Supporting Information for

Timing and characterization of multiple fluid flow events in the northern South China Sea:

Implications for hydrocarbon maturation

Entao Liu1,2,3\*, I. Tonguç Uysal3,4, Hua Wang1, Yuexing Feng3, Songqi Pan5, Huajun Gan1, Ai Duc Nguyen3, Jian-xin Zhao1,3,6\*

*1 Key Laboratory of Tectonics and Petroleum Resources, Ministry of Education, China University of Geosciences, Wuhan 430074, China*

*2 Shandong Provincial Key Laboratory of Depositional Mineralization & Sedimentary Minerals, Shandong University of Science and Technology, Qingdao 266590, China*

*3 Radiogenic Isotope Facility, School of Earth and Environmental Sciences, The University of Queensland, Brisbane, Qld 4072, Australia*

*4 Ankara University, Geological Engineering Department, Gölbaşı, Ankara, Turkey*

*5 PetroChina Research Institute of Petroleum Exploration & Development, Beijing 100083, China*

*6 Beijing SHRIMP Center, Chinese Academy of Geological Sciences, Beijing 100037, China*

**Contents of this file**

Table S1: Vitrinite reflectance (VR) estimated palaeotemperatures and oxygen–hydrogen data for the illite samples from Beibuwan Basin, South China Sea

Table S2: Trace element data for the illite samples from Beibuwan Basin, South China Sea

**Table S1.** Vitrinite reflectance (VR) estimated palaeotemperatures and oxygen–hydrogen data for clays. δD and δ18O fluid values are calculated using VR estimated palaeotemperatures.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sample | Depth  (m) | Grain Size  (µm) | I/S ordering | VR estimated  Palaeotemperature | Mineral δ18O | Mineral  δD | Waterδ18O | Water δD |
| F6\_2895 | 2895 | <0.2 | R=1-R≥3 | 170 | 8.38 | -72.7 | -0.04 | -53.5 |
| F1\_3133 | 3133 | <0.2 | R≥3 | 190 | 9.57 | -64.7 | 2.18 | -47.4 |
| F1\_3342 | 3342 | <0.2 | R≥3 | 190 | 11.4 | -70.0 | 3.98 | -52.7 |
| IR2\_3159 | 3159 | <0.2 | R≥3 | 250 | 9.79 | -77.3 | 4.81 | -64.8 |
| IR1\_3264.2 | 3264.2 | <1.0 | R≥3 | 250 | 10.6 | -79.6 | 5.62 | -67.1 |
| IR3\_3020 | 3020 | <0.2 | R≥3 | 250 | 12.2 | -56.0 | 6.89 | -42.8 |

Table S2. Trace element data for the illite samples from Beibuwan Basin, South China Sea

