

Note:  
AA: Flame Atomic Absorption Spectrometry  
AAN: Non-Flame Atomic Absorption Spectrometry  
AF: Atomic Fluorescence Spectrometry  
COL: Colorimetry  
EC: Coulometric Titration Method  
EL: Coulometric Method  
ENAA: Etra-Thermo Neutron Activation Method  
ES: Emission Spectrography  
FP: Flame Photometry  
GR: Gravimetry  
GV: Gas Volume Method  
IC: Ion Chromatography  
ICP: Inductively Coupled Plasma Method  
ISE: Ion Selective Electrode Method  
LF: Laser Fluorescence Spectrometry  
MS: Mass Spectrometry  
NA: Neutron Activation Method  
POL: Polarography  
PT: Potential Titration Method  
VOL: Volumetry  
XRF: X-Ray Fluorescence Spectrometry

Certificate of Certified Reference Material


NCS DC 71304

Rock

Reissued in 2016

Approved by China National Analysis Center for Iron and Steel

(Beijing China)

  
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**China National Analysis Center for Iron and Steel**

| Certified Values and Uncertainty |                                  |                                 |                                    |                                    |             |                    |                     |                                  |
|----------------------------------|----------------------------------|---------------------------------|------------------------------------|------------------------------------|-------------|--------------------|---------------------|----------------------------------|
|                                  | Chemical Composition (µg/g)      |                                 |                                    |                                    |             |                    |                     |                                  |
| NCS DC71304                      | Ag                               | As                              | B                                  | Ba                                 | Be          | Bi                 | Br                  | Cd                               |
| Certified Values                 | 0.05±0.03                        | 0.21±0.12                       | 1.84±0.56                          | 86.2±6.6                           | (0.98)      | 0.04±0.02          | (0.32)              | 0.09±0.03                        |
| Standard Deviation               | 0.03                             | 0.19                            | 0.78                               | 9.2                                |             | 0.03               |                     | 0.04                             |
| NCS DC71304                      | Ce                               | Co                              | Cr                                 | Cs                                 | Cu          | Dy                 | Er                  | Eu                               |
| Certified Values                 | 4.2±0.7                          | 93.0±2.0                        | 14.5±2.4                           | (0.17)                             | 28.3±1.0    | 1.11±0.23          | 0.47±0.05           | 0.74±0.04                        |
| Standard Deviation               | 1.1                              | 5.2                             | 4.7                                |                                    | 2.0         | 0.32               | 0.06                | 0.07                             |
| NCS DC71304                      | Ga                               | Gd                              | Ge                                 | Hf                                 | Hg          | Ho                 | I                   | In                               |
| Certified Values                 | 23.7±2.6                         | 1.31±0.39                       | 1.06±0.29                          | 0.65±0.18                          | (0.005)     | 0.20±0.01          | 0.08±0.05           | 0.12±0.04                        |
| Standard Deviation               | 3.6                              | 0.58                            | 0.37                               | 0.22                               |             | 0.02               | 0.04                | 0.04                             |
| NCS DC71304                      | La                               | Li                              | Lu                                 | Mo                                 | Nb          | Nd                 | Ni                  | Pb                               |
| Certified Values                 | 1.71±0.19                        | 1.94±0.32                       | 0.06±0.03                          | (0.094)                            | 9.3±3.1     | 4.10±0.46          | 69±5                | (5.16)                           |
| Standard Deviation               | 0.35                             | 0.45                            | 0.04                               |                                    | 4.3         | 0.79               | 10                  |                                  |
| NCS DC71304                      | Pr                               | Rb                              | Sb                                 | Sc                                 | Se          | Sm                 | Sn                  | Sr                               |
| Certified Values                 | 0.84±0.19                        | (4.79)                          | 0.04±0.02                          | 22.5±2.2                           | 0.26±0.09   | 1.22±0.06          | 0.89±0.30           | 612±35                           |
| Standard Deviation               | 0.25                             |                                 | 0.02                               | 3.1                                | 0.11        | 0.11               | 0.36                | 61                               |
| NCS DC71304                      | Ta                               | Tb                              | Te                                 | Th                                 | Tl          | Tm                 | U                   | V                                |
| Certified Values                 | (0.56)                           | 0.20±0.04                       | 0.010±0.003                        | (0.28)                             | 0.07±0.02   | 0.09±0.03          | (0.086)             | 768±21                           |
| Standard Deviation               |                                  | 0.07                            | 0.004                              |                                    | 0.02        | 0.04               |                     | 42                               |
| NCS DC71304                      | W                                | Y                               | Yb                                 | Zn                                 | Zr          | SiO <sub>2</sub> * | Ti O <sub>2</sub> * | Al <sub>2</sub> O <sub>3</sub> * |
| Certified Values                 | (0.10)                           | 4.9±0.8                         | 0.36±0.05                          | 118±5                              | 29±11       | 35.69±0.07         | 7.69±0.09           | 14.14±0.14                       |
| Standard Deviation               |                                  | 1.3                             | 0.08                               | 11                                 | 16          | 0.15               | 0.20                | 0.30                             |
| NCS DC71304                      | Fe <sub>2</sub> O <sub>3</sub> * | FeO*                            | MnO*                               | MgO*                               | CaO*        | Na <sub>2</sub> O* | K <sub>2</sub> O*   | H <sub>2</sub> O <sup>+</sup> *  |
| Certified Values                 | 9.90±0.30                        | 13.36±0.28                      | 0.193±0.005                        | 5.25±0.06                          | 9.86±0.10   | 2.11±0.02          | 0.15±0.01           | 1.09±0.06                        |
| Standard Deviation               | 0.63                             | 0.53                            | 0.014                              | 0.13                               | 0.22        | 0.05               | 0.02                | 0.10                             |
| NCS DC71304                      | CO <sub>2</sub> *                | P <sub>2</sub> O <sub>5</sub> * | F*                                 | S*                                 | Cl*         | C(T) *             | Others*             | Σ*                               |
| Certified Values                 | 0.12±0.04                        | 0.028±0.002                     | 0.006±0.001                        | 0.37±0.02                          | 0.006±0.002 | (0.039)            | 0.27                | 100.21                           |
| Standard Deviation               | 0.08                             | 0.004                           | 0.002                              | 0.02                               | 0.002       |                    |                     |                                  |
| NCS DC71304                      | O/F,S,Cl*                        | Σ(Corr)*                        | Fe <sub>2</sub> O <sub>3</sub> TR* | Fe <sub>2</sub> O <sub>3</sub> TC* |             |                    |                     |                                  |
| Certified Values                 | 0.19                             | 100.02                          | 24.75±0.084                        | 24.75                              |             |                    |                     |                                  |
| Standard Deviation               |                                  |                                 | 0.21                               |                                    |             |                    |                     |                                  |

