



United States Geological Survey Certificate of Analysis

Manganese Nodule, NOD-P-1

NOD-P-1 is a reference material which can be used to establish analytical accuracy in the analysis of manganese nodules or other geologic samples with elevated manganese concentrations. Material used in the preparation of the standard was collected from the Pacific ocean (14°50' N, 124°28' W) at a depth of 4,300 meters.

Recommended concentrations for elements and oxides are reported when results from USGS interlaboratory studies (Flanagan and Gottfried, 1980) using independent methods of analysis are in statistical agreement. Supplemental information derived from international data compilations (Abbey, 1983, Govindaraju, 1994) is also provided.

Information concentrations are given when results are based on analyses obtained using a single technique or when data from different procedures are not in statistical agreement.

Recommended values

Oxide	Wt %	±	Oxide	Wt %	±
SiO ₂	13.9	0.034	MnO	37.6	0.10
Al ₂ O ₃	4.8	0.092	Na ₂ O	2.2	0.006
Fe ₂ O ₃ T	8.3	0.044	K ₂ O	1.2	0.014
CaO	3.1	0.016	TiO ₂	0.5	0.003
MgO	3.3	0.014	P ₂ O ₅	0.46	0.005

Element	µg/g	±	Element	µg/g	±
Ba	3350	28	Pb	560	6
Co	2240	11	Sr	680	3
Cu	11500	49	V	570	10
Mo	760	4	Zn	1600	6
Ni	13400	64			

Information values

Element	µg/g	Element	µg/g
Ce	290	La	104
Dy	27	Lu	1.8
Er	12	Nd	120
Eu	7.5	Sm	30
Gd	28	Yb	13

Denver, Colorado
revised March 1995

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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., and Gottfried, D., 1980, USGS Rock Standards, III: Manganese-Nodule Reference Samples USGS-Nod-A-1 and USGS-Nod-P-1, U.S. Geological Survey Professional Paper, 1155, p-39

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

Glossary

Fe ₂ O ₃ T	Total iron concentration expressed as Fe ₂ O ₃
C _{tot}	Total concentration of carbon
S _{tot}	Total concentration of sulfur
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

Drying instructions

Prior to analysis samples of NOD-P-1 should be dried at 110°C for 24 hours. Samples should be stored in a desiccator if not used immediately. Reports indicate that NOD-P-1 can absorb up to 10% by weight of moisture when exposed overnight to air.

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.

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BACK

URL: http://minerals.cr.usgs.gov/geo_chem_stand/manganp1.pdf