteorological conditions. Correlations of fall-out levels with height and duration of inversion layers associated with these meteorological conditions are being further investigated.

It may be noted that no fall-out activity was detected from the resumed high-altitude series at Johnston Island.

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ASTRONOMY

Wake Spectrum of a Leonid Meteor

WHILE photographing meteor spectra using a conventional meteor spectrograph with a rotating shutter arrangement, wake spectra may sometimes be obtained in the breaks between the segments of the primary spectra. Credit goes to the Canadians for obtaining the existing seven wake spectra¹ in the world.

This communication describes the eighth wake spectrum in the world (Fig. 1). This is found between the fourth and fifth segments of the primary spectrum of a Leonid meteor, already described². As in six of the previous cases, this wake spectrum is also confined close to the region of a strong flare. There has been some dispute⁴ in explaining the mechanism of the formation of wake spectrum, although the latter is agreed to be a low excitation recombination spectrum^{1,3} involving elements common in the primary spectrum. Millman⁴ attributed the strong secondary (wake) spectrum of No. 126 to the fragments of the main meteoroid trailing behind it. He also suggested that the number of such trailing particles increases at the time of a burst. Öpik⁵ objected to this explanation on the basis that the deceleration of the fragments behind the main mass may not be sufficient. Halliday¹ suggested that the burst of a large portion of the meteoroid might have occurred at the position of the wake spectrum, converting it into atomic form, which suffered a large deceleration. This might have remained at almost the same place producing the recombination wake spectrum, while the rest of the meteoroid proceeded in its flight. This stands as the only probable explanation for the deceleration mechanism.

It may be noted that the secondary spectrum between the first and the second segments of the primary spectrum² of this Leonid meteor has occurred at a position where there was no burst. However, fragmentation of loosely attached particles might have occurred, high in the atmosphere, simultaneously converting them into the atomic form, which suffered a large deceleration, producing the weak secondary spectrum. The luminosity of this wake spectrum may depend on the mass fragmented. This explanation may also be extended to all the wake spectra, which are not associated with flares. Another example of such a wake spectrum is that of No. 212¹, where the light curve had a smooth variation, and the wake spectrum