Note:

- \* means major element (dry basis, in percent).
- Certified values are calculated according to analytical results of 20 independent laboratories.
- The sample is powder packed in glass bottle. The minimum package is 50 grams.

| Analytical Methods |                          |                                 |                          |
|--------------------|--------------------------|---------------------------------|--------------------------|
| Ag                 | AAN,AA,ES,MS             | V                               | POL,COL,ICP,NA,XRF,ES    |
| As                 | AF,NA,COL,XRF,ICP        | W                               | POL,COL,NA,MS            |
| B                  | COL,POL,ES,ICP           | Zn                              | AA,POL,XRF,NA,ICP        |
| Ba                 | NA,ICP,XRF,AAN,ES        | Zr                              | XRF,COL,ICP,NA,ES,MS,POL |
| Be                 | ICP,POL,COL,ES,AAN       | La                              | ICP,NA, ,POL, MS,ES, XRF |
| Bi                 | POL,ES,MS,ICP,AF         | Ce                              | ICP,NA,MS,POL,XRF        |
| Br                 | COL, IC , NA             | Pr                              | ICP, POL,MS,             |
| Cd                 | AAN,POL,AA,ICP,MS        | Nd                              | ICP, POL,MS,NA           |
| Cl                 | COL,NA,IC                | Sm                              | ICP, POL,MS,NA           |
| Co                 | AAS,COL,NA,ICP,POL,XRF   | Eu                              | ICP,NA,POL,MS            |
| Cr                 | COL,ICP,POL,AA,XRF,ES,NA | Gd                              | ICP,NA,POL,MS            |
| Cs                 | NA,AAN,ES,MS,FP          | Tb                              | ICP,NA,POL,MS            |
| Cu                 | AA,POL,ICP,COL,XRF,ES    | Dy                              | ICP,NA,POL,MS            |
| F                  | ISE,COL,IC               | Ho                              | ICP,NA,POL,MS            |
| Ga                 | COL,XRF,AAN,POL          | Er                              | ICP,POL,MS               |
| Ge                 | COL,POL,XAF              | Tm                              | ICP,POL,MS,              |
| Hf                 | NA,COL,ES,MS             | Yb                              | ICP,NA,POL,MS,ES         |
| Hg                 | AF,AA                    | Lu                              | ICP,NA,POL,MS            |
| I                  | COL,VOL,IC               | Y                               | ICP,NA,POL,MS,XRF        |
| In                 | COL,AAN,POL,MS,ES        | SiO <sub>2</sub>                | GR,VOL,XRF,COL           |
| Li                 | AA,FP,ICP                | Al <sub>2</sub> O <sub>3</sub>  | VOL,COL,XRF,NA           |
| Mo                 | POL,COL,NA,MS            | TFe <sub>2</sub> O <sub>3</sub> | VOL,COL,AA,XRF,NAA,ENAA  |
| Nb                 | COL,ICP,XRF,MS,POL       | FeO                             | VOL,COL,EC               |
| Ni                 | AA,ICP,COL,XRF,POL,NA,ES | Fe <sub>2</sub> O <sub>3</sub>  | VOL,COL,PT               |
| Pb                 | AA,POL,XRF,ICP,ES        | MgO                             | VOL,AA,XRF               |
| Rb                 | AA,NA,XRF,ES,MS,AAN      | CaO                             | VOL,AA,XRF               |
| Sc                 | NA,ICP,ES                | Na <sub>2</sub> O               | AA,FP,XRF,NA             |
| Sb                 | AF,NA,ENAA               | K <sub>2</sub> O                | AA,FP,XRF                |
| Se                 | AF,POL,COL               | TiO <sub>2</sub>                | COL,XRF,ICP              |
| Sn                 | POL,ES,AAN,MS            | MnO                             | AA,COL,XRF,ICP           |
| Sr                 | ICP,XRF,AA,NA,ES         | P <sub>2</sub> O <sub>5</sub>   | COL,XRF                  |
| Ta                 | COL,NA,MS                | S                               | GR,VOL                   |
| Th                 | COL,NA,MS,XRF,ICP        | H <sub>2</sub> O <sup>+</sup>   | GR,EL                    |
| Te                 | NNA,AF,POL,COL           | CO <sub>2</sub>                 | VOL,GV,EL,GR             |
| Tl                 | COL,AAN,POL,ES,MS,AA     | Tc                              | VOL,GR,EL                |
| U                  | COL,POL,NA,ICP,LF,MS     | C(Org)                          | VOL                      |