RADIUM-226 CONTENT IN SOIL OF THE HIGH NATURAL BACKGROUND RADIATION AREA OF RAMSAR (IRAN)

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ABSTRACT

The existence of a high natural radiation area in the northern part of Iran (Ramsar) is proved. Ra 226 in soil is measured. The results are: minimum 23.5 pCi/g and maximum 999 pCi/g soil. Environmental radioactivity is from 0.1 to 5 mr/h.

INTRODUCTION

Ramsar is a northern coastal town in Iran. The area is pretty rich with mineral springs. First investigations on radium-226 in water started in 1967 (3). Especially high values found at that time necessitated to carry out further studies in the area.

With the collaboration of the "Service de Protection Sanitaire" of "Commissariat à l'Energie Atomique" (Fontenay-aux-Roses, France), a study started first of all on soil radioactivity and later on soil-plant transfer of radioactivity. The primary results are summarized in this report.

MATERIALS AND METHODS

Until now about one square kilometer is found with high natural background radiation area (more than 200 counts per second (e/s) for environmental radioactivity) For soil radioactivity measurements, three fields with different environmental radioactivity from 500 to more than 15000 counts per second were selected. Background of nonradioactive area is about 30 c/s.

Two ways of assaying soil have been used:

a- for one measurement, three samples spaced of one

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meter forming a triangle (fig. 1-a) used until 1974.

b- in a second series of measurements, six samples from 6 points shaped like fig. 1-b.

Because of the small depth of light soil, amount of soil taken for measurement is not always the same . In some places, rock is found at twenty centimeters depth.

After homogenization, fifty grams was taken for chemical treatment, as described earlier. There is only one difference in the treatment: soil has insoluble components even in the acid. Therefore, a residue has to be thrown away, thus we obtain a minimal value of 226Ra content. An appreciable quantity of 226Ra may effectively be lost with the residue.

Most analyses have been carried out in Teheran. Emanation method, reported by Rushing (6), gives the Ra-226 content of soil. To compare the results, we sent some samples to the Environmental measurements laboratory (New-York, U.S.A) and to the "Service de Protechtion Sanitaire" of C.E.A (France).

RESULTS AND DISCUSSION

Radium-226 of soil of the three fields are tabulated in Table 1. Radioactivity of soil is not constant from one point to another even in the same field like environmental radioactivity. This may explain the differences between our results and E.M.L. for field 1. The other results from E.M.L. and C.E.A. for fields 2 and 3 are in agreement with ours.

At the end of Table 1, we put results from M. Delpoux (1), who gives radium and uranium content of an uraniferous soil. In comparison radium concentration in Ramsar is too high while uranium concentration is too low. J. Osmond (5) cited by M. Delpoux, has estimated the mean uranium concentration of sedimentary rocks as 2.4 ppm and 3.5 ppm for igneous rocks. We think that Ramsar soil does not content more uranium than any other soil. In the contrary, the Ra-226 concentration is much higher than expected.

As a summary, we tabulated in Table 2 minimal and maximal values of radium in soil and environmental radioactivity for the three fields and for a non-radioactive part of Ramsar area.

For better comparison with results of other high background radiation areas in India and Brazil, we report in figure 2 the equivalence between the number of counts per second and the millirontgens per hour for environmental radioactivity. It is reported (2) that both in India and Brazil the "hot spots" on black sand range from 3 to 5 mr/h. Ramsar

is found to have the same order of magnitude for environmental radioactivity. It is more complex to compare the three region from the point of view of soil. In both Brazil and India it is a monazite soil. In Iran it is not monazite but soil study has not yet been completed.

In Ramsar areas, underground water is near the ground level and springs are present everywhere (about fifty in the area concerned). Radioactive and non-radioactive waters exist. In the vicinity of the first ones, soil is radioactive and near the others we did not find any appreciable quantity of radium-226 in soil. So we may conclude that radium-226 in soil comes from water. Further studies in this area will clarify the situation.

