**Table S1.** Tests of precision and accuracy of Mg isotope analyses

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Sample | δ26Mg | 2σ | δ25Mg | 2σ | N |
| **Pure Mg solution in this study** |  |  |  |  |  |
| Cambridge 1 | -2.56 | 0.07 | -1.30 | 0.02 | 8 |
| DSM3 | 0.05 | 0.07 | 0.03 | 0.05 | 8 |
|  |  |  |  |  |  |
| **Standard Samples** |  |  |  |  |  |
| IAPSO seawater | -0.81 | 0.03 | -0.41 | 0.04 | 2 |
| DST-2b | -0.28 | 0.05 | -0.15 | 0.04 | 4 |
| BHVO-2b | -0.28 | 0.11 | -0.15 | 0.06 | 2 |
|  |  |  |  |  |  |
| **Reference** |  |  |  |  |  |
| Cambridge 1 (An and Huang, 2014) | -2.597 | 0.042 | -1.343 | 0.036 | 49 |
| Cambridge 1 (Teng et al., 2015) | -2.623 | 0.03 | -1.358 | 0.03 | ﹥20 |
| DSM3 (Tipper et al., 2010) | 0 | 0.05 | 0 | 0.03 | 100 |
| DSM3 (Li et al., 2012) | 0.02 | 0.13 | 0 | 0.09 | 109 |
| IAPSO seawater (Teng et al., 2015) | -0.83 | 0.09 | -0.42 | 0.06 | ﹥20 |
| Seawater (Ling et al., 2011) | -0.832 | 0.068 | -0.432 | 0.053 | 40 |
| BHVO-2b (Teng, 2017) | -0.24 | 0.08 | -0.12 | 0.05 |  |
| DST-2b (Bizzarro et al., 2011)) | -0.23 | 0.03 | -0.12 | 0.02 | 7 |
| DST-2b (Teng et al., 2015) | -0.32 | 0.06 | -0.17 | 0.04 | ﹥20 |

Reference:

An, Y., Huang, F., 2014. A review of Mg isotope analytical methods by MC-ICP-MS. Journal of Earth Science 25, 822-840.

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Teng, F.-Z., Li, W.-Y., Ke, S., Yang, W., Liu, S.-A., Sedaghatpour, F., Wang, S.-J., Huang, K.-J., Hu, Y., Ling, M.-X., Xiao, Y., Liu, X.-M., Li, X.-W., Gu, H.-O., Sio, C.K., Wallace, D.A., Su, B.-X., Zhao, L., Chamberlin, J., Harrington, M., Brewer, A., 2015. Magnesium Isotopic Compositions of International Geological Reference Materials. Geostandards and Geoanalytical Research 39, 329-339.

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**Table S2.** The results of XRD analyses for the carbonate in Quse Formation

