tain clays. This may be considered the first step in the process of concentration of the uranium.

Because of an increase in the thermal environment of the clays, aging of the material, or the introduction of chemically more active ions into the system, the uranium is displaced and again put into solution. Carbonaceous material, in the path of the displaced ions, would act as a "filter" and again concentrate, and this time fix, the uranium ions.

For the concentration of uranium according to the above suggestions it is probably important that an oxidizing environment prevail. Alkaline solutions cause the graphite layers to expand to such an extent that they may be converted into a colloidal suspension, leading to a final breakdown of the graphite structure. Colloids containing uranium would then be adsorbed again on clays and similar minerals.[4]

The above discussion does not, however, account for the uranium in the bauxite core. The clay mineral in the core is kaolinite, a clay with very little base exchange capacity. The drill core contained siderite distributed throughout its entire length. The carbonate solutions of high pH should disperse or leach the uranium from the core. When tested in the beta counter, the siderite-rich material showed almost no radioactivity.

The drill core contained large amounts of titanium and zirconium. These elements form ions similar to the uranyl ion:

$$UO_2(OH)_2 \rightarrow TiO^{++} + 2OH$$
$$ZrO(OH)_2 \rightarrow ZrO^{++} + 2OH$$
$$UO_2(OH)_2 \rightarrow UO_2^{++} + 2OH$$

Certain portions of the drill core that contained no titanium or zirconium minerals showed high assays for these two elements. The elements must have been present in the form of adsorbed ions on one of the minerals in the core. The writer believes that the uranium was introduced into the deposit in the form of the uranyl ion, concentrated along with the titanates and zirconates which were in the form of the above ions, and was adsorbed on the aluminum mineral gibbsite, thus giving rise to the relatively high radioactivity found. The radioactivity of some of the samples from the drill core are listed in Table 1.

TABLE 1

RADIOACTIVITY OF SOME OF THE MINERALS IN THE DRILL CORE

Samples from the drill core	10^{-12} gm/gm Ra equivalent
Ilmenite and brookite	8.1
Sample 1 (92% kaolinite) ..	9.6
" 2 (74% gibbsite) ...	13.1
" 3 (54% siderite) ...	8.6

Miss Geraldine Sullivan, working on a program sponsored by the Geological Society of America at the Geochemical Laboratory of Massachusetts Institute of Technology, found that the average β-radioactivity for 233 shales was 9×10^{-12} gm/gm Ra equivalent. This figure can be used as a basis of comparison for the radioactivity of the samples listed in the above table. Almost all of the uranium is located in the sample containing a large amount of gibbsite, whereas the kaolinite specimen shows very little radioactivity.

[4] Could a process such as this account for the high radioactivity of certain carbonaceous shales or have something to do with the formation of oil by the polymerization of the highly active carbon into hydrocarbons by radioactive processes?

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Penicillin Blood and Milk Concentrations in the Normal Cow Following Parenteral Administration

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The question of whether or not penicillin can be demonstrated in the milk of the dairy cow following parenteral administration has been undergoing considerable study. Seeley, *et al.* (*6*) tested milk of a normal cow for penicillin activity following intravenous administration. A total of 500,000 units was injected in two portions of 15 ml each about 1 min apart. No measureable amounts of penicillin were present when samples of milk were taken at frequent intervals for 24 hrs after dosing. Watts and McLeod (*7*) injected doses up to 1,000,000 units of penicillin intramuscularly into normal heifers and were unable to detect the drug in the milk. Barker and Dussault (*1*) treated a cow infected with mastitis streptococci with a total dosage of 2,681,000 units of penicillin, administered intramuscularly at 8-hr intervals over a period of 4 days and, on the basis of their results, stated that the lactating bovine mammary gland appears to be nonpermeable to penicillin.

When high, persisting blood concentrations were obtained following parenteral administration of Sulfamethazine in the dairy cow, significant amounts of the drug in the milk were demonstrated (*4*). When low blood levels were obtained after sulfathiazole administration and the

[1] The authors are indebted to Miss Frances L. Clapp and Miss Frances W. Bingham, of the Biological Testing Section, for penicillin assays and to H. Mundle and S. C. Griffith, of the Animal Industry Section, for aid in the conduct of the program.

drug was rapidly excreted, little or no drug was present in the milk (*5*). Therefore, it seemed likely that, if penicillin blood concentrations were sufficiently high and persistent, penicillin could be demonstrated in milk.

