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GEOCHEMICAL PROSPECTING METHOD FOR DETERMINATION OF URANIUM.

by

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INTRODUCTION

The method used by the author to determine uranium in geochemical prospecting is described.

SAMPLING.

(a) Soil

Soil samples for reconnaissance prospecting are usually collected at intervals of 100 feet in traverses along the sides of steep ridges. As many as 3 traverses may extend along the side of a ridge of particular interest (i.e. one near the top, one near the bottom, and one between these two). Grid patterns are used for sampling on flat ground or for detailed investigation around known deposits.

Assistants using pick and shovel collect the samples from a depth of 1 foot below the surface. Where soil cover is deep the most significant results are usually obtained at depths greater than 2 feet and a mechanical or hand auger may be used for sampling.

About 1 lb. of dry soil is placed on a shovel and the fine fraction separated by applying a vertical vibrating motion which causes the coarse fraction to move to one side where it is easily removed. About 10 grams of the fines (80 mesh) are placed in a numbered paper bag for transport to the laboratory.

(b) Rock

Several chips of rock from the sampling point are placed in a numbered paper bag and transported to the laboratory.

(c) Botanical Samples

Leaves have been found the most suitable component when tree sampling is carried out. If they are available a number of leaves are collected around the tree at head height, but if they cannot be reached from the ground a branch can be brought down by using a long rope weighted at one end. Fifteen to twenty leaves are collected and placed in a labelled cloth bag.

SAMPLE PREPARATION

(a) Soil and Rock

1 to 2 gm. of soil or rock sample are pulverized to about 150 mesh with an agate pestle and mortar. The crushed sample is stored in a small labelled tube.

(b) Leaves

Leaf samples are removed from the bags and allowed to dry in the open for at least two days. A one gram sample,

selected from small portions of a number of leaves, is ashed slowly in a silica crucible over a bunsen burner. After weighing the ash is transferred to a labelled tube.

TESTING PROCEDURE

Five milligrams of soil, rock or ash sample are weighed on a torsion balance (100 mgm. capacity) and placed in a shallow depression on the top of 3 grams of flux in a special platinum dish. The sample is then covered with flux to prevent loss. The flux contains 45.5% sodium carbonate, 45.5% potassium carbonate, and 9% sodium fluoride.

The dish containing the flux and sample is placed on a silica triangle which is on a tripod over a Maker-type burner. The flame is adjusted so that the flux takes two minutes to melt, and the mixture is kept in a molten state for one minute. The lowest possible temperature for the flux to remain liquid should be used. The dish is then removed from the burner, using platinum tipped tongs, and is placed on a clean level tile. When cold the disc is removed from the dish by inverting, and numbered with black pencil. The dishes are stored in concentrated hydrochloric acid and before use they are washed at least twice with distilled water and dried over a burner.

Standard discs are prepared by adding known amounts of uranium in solution to the dishes. After evaporating the solvent under radiant heaters or over a very low Bensen flame 3 grams of flux are added and the fusion carried out as described above. A blank is prepared by using only flux for the fusion. The standard series normally contains discs with 0, 0.01, 0.025, 0.05, 0.075, 0.1, 0.15 and 0.2 ~~gammas~~ µg of uranium (1 ~~gamma~~ µg = 10^{-6} gram = 1 microgram). This series corresponds to 0, 2, 5, 10, 15, 20, 30 and 40 parts per million uranium in the unknown samples, if 5 milligrams of sample have been used for the fusion.

Unknown and standard discs are compared visually with the aid of an Hanovia Model 16 ultra-violet light. Yellow glasses must be worn when using this light. The results are reported directly in ppm uranium in the original sample of soil or ash.

HYDROGEOCHEMICAL PROSPECTING FOR URANIUM

A 500 millilitre sample of water is collected in a polythene or Pyrex bottle and the pH determined using a short-range pH paper. Half a gram of sodium bisulphate is added to collect the uranium as a complex sulphate. One hundred millilitres of the sample is then passed through a previously prepared resin column, the flow being controlled at the bottom by a screw clip on a rubber tube. The 100 millilitres should take longer than 10 minutes to pass through the column. This step is best carried out at the sampling points to avoid unnecessary transport of the bulky water samples.

The resin is De-Acidite FF which has been scrubbed with dilute sulphuric acid and treated with sodium hydroxide solution.

The column containing the resin is taken to the laboratory where the resin is transferred to a platinum dish and ashed over a low flame. When completely ashed, 3 grams of flux are added to the dish and the sample is fused as described for soil samples. Standards are the same as for soil samples but they correspond to 0, 0.1, 0.25, 0.5, 0.75, 1.0, 1.5 and 2.0 parts per thousand million uranium in the original water samples.

APPARATUS AND CHEMICALS REQUIRED FOR URANIUM TESTS IN GEOCHEMICAL PROSPECTING.

1 pestle and mortar, agate.
1 spoon, horn
12 crucibles, silica
4 triangles, silica
4 tripods, iron
4 burners, Meker or Bunsen
1 Balance, torsion, 100 mgm.
12 dishes, platinum
2 pair tongs, platinum tipped
1 Ultraviolet light, Hanovia Model 16.
2 bottles, polythene, 1 gallon
2 pipettes, 1 ml., graduated in 0.01 ml.
500 bags, brown paper, 1 lb. size
500 test tubes, 2" with bark stoppers and labels
1 notebook and pencil
1 winchester hydrochloric acid, A.R.
2 lb. sodium carbonate
2 lb. potassium carbonate
250 gm. sodium fluoride
5 gm. uranyl nitrate
1 bottle nitric acid, 100ml. (to add to the standards)
1 bottle for 0.01% standard, 100 ml. (100 ~~gammas~~ µg per ml.)
1 bottle for 0.001% standard, 100 ml. (10 ~~gammas~~ µg per ml.)
1 bottle for 0.0001% standard, 250 ml. (1 ~~gamma~~ µg per ml.)
1 bottle for 0.00001% standard, 250 ml. (1/10 ~~gamma~~ µg per ml.)
1 Demineralizer cartridge.

ADDITIONAL APPARATUS AND CHEMICALS FOR WATER TESTS.

4 bottles, polythene or Pyrex, 500 ml.
1 cylinder, measuring, 100 ml.
2 funnels, filter, polythene.
6 tubes, $\frac{3}{8}$" diameter, 5" long, polythene or Pyrex.
6 inches rubber tube to fit tubes above
2 clips, screw
4 beakers, 250 ml.
1 ft. glass rod.
1 pHydrion dispenser and rolls of short range pH papers
1 pkt. filter paper, Whatman No. 1, 12.5 cm.
1 lb. sodium bisulphate, A.R.
1 lb. De-Acidite FF resin.
1 bottle sulphuric acid A.R., 500 ml.
1 lb. sodium hydroxide, A.R.