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Sample Number | Depth/m | mineral contents | | | calcite | dolomite | |
| quartz | calcite | dolomite | d (104) | d (104) | (104) FWHM |
| 1 | 63 | 0.0 | 1.9 | 98.1 | 3.0291 | 2.9018 | 0.209 |
| 2 | 64 | 0.0 | 3.6 | 96.4 | 3.0347 | 2.9017 | 0.229 |
| 3 | 65 | 0.0 | 9.8 | 90.2 | 3.0366 | 2.8965 | 0.246 |
| 4 | 66 | 0.0 | 1.2 | 98.8 | 3.0348 | 2.8947 | 0.277 |
| 5 | 67 | 0.0 | 14.3 | 85.7 | 3.0367 | 2.9018 | 0.232 |
| 6 | 69 | 0.0 | 9.7 | 90.3 | 3.035 | 2.9017 | 0.237 |
| 7 | 70 | 0.0 | 1.3 | 98.7 | 3.0327 | 2.9018 | 0.23 |
| 8 | 72 | 0.0 | 1.7 | 98.3 | 3.031 | 2.9034 | 0.226 |
| 9 | 76 | 0.0 | 0.8 | 99.2 | 3.029 | 2.9016 | 0.238 |
| 10 | 79 | 0.0 | 18.0 | 82.0 | 3.0349 | 2.9017 | 0.229 |
| 11 | 82 | 0.0 | 3.4 | 96.6 | 3.0348 | 2.9017 | 0.222 |
| 12 | 84 | 0.0 | 10.3 | 89.7 | 3.0349 | 2.9018 | 0.217 |
| 13 | 87 | 0.0 | 6.3 | 93.7 | 3.0366 | 2.9018 | 0.212 |
| 14 | 90 | 0.0 | 10.2 | 89.8 | 3.0349 | 2.9017 | 0.212 |
| 15 | 95 | 0.0 | 25.5 | 74.5 | 3.0347 | 2.9018 | 0.183 |
| 16 | 97 | 0.0 | 4.1 | 95.9 | 3.0331 | 2.9034 | 0.188 |
| 17 | 99 | 0.0 | 12.1 | 87.9 | 3.0348 | 2.9017 | 0.192 |
| 18 | 100 | 0.0 | 33.4 | 66.6 | 3.0349 | 2.9017 | 0.222 |
| 19 | 101 | 0.0 | 4.2 | 95.8 | 3.033 | 2.9016 | 0.204 |
| 20 | 103 | 0.0 | 15.4 | 84.6 | 3.0348 | 2.9018 | 0.181 |
| 21 | 104 | 0.0 | 32.5 | 67.5 | 3.0348 | 2.9015 | 0.24 |
| 22 | 105 | 0.0 | 5.4 | 94.6 | 3.0311 | 2.9017 | 0.194 |
| 23 | 106 | 0.0 | 5.6 | 94.4 | 3.033 | 2.9018 | 0.194 |
| 24 | 107 | 0.0 | 6.1 | 93.9 | 3.0348 | 2.9017 | 0.175 |
| 25 | 109 | 0.0 | 8.9 | 91.1 | 3.0349 | 2.9017 | 0.216 |
| 26 | 111 | 0.0 | 12.4 | 87.6 | 3.0348 | 2.9015 | 0.221 |
| 27 | 113 | 0.0 | 14.4 | 85.6 | 3.0349 | 2.9017 | 0.188 |
| 28 | 115 | 0.0 | 22.6 | 77.4 | 3.0349 | 2.9018 | 0.178 |
| 29 | 119 | 0.0 | 2.7 | 97.3 | 3.0292 | 2.9015 | 0.196 |
| 30 | 122 | 0.0 | 1.8 | 98.2 | 3.0329 | 2.9017 | 0.203 |
| 31 | 126 | 0.0 | 6.4 | 93.6 | 3.0349 | 2.8948 | 0.236 |