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sample - (Drill hole\_depth) | Grain Size | Aliquot | Li | Be | Sc | V | Cr | Co | Ni | Rb | Sr | Y | Zr | Nb | Sn | Cs | Ba | La | Ce |
| F6\_2882/<0.1R | <0.1 | R | 77.0 | 3.81 | 7.04 | 84.7 | 64.1 | 22.0 | 28.0 | 129 | 89.3 | 5.67 | 31.0 | 4.48 | 8.70 | 14.0 | 573 | 61.6 | 130 |
| F7\_2584/0.1-0.2R | 0.1-0.2 | R | 55.1 | 4.12 | 10.9 | 136 | 102 | 18.1 | 29.0 | 401 | 267 | 16.5 | 73.3 | 8.85 | 12.2 | 23.9 | 318 | 333 | 576 |
| F7\_2584/<0.1R | <0.1 | R | 37.1 | 2.19 | 5.74 | 67.2 | 96.6 | 23.4 | 38.6 | 131 | 287 | 6.28 | 21.1 | 1.96 | 6.04 | 10.7 | 421 | 91.6 | 153 |
| F6\_2883/<0.2R | <0.2 | R | 69.9 | 4.68 | 17.5 | 153 | 114 | 27.4 | 63.2 | 232 | 106 | 13.4 | 49.9 | 4.02 | 6.65 | 36.8 | 264 | 39.2 | 71.5 |
| F6\_2895/0.1-0.2R | 0.1-0.2 | R | 3.52 | 1.40 | 3.17 | 42.1 | 17.5 | 4.06 | 13.1 | 451 | 59.5 | 2.52 | 8.98 | 1.05 | 3.01 | 5.11 | 526 | 8.09 | 17.5 |
| F6\_2895/<0.1R | <0.1 | R | 8.96 | 0.98 | 3.41 | 41.2 | 19.6 | 5.98 | 13.9 | 285 | 56.4 | 1.50 | 5.97 | 0.38 | 2.71 | 5.39 | 789 | 6.20 | 11.5 |
| F1\_3133/<0.2L | <0.2 | L | 51.6 | 0.38 | 0.11 | 1.03 | 0.12 | 6.99 | 6.9 | 8.85 | 209 | 0.46 | 0.16 | 0.01 | 0.11 | 0.07 | 14.0 | 0.11 | 0.36 |
| F3\_3035/<0.2R | <0.2 | R | 80.3 | 1.21 | 8.81 | 40.2 | 39.2 | 81.3 | 290 | 55.6 | 66.9 | 2.64 | 8.54 | 0.47 | 1.65 | 8.64 | 63.9 | 4.22 | 7.55 |
| F1\_3334/<0.2UN | <0.2 | UN | 97.5 | 6.01 | 18.9 | 147 | 95.2 | 14.3 | 30.3 | 229 | 95.0 | 14.2 | 53.0 | 5.39 | 7.86 | 33.2 | 834 | 28.9 | 56.4 |
| F1\_3342/<0.2UN | <0.2 | UN | 65.4 | 1.38 | 9.69 | 65.9 | 27.3 | 18.1 | 26.5 | 89.9 | 18.8 | 5.12 | 7.49 | 0.52 | 3.95 | 6.38 | 322 | 6.16 | 11.0 |
| F5\_2993/0.2-0.5UN | 0.2-0.5 | UN | 80.1 | 4.57 | 13.6 | 103 | 58.9 | 8.92 | 14.3 | 169 | 49.0 | 23.0 | 77.5 | 8.33 | 6.71 | 22.6 | 194 | 37.0 | 83.5 |
| F2\_3340/<0.2L | <0.2 | L | 120 | 0.64 | 0.10 | 7.12 | 0.41 | 2.61 | 4.2 | 4.07 | 31.8 | 0.28 | 0.15 | 0.01 | 0.09 | 0.14 | 29.1 | 0.11 | 0.28 |
