

## Preliminary Product Information Sheet

Microanalytical Reference Material

### NFHS-2-NP

Nano-particulate pressed powder pellet

#### Calcium Reference Value

Analyte	Value	Uncertainty (95% CL)	Unit
Ca	38.53	0.61	g/100g

The calcium reference value was determined after a three-acid total digestion by SF-ICP-MS, after a four-acid total digestion by ICP-OES and XRF and was subsequently used to convert element ratios into element mass fractions.

#### Reference Values

Analyte	Value	Uncertainty (95% CL)	Unit	Analyte	Value	Uncertainty (95% CL)	Unit
Li	1.63	0.15	µg/g	Ba	76	1	µg/g
B	7.7	0.8	µg/g	La	2.43	0.11	µg/g
Na	1195	52	µg/g	Ce	1.5	0.1	µg/g
Mg	637	28	µg/g	Pr	0.46	0.04	µg/g
Sc	0.44	0.05	µg/g	Nd	1.90	0.09	µg/g
Mn	87	4	µg/g	Sm	0.378	0.004	µg/g
Co	0.71	0.05	µg/g	Eu	0.09	0.01	µg/g
Ni	1.64	0.11	µg/g	Gd	0.44	0.06	µg/g
Cu	8.8	0.3	µg/g	Tb	0.07	0.01	µg/g
Zn	15.9	1.5	µg/g	Dy	0.44	0.02	µg/g
Ga	0.19	0.02	µg/g	Ho	0.100	0.001	µg/g
Rb	1.12	0.06	µg/g	Er	0.30	0.01	µg/g
Sr	1190	45	µg/g	Tm	0.040	0.001	µg/g
Y	3.91	0.16	µg/g	Yb	0.25	0.01	µg/g
Cd	0.163	0.009	µg/g	Lu	0.040	0.005	µg/g
Sn	0.29	0.02	µg/g	Pb	1.65	0.05	µg/g
Cs	0.08	0.01	µg/g	Th	0.14	0.01	µg/g

#### Information Values

Analyte	Value	Uncertainty (95% CL)	Unit	Analyte	Value	Uncertainty (95% CL)	Unit
Al	641	45	µg/g	V	1.20	0.19	µg/g
Ti	39.4	1.2	µg/g	Cr	1.3	0.2	µg/g
Si	3881	149	µg/g	Fe	532	36	µg/g
P	91	8	µg/g	Zr	2.5	0.4	µg/g
S	244	45	µg/g	Hf	0.05	0.03	µg/g
K	205	23	µg/g	U	0.12	0.03	µg/g

The assigned values are the present best estimates of the true content for each element in the nano-particulate powder. The powder was characterized using different ICP-MS, ICP-OES and XRF analyses. Six laboratories were involved in the measurements. Further, each Laboratory's performance was statistically evaluated following recommendations from ISO Guide 35<sup>[1]</sup>. The expanded uncertainty is only composed of the uncertainty components from characterisation.

Verifying homogeneity tests were performed on the nano-pellets in two laboratories using LA-ICP-MS and in accordance with ASTM E826-14<sup>[2]</sup>.

#### Isotopic Reference Value

Analyte	Value	Uncertainty (95% CL)
<sup>87/86</sup> Sr	0.709163	0.000008

Strontium isotope ratios of the powder were measured by three different laboratories using TIMS and MC-ICP-MS. Homogeneity of Sr ratio of the pellet was verified by repeated LA-MC-ICP-MS by two laboratories.

#### Isotopic Information Values

Analyte	Value	Analyte	Value
$\delta^{25/24}\text{Mg}_{\text{DSM-3}}$	-1.898	<sup>208/207</sup> Pb	2.4215
$\delta^{26}\text{Mg}_{\text{DSM-3}}$	-3.6845	<sup>232/230</sup> Th	51200
<sup>206/204</sup> Pb	17.858	<sup>235/234</sup> U	100
<sup>207/204</sup> Pb	15.591	<sup>238/235</sup> U	139
<sup>208/204</sup> Pb	37.770	$\delta^{13}\text{C}_{\text{VPDB}}$	0.79
<sup>207/206</sup> Pb	0.87306	$\delta^{18}\text{O}_{\text{VPDB}}$	-0.04
<sup>208/206</sup> Pb	2.11506		

All isotopic values are the present best estimates for the nano-particulate powder.

$\delta^{25/24}\text{Mg}$  and  $\delta^{26}\text{Mg}$  were measured by MC-ICP-MS in one laboratory and calculated against DSM-3. The Pb ratios were obtained by TIMS also from one laboratory.  $\delta^{13}\text{C}$  and  $\delta^{18}\text{O}$  values were measured with IRMS in five different laboratories and calculated against VPDB.

Unless stated otherwise a coverage factor  $k = 2$  for all values was applied to reach a confidence level of 95 %, as defined in the Guide to the Expression of Uncertainty in Measurement (GUM)<sup>[3]</sup>. Information values in general did not fulfil all necessary statistical criteria of a reference value and should neither be considered for calibration nor validation.

