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By
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THE-RADIUM-URANIUM RATIO IN AAA (PITCHBLENDE) ORE; III

By F. A. Morecombe

G. L. Martin, in the first paper, dated July, 1945, concerned with the radium-uranium ratio in AAA ore made a critical survey of the literature attempting to establish the best value for the theoretical ratio. The average ratio obtained on AAA ore samples in the M.C.W. laboratory was compared with this theoretical value. The results of check analyses made by different laboratories were given.

F. C. Edwards reviewed the problem of the radium-uranium ratio in a paper dated January 1946.

On the basis of further results and further information on Ra-U ratio in pitchblende ore obtained by this laboratory, it was felt desirable to review G. L. Martin's paper and the conclusions reached there and in F. C. Edwards' report.

"The theoretical value for the radium-uranium ratio is uncertain within rather wide limits. The best available ratio seems to be 3.68×10^{-7} ."

Information received by this laboratory indicates that the values of the half-lives of both radium and uranium have been reestablished. The "latest and presumably the best" value for radium is 1622 ± 13 years as determined by T. P. Kohman and associates at the Argonne laboratory. The most recent and presumably the best values for uranium is 4.51×10^9 years.

Using these two half-lives, the theoretical ratio becomes:

$$\frac{1622 \pm 13}{4.51 \times 10^9} = 3.60 \pm 0.03 \times 10^{-7}$$

As there is no reason for not accepting these latest figures, this laboratory will henceforth use this figure whenever necessary, and will no longer use the figure thought best by G. L. Martin in July, 1945. The difference is, of course, almost negligible.

"The average value obtained on 43 AAA ore samples submitted to our laboratory is $3.85 \pm 0.18 \times 10^{-7}$. While somewhat higher than many of the

values for the theoretical ratio, it is not significantly higher than the one chosen as the best."

This statement of G. L. Martin was commented upon by F. C. Edwards as follows:

"The 43 AAA ore samples represented about 20,000 pounds of ore. Since the first report, thirty-two additional AAA ore samples representing about 200,000 pounds have been run. The average ratio for these thirty-two ore samples was $3.28 \pm 0.05 \times 10^{-7}$."

Since the statement made by F. C. Edwards was written, 69 additional AAA ore samples representing 5,000,000 lbs. have been run. The average ratio, using the accepted value for the uranium assay was $3.39 \pm 0.15 \times 10^{-7}$. This value, lying between those reported by Martin and Edwards is fairly close to the theoretical value. The mean error of the average of this third series is about the same as that obtained in the first series and four times as large as that obtained in the second series. This discrepancy between the average mean errors of the second and third results may be due to the increased radium content in the AAA ore represented in the third result.

It should be noted at this point that the radium-uranium ratio obtained by using N.B.S. radium results and the accepted assay results is $3.29 \pm 0.044 \times 10^{-7}$. This figure, if correct, makes the M.C.W. figure 3.03% high on the average of the 69 ore lots represented. If M.C.W. X assays and M.C.W. My assays are used, the ratio averages 3.45×10^{-7} , a value even closer to the theoretical. All this time our K-65 figures were in excellent agreement with M.I.T.

"Comparison of results obtained on check samples and standard samples indicates that our results are as accurate as can be expected, considering the inherent accuracies of the method."

The last paragraph written above gives a good picture of the present status. It should be noted at this time, however, that on the comparison of the six standard samples run at M.C.W. and at five other laboratories, M.C.W. was higher than N.B.S., our present check laboratory, on 5 of the 6 samples. That comparison was made prior to July, 1945. The average high of these five samples was 2.9%, an indication that M.C.W. was giving high results over two years ago. This can be seen only by comparing those results with the great number run since then.

When the same standard samples are run, as they are periodically, results as good as those originally gotten are obtained. This is an indication that our laboratory is as accurate now as it was two years ago.

The practice of sending out check samples has been discontinued owing to the two to three month delay in obtaining results.

"Before the ratio in AAA ore can be fixed at any figure, it will be necessary to analyze samples representing larger quantities of ore than those we have run. Without knowing something of the history of the material, it is impossible to decide if the theoretical ratio can be applied to this material."

The first part of the above statement suggesting more results be obtained seems to now be taken care of. The latter part of the conclusion must be reiterated at this point. In view of both M.C.W. and N.B.S. obtaining ratios lower than the theoretical, it would appear that the theoretical ratio will not apply. The differences, however, 5.8% for M.C.W. and 8.6% for N.B.S. are almost within experimental limits. Here again the difference is 2.8% which agrees fairly well with the 3.03% figure obtained earlier in this paper.

It would be interesting to know whether the A. E. C. knows anything about the theoretical ratio of My/X in this ore, and the value they use, if any.