| F1\_3342/<0.2L | <0.2 | L | 99.2 | 1.06 | 0.28 | 4.60 | 1.87 | 23.1 | 26.4 | 8.80 | 29.7 | 1.31 | 4.78 | 0.16 | 0.30 | 0.25 | 133 | 1.80 | 3.94 |
| F4\_3223/<0.2UN | <0.2 | UN | 59.6 | 3.29 | 20.7 | 177 | 66.4 | 6.01 | 15.4 | 151 | 65.5 | 5.64 | 26.7 | 3.39 | 6.76 | 13.5 | 74.2 | 8.48 | 15.6 |
| F3\_3035/0.2-0.5R | 0.2-0.5 | R | 65.9 | 3.53 | 17.4 | 154 | 111 | 8.58 | 20.6 | 245 | 96.5 | 17.7 | 76.0 | 6.27 | 6.87 | 37.4 | 289 | 63.5 | 116 |
| F1\_3133/<0.2R | <0.2 | R | 13.9 | 1.15 | 4.50 | 47.2 | 26.6 | 5.49 | 10.2 | 172 | 61.4 | 2.73 | 17.1 | 2.05 | 6.26 | 9.02 | 489 | 3.74 | 6.69 |
| F4\_3233/<0.2L | <0.2 | L | 35.5 | 0.64 | 0.18 | 1.35 | 18.1 | 15.5 | 27.1 | 7.92 | 223 | 1.18 | 0.82 | 0.02 | 0.08 | 0.09 | 281 | 1.07 | 2.01 |
| F1\_3133/0.2-0.5R | 0.2-0.5 | R | 35.0 | 2.50 | 9.22 | 89.0 | 49.5 | 8.58 | 12.3 | 435 | 40.9 | 11.4 | 60.5 | 7.66 | 11.9 | 17.4 | 381 | 13.3 | 25.2 |
| F5\_2993/<0.2UN | <0.2 | UN | 64.1 | 1.34 | 8.39 | 30.6 | 20.2 | 8.35 | 11.4 | 56.9 | 21.7 | 4.26 | 15.9 | 1.58 | 1.99 | 7.03 | 65.5 | 6.58 | 14.3 |
| IR3\_3021/<0.2R | <0.2 | R | 52.8 | 5.46 | 16.7 | 156 | 77.8 | 11.8 | 19.1 | 243 | 84.0 | 17.7 | 48.1 | 5.46 | 6.56 | 26.0 | 777 | 21.2 | 42.9 |
| IR4\_3022/<0.5R | <0.5 | R | 93.9 | 5.22 | 17.1 | 144 | 99.0 | 8.58 | 21.8 | 353 | 58.3 | 22.2 | 96.8 | 11.3 | 8.81 | 34.2 | 386 | 46.3 | 91.5 |
| IR3\_3021.5/0.5-1.0R | 0.5-1.0 | R | 83.0 | 4.92 | 16.5 | 108 | 61.9 | 12.4 | 20.7 | 249 | 70.4 | 27.0 | 93.6 | 12.6 | 7.09 | 33.4 | 1150 | 50.1 | 101 |
| IR4\_3024/<0.1R | <0.1 | R | 36.6 | 5.36 | 13.5 | 107 | 70.2 | 25.0 | 60.1 | 398 | 17.2 | 3.99 | 29.9 | 1.69 | 7.02 | 28.9 | 3088 | 3.87 | 7.39 |
| IR3\_3020/0.1-0.2R | 0.1-0.2 | R | 55.9 | 4.59 | 19.3 | 133 | 75.2 | 14.5 | 22.6 | 522 | 51.9 | 17.1 | 72.9 | 6.45 | 8.11 | 60.5 | 1854 | 21.9 | 42.4 |
| IR2\_3160/<0.5UN | <0.5 | UN | 96.0 | 5.16 | 16.5 | 141 | 92.1 | 8.60 | 22.2 | 340 | 47.2 | 17.1 | 97.4 | 11.7 | 8.28 | 33.7 | 218 | 44.4 | 85.4 |
