



**United States Geological Survey**  
**Certificate of Analysis**

**Devonian Ohio Shale, SDO-1**

SDO-1 is a reference sample which can be used to establish analytical accuracy in the analysis of organic- and sulfur-rich sedimentary rocks. The sample is relatively radioactive, giving counts two four times background over 0-225 feet. It was collected from the Huron Member of the Ohio Shale near Morehead, Kentucky.

Concentrations were determined by cooperating laboratories using a variety of analytical methods. If the results from 5 or more laboratories and 3 or more independent methods are in statistical agreement, concentrations are recommended. Less well-established concentrations are given as averages or ranges. (Kane and others, 1990). Concentrations listed are for as received material

**Recommended values**

Oxide	Wt %	s.d.	Oxide	Wt %	s.d.
Al <sub>2</sub> O <sub>3</sub>	12.27	0.23	MnO	0.042	0.005
CaO	1.05	0.047	Na <sub>2</sub> O	0.38	0.026
Fe <sub>2</sub> O <sub>3 tot</sub>	9.34	0.21	P <sub>2</sub> O <sub>5</sub>	0.11	0.007
K <sub>2</sub> O	3.35	0.061	SiO <sub>2</sub>	49.28	0.63
MgO	1.54	0.038	TiO <sub>2</sub>	0.71	0.031
Element	mg/kg	s.d.	Element	mg/kg	s.d.
As	68.5	8.6	Ni	99.5	9.9
Ba	397	38	Pr	8.9	0.66
Ce	79.3	7.8	Rb	126	3.9
Co	46.8	6.3	So	13.2	1.5
Cr	66.4	7.6	Sm	7.7	0.81
Dy	6.0	0.65	Sr	75.1	11.0
Eu	1.6	0.22	U	48.8	6.5
Ga	16.8	1.8	V	160	21
La	38.5	4.4	Y	40.6	6.5
Mo	134	21	Yb	3.4	0.46
Nb	11.4	1.2	Zn	64.1	6.9
Nd	36.6	3.3	Zr	165	24

Reston, Virginia  
 August 1991

David B. Smith  
 Branch of Geochemistry

## Information values

Item	Wt %	s.d.	Item	Wt %	s.d.
CO <sub>2</sub>	1.01	0.21	H <sub>tot</sub>	1.34	0.06
C <sub>tot</sub>	9.95	0.44	N <sub>tot</sub>	0.347	0.043
C <sub>org</sub> calc	9.68	0.45	S <sub>tot</sub>	5.35	0.44
C <sub>org</sub> measured	(range 8.98 - 10.4)		LOI	21.7	0.90
			H <sub>2</sub> O	1.21	0.50

  

Element	mg/kg	s.d.	Element	mg/kg	s.d.
B	128	11	Ho	1.2	0.11
Be	3.3	0.57	Li	28.6	5.5
Cs	6.9	1.2	Lu	0.54	0.14
Cu	60.2	9.6	Pb	27.9	5.2
Er	3.6	0.55	Sn	3.7	1.2
F	697	88.5	Ta	1.1	0.13
Gd	7.4	1.9	Tb	1.2	0.24
Hf	4.7	0.75	Th	10.5	0.55
Hg	0.19	0.08	Tm	0.45	0.08

## Range

Element	mg/kg	Element	mg/kg
Ag	0.094 - 0.17	Ge	1.3
Au	0.002 - 0.0035	In	<0.2
Bi	2 - <10	Sb	4.1 - 4.8
Br	5	Se	1.9 - 6.8
Cd	<2 - <10	W	3.3

## Glossary

Fe <sub>2</sub> O <sub>3</sub> T	Total iron concentration expressed as Fe <sub>2</sub> O <sub>3</sub>
C <sub>tot</sub>	Total carbon concentration
C <sub>inorg</sub>	Inorganic carbon concentration
C <sub>org</sub> measured	Total organic carbon measured
C <sub>org</sub> calc	Total organic carbon calculated (C <sub>tot</sub> - C <sub>inorg</sub> )
S <sub>tot</sub>	Total sulfur concentration
LOI	Loss on ignition
H <sub>2</sub> O	Moisture
Wt %	Total element concentration expressed as weight percent
mg/kg	Total element concentration expressed as milligrams of element per kilogram of solid sample
±	One standard deviation
s.d.	One standard deviation

## Bibliography

Kane, J.S., Arbogast, B.F. and Leventhal, J.S., 1990, Characterization of Devonian Ohio Shale SDO-1 as a USGS geochemical reference sample: Geostandards Newsletter, v. 14, 169-196.

## 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 \$65.00 (U.S.) **except** DGPM-1 which is \$150.00 (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.

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U.S. Geological Survey  
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Tel: 303-236-2454  
FAX: 303-236-3200 or 303-236-1425  
e-mail: [swilson@usgs.gov](mailto:swilson@usgs.gov)

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