| 32 | 127 | 0.0 | 3.9 | 96.1 | 3.0348 | 2.8947 | 0.236 |
| 33 | 128 | 0.0 | 12.4 | 87.6 | 3.0349 | 2.8948 | 0.23 |
| 34 | 129 | 0.0 | 2.1 | 97.9 | 3.0364 | 2.9017 | 0.136 |
| 35 | 130 | 0.0 | 2.3 | 97.7 | 3.0348 | 2.9016 | 0.162 |
| 36 | 131 | 0.0 | 2.0 | 98.0 | 3.033 | 2.8948 | 0.247 |
| 37 | 132 | 0.0 | 2.3 | 97.7 | 3.0346 | 2.8947 | 0.246 |
| 38 | 133 | 0.0 | 3.2 | 96.8 | 3.0348 | 2.8928 | 0.22 |
| 39 | 134 | 0.0 | 2.9 | 97.1 | 3.0348 | 2.9016 | 0.227 |
| 40 | 1 | 2.9 | 95.2 | 1.9 | 3.0309 | 2.9019 | 0.156 |
| 41 | 11 | 1.8 | 90.4 | 7.8 | 3.0309 | 2.9068 | 0.159 |
| 42 | 21 | 2.5 | 90.8 | 6.7 | 3.0291 | 2.9036 | 0.171 |
| 43 | 31 | 1.9 | 94.7 | 3.4 | 3.0309 | 2.9053 | 0.168 |
| 44 | 41 | 1.3 | 95.6 | 3.0 | 3.0329 | 2.9053 | 0.146 |
| 45 | 51 | 2.8 | 97.2 | 0.0 | 3.0309 |  | 0.216 |
| 46 | 55 | 1.9 | 96.0 | 2.0 | 3.031 | 2.9054 | 0.169 |

**Table S3.** The trace element compositions in the carbonates in Quse Formation

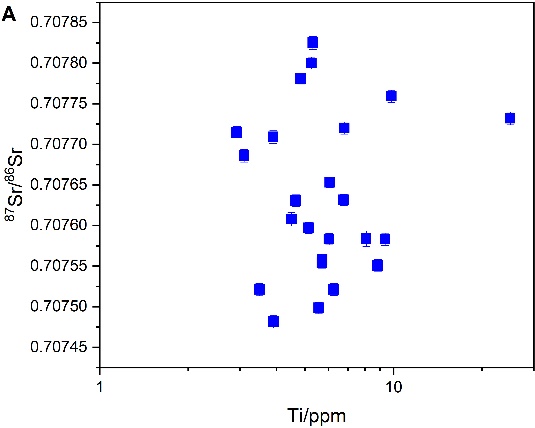
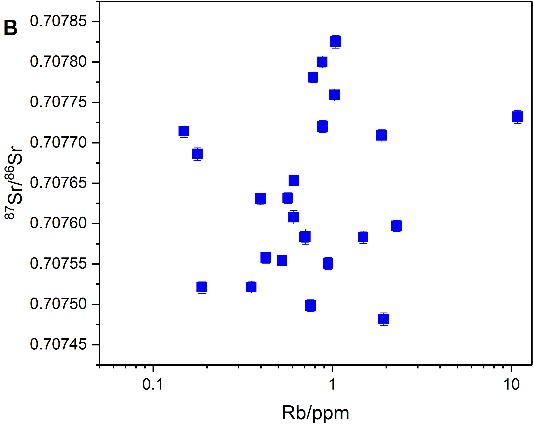
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sample Number | Depth/m | concentration/ppm | | | | | | | | | | | | | | | |
| Li | Sc | Ti | V | Cr | Mn | Co | Ni | Cu | Zn | Rb | Sr | Mo | Cd | Ba | U |
| 1 | 63 | 2.47 | 0.40 | 6.04 | 4.08 | 3.73 | 67.28 | 1.49 | 11.65 | 1.48 | 96.01 | 0.70 | 113.70 | 0.24 | 0.19 | 3.12 | 1.32 |
| 2 | 64 | 2.10 | 0.43 | 6.00 | 6.85 | 4.56 | 101.53 | 1.66 | 12.83 | 2.02 | 118.31 | 0.66 | 103.09 | 0.18 | 0.24 | 3.12 | 1.13 |
| 3 | 65 | 1.48 | 0.43 | 5.25 | 6.25 | 4.36 | 92.47 | 1.46 | 11.72 | 1.51 | 90.94 | 0.88 | 92.32 | 0.16 | 0.18 | 2.87 | 0.87 |
| 4 | 66 | 1.62 | 0.22 | 4.76 | 2.93 | 3.87 | 62.86 | 1.35 | 10.73 | 1.22 | 76.67 | 0.42 | 91.46 | 0.14 | 0.14 | 2.64 | 1.06 |
| 5 | 67 | 1.27 | 0.43 | 4.84 | 3.52 | 4.16 | 92.02 | 1.44 | 11.47 | 1.37 | 69.83 | 0.78 | 93.26 | 0.11 | 0.17 | 2.82 | 0.93 |
| 6 | 69 | 1.47 | 0.51 | 6.18 | 3.92 | 4.43 | 83.20 | 1.55 | 12.11 | 1.48 | 103.61 | 0.80 | 100.55 | 0.14 | 0.19 | 3.18 | 1.02 |