| IR2\_3164.3/<0.1R | <0.1 | R | 11.4 | 0.54 | 1.19 | 12.0 | 72.0 | 18.1 | 41.1 | 234 | 165 | 0.63 | 1.69 | 0.23 | 3.03 | 3.98 | 6489 | 1.30 | 2.26 |
| IR2\_3164.3/<0.1L | <0.1 | L | 328 | 1.07 | 1.13 | 4.87 | 89.0 | 28.9 | 72.0 | 25.6 | 127 | 0.36 | 1.14 | 0.06 | 0.83 | 0.42 | 181 | 0.36 | 0.76 |
| IR2\_3159/0.1-0.2R | 0.1-0.2 | R | 48.3 | 5.68 | 18.7 | 147 | 82.7 | 11.8 | 17.8 | 440 | 37.6 | 14.1 | 63.1 | 6.63 | 7.55 | 37.8 | 1450 | 21.4 | 42.7 |
| IR2\_3159/<0.1UN | <0.1 | UN | 152 | 2.33 | 4.53 | 42.3 | 19.2 | 4.88 | 6.10 | 127 | 32.7 | 1.13 | 8.34 | 0.46 | 1.91 | 5.87 | 513 | 1.17 | 2.34 |
| IR1\_3264.2/0.1-0.2UN | 0.1-0.2 | UN | 52.7 | 4.03 | 6.54 | 75.2 | 36.3 | 7.86 | 9.34 | 257 | 68.4 | 4.77 | 32.1 | 2.18 | 3.92 | 11.5 | 948 | 6.45 | 13.1 |
| IR1\_3264.4/0.2-0.5R\_acetic | 0.2-0.5 | R | 34.8 | 6.04 | 15.1 | 122 | 76.3 | 5.65 | 13.8 | 433 | 36.3 | 17.2 | 80.4 | 9.43 | 7.51 | 23.4 | 699 | 25.5 | 52.6 |
| IR1\_3264.3/0.2-0.5R | 0.2-0.5 | R | 9.11 | 1.06 | 1.42 | 13.2 | 16.5 | 10.5 | 16.3 | 443 | 130 | 1.14 | 5.01 | 1.57 | 2.88 | 3.46 | 2689 | 4.74 | 9.26 |
| IR1\_3264.3/0.1-0.2R | 0.1-0.2 | R | 3.60 | 0.80 | 1.17 | 12.2 | 80.5 | 11.8 | 36.1 | 404 | 136 | 0.50 | 2.32 | 0.54 | 2.74 | 3.44 | 3269 | 1.65 | 3.01 |
| IR1\_3264.2/0.1-0.2R | 0.1-0.2 | R | 3.35 | 0.95 | 1.94 | 20.4 | 20.7 | 8.44 | 11.3 | 412 | 93.1 | 1.19 | 5.69 | 0.90 | 3.34 | 4.19 | 2262 | 2.28 | 4.31 |
| IR1\_3264.3/0.2-0.5R | 0.2-0.5 | R | 3.74 | 0.87 | 1.48 | 13.7 | 15.5 | 8.19 | 14.6 | 453 | 96.0 | 1.16 | 5.15 | 1.63 | 3.02 | 3.58 | 2155 | 4.80 | 9.33 |
| IR1\_3264.3/1.0-2.0R | 1.0-2.0 | R | 7.94 | 1.05 | 2.20 | 18.2 | 24.6 | 7.20 | 12.3 | 416 | 158 | 4.99 | 16.9 | 6.54 | 3.92 | 3.67 | 3581 | 47.4 | 100 |
| IR1\_3264.4/0.1-0.2R | 0.1-0.2 | R | 30.7 | 5.12 | 13.4 | 108 | 69.8 | 11.0 | 23.5 | 408 | 27.0 | 9.57 | 52.6 | 4.96 | 6.77 | 25.2 | 2363 | 11.8 | 23.6 |
| IR1\_3264.2/0.2-0.5R | 0.2-0.5 | R | 4.71 | 1.13 | 2.52 | 24.3 | 25.3 | 9.05 | 11.7 | 466 | 82.4 | 2.36 | 11.1 | 2.56 | 4.06 | 4.94 | 1784 | 6.20 | 12.3 |