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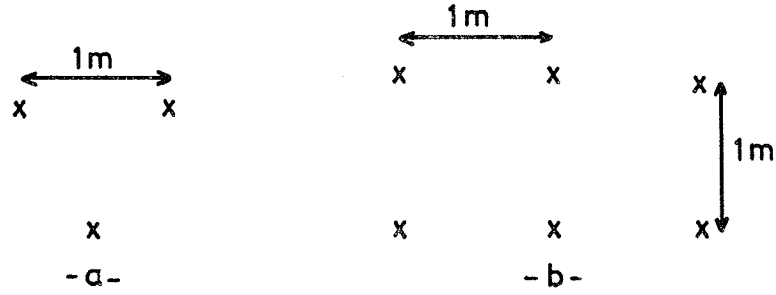

Fig.1: Ways of assaying soil

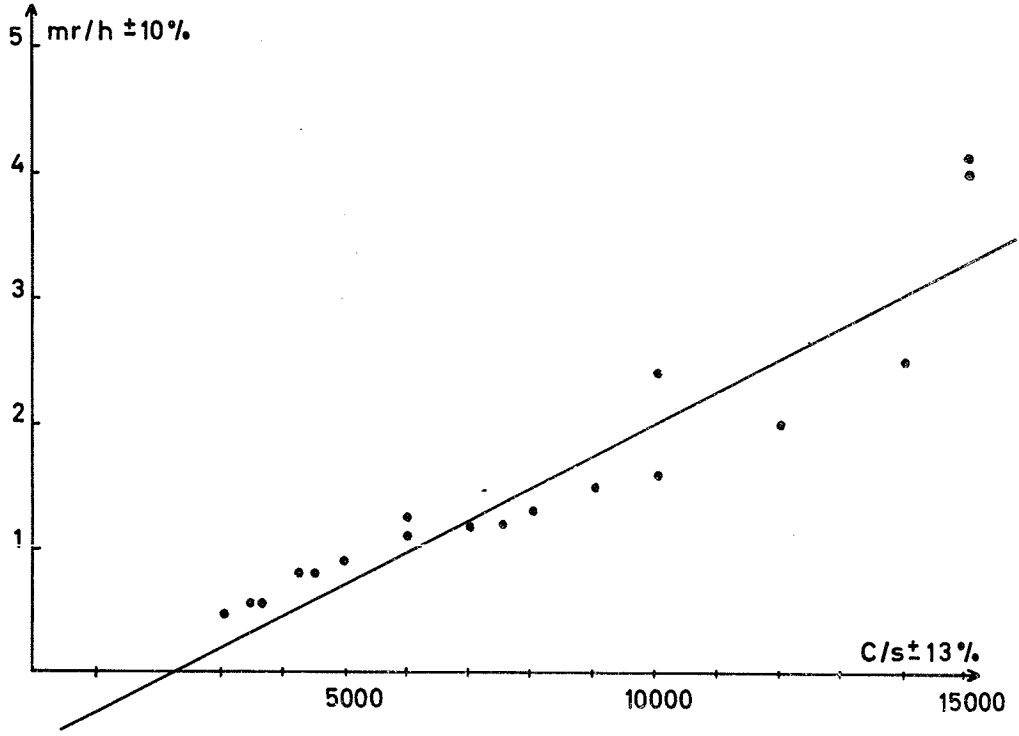

Fig. 2: Comparison between counts per second and millirontgens per hour for environmental radioactivity.

Table 1: Radioactivity of soil

Location	date	^{226}Ra pCi/g	U ppm	Laboratory
field 1	1973	46. 2±06 (1) 60 ±0.2 (2)	4.96 (2)	EML (USA)
	1974	294 ± 16		Teheran
		89 ± 8		
		89 ± 8		
		92 ± 6.5		
		90 ± 9		
field 2	1974	398 ± 35		Teheran
		999 ± 100		
		999 ± 100		
	1975	984 ± 78		CEA (France)
		590 ± 40		Teheran
field 3	1973	21 ± 3		Teheran
		22 ± 1.5		
	1975	23.5 ± 0.9	1.43	
	1973	17. 1±0. 1 (1)		EML (USA)
BACKGROUND	1973	<0.1		Teheran
France	min 25.7 max 239.5		min. 57 max 1050	ref De 74

(1) - spectrometry, (2) radiochemistry

Table 2: Radioactivity of soil and environmental radioactivity

Location	counts per second	RA - 226 minimum	p Ci/g of soil maximim
field 1	min 1000 average 2000 max 10000	89 ± 8	294 ± 8
field 2	min 2000 average 4000 max > 15000	398 ± 55	999 ± 100
field 3	min 400 average 500 max 1000	23.5 ± 1	
background	30	< 0.1	