Two trials were instituted in normal cows, free of clinical mastitis on udder palpation and physical appearance of the milk on strip cup test. In Experiment I, one cow weighing 1,300 lbs and milking 55 lbs daily received a total dosage of 16,250,000 units of amorphous penicillin sodium. In Experiment II, one cow weighing 1,380 lbs and milking 35 lbs daily received a total of 17,250,000 units of crystalline penicillin G sodium. In each case, the penicillin was reconstituted in 1 cc of saline for each 200,000 units of penicillin. The drug was administered subcutaneously at the rate of 5,000 units/lb of body weight for the first dose and 2,500 units/lb for three subsequent doses at 6-hr intervals. Blood and milk samples were taken 15 min and 1 hr after the first dose, and at hourly intervals thereafter,

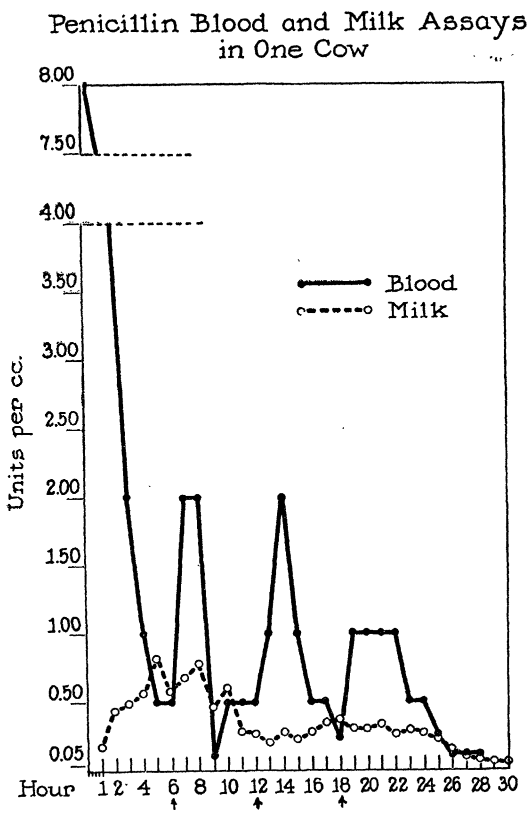

FIG. 1

through 30 hrs. The cows were completely milked out immediately before the first injection and at 12-hr intervals thereafter.

Blood serum assays were made according to the method of Chandler, Price, and Randall (*2*).

Milk assays were made by a modification of the *B. subtilis* cup-plate method of Foster and Woodruff (*3*). Filter paper discs (7 mm in diameter) were used instead of cups. Three cc of seeded agar was used, and 0.03 cc of the material to be tested was added to each disc. Plates were incubated at 39° C and were read after 4 hrs. The unitage of the test sample was determined by referring the diameter of zones of inhibition to a standard curve run daily on the specific body fluid, to which had been added standard penicillin in appropriate amounts.

Penicillin blood and milk concentrations obtained in Experiment I are shown in Fig. 1. A high level of 8 units/cc of blood was recorded 15 min after the first dose, and this decreased steadily to a low of 0.5 unit in about 5 hrs. After each subsequent dose, the level rose again, reaching high levels of 2 units, 2 units, and 1 unit at the 7th, 14th, and 19th hrs, respectively. At the 29th and 30th hrs, there was less than 0.03 unit, the lowest level that can be measured.

The milk level recorded 15 min after the first dose was less than 0.05 unit/cc. This rose steadily to a high of 0.84 unit/cc at the 5th hr, decreased slightly, and rose again after the second dose to 0.78 unit at the 8th hr. There was a very slight increase after each injection of penicillin. Although there was no measurable blood level after the 28th hr, a milk level of 0.06 unit was still present at 30 hrs.

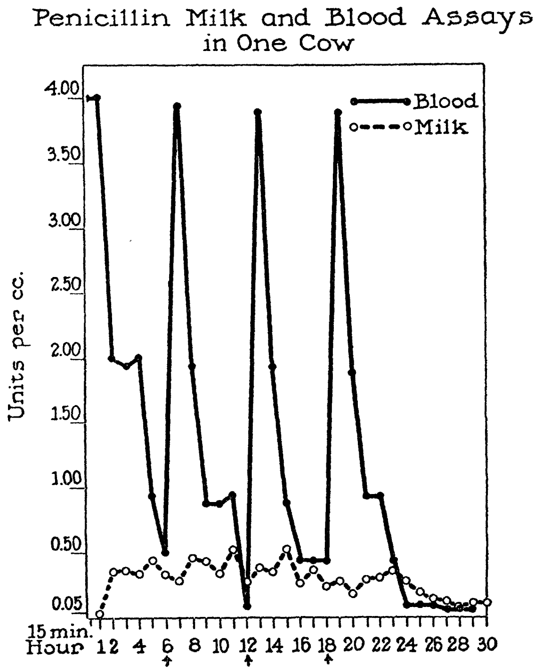

FIG. 2

Fig. 2 shows blood and milk concentrations obtained in Experiment II. A level of 4 units/cc of blood was recorded at 15 min and persisted through 1 hr. As in the first test, the blood concentrations decreased to approximately 0.5 unit or less within each 6-hr period. Following each subsequent dose, the levels rose to slightly less than the highest level recorded. There were no measurable amounts of the drug in the blood after 29 hrs. The milk level curve was similar to that recorded in the first experiment, with a high of 0.53 unit at 15 hrs and 0.1 unit at 30 hrs.