| IR1\_3264.3/0.5-1.0R | 0.5-1.0 | R | 5.46 | 0.97 | 1.87 | 16.2 | 20.7 | 7.47 | 13.1 | 461 | 92.1 | 2.71 | 10.1 | 3.81 | 3.41 | 3.79 | 1842 | 18.1 | 37.3 |
| IR2\_3264.3/<0.1R | <0.1 | R | 12.3 | 0.56 | 1.24 | 12.0 | 4.0 | 18.9 | 42.3 | 246 | 172 | 0.68 | 1.72 | 0.24 | 3.23 | 4.12 | 6767 | 1.34 | 2.32 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sample - (Drill hole\_depth) | Grain Size | Aliquot | Pr | Nd | Sm | Eu | Gd | Tb | Dy | Ho | Er | Tm | Yb | Lu | Hf | Ta | Pb | Th | U | LREE | HREE | REE | EuN\* |
| F6\_2882/<0.1R | <0.1 | R | 12.0 | 37.7 | 5.02 | 0.71 | 2.40 | 0.26 | 1.11 | 0.22 | 0.69 | 0.10 | 0.64 | 0.10 | 1.38 | 0.59 | 33.1 | 14.6 | 3.43 | 247 | 5.51 | 253 | 0.85 |
| F7\_2584/0.1-0.2R | 0.1-0.2 | R | 37.1 | 110 | 12.4 | 1.65 | 5.38 | 0.66 | 3.19 | 0.64 | 2.01 | 0.28 | 1.74 | 0.26 | 2.41 | 1.17 | 124 | 20.4 | 3.98 | 1070 | 14.16 | 1084 | 0.83 |
| F7\_2584/<0.1R | <0.1 | R | 13.7 | 38.9 | 4.09 | 0.54 | 1.74 | 0.23 | 1.12 | 0.23 | 0.71 | 0.10 | 0.62 | 0.09 | 0.75 | 0.27 | 98.9 | 5.92 | 2.44 | 302 | 4.84 | 307 | 0.83 |
| F6\_2883/<0.2R | <0.2 | R | 7.27 | 23.3 | 3.61 | 0.77 | 2.87 | 0.43 | 2.42 | 0.50 | 1.44 | 0.21 | 1.32 | 0.20 | 1.80 | 0.37 | 1.27 | 28.3 | 28.3 | 146 | 9.40 | 155 | 1.03 |
| F6\_2895/0.1-0.2R | 0.1-0.2 | R | 1.85 | 6.63 | 1.24 | 0.24 | 0.87 | 0.11 | 0.55 | 0.11 | 0.30 | 0.04 | 0.26 | 0.04 | 0.36 | 0.25 | 29.8 | 2.10 | 0.63 | 35.5 | 2.27 | 37.8 | 0.99 |
| F6\_2895/<0.1R | <0.1 | R | 1.07 | 3.44 | 0.53 | 0.09 | 0.39 | 0.06 | 0.31 | 0.06 | 0.18 | 0.03 | 0.16 | 0.02 | 0.26 | 0.11 | 47.8 | 1.12 | 0.42 | 22.8 | 1.22 | 24.0 | 0.88 |
| F1\_3133/<0.2L | <0.2 | L | 0.05 | 0.26 | 0.09 | 0.02 | 0.09 | 0.02 | 0.09 | 0.02 | 0.04 | 0.01 | 0.04 | 0.01 | 0.01 | 0.00 | 7.20 | 0.20 | 1.89 | 0.89 | 0.31 | 1.21 | 1.11 |
| F3\_3035/<0.2R | <0.2 | R | 0.78 | 2.63 | 0.47 | 0.11 | 0.43 | 0.07 | 0.43 | 0.09 | 0.27 | 0.04 | 0.25 | 0.04 | 0.35 | 0.05 | 0.32 | 10.5 | 10.6 | 15.7 | 1.63 | 17.4 | 1.01 |
