United States Geological Survey
Certificate of Analysis

Green River Shale, SGR-1

Sample for this reference material was collected from the Mahogany zone of the Green River Formation. It is a petroleum and carbonate-rich shale. At the time of preparation, shale oil tests yield 51 to 57 gallons per ton.

Element concentrations were determined by cooperating laboratories using a variety of analytical methods. Certificate values are based primarily on international data compilations (Abbey, 1983, Gladney and Roelandts, 1988, Govindaraju, 1994). Initial USGS studies (Flanagan, 1976) provide limited background information on this reference material.

Recommended values

Oxide	Wt %	±	Oxide	Wt %	±
SiO_2	28.2	0.21	CaO	8.38	0.17
Al_2O_3	6.52	0.21	MgO	4.44	0.20
K_2O	1.66	0.10	P_2O_5	0.328	0.066
Na_2O	2.99	0.13	TiO_2	0.253	0.025
Fe_2O_3T	3.03	0.14	S_{tot}	1.53	0.11

Element	µg/g	±	Element	µg/g	±	Element	µg/g	±
As	67	5	Eu	0.56	0.09	Sb	3.4	0.5
B	54	3	F	1960	240	Sc	4.6	0.7
Ba	290	40	Hf	1.4	0.14	Sm	2.7	0.3
Ce	36	4	La	20	1.8	Sr	420	30
Co	12	1.5	Li	147	26	Th	4.8	0.21
Cr	30	3	Mn	267	34	U	5.4	0.4
Cs	5.2	0.3	Mo	35	0.9	V	130	6
Cu	66	9	Nd	16	1.7	W	2.6	0.06
Er	1.1	0.14	Pb	38	4	Zn	74	9

Oxide	Wt %	Oxide	Wt %
Fe_2O_3	1.46	FeO	1.41
C_{tot}	28	Cinorg	3.2

Element	µg/g	Element	µg/g	Element	µg/g
Cd	0.9	Ho	0.4	Sn	1.9
Cl	32	Li	147	Tm	0.17
Dy	1.9	Nb	5.2	Y	13
Ga	12	Ni	29	Yb	0.94
Gd	2	Se	3.5	Zr	53
Hg	0.3				

Denver, Colorado
revised May 2014

Dr. Stephen Wilson
Reference Material Project, CGGSC

Bibliography

Abbey, S., 1983, Studies in "Standard Samples" of Silicate Rocks and Minerals 1969-1982, Canadian Geological Survey paper 83-15, p-114.

Flanagan, F.J., 1976, Descriptions and Analyses of Eight New USGS Rock Standards, U.S. Geological Survey Professional Paper 840, p 192

Gladney, E.S., and Roelandts, I., 1988, 1987 Compilation of Elemental Concentration Data for USGS BHVO-1, MAG-1, QLO-1, RGM-1, SCo-1, SDC-1, SGR-1, and STM-1, Geostandards Newsletter, 12: 253-362.

Govindaraju, K., 1994, 1994 Compilation of Working Values and Descriptions for 383 Geostandards, Geostandards Newsletter, 18:1-158

Glossary

Fe_2O_3T	Total iron expressed as Fe_2O_3
C_{tot}	Total carbon concentration
C_{inorg}	Inorganic carbon concentration
S_{tot}	Total sulfur concentration
Wt %	Percent of total element concentration
µg/g	Total element concentration expressed as micrograms of element per gram of solid sample
±	One standard deviation

Notes

Unless otherwise indicated total element concentrations are reported for material on an as-received basis, i.e., no drying.

Ordering Information

USGS reference materials (RMs) may be obtained directly from Dr. Stephen A. Wilson at the address or numbers listed below. The price for each bottle of RM is $ 80.00 (U.S.) **except** DGPM-1 which is $175.00 (U.S.). This cost includes all shipping and handling charges using normal mail delivery. Urgent requests for RMs should be initiated by FAX or e-mail. If required, overnight delivery is available with these charges added to the final bill.

Dr. Stephen A. Wilson
U.S. Geological Survey
Box 25046, MS 964
Denver, CO 80225

Tel: 303-236-2454
FAX: 303-236-3200 or 303-236-1425
e-mail: swilson@usgs.gov

Payment Options

Domestic customers: Payment options include purchase order, check, money order, or credit card (Visa, Mastercard).

International customers: Payment on foreign orders may be made by any of the following:

a. Banker's draft against an international bank,
b. International money order,
c. Credit card (Visa, Mastercard)

Payments for domestic or international orders using a credit card receive a 10% discount on the per bottle price.
