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^{210}Pb CONTENT OF RAINFALL IN THE SHEPHELA (ISRAEL COASTAL PLAIN)

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(כולל כותרת ותקציר בעברית)

ABSTRACT

Rainfall at two stations in the Shephela (Israel Coastal Plain) was analyzed for ^{210}Pb during the winter of 1974-75. The highest concentrations of ^{210}Pb were found in samples collected early in the rainy season. It seemed that there was a small, but significant difference between the two stations. The total activity at the Bet-Dagan station (near Tel-Aviv) and generally also the activities in the individual samples collected at this station were lower than the respective activities at the Gan-Shomron station (60 kms to the north).

תכולת ^{210}Pb במשקעי גשם בשפלה

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אייר תשל"ז - מאי 1977

תקציר

נקבעה תכולת ^{210}Pb במשקעי הגשם בשתי תחנות באזור השפלה בתוך 75-1974. הריכוזים הנדולים ביותר של ^{210}Pb נמצאו בדוגמאות שנאספו בראשיתה של עונת הגשמים. נראה שישנו הבדל קטן אך משמעותי בין הממצאים של שתי התחנות. האקטיביות הכוללת שנמצאה בתחנת בית-דגן (ליד תל-אביב) זכן מידות האקטיביות בדוגמאות הבודדות שנאספו באותה תחנה נמצאו נמוכות יותר ממידות האקטיביות המתאימות שנמצאו בתחנת גן-שומרון (60 ק"מ צפונית לבית-דגן).

Information about the ^{210}Pb content of rain-water and of fall-out can be instrumental in the study of atmospheric circulation. The present study was initiated with the aim of supplying some information that seems to be lacking for Israel

Rain-water was collected in the 1974-75 winter at the Meteorological Service Center in Bét-Dagan and at the meteorological station in Gan-Shomron. These stations are located in the Shephela (Israel Coastal Plain) at a distance of 8 and 10 km, respectively, from the sea. Bét-Dagan lies south-east of Tel-Aviv, on the verge of a densely populated area; Gan-Shomron lies 60 km to the north, in rural surroundings.

At each of the stations rain-water was collected in the same way in two vessels, to assure that no over-filling should happen. The rain collection area of the two vessels (combined) was 1250 cm^2. In most cases collection was carried out for 24 hours ending at 8 am, at the day noted. In some instances a few days' rainfall was combined into one sample, as indicated in tables 1-2. The samples were stored in plastic containers which were later transported to the laboratory. A period of few days up to several weeks elapsed between the time of collection and analysis. In the laboratory the volume of the sample was measured and a 15 mg of Pb-carrier was added, as well as a measured quantity of ^{208}Po spike, necessary for the envisaged determination of ^{210}Po at a later stage of the analysis.

The solution was equilibrated by heating for several hours and Pb was precipitated as $PbCrO_4$ and separated by centrifugation. The precipitate was dissolved in HCℓ and the solution, made up to 1.5N HCℓ, loaded on a 8 mm (ID) column packed with a Dowex 1X8, 100-200 mesh resin to a height of about 10 cm. The resin

was washed with 1.5N HCl and the retained Pb was eluted with water and precipitated as chromate. The precipitate was filtered on a Millipore filter. A source was then prepared and the β-radiation of the ingrowing ^{210}Bi counted several times during one month in a low-level, window-end proportional counter. The counter was clibrated with a ^{90}Sr-^{90}Y standard source; the background of the counter was 1.39 cpm (counts per minute). After the ^{210}Bi reached equilibrium with the ^{210}Pb, the source was leached in HNO_3 (1:1 by volume) and the solution was analyzed for Pb (by titration of the chromate). The ^{210}Pb content of the sample was then determined from the chemical yield and the ^{210}Bi count. No correction was made for the decay of ^{210}Pb between time of sampling and time of counting, because the correction would have changed the results by a fraction of one percent only.

The results obtained are tabulated in tables 1 and 2. A few samples had to be rejected because of mishandling; the discarded samples represent 7.3% of the collected rainfall from the Bet-Dagan station, and 11.1% of that from the Gan-Shomron station.