| F1\_3334/<0.2UN | <0.2 | UN | 6.22 | 21.9 | 3.67 | 0.64 | 2.74 | 0.43 | 2.48 | 0.53 | 1.55 | 0.24 | 1.46 | 0.22 | 1.87 | 0.48 | 1.49 | 24.3 | 24.4 | 118 | 9.63 | 127 | 0.87 |
| F1\_3342/<0.2UN | <0.2 | UN | 1.06 | 3.72 | 0.79 | 0.19 | 1.09 | 0.19 | 1.05 | 0.19 | 0.45 | 0.06 | 0.31 | 0.04 | 0.35 | 0.05 | 0.88 | 15.1 | 15.2 | 22.9 | 3.38 | 26.3 | 0.86 |
| F5\_2993/0.2-0.5UN | 0.2-0.5 | UN | 8.55 | 31.8 | 6.55 | 1.20 | 5.70 | 0.84 | 4.47 | 0.87 | 2.32 | 0.33 | 1.99 | 0.29 | 2.41 | 0.73 | 1.15 | 15.2 | 15.1 | 169 | 16.81 | 185 | 0.85 |
| F2\_3340/<0.2L | <0.2 | L | 0.04 | 0.21 | 0.08 | 0.02 | 0.10 | 0.01 | 0.07 | 0.01 | 0.03 | 0.00 | 0.02 | 0.00 | 0.01 | 0.00 | 4.67 | 0.15 | 1.57 | 0.75 | 0.24 | 0.99 | 0.83 |
| F1\_3342/<0.2L | <0.2 | L | 0.40 | 1.47 | 0.31 | 0.06 | 0.30 | 0.04 | 0.24 | 0.05 | 0.14 | 0.02 | 0.14 | 0.02 | 0.16 | 0.01 | 5.71 | 0.87 | 2.36 | 7.97 | 0.95 | 8.93 | 0.81 |
| F4\_3223/<0.2UN | <0.2 | UN | 1.60 | 5.37 | 0.91 | 0.18 | 0.74 | 0.13 | 0.89 | 0.21 | 0.66 | 0.11 | 0.71 | 0.11 | 1.00 | 0.34 | 0.90 | 29.1 | 28.9 | 32.2 | 3.55 | 35.7 | 0.94 |
| F3\_3035/0.2-0.5R | 0.2-0.5 | R | 11.5 | 35.9 | 5.03 | 1.04 | 3.79 | 0.57 | 3.21 | 0.66 | 1.89 | 0.28 | 1.76 | 0.27 | 2.40 | 0.55 | 1.33 | 17.6 | 17.8 | 233 | 12.4 | 245 | 1.03 |
| F1\_3133/<0.2R | <0.2 | R | 0.68 | 2.20 | 0.34 | 0.07 | 0.29 | 0.06 | 0.43 | 0.11 | 0.35 | 0.06 | 0.41 | 0.06 | 0.67 | 0.24 | 11.2 | 2.66 | 1.08 | 13.7 | 1.77 | 15.5 | 1.01 |
| F4\_3233/<0.2L | <0.2 | L | 0.20 | 0.72 | 0.18 | 0.03 | 0.21 | 0.04 | 0.19 | 0.04 | 0.10 | 0.01 | 0.09 | 0.01 | 0.01 | 0.00 | 20.0 | 0.13 | 1.82 | 4.22 | 0.68 | 4.90 | 0.77 |
| F1\_3133/0.2-0.5R | 0.2-0.5 | R | 2.63 | 8.79 | 1.51 | 0.36 | 1.36 | 0.26 | 1.81 | 0.45 | 1.42 | 0.24 | 1.53 | 0.23 | 2.07 | 0.86 | 33.8 | 10.1 | 3.33 | 51.7 | 7.31 | 59.1 | 1.08 |
| F5\_2993/<0.2UN | <0.2 | UN | 1.47 | 5.38 | 1.10 | 0.20 | 0.96 | 0.14 | 0.78 | 0.16 | 0.42 | 0.06 | 0.38 | 0.06 | 0.54 | 0.14 | 0.42 | 3.99 | 3.97 | 29.0 | 2.95 | 32.0 | 0.86 |
