MISCELLANY

Storage of Standard Solutions in Polythene Bottles

In the determination of the ages of rocks by the method of rubidium–strontium isotope dilution analysis, many laboratories have stored the standard rubidium chloride, strontium chloride and spike rubidium-87, strontium-85 solutions in polythene bottles. After keeping the bottles for several months discrepancies were found in standard and spike solutions, and it was thought that they might be accounted for by loss of water during storage. This communication describes some experiments to investigate this possibility.

A series of bottles identical to those used in the actual age analyses were filled with either water or hydrochloric acid (2·5 *N*, 6 *N*): they were tightly sealed and stored in the usual way at room temperature (20°–23° C.). The bottles were then weighed after various intervals of time, the changes in weight being assumed to be due to loss or gain of water.

The results of these experiments are shown in Fig. 1, and the conclusions drawn are:

Bottle No. 1. Demineralized water was placed in the sealed bottle, which was kept at room temperature. The bottle continuously lost weight which amounted to 0·17 per cent.

Bottle No. 2. A bottle containing the same volume of water as No. 1 was placed in a beaker surrounded by water so that the levels of the liquid both within the bottle and outside it were identical. During the first ten days the bottle increased in weight, presumably through the absorption of water on the outer wall: afterwards the bottle lost weight.

Bottle No. 3. In this case the bottle contained 6 *N* hydrochloric acid, and the loss in weight followed the same pattern as in bottle No. 1.

Bottle No. 4. This bottle was treated in an identical manner to the solutions used in isotope dilution analyses. For this purpose the bottle was opened for a few minutes once a week. The loss in weight was approximately twice that found for the sealed bottles.

Bottle No. 5. This was made of 'Pyrex' glass closed with a tight-fitting polythene stopper. The loss in weight was considerably lower.

It is evident that there may be a loss of liquid from these polythene bottles at a rate of approximately 2 per cent a year. Even in the case of the 'Pyrex' bottle there was a slight loss in weight presumably through the loss of water vapour through the polythene stopper.

It is very difficult to screw the stoppers of polythene bottles securely so that they remain so for several months. Over a period of a few weeks stoppers were found to be slightly loose, and this probably facilitates the loss of water vapour.

Calibration of spike solutions over a period of one year showed an increase in salt concentration of approximately 2 per cent. This agrees well with the conclusion that the loss in weight of the bottles is due to loss of water or water vapour.

The possibility of some loss of salt from the solution by absorption on the inner polythene wall or actual passage of salt through the walls was checked by analysing a spike bottle that had contained 80 ml. of rubidium spike solution sealed in the bottle for the period of one year. A sample of polythene was removed from the base of the 1-litre bottle which had been in contact with the liquid and another removed from the neck of the flask which had been in contact with water vapour. If we assume a rubidium content of approximately 1·0 p.p.m. for the polythene this would account for the amount present in the neck of the flask. The base of the flask contained twice as much rubidium but the excess amount was easily removed by steaming, indicating that the excess was adsorbed on the inner surface of the bottle.

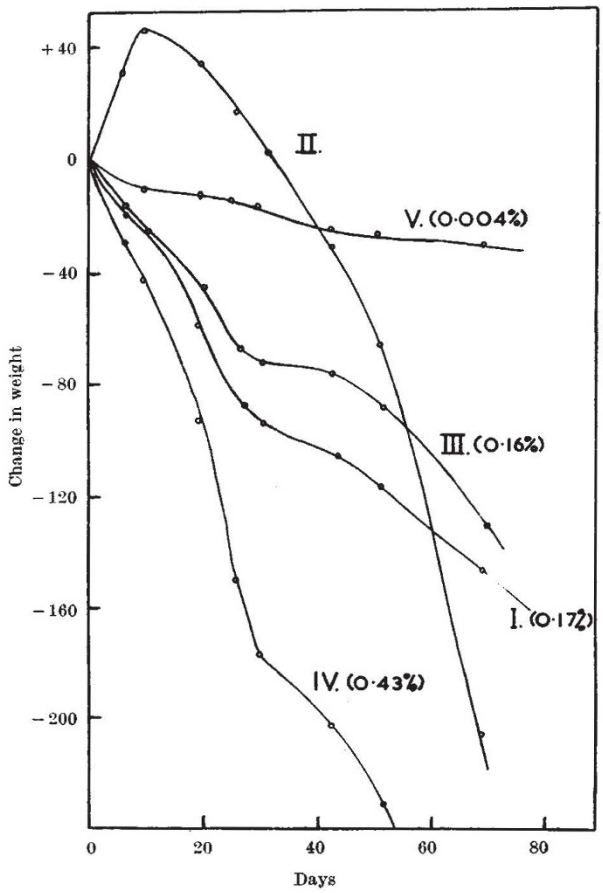

Fig. 1. Change in weight of polythene bottles during storage. The change is measured in mgm. and the total percentage loss over a period of 75 days is given adjacent to the bottle number

Further experiments have shown that the concentration of solutions at the rate of about 2 per cent a year only applies to litre bottles that are at least two-thirds full. In an actual case of 80 ml. of solution left for a period of one year the increase in concentration amounted to 48 per cent.

If it is essential to maintain the concentration of a dilute standard solution over the period of about one year it would seem advisable to store the solution in a 'Pyrex' or, more preferably, a quartz container with a close-fitting glass or silica stopper.

In the determination of ages of rock by the rubidium–strontium method, if the original volumes of both spikes are the same, and they are used at the same rate, this is not likely to affect the actual age of the sample, but the total rubidium and strontium contents will be in error.

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