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Fluorine Content of 15 U.S.G.S. Reference
Samples by Selective Ion Electrode

by

U.S. Geological Survey

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The fluorine in 15 USGS reference samples having known and unknown fluorine contents was determined using a slight modification of the selective ion electrode method described by Ingram (1970). This method is used on a routine basis in the Branch of Geochemistry, USGS, because of its suitability for the determination of fluorine in a wide range of geologic materials without the need for prior separation of alumina.

Briefly, 100 mg of sample is fused with a 5:1 sodium carbonate - zinc oxide flux at 900°C and the fusion cake is leached overnight with distilled water. Following filtration, the solution is acidified with 2 ml of 6N hydrochloric acid. A 10 ml aliquot of this solution is diluted with a 10 ml aliquot of a 0.2M sodium citrate-0.2M potassium nitrate solution and the potential of this solution is measured. One electrode was used to read all sample potentials.

For reference samples estimated to contain fluorine in the range, 800-4000 ppm, a 50 mg sample weight was used. The potentials of the solutions of these smaller samples may then be measured, without dilution, for reference samples believed to contain up to 4000 ppm. Where a sample is believed to have a fluorine content greater than 4000 ppm, the solution of a 50 mg sample is first diluted and the potential of a 10 ml aliquot of the diluted solution is measured. This modification was found to save considerable time, over the original procedure with two electrodes, without sacrificing precision.

Discussion and limits

The determinations of fluorine by this method, together with the mean, standard deviation, and relative error, are given in Table 1. These determinations were obtained over a period of nine months and represent the excellent reproducibility of this method for a variety of rock samples.

A comparison of the data for fluorine by this method and of the values in the literature are given in Table 2. The fluorine data reported in reference 6 and 7 in Table 2 are compilations of data including data that were obtained by methods other than the sodium carbonate-potassium carbonate fusion process of this method. The differences in the data of those references to the data of this work most likely represents inter-laboratory biases. This work is in agreement with the work of Stecher (1983) on a value of 3600ppm F for GSP-1 as compared to the previously assigned value of 3200ppm F.

Table 1. --Fluorine Value for 15 USGS Reference Samples (ppm)

Reference Samples	Fluorine	mean	S.D.	relative error
G-1	580, 600, 620, 640, 680 640, 640, 640, 620, 640 600, 600, 580, 620, 620 620	621	26	4%
G-2	1280, 1300, 1200, 1280 1280, 1320, 1360, 1280 1360, 1400, 1400, 1400 1400, 1360, 1360, 1360 1360, 1360, 1320	1336	54	4%
GSP-1	3600, 3600, 3800, 3800 3400, 3700, 3800	3671	150	4%
QL0-1	260, 300, 300, 300, 300 290, 300, 280, 260, 290 280, 290, 270, 270, 260 260, 300, 270, 310, 280 290, 280	284	16	6%
BCR-1	450, 500, 480, 500, 500 460, 460, 500, 480, 480 500, 490, 460, 460, 460 480, 500, 460, 480, 460 500, 480	480	18	4%
BHVO-1	390, 420, 400, 400, 400 400, 400, 390, 360, 380 440, 420, 380, 390, 370 390, 360, 420, 380, 360	393	22	5%
STM-1	960, 1000, 920, 960, 960 1040, 960, 960, 1000 920, 960, 880, 880, 1000 960, 960, 920, 1000, 880 960, 920, 920	951	43	4%
SDC-1	600, 620, 600, 620, 580 600, 580, 600, 600, 620 660, 580, 600	605	22	4%
RGM-1	320, 360, 340, 350, 360 400, 350, 400, 370, 400	365	28	7%
SCo-1	700, 800, 780, 780	765	44	4%
BIR-1	4, 2, 2	3	1	35%
MAG-1	760, 680, 680, 700	705	38	5%
AGV-1	400, 360, 440, 440, 420, 440	417	2	7%
W-2	230, 230, 220, 220, 200 230, 210, 220, 220, 220	220	9	4%
DNC-1	8, 9, 10, 7, 10, 10	9	1	13%

Table 2.-- Fluorine Content of 15 USGS Reference Samples:
Comparison of Data

Reference Sample	Fluorine Content (ppm)								
	this work	(5)	(8)	(2)	(7)	(4)	(1)	(3)	(6)
G-1	621	-----	-----	-----	-----	724	690	-----	-----
G-2	1340	-----	-----	-----	1283	1480	1290	-----	1295
GSP-1	3671	-----	-----	-----	3659	3863	3200	-----	-----
QL0-1	284	256	271	252	-----	-----	-----	275	265
BCR-1	480	-----	-----	-----	477	-----	470	-----	490
BHVO-1	393	-----	380	397	-----	-----	-----	380	390
STM-1	951	900	890	875	-----	-----	-----	930	-----
RGM-1	365	342	325	383	-----	-----	-----	360	345
BIR-1	30	-----	-----	-----	-----	-----	-----	-----	37
SDC-1	605	621	587	575	-----	-----	-----	600	-----
SCO-1	760	779	749	719	-----	-----	-----	-----	-----
MAG-1	705	-----	737	716	-----	-----	-----	970	-----
AGV-1	417	-----	-----	-----	442	-----	435	-----	435
W-2	220	-----	-----	-----	-----	-----	-----	-----	241
DNC-1	90	-----	-----	-----	-----	-----	-----	-----	83

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