| 7 | 70 | 1.60 | 0.38 | 6.77 | 4.09 | 3.52 | 78.98 | 1.62 | 12.59 | 1.78 | 139.36 | 0.57 | 98.42 | 0.13 | 0.27 | 2.84 | 0.99 |
| 8 | 72 | 1.90 | 0.41 | 7.33 | 4.48 | 4.61 | 55.94 | 1.76 | 13.11 | 2.18 | 88.12 | 0.71 | 115.61 | 0.16 | 0.17 | 3.36 | 1.14 |
| 9 | 76 | 2.42 | 0.90 | 9.37 | 5.49 | 4.79 | 63.96 | 1.69 | 12.42 | 2.05 | 101.78 | 1.49 | 119.20 | 0.15 | 0.20 | 4.76 | 1.12 |
| 10 | 79 | 1.34 | 0.32 | 5.87 | 5.84 | 4.02 | 153.33 | 1.85 | 16.03 | 2.13 | 98.16 | 0.46 | 107.29 | 0.15 | 0.18 | 2.72 | 0.81 |
| 11 | 82 | 1.82 | 0.32 | 5.71 | 4.59 | 4.49 | 69.39 | 1.61 | 13.73 | 2.15 | 75.43 | 0.53 | 112.89 | 0.20 | 0.18 | 2.96 | 1.12 |
| 12 | 84 | 2.19 | 0.39 | 7.81 | 7.40 | 4.21 | 111.52 | 2.35 | 18.37 | 4.39 | 128.23 | 0.55 | 123.11 | 0.16 | 0.24 | 3.52 | 1.05 |
| 13 | 87 | 2.10 | 0.56 | 8.07 | 6.40 | 4.67 | 96.13 | 1.72 | 15.09 | 2.95 | 85.86 | 0.71 | 115.03 | 0.19 | 0.17 | 3.03 | 1.12 |
| 14 | 90 | 1.46 | 0.20 | 5.54 | 4.05 | 3.64 | 101.74 | 1.51 | 12.37 | 2.04 | 80.74 | 0.44 | 85.97 | 0.17 | 0.24 | 2.10 | 0.84 |
| 15 | 95 | 1.57 | 0.76 | 5.32 | 6.18 | 6.89 | 161.81 | 1.33 | 11.52 | 0.56 | 29.86 | 1.04 | 100.97 | 0.22 | 0.11 | 3.16 | 2.33 |
| 16 | 97 | 2.75 | 1.93 | 10.42 | 7.77 | 10.01 | 53.82 | 1.55 | 12.90 | 1.34 | 42.87 | 2.29 | 128.61 | 0.26 | 0.10 | 5.73 | 1.61 |
| 17 | 99 | 1.97 | 0.61 | 9.83 | 7.93 | 6.05 | 106.74 | 1.81 | 15.29 | 3.82 | 109.35 | 1.03 | 102.26 | 0.19 | 0.26 | 3.16 | 1.21 |
| 18 | 100 | 1.10 | 0.35 | 3.12 | 5.48 | 4.04 | 157.87 | 1.24 | 10.84 | 0.72 | 20.52 | 0.44 | 84.78 | 0.18 | 0.08 | 1.83 | 1.61 |
| 19 | 101 | 1.60 | 0.23 | 4.65 | 3.60 | 3.99 | 68.58 | 1.25 | 11.15 | 4.13 | 134.46 | 0.40 | 87.37 | 0.16 | 0.43 | 2.15 | 0.92 |
| 20 | 103 | 2.04 | 0.26 | 4.49 | 2.31 | 2.80 | 64.38 | 1.21 | 9.38 | 0.53 | 13.39 | 0.61 | 101.79 | 0.19 | 0.05 | 3.12 | 1.17 |
| 21 | 104 | 1.34 | 0.53 | 3.57 | 1.65 | 6.80 | 94.00 | 1.34 | 11.97 | 0.50 | 13.00 | 0.28 | 88.42 | 0.21 | 0.05 | 2.18 | 1.16 |