| IR3\_3021/<0.2R | <0.2 | R | 4.89 | 18.4 | 3.89 | 0.81 | 3.67 | 0.57 | 3.28 | 0.67 | 1.83 | 0.26 | 1.59 | 0.23 | 1.72 | 0.46 | 1.51 | 24.2 | 24.3 | 92.2 | 12.1 | 104 | 0.93 |
| IR4\_3022/<0.5R | <0.5 | R | 9.91 | 34.4 | 6.10 | 1.06 | 4.91 | 0.74 | 4.10 | 0.84 | 2.37 | 0.36 | 2.25 | 0.33 | 2.94 | 0.94 | 32.8 | 28.6 | 6.25 | 189 | 15.90 | 205 | 0.84 |
| IR3\_3021.5/0.5-1.0R | 0.5-1.0 | R | 11.1 | 39.1 | 7.03 | 1.17 | 5.74 | 0.86 | 4.93 | 1.02 | 2.87 | 0.44 | 2.70 | 0.40 | 2.76 | 0.94 | 44.4 | 23.1 | 4.85 | 209 | 18.96 | 228 | 0.80 |
| IR4\_3024/<0.1R | <0.1 | R | 0.76 | 2.61 | 0.50 | 0.05 | 0.54 | 0.10 | 0.68 | 0.16 | 0.59 | 0.09 | 0.61 | 0.09 | 1.17 | 0.14 | 28.9 | 3.81 | 1.37 | 15.2 | 2.86 | 18.0 | 0.38 |
| IR3\_3020/0.1-0.2R | 0.1-0.2 | R | 4.52 | 15.5 | 2.77 | 0.37 | 2.49 | 0.44 | 2.80 | 0.63 | 1.89 | 0.31 | 1.98 | 0.30 | 2.27 | 0.49 | 41.2 | 15.6 | 3.26 | 87.5 | 10.8 | 98.3 | 0.61 |
| IR2\_3160/<0.5UN | <0.5 | UN | 9.02 | 29.8 | 4.54 | 0.73 | 3.03 | 0.47 | 2.89 | 0.64 | 1.98 | 0.32 | 2.07 | 0.32 | 2.89 | 0.97 | 18.5 | 23.7 | 6.33 | 174 | 11.73 | 186 | 0.85 |
| IR2\_3164.3/<0.1R | <0.1 | R | 0.23 | 0.79 | 0.15 | 0.01 | 0.14 | 0.02 | 0.12 | 0.02 | 0.06 | 0.01 | 0.05 | 0.01 | 0.09 | 0.04 | 124 | 0.61 | 0.25 | 4.74 | 0.44 | 5.18 | 0.39 |
| IR2\_3164.3/<0.1L | <0.1 | L | 0.09 | 0.32 | 0.08 | 0.02 | 0.09 | 0.02 | 0.09 | 0.02 | 0.04 | 0.01 | 0.03 | 0.00 | 0.05 | 0.01 | 35.4 | 0.19 | 0.88 | 1.63 | 0.30 | 1.93 | 1.06 |
| IR2\_3159/0.1-0.2R | 0.1-0.2 | R | 4.62 | 15.8 | 2.73 | 0.41 | 2.33 | 0.40 | 2.39 | 0.53 | 1.57 | 0.26 | 1.65 | 0.25 | 2.12 | 0.53 | 29.5 | 15.7 | 2.77 | 87.7 | 9.37 | 97.1 | 0.71 |
| IR2\_3159/<0.1UN | <0.1 | UN | 0.24 | 0.82 | 0.15 | 0.04 | 0.14 | 0.03 | 0.18 | 0.04 | 0.14 | 0.02 | 0.17 | 0.03 | 0.32 | 0.04 | 0.84 | 16.6 | 16.7 | 4.75 | 0.75 | 5.50 | 1.10 |
| IR1\_3264.2/0.1-0.2UN | 0.1-0.2 | UN | 1.32 | 4.48 | 0.80 | 0.19 | 0.71 | 0.12 | 0.81 | 0.19 | 0.60 | 0.10 | 0.71 | 0.11 | 1.04 | 0.20 | 1.63 | 39.0 | 39.1 | 26.3 | 3.35 | 29.7 | 1.09 |