The results obtained in these experiments indicate that in the dairy cow, where there is rapid excretion of a drug, measurable amounts of that drug in the milk are not likely to be found unless blood concentrations are high and persistent. The actual drug concentration in the milk may not have great significance, but it indicates that the drug is present in the secreting tissues. The total dosage of an antibiotic or a sulfonamide used during the course of treatment is relatively unimportant. However, the dose-time-weight relationship is important.

The purpose of this report is not to suggest the parenteral administration of penicillin for the treatment of mastitis. Penicillin can be localized in the udder by intramammary infusions without as rapid loss as when the drug is administered parenterally, and higher concentrations can be achieved on smaller dosage and less frequent administration. It is interesting to note, however, that there is diffusion of penicillin from blood to milk.

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Variations in Total Counts of P^{32} and I^{131} for Dishes of Different Atomic Number[1]

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In the measurement of radioactive isotopes in the laboratories throughout the country one finds variations as great as 50%. Some of the discrepancy may be due to the different materials of which the dishes used to measure the radiation are made. With this point in mind, the amount of radiation reflected from various materials was measured from given amounts of P^{32} and I^{131}.

Radioactive phosphorus emitting beta rays with a maximum energy of 1.7 Mev was evaporated to dryness on filter paper, Al, Cu, Sn, and Pb dishes, the amount of radioactive material being contained within a circle of about 1 cm in diameter. Measurements were made at a distance of 10 cm with a Geiger counter tube, the glass wall of which was 0.12 mm thick. The percentage reflection using paper as zero reflector increased with the atomic number of the various materials. Percentage reflection is defined as

$$100 \times \frac{I - I_0}{I_0},$$

where I = intensity in counts per minute of the primary beam and the reflected beam, and I_0 = intensity of the primary beam.

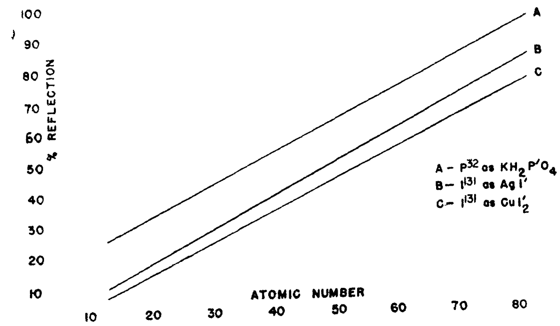

FIG. 1

Fig. 1 is a plot of the atomic number of the reflecting materials vs. percentage reflection. Measurements taken at 15 and 20 cm from the tube gave the same percentage reflection. Similar data at 10 cm from the tube were taken in a lead house, and the reflection ratios were the same as those in air.

Identical technique was followed for I^{131}, which emits beta rays with a maximum energy of 0.7 Mev and gamma rays with a maximum energy of 0.4 Mev.

Since I^{131} sublimes and is difficult to handle, it was first bound as silver iodide by the use of $NaHSO_3$ and $AgNO_3$. Other samples were bound as cupric iodide by the use of $NaHSO_3$ and cupric acetate. Measurements of these two salts showed a variation of only about 6% and suggest that I^{131} may be measured in either form, since there is no appreciable scatter from the copper or silver atoms or from the residual nonradioactive salts.

The data obtained by the use of AgI and CuI_2 in dishes of different materials are also presented in Fig. 1. Both of these plots fall below that for P^{32}, which fact is in reasonable agreement with the data published by Zumwalt (*1*).

The results obtained from these experiments show that the percentage reflection from the various dishes bears linear relation to the atomic number of the reflecting material when filter paper is used as a nonreflecting material. From this work it may be concluded that the amount of radioactivity as reported will vary considerably according to the type of dish used.

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[1] Supported in part by N5,ORI–76 Project, Order VII, NR–171–105.

The P^{32} and I^{131} used in this investigation were supplied by Clinton Laboratories and obtained on allocation from the U. S. Atomic Energy Commission.

[2] The authors wish to thank Charles K. Spalding and Kathryn H. Haley for their assistance in preparing this paper.