At the Bet-Dagan station the total activity contained in the 16 samples (combined volume of 58.2 litres) was 100.256 dpm (disintegrations per minute) ^{210}Pb. Approximately two thirds of this activity was contained in 5 samples (6 days' rainfall). The highest specific activity, 5.0 dpm per litre, was found in sample A3, collected early in the rainy season (24 November 1974). Rather low activities were found for most of the winter (excepting sample A21, 27 January 1975). Samples collected late in February (including rainfall collected on 1 March) were more active. The highest specific activity in this group (3.6 dpm per litre) was found in sample A24, of February 1975.

A total ^{210}Pb activity of 163.670 dpm was found in the Gan-Shomron samples. The temporal distribution of this activity did not differ substaintially from that of the Bét-Dagan samples. Still, there seemed to be some differences. The first sample of the season (A4, 24 November 1974) contained 27.653 dpm, the highest value found in this investigation in 24 hours' rainfall. Also the specific activity of this sample, 7.9 dpm ^{210}Pb per litre, was outstanding. As for the specific activity of the Gan-Shomron samples collected after mid-December it was as low as that of the Bét-Dagan samples. For the later part of the winter, the values of both the total activity and the average of the specific activity, were higher for the Gan-Shomron samples than for those of Bét-Dagan. Incidentally rainfall during the later part of the winter, and annual rainfall, are a little greater in Gan-Shomron than in Bét-Dagan.

These difference, though not considerable, may be significant and perhaps lead to some correlation between general or local meteorological events and the ^{210}Pb content of rain-water.

Table 1 ^{210}Pb activity in rainfall samples collected at Bét-Dagan station.

Sample	Date	Volume	^{210}Pb activity	
			absolute	specific
		(mℓ)	(dpm)	(dpm/ℓ)
A1	18 November 1974	1580	2.330	1.47
A3	24 November 1974	3700	18.567	5.02
A7	4-5 December 1974	8350	12.835	1.53
A5	10 December 1974	4750	11.232	2.35
A6	11 December 1974	4800	5.735	1.19
A15	8 January 1975	2000	0.309	0.15
A17	10-11 January 1975	2350	0.692	0.29
A18	26 January 1975	2050	1.620	0.79
A21	27 January 1975	3250	5.298	1.63
A19	1 February 1975	4950	0.382	0.08
A20	2-3 February 1975	4970	2.458	0.50
A25	9-10 February 1975	3400	5.953	1.76
A24	20 February 1975	3900	14.000	3.60
A27	28 February 1975	2600	7.209	2.78
A26	1 March 1975	3900	10.614	2.72
A42	17-18 March 1975	1650	1.019	0.62

Table 2 ^{210}Pb activity in rainfall samples collected at Gan-Shomron station.

Sample	Date	Volume	^{210}Pb activity	
			absolute	specific
		(mℓ)	(dpm)	(dpm/ℓ)
A4	24 November 1974	3500	27.653	7.90
A11	3-5 December 1974	6400	21.300	3.33
A2	17-19 December 1974	3200	9.758	3.05
A13	20 December 1974	2250	1.784	0.80
A14	4-5 January 1975	3600	1.274	0.35
A9	8-13 January 1975	18050	5.097	0.28
A28	27 January 1975	2850	11.578	0.40
A29	28 January 1975	2600	7.155	2.70
A32	3 February 1975	2900	7.209	2.49
A33	6 February 1975	2050	8.465	4.12
A34	7-8 February 1975	2300	6.481	2.81
A31(*)	9 February 1975	1000	3.768	3.77
A35(*)	9 February 1975	4550	19.479	4.28
A36	10 February 1975	1600	2.749	1.72
A37	20-21 February 1975	4450	13.800	3.11
A41	28 February 1975	2000	7.100	3.55
A39	1 March 1975	4600	6.645	1.44
A40	17-18 March 1975	1750	3.295	1.89

(*)Two samples were collected on 9 February 1975.

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