| IR1\_3264.4/0.2-0.5R\_acetic | 0.2-0.5 | R | 5.73 | 20.9 | 4.14 | 0.76 | 4.13 | 0.64 | 3.50 | 0.69 | 1.91 | 0.30 | 1.87 | 0.28 | 2.43 | 0.75 | 23.4 | 19.9 | 3.90 | 110 | 13.3 | 123 | 0.80 |
| IR1\_3264.3/0.2-0.5R | 0.2-0.5 | R | 0.96 | 3.26 | 0.59 | 0.02 | 0.41 | 0.05 | 0.24 | 0.05 | 0.14 | 0.02 | 0.14 | 0.02 | 0.22 | 0.20 | 34.8 | 2.46 | 0.47 | 18.8 | 1.07 | 19.9 | 0.14 |
| IR1\_3264.3/0.1-0.2R | 0.1-0.2 | R | 0.30 | 1.00 | 0.18 | 0.03 | 0.13 | 0.02 | 0.10 | 0.02 | 0.06 | 0.01 | 0.06 | 0.01 | 0.13 | 0.07 | 33.6 | 0.86 | 0.21 | 6.17 | 0.42 | 6.58 | 0.89 |
| IR1\_3264.2/0.1-0.2R | 0.1-0.2 | R | 0.45 | 1.50 | 0.29 | 0.01 | 0.26 | 0.04 | 0.23 | 0.05 | 0.14 | 0.02 | 0.14 | 0.02 | 0.25 | 0.11 | 25.0 | 1.41 | 0.40 | 8.84 | 0.92 | 9.76 | 0.22 |
| IR1\_3264.3/0.2-0.5R | 0.2-0.5 | R | 0.97 | 3.25 | 0.58 | 0.06 | 0.42 | 0.05 | 0.24 | 0.05 | 0.14 | 0.02 | 0.14 | 0.02 | 0.23 | 0.21 | 28.3 | 2.51 | 0.45 | 19.0 | 1.07 | 20.1 | 0.56 |
| IR1\_3264.3/1.0-2.0R | 1.0-2.0 | R | 10.8 | 37.3 | 6.92 | 2.01 | 4.45 | 0.37 | 1.22 | 0.20 | 0.60 | 0.07 | 0.48 | 0.07 | 0.64 | 0.79 | 55.2 | 24.17 | 1.43 | 205 | 7.46 | 212 | 1.56 |
| IR1\_3264.4/0.1-0.2R | 0.1-0.2 | R | 2.53 | 9.01 | 1.72 | 0.17 | 1.77 | 0.30 | 1.78 | 0.38 | 1.13 | 0.19 | 1.19 | 0.18 | 1.73 | 0.40 | 37.7 | 9.72 | 2.40 | 48.9 | 6.93 | 55.8 | 0.41 |
| IR1\_3264.2/0.2-0.5R | 0.2-0.5 | R | 1.31 | 4.42 | 0.80 | 0.13 | 0.63 | 0.09 | 0.47 | 0.10 | 0.28 | 0.04 | 0.28 | 0.04 | 0.43 | 0.30 | 30.4 | 3.52 | 0.77 | 25.1 | 1.93 | 27.1 | 0.80 |
| IR1\_3264.3/0.5-1.0R | 0.5-1.0 | R | 4.02 | 13.8 | 2.54 | 0.74 | 1.67 | 0.16 | 0.61 | 0.11 | 0.33 | 0.04 | 0.30 | 0.04 | 0.39 | 0.47 | 37.6 | 9.42 | 0.87 | 76.5 | 3.26 | 79.8 | 1.54 |
| IR2\_3264.3/<0.1R | <0.1 | R | 0.24 | 0.82 | 0.16 | 0.01 | 0.14 | 0.02 | 0.12 | 0.02 | 0.06 | 0.01 | 0.06 | 0.01 | 0.09 | 0.04 | 126 | 0.62 | 0.25 | 4.89 | 0.44 | 5.33 | 0.38 |

U = un-treated, L = leachate, R = residue.

EuN\* = 2EuN /(SmN+GdN), where N denotes upper continental crust- normalized