This product information sheet is valid for:

**Pellet serial number:** {SERIENNUMMER}

**Date of dispatch:** {LIEFERDATUM}

**Intended Use**

This microanalytical reference material (MRM) is designed for use by laboratories undertaking the determination of major and trace element mass fractions in carbonate and equivalent matrices with LA-ICP-MS (Laser Ablation Inductively Coupled Plasma Mass Spectrometry). It is suitable for calibration and as a secondary reference material for the assessment of a measurement procedure and quality control. Note that the material may only be used for a single purpose in the same measurement process. For example, it must not be used for calibration and method validation at the same time.

**Description of the MRM**

This MRM is a nanoparticulate pressed powder pellet of the carbonate powder "NFHS-2-NP". The starting material is an aliquot, provided by The Royal Netherlands Institute for Sea Research (NIOZ), of NFHS-1 (NIOZ Foraminifera House Standard). It stems from a calcareous ooze collected at the Walvis Ridge (SE Atlantic) at 2878 m of water depth. It consists purely out of foraminifera. The powder was produced in cooperation with NIOZ and subjected to our own material-specific milling protocol and pressed without any binders using a programmable hydraulic press. The fortification of contrasting colour surrounding the reference material is, according to the manufacturer, an "organic compound". The exact composition is not specified any closer. The certificate of analysis is available on demand.

**Handling advice and Storage**

Avoid touching the pellet's surface directly in order to prevent contamination. Also, do not clean the surface with any liquids as it may compromise the pellet's integrity.

Please note the label marks the bottom of the pellet.

Store the MRM in a desiccator and or in a dark and dry environment.

The myStandards GmbH cannot be held responsible for changes that happen during storage of the material at the customer's premises, especially with respect to opened samples.

**Period of Validity**

Provided the storage and handling conditions are met, no chemical alteration is known to exist, and the assigned values will remain stable. Therefore, the product information and assigned values for this MRM are valid for one year from the date of dispatch, pending further stability data. This validity may be extended as further evidence of stability becomes available. The manufacturer will inform the customer if any alterations occur.

**Safety instructions**

Nano-particulate powders can cause harm if ingested, inhaled or in contact with skin. In their pressed form however, they do not exhibit any dusting. If a pellet should accidentally break, we advise wearing a dust mask during clean up.

**Further Information**

Detailed information on the characterisation of the reference material can be found in the related paper<sup>[4]</sup>.

Due to processing a part of the sample material may be seen on the fortification, this does not reduce the performance of the MRM. Please refrain from using this part of the pellet.

The pellets are sold exclusively via the myStandards GmbH and authorised subcontractors.

#### List of participating laboratories:

- NIOZ Royal Netherlands Institute for Sea Research
- Utrecht University Department of Earth Sciences
- Johannes Gutenberg University Institute of Geosciences
- Lamont-Doherty Earth Observatory Department of Earth and Environmental Sciences of Columbia University
- Alfred-Wegener-Institute
- University of Southampton National Oceanography Centre
- GEOMAR Helmholtz Centre for Ocean Research
- MARUM University of Bremen
- University of Modena Department of Chemical and Geological Sciences
- University of California at Davis Stable Isotope Laboratory
- IsoAnalysis UG
- Physikalisch-Technische Bundesanstalt – National Metrology Institute

#### Document History

Version	Date	Changes applied
1.0	17.02.2021	First publication
2.0	28.04.2022	Finalization after paper publication
3.0	24.04.2023	Updated link to terms and conditions; Adaptation to automatically fill in the date and individual pellet characteristics
4.0	22.12.2025	Change of Cu, Si, & Rb values after milling new batch and checking homogeneity as well as differences in composition

#### References

[1] **ISO Guide 35:2017 (E)**, *Reference materials – Guidance for characterization and assessment of homogeneity and stability*

[2] **ASTM E826-14**, *Standard Practice for Testing Homogeneity of a Metal Lot or Batch in Solid Form by Spark Atomic Emission Spectroscopy*. ASTM International, West Conshohocken, PA, 2014. [www.astm.org](http://www.astm.org)

[3] **ISO/IEC Guide 98-3:2008**, *Uncertainty of measurement - Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

[4] **Boer, W., Nordstad, S., Weber, M., Mertz-Kraus, R., Hönisch, B., Bijma, J., Raitzsch, M., Wilhelms-Dick, D., Foster, G.L., Goring-Harford, H., Nürnberg, D., Hauff, F., Kuhnert, H., Lugli, F., Spero, H., Rosner, M., van Gaever, P., de Nooijer, L.J. and Reichart, G.-J. (2022)**, *A New Calcium Carbonate Nano-Particulate Pressed Powder Pellet (NFHS-2-NP) for LA-ICP-OES, LA-(MC)-ICP-MS and  $\mu$ XRF*.

Geostandards and Geoanalytical Research. Accepted Author Manuscript. <https://doi.org/10.1111/ggr.12425>

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