



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 ₂ O ₃	6.52	0.21	MgO	4.44	0.20
K ₂ O	1.66	0.10	P ₂ O ₅	0.328	0.066
Na ₂ O	2.99	0.13	TiO ₂	0.253	0.025
Fe ₂ O ₃ T	3.03	0.14	S _{tot}	1.53	0.11
Element	µg/g	±	Element	µg/g	±
As	67	5	Eu	0.56	0.09
B	54	3	F	1960	240
Ba	290	40	Hf	1.4	0.14
Ce	36	4	La	20	1.8
Co	12	1.5	Li	147	26
Cr	30	3	Mn	267	34
Cs	5.2	0.3	Mo	35	0.9
Cu	66	9	Nd	16	1.7
Er	1.1	0.14	Pb	38	4
Sb	3.4	0.5	Zn	74	9
Sc	4.6	0.7			
Sm	2.7	0.3			
Sr	420	30			
Th	4.8	0.21			
U	5.4	0.4			
V	130	6			
W	2.6	0.06			
Oxide	Wt %		Oxide	Wt %	
Fe ₂ O ₃	1.46		FeO	1.41	
C _{tot}	3.16				
Element	µg/g		Element	µg/g	
Cd	0.9		Ho	0.4	
Cl	32		Li	147	
Dy	1.9		Nb	5.2	
Ga	12		Ni	29	
Gd	2		Se	3.5	
Hg	0.3		Sn	1.9	
			Tm	0.17	
			Y	13	
			Yb	0.94	
			Zr	53	

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

$\text{Fe}_2\text{O}_3\text{T}$	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
$\mu\text{g/g}$	Total element concentration expressed as micrograms of element per gram of solid sample
\pm	One standard deviation

Notes

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

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URL: http://minerals.cr.usgs.gov/geo_chem_stand/shale.pdf