| 22 | 105 | 2.46 | 0.80 | 8.85 | 3.90 | 5.75 | 58.56 | 1.13 | 9.86 | 0.92 | 22.26 | 0.95 | 115.79 | 0.23 | 0.05 | 3.81 | 1.13 |
| 23 | 106 | 2.32 | 0.78 | 8.79 | 5.01 | 5.13 | 81.13 | 1.44 | 11.95 | 2.23 | 52.94 | 1.14 | 113.65 | 0.23 | 0.11 | 4.39 | 1.06 |
| 24 | 107 | 2.49 | 0.80 | 5.57 | 3.08 | 8.31 | 57.41 | 1.08 | 9.62 | 0.44 | 18.86 | 0.76 | 122.52 | 0.27 | 0.04 | 4.16 | 1.08 |
| 25 | 109 | 2.05 | 0.50 | 6.97 | 3.47 | 5.22 | 68.04 | 1.18 | 10.81 | 0.94 | 52.10 | 0.79 | 113.01 | 0.19 | 0.16 | 2.58 | 0.88 |
| 26 | 111 | 1.85 | 0.37 | 6.07 | 4.09 | 4.88 | 97.86 | 1.41 | 11.83 | 1.22 | 59.78 | 0.61 | 106.83 | 0.20 | 0.15 | 5.95 | 0.86 |
| 27 | 113 | 2.40 | 0.71 | 9.92 | 5.74 | 7.62 | 112.45 | 1.94 | 12.12 | 1.82 | 57.49 | 1.33 | 105.62 | 0.26 | 0.14 | 9.72 | 0.99 |
| 28 | 115 | 2.22 | 0.50 | 6.80 | 5.51 | 5.17 | 95.33 | 1.50 | 13.03 | 0.65 | 22.11 | 0.88 | 109.29 | 0.27 | 0.06 | 3.54 | 1.28 |
| 29 | 119 | 2.24 | 0.30 | 12.35 | 11.42 | 5.57 | 68.95 | 1.54 | 14.96 | 4.15 | 94.97 | 0.70 | 104.49 | 0.27 | 0.20 | 3.19 | 1.05 |
| 30 | 122 | 2.86 | 0.16 | 5.72 | 6.87 | 3.89 | 92.15 | 1.27 | 12.42 | 2.24 | 61.83 | 0.43 | 120.26 | 0.23 | 0.08 | 2.32 | 1.26 |
| 31 | 126 | 2.54 | 0.05 | 3.10 | 8.41 | 3.81 | 178.07 | 1.35 | 11.30 | 1.06 | 47.61 | 0.18 | 105.81 | 0.18 | 0.10 | 2.31 | 1.28 |
| 32 | 127 | 2.41 | 0.13 | 5.45 | 10.88 | 5.60 | 142.99 | 1.40 | 13.49 | 2.89 | 81.58 | 0.18 | 102.06 | 0.15 | 0.16 | 2.37 | 1.19 |
| 33 | 128 | 2.36 | 0.03 | 2.93 | 8.41 | 4.41 | 194.86 | 1.34 | 11.97 | 1.39 | 51.43 | 0.15 | 107.14 | 0.20 | 0.11 | 2.17 | 1.13 |
| 34 | 129 | 2.10 | 0.40 | 9.40 | 9.80 | 5.00 | 80.24 | 1.20 | 11.80 | 2.40 | 40.38 | 0.70 | 104.30 | 0.20 | 0.10 | 2.80 | 1.50 |
| 35 | 130 | 2.16 | 0.09 | 6.26 | 6.55 | 3.51 | 105.18 | 1.19 | 11.66 | 1.84 | 31.52 | 0.35 | 106.70 | 0.21 | 0.05 | 2.18 | 1.40 |
| 36 | 131 | 1.87 | 0.17 | 6.77 | 9.58 | 3.23 | 81.68 | 1.25 | 11.74 | 3.46 | 27.97 | 0.33 | 92.21 | 0.18 | 0.05 | 1.82 | 1.15 |
| 37 | 132 | 1.88 | 0.02 | 3.49 | 10.07 | 3.20 | 111.72 | 1.36 | 11.49 | 2.44 | 36.29 | 0.19 | 102.97 | 0.19 | 0.15 | 1.98 | 1.24 |
| 38 | 133 | 1.73 | 0.23 | 7.30 | 11.16 | 3.79 | 154.52 | 1.51 | 13.83 | 2.64 | 64.90 | 0.31 | 95.53 | 0.15 | 0.17 | 2.21 | 1.18 |
| 40 | 1 | 4.55 | 2.51 | 24.95 | 11.59 | 11.43 | 87.49 | 3.65 | 28.02 | 3.55 | 5.32 | 10.85 | 455.94 | 0.34 | 0.04 | 15.38 | 0.51 |
| 41 | 11 | 1.13 | 0.39 | 5.23 | 2.52 | 3.80 | 53.52 | 1.65 | 15.22 | 0.66 | 1.63 | 1.85 | 276.35 | 0.17 | 0.02 | 7.52 | 0.36 |
| 42 | 21 | 1.15 | 0.85 | 5.14 | 3.90 | 4.82 | 60.04 | 2.07 | 14.99 | 1.16 | 3.89 | 2.28 | 218.86 | 0.18 | 0.02 | 5.43 | 0.47 |
| 43 | 31 | 1.78 | 1.10 | 12.61 | 4.24 | 5.60 | 72.96 | 2.02 | 17.43 | 1.91 | 3.64 | 3.75 | 274.40 | 0.18 | 0.02 | 6.75 | 0.32 |
| 44 | 41 | 0.79 | 0.44 | 3.89 | 3.42 | 3.77 | 64.85 | 1.86 | 15.92 | 1.21 | 1.10 | 1.89 | 176.35 | 0.15 | 0.02 | 21.79 | 0.38 |
| 45 | 51 | 1.65 | 0.81 | 5.62 | 4.99 | 4.31 | 70.84 | 3.23 | 14.56 | 2.73 | 5.22 | 3.73 | 253.60 | 0.19 | 0.05 | 6.77 | 0.31 |
| 46 | 55 | 1.00 | 0.57 | 3.90 | 2.91 | 4.46 | 65.95 | 1.96 | 17.82 | 1.04 | 11.38 | 1.94 | 323.59 | 0.21 | 0.15 | 5.27 | 0.31 |

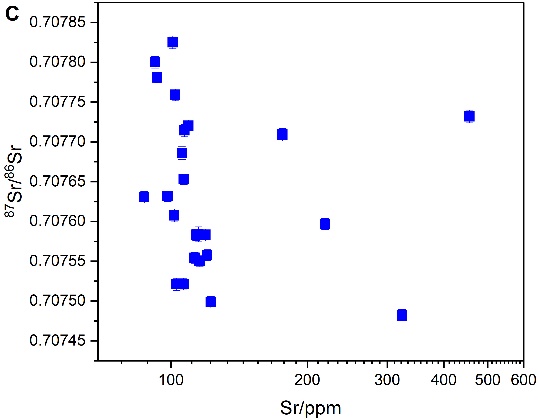
**Table S4.** C-O-Sr isotope compositions in the carbonate in Quse Formation

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Sample Number | Depth/m | 87Sr/86Sr | SE | δ13C | SE | δ18O | SE |
| 1 | 63 | 0.7075831 | 0.0000069 | 3.5 | 0.03 | -2.2 | 0.04 |
| 3 | 65 | 0.7078 | 0.0000073 | 3.1 | 0.02 | -5.4 | 0.04 |
| 5 | 67 | 0.7077808 | 0.0000067 | 3.2 | 0.01 | -4.9 | 0.03 |
| 7 | 70 | 0.7076315 | 0.0000066 | 3.7 | 0.03 | -3.7 | 0.04 |
| 9 | 76 | 0.707583 | 0.0000075 | 3.9 | 0.04 | -3.4 | 0.04 |
| 11 | 82 | 0.7075541 | 0.0000066 | 3.6 | 0.03 | -2.6 | 0.03 |
| 13 | 87 | 0.7075838 | 0.0000093 | 3.2 | 0.02 | -3.9 | 0.03 |
| 15 | 95 | 0.707825 | 0.0000079 | 2.7 | 0.02 | -4.5 | 0.04 |
| 17 | 99 | 0.7077591 | 0.0000074 |  |  |  |  |
| 19 | 101 | 0.7076306 | 0.0000073 | 3.0 | 0.02 | -3.5 | 0.04 |
| 20 | 103 | 0.7076076 | 0.0000082 | 2.9 | 0.03 | -2.6 | 0.04 |
| 22 | 105 | 0.7075504 | 0.0000075 | 3.3 | 0.02 | -2.6 | 0.02 |
| 24 | 107 | 0.7074985 | 0.0000072 | 3.4 | 0.03 | -2.6 | 0.03 |
| 26 | 111 | 0.7076531 | 0.0000066 | 2.6 | 0.04 | -4.6 | 0.04 |
| 28 | 115 | 0.70772 | 0.0000075 | 2.3 | 0.01 | -2.8 | 0.03 |
| 30 | 122 | 0.7075577 | 0.0000068 | 3.3 | 0.02 | -0.8 | 0.03 |
| 31 | 126 | 0.7076859 | 0.0000079 | 2.6 | 0.02 | -2.7 | 0.03 |
| 33 | 128 | 0.7077143 | 0.0000078 | 2.3 | 0.02 | -3.3 | 0.04 |
| 35 | 130 | 0.7075213 | 0.0000072 | 3.2 | 0.04 | -1.4 | 0.05 |
| 37 | 132 | 0.7075211 | 0.0000076 | 3.1 | 0.02 | -1.8 | 0.03 |
| 38 | 133 |  |  | 2.9 | 0.03 | -3.1 | 0.01 |
| 39 | 134 | 0.7076012 | 0.0000077 | 3.1 | 0.02 | -2.4 | 0.01 |
| 40 | 1 | 0.7077319 | 0.0000079 | 2.9 | 0.04 | -6.2 | 0.04 |
| 41 | 11 |  |  | 3.0 | 0.03 | -5.8 | 0.02 |
| 42 | 21 | 0.707597 | 0.0000069 | 2.8 | 0.02 | -6.4 | 0.01 |
| 43 | 31 |  |  | 2.7 | 0.03 | -5.7 | 0.02 |
| 44 | 41 | 0.7077089 | 0.0000078 | 1.9 | 0.02 | -9.5 | 0.02 |
| 45 | 51 |  |  | 2.6 | 0.02 | -4.5 | 0.02 |
| 46 | 55 | 0.7074816 | 0.0000078 | 2.6 | 0.02 | -4.3 | 0.03 |

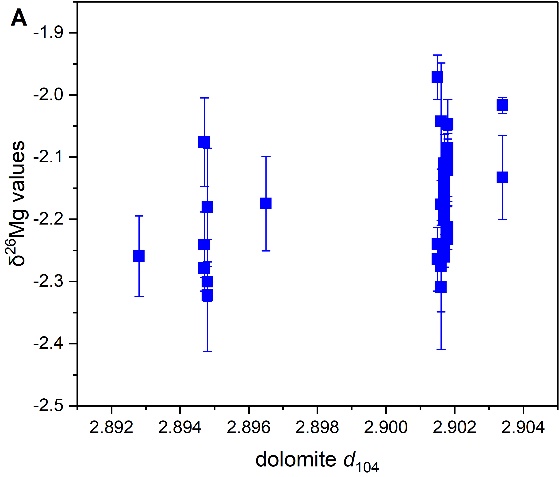
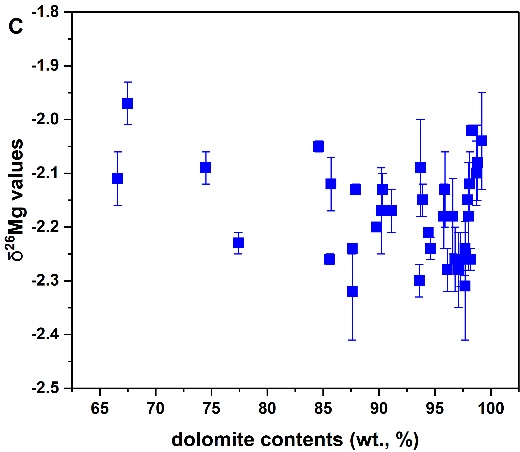
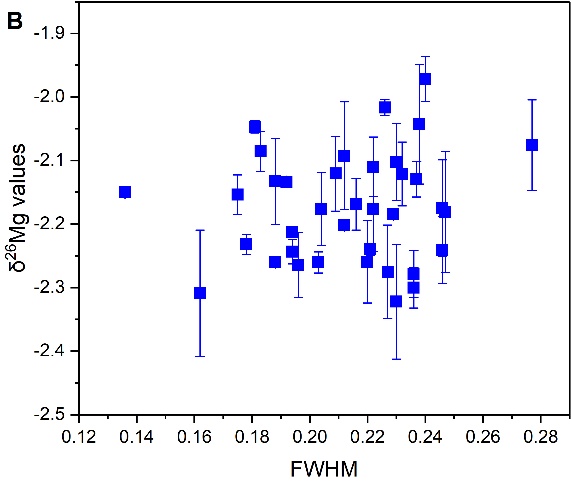
**Table S5.** Mg isotope data for dolomite in dolostones in Quse Formation

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Sample Number | Depth/m | δ26Mg | 2SD | δ25Mg | 2SD | n |
| 1 | 63 | -2.12 | 0.06 | -1.14 | 0.05 | 2 |
| 2 | 64 | -2.18 | 0.00 | -1.18 | 0.01 | 2 |
| 3 | 65 | -2.17 | 0.08 | -1.16 | 0.08 | 3 |
| 4 | 66 | -2.08 | 0.07 | -1.11 | 0.10 | 3 |
| 5 | 67 | -2.12 | 0.05 | -1.13 | 0.02 | 2 |
| 6 | 69 | -2.13 | 0.03 | -1.13 | 0.02 | 2 |
| 7 | 70 | -2.10 | 0.06 | -1.11 | 0.01 | 2 |
| 8 | 72 | -2.02 | 0.01 | -1.08 | 0.01 | 2 |
| 9 | 76 | -2.04 | 0.09 | -1.10 | 0.04 | 3 |
| 11 | 82 | -2.18 | 0.07 | -1.13 | 0.01 | 2 |
| 13 | 87 | -2.09 | 0.09 | -1.06 | 0.04 | 2 |
| 14 | 90 | -2.20 | 0.00 | -1.14 | 0.07 | 2 |
| 15 | 95 | -2.09 | 0.03 | -1.06 | 0.01 | 2 |
| 16 | 97 | -2.13 | 0.07 | -1.16 | 0.13 | 3 |
| 17 | 99 | -2.13 | 0.01 | -1.15 | 0.06 | 2 |
| 18 | 100 | -2.11 | 0.05 | -1.13 | 0.06 | 2 |
| 19 | 101 | -2.18 | 0.06 | -1.15 | 0.05 | 2 |
| 20 | 103 | -2.05 | 0.01 | -1.11 | 0.02 | 2 |
| 21 | 104 | -1.97 | 0.04 | -1.05 | 0.03 | 2 |
| 22 | 105 | -2.24 | 0.02 | -1.08 | 0.02 | 2 |
| 23 | 106 | -2.21 | 0.00 | -1.08 | 0.02 | 2 |
| 24 | 107 | -2.15 | 0.03 | -1.10 | 0.06 | 2 |
| 25 | 109 | -2.17 | 0.04 | -1.14 | 0.03 | 2 |
| 26 | 111 | -2.24 | 0.01 | -1.15 | 0.07 | 2 |
| 27 | 113 | -2.26 | 0.01 | -1.14 | 0.03 | 2 |
| 28 | 115 | -2.23 | 0.02 | -1.12 | 0.02 | 2 |
| 29 | 119 | -2.26 | 0.05 | -1.14 | 0.03 | 2 |
| 30 | 122 | -2.26 | 0.02 | -1.13 | 0.03 | 2 |
| 31 | 126 | -2.30 | 0.03 | -1.14 | 0.09 | 2 |
| 32 | 127 | -2.28 | 0.04 | -1.16 | 0.02 | 2 |
| 33 | 128 | -2.32 | 0.09 | -1.18 | 0.02 | 3 |
| 34 | 129 | -2.15 | 0.00 | -1.09 | 0.05 | 2 |
| 35 | 130 | -2.31 | 0.10 | -1.19 | 0.03 | 6 |
| 36 | 131 | -2.18 | 0.10 | -1.08 | 0.03 | 2 |
| 37 | 132 | -2.24 | 0.05 | -1.13 | 0.01 | 2 |
| 38 | 133 | -2.26 | 0.06 | -1.13 | 0.04 | 2 |
| 39 | 134 | -2.28 | 0.07 | -1.16 | 0.05 | 6 |



**Fig.S1.** The cross-plot showing the relationship between trace elements, and Sr isotope ratios. (A) The cross-plot between Ti contents and 87Sr/86Sr ratios; (B) The cross-plot between Rb contents and 87Sr/86Sr ratios; (C) The cross-plot between Sr contents and 87Sr/86Sr ratios.

**Fig.S2.** The cross-plot showing the relationship between δ26Mg values and the parameters of dolomite lattice. (A) The cross-plot between δ26Mg values and *d*104 values; (B) The cross-plot between 26Mg values and the dolomite FWHM (104); (C) The cross-plot between δ26Mg values and dolomite contents